VARIATION OF HUMAN STATURE IN INDIA

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By
N. T. MATHEW

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SUMMARY AND CONCLUSIONS

This is the first investigation on a large-scale (1,47,066 measurements) of human stature in India based on data from all parts of the country. Work done hitherto has been on much smaller series which can in no way be considered representative of the country as a whole. In the present study certain interesting and important results have been obtained which we shall now summarise. Many of the comparisons between meaningful groups involve small differences which would require fairly large samples to establish with statistical significance. This consideration will apply not only to stature but to other body measurements also. Progress in anthropometry will in future perhaps depend more on obtaining large enough samples than on refinement of statistical tools. The chief merit of the present study is that it is based on a large sample.

Our results refer to the stratum of society from which volunteers come forward to join the army. How far this stratum differs from the general population in respect of stature we are not in a position to say as information about the general population does not exist at present. It is hoped that the present work will help to create interest for a random sample survey on an adequate scale to estimate stature and other physical characteristics of the population.

The overall average stature of the entire series is 65".69 and the standard deviation is 2".17.

The sample includes both those who were accepted by the army as well as those who were rejected. An extensive investigation has shown that there is no material difference between the distributions of stature of these two groups though even the small differences that exist are in some cases statistically significant. The difference in mean values of stature is 0".06 between accepted and rejected candidates for recruitment.

The normality of the distribution of stature in different communities in different age groups of each community has been investigated in detail. On theoretical considerations and on past experience of material from different parts of the world stature as well as other anthropometric measurements may be expected to follow the normal distribution. In our data there are many significant departures from normality, though the magnitude of the differences are generally small. As the analysis of variance tests which we have carried out are not very sensitive to moderate changes from normality we may not be making any wrong conclusions in using normal theory. To throw light on the normality of the distribution of stature we have made use of sizeable series of measurements from several past surveys from India and England. A new method known as Tractile graphical analysis which was used to study normality of distribution has given interesting results.

The effect of partial curtailment of frequencies below the standards of stature prescribed by the army for recruitment from different communities has been examined. The effect in general is to enhance the apparent average stature and to reduce the apparent standard deviation. Here, also, it has been possible to make sure by trying out in a few cases that the differences between communities and the changes over time we have observed have not been unduly affected by the distortion in frequencies introduced by recruitment standards.

The pattern of change in stature with increasing age is found to be similar to that observed by earlier investigators. Stature increases till age 19 to 23 and then decreases with advance of age. The maximum stature is reached earliest in West Bengal and Bihar at the age of 19. The pattern of variation in different states can be seen in Chart 5.1. The significance of age differences in stature has been tested for the major states and for major communities within the states.

The 'communities' are racial, territorial and religious groups into which we have classified the sample taking into account the traditional 'classes' in the army. We have twenty-five such communities including a residual one. There are significant differences in respect of stature between communities in all states except Jammu and Kashmir in the north and Kerala in the south. The differences persist in individual age groups for which we find that 56 out of 90 variance ratios are significant.

An interesting finding is that when members of the same community are located in different states there is a tendency for the average stature to approximate towards the general average of the respective states.

Regional variations in stature as reflected in the mean values for states and districts are nearly of the same magnitude as the variations among communities. The tallest state is Rajasthan and the shortest is Nepal. The district averages when represented on a map of India reveal an interesting pattern of variation. Firstly, there is a general trend in stature with high values in the north-west decreasing gradually towards the east and south. Secondly, it is observed that in mountainous and hilly tracts the inhabitants are shorter than in the plains. The consumption of milk in different regions appears to be positively correlated with average stature. The significance of regional differences in stature has been tested by analysis of variance between and within states and also between and within districts in different states separately for age groups and communities.

The most important result that has been obtained is the existence of secular trend in human stature in India. This has never been noticed in this country before. We have evidence to show that stature is increasing at varying rates in all the states analysed except West Bengal where it appears to be decreasing and in Jammu and Kashmir where it is probably stationary. The rate of increase in other states varies from about one inch in 25 years in Punjab to nearly one inch in ten years in Kerala. The significance of the

secular trend has been tested separately for different age groups as also for majority communities. It is known that increases in adult stature have taken place in Europe and America during the past but ours is the first investigation of this problem in India.

We have collected some data on stature reaching back over a hundred years to 1844 which provide some indication of long-term variations. From a graphical representation of the mean values it appears possible that long-term cycles of change have taken place over the years. This however needs to be confirmed by more abundant data which may be forthcoming if a search is made in the long established record offices of the army.

In our work we had to deal with one factor at a time subdividing the material in such a way as to exclude the effect of other factors as best as we could. The original sample design had provided for the collection of the same number of measurements from each age group of each community each year. Though in practice this design could not be fully adhered to, it was possible to salvage a three-factor arrangement of 10 communities x 6 age groups x 7 years with equal numbers in each cell. Analysis of the 420 mean values thus produced confirms the earlier results especially the finding about secular trend free from the possible criticism that the observed effects may in fact be only a reflection of age differences or community differences. Further the significance of interactions shows that the pattern of change with age, and also the secular trend differs among communities. Regression coefficients calculated for each age group of each community clearly show the existence of a positive secular trend except among Bihari Hindus for whom the trend is negative in these age groups.

An analysis similar to the above from the same set of 420 samples shows that there is a downward secular trend in standard deviations. This finding confirms the result reached earlier (in connection with the work on the effect of truncation of frequencies) that the progressive increase in the average stature is not due to a

general increase in all individuals but most probably due to shorter individuals becoming rarer. Perhaps those sections of the population which were unable to develop fully in stature due to lack of proper nutrition are now catching up with the more fortunate sections as environmental conditions improve. This is only a speculation but it tallies with the finding that the rate of secular increase is highest in Kerala where the level of living is now rapidly changing and lowest in Punjab where food consumption was high in the past. The declining trend in West Bengal may also be due to deteriorating conditions especially during the last war when the Bengal famine took place.

Using material from an army anthropometric survey conducted in 1951-52 we have presented the correlation of stature with 42 other body measurements with separate figures for 20 different communities. It is suggested that the correlations with vertical measurements decrease with the magnitude of these measurements in an interesting manner. These vertical measurements are not, as one would expect, proportional to stature but have an element of independent random variation.

From the same sample as above, it has been shown that blood group is significantly related to stature. People of blood group B are taller than people of other blood groups. The magnitude of the difference is small - eight millimeters between the tallest and shortest blood groups - and significance of the difference could not have been established without the comparatively large series (4,000 individuals) that we have. As far as we are aware this result has not been noticed before either in India or elsewhere.

The data on recruits has been used to make a large-scale investigation of the correlation between stature and weight and chest girth. The overall correlation between stature and weight is 0.561. This varies from 0.410 to 0.579 among different states and from 0.529 to 0.587 among the different age groups of Punjab state. The

correlation between stature and maximum chest girth varies between 0.231 and 0.328 in the four states for which we have calculated this coefficient. The corresponding values for minimum chest girth are 0.236 and 0.318.

Several directions in which further work on human stature may be developed are pointed out.

CHAPTER I. INTRODUCTION

1.1. Survey of stature

The wide range of variation in human stature in India has not been subjected to a comprehensive study so far. Indeed no completely satisfactory study may be possible in view of the prohibitive cost and the intrinsic difficulties of selecting a random sample and obtaining trustworthy measurements. A number of anthropometrists like Risley (1891), Karve (1948), Mahalanobis, Majumdar and Rao (1949) have discussed stature in certain regions of the country. These series do not exceed a few thousand and the interest in stature is somewhat incidental. Many interesting and valuable studies of stature have been carried out in England and America and possibly other countries in connection with nutritional and growth studies, health surveys, research on clothing etc. A number of important publications are included in the list of references.

If the people of India could be regarded in a physical sense as a homogeneous population, then perhaps a sample of a thousand normal adults would have been sufficient to provide a satisfactory estimate of the average Indian stature and its range of variation. In actual fact the population is far from homogeneous and it is the possible distinctions among different segments that make a study of stature worthwhile and at the same time extremely difficult. To begin with, there are naturally differences of sex and age which in different combinations will make it interesting to study a large number of groups. Then there are differences which may be associated with racial stock, geographical regions and food habits and also changes that may take place over time. One would have liked to have random samples each a few hundred strong from at least the most significant of the many segments into which the population could be divided by means of these distinctions. However,

there is no prospect of money and other resources being made available for tackling this problem in a big way.

1.2. Sources of data

As a random sample survey is not possible the next best thing is to look around for any large body of data even if it does not constitute strictly a random or representative sample from the groups in which we are interested. The possible sources are from insurance companies, schools and colleges and from recruiting centres. Data from insurance companies relate to the 'insuring population' which in India is a small minority of comparatively well to do persons who may not be representative of the general population. Measurements of school children and colleges boys and girls may be good for studies of growth rates but are not very suitable for investigation of racial differences or regional variations. We are thus forced to fall back on measurements of army recruits.

1.3. Army recruits

Physical measurement of army recruits must have been in existence ever since armies began functioning in an organized way. The present position in India is that measurements of stature along with some other physical measurements are recorded at the time of medical examination of each recruit. These records are embodied in what are known as 'rough rolls' at different recruiting centres all over the country. Rough rolls are preserved for a period of five years after which they are destroyed. For recruits who successfully complete their training and become soldiers the records of stature and weight are entered in 'long rolls' which are meant to be preserved for 25 years after the soldiers' release or a total of over forty years. However as these long rolls are deposited along with

other documents in Record Offices in different parts of the country, it will be a laborious task to assemble the records of physical measurements in a form ready for statistical analysis. It is thus the labour involved that is the chief obstacle in the way of extending a survey of trends in stature backwards to at least 40 years. We shall see during the course of the present study that such a survey would be a highly desirable project if the resources necessary could be found.

1.4. Origin of the present work

The present study makes use of data from the rough rolls maintained by recruiting offices. The work began in 1953 when the Census Commissioner inquired whether the Ministry of Defence could supply the average stature and weight of army recruits year by year over a period of thirty years or so in order to study general trends. Information for this purpose was not readily available at that time; but the Census Commissioner suggested that a summary of the data available at the recruiting offices may be preserved for use in future scientific work. He thought that such records, if maintained over a period of years, would be useful for the study of progressive trends in the physique of different classes of people in this country.

This suggestion was accepted by the authorities concerned and arrangements were made for transcribing into a form suitable for preservation, data relating to a sample of recruits each year. The clerical staff necessary for dealing with the data of 16 to 20 thousand recruits every year was provided. When the decision to start this work was made the earliest year for which rough rolls were available was 1948. The records for a hundred or more previous years must have been destroyed without yielding any information of scientific value.

1.5. Collection of data

Rough rolls for 1949 (which was the year tackled first) were brought to the Army Statistical Organisation from all recruiting offices and data relating to 23,225 recruits were copied out. In selecting recruits into the sample age groups and communities were kept distinct and as far as possible 100 recruits belonging to each age group were selected for each community. From some communities more than 100 were taken in 1949, as the standard size of sample was decided later. When for any particular age and community group 100 recruits were not available all available recruits were included.

1.6. Age groups and communities

The range of age from 17 to 35 was divided into ten age-groups, namely, the individual ages from 17 through 23 and the groups 24-25, 26-30 and 31-35. Twenty-five 'communities' are defined for this study based on regional, racial and religious considerations in such a way that every recruit will belong to one and only one of these communities. The twenty-fifth community is an omnibus group of 'other' communities. Some of these communities coincide with the traditional 'classes' which maintained their identity in the Indian army till recent times, and are still recognized groups even though now recruitment is open to every citizen of India. These communities are by and large non-intermarrying groups and to that extent their boundaries may indicate racial distinctions. However, many of these communities have non-intermarrying groups within them, and are not necessarily racial in the sense of possessing a common origin. The names of these communities will appear in several of our tables, and short notes and specimen photographs from some communities are given in Appendix 1A.

1.7. States

There are at present fifteen states and six union territories in India. At the time of collection of the data for the present study the number of units was different. In our analysis we have in many places selected nine states for special study rather arbitrarily for the reason that from each of them we have more than 5,000 recruits. This leaves out some important states like Andhra Pradesh, Assam, Madhya Pradesh, Mysore, Orissa and all the union territories from detailed analysis. Nepal is not a part of India though the Indian army recruits considerable numbers of Nepalese. The undivided state of Bombay is retained because at the time of commencement of this work that state had not been divided. Most of the recruits from Bombay however belong to the present state of Maharashtra.

1.8. The basic material

For each recruit the data recorded consists of: (a) year of recruitment, (b) military station at which recruited, (c) age, (d) stature in inches, (e) weight in pounds, (f) maximum chest girth in inches, (g) minimum chest girth in inches, (h) home state, (i) home district, (j) religion and (k) community.

The work for 1949 was repeated for 1948 and for 1950 and subsequent years. The work is even now continuing. The original intention was that the accumulation of data should go on for three decades before investigating long-term trends in the physical characters under study. This is still the plan and it is hoped that the work will continue and at the right stage a more comprehensive analysis will be carried out.

The present study deals mainly with data for eight years from 1948 through 1955 and may be regarded as a pilot project. Further this study is concerned with

stature and will touch upon other measurements only incidentally. The number of measurements of stature with which we shall be concerned are shown in Table 1.1 separately for different years of recruitment.

Table 1.1 Number of measurements of stature studied

year of recruitment	number
1948	17,629
1949	23,225
1950	18,338
1951	18,938
1952	17,282
1953	16,151
1954	17,539
1955	17,964
total	147,066

Some data will be taken also from a survey of soldiers carried out in 1952-53 in which some hundred physical measurements were made on 4,000 soldiers. Data for a period of over 100 years from 1844 to 1947 which was extracted from old long rolls that happened to be preserved at one of the Regimental Centres is also used to examine the trend of stature.

1.9. Mistakes and imperfections

As already mentioned, the work of data collection started in 1953. The statistical analysis was also spread over a number of years and a number of men in whose ranks many changes took place during the course of the work.

A good deal of the work had to be done using punched card equipment which are capable of introducing errors and discrepancies in large scale operations quite apart from the human errors inherent in manual compilations and calculations. Care was taken to eliminate mistakes by cross checks and duplicated work. In spite of all this it will be too much to expect that all the numerical figures presented in the succeeding pages will be free from error. However, it is fairly certain that the significant results noticed and the conclusions drawn are not vitiated by numerical mistakes. A very enlightening discussion of recording and computing errors in anthropometric work is given by Healy (1952).

The basic data itself is subject to numerous limitations some of which may be mentioned at this stage. To begin with, we do not have a random sample from the population of India. Our sample may be representative of the strata from which volunteers for recruitment into the army come forward. But in discussing Indian stature on the basis of this data we are making a generalisation which may not be valid. However, we shall use the term "Indian stature" as shorthand for "stature of volunteers for the Indian army".

Data relating to recruits will not be quite satisfactory for providing estimates of the average stature of Indians, or for inhabitants of any region within India. There is bound to be a bias due to selection the extent of which we cannot determine as there are no other objective estimates. However, it may be reasonable to expect that whatever bias there is, remains constant from year to year so long as recruiting standards are not altered so that comparisons of differences may be more meaningful than absolute estimates. The bias also be more or less steady among age groups. There is less reason to expect that it will be constant from community to community as the basic standards themselves are different.

At the recruiting centres where the measurements are made the methods used are not very sophisticated. The subject is made to stand with his back against a wall, barefoot, and in an erect position. Inches and subdivisions of inches are marked on a scale on the wall and the stature of the subject is read off using a foot-rule to indicate the level of the highest point of the head. There is scope for personal equation and rounding off error in this method. We do not know the extent to which these have affected our data. Some remarks on rounding off errors will be made in Chapter II.

Recruitment standards which differ among 'classes' have had some influence in distorting the distribution of stature. This will be discussed in Chapter III. Similarly, the effect of mixing up measurements for accepted recruits and rejected candidates for recruitment will be considered in Chapter IV. We shall often refer to both these groups loosely as 'recruits'. Lack of normality in the distributions of stature will be considered in detail in Chapter II.

1.10. Objects and methods

In this work we have explored the records of stature of more than 1,47,000 persons and some supplementary data in a search for interesting findings. The statistical methods used are straight-forward and well suited for the purpose. We have made extensive use of the analysis of variance technique for which mankind owes a deep debt of gratitude to the late Sir Ronald A. Fisher. This technique appears to be particularly appropriate for locating significant elements of variation in measurements of human stature. We have done fair justice to Fisher's g_1 and g_2 which are equivalent to Karl Pearson's B_1 and B_2 for testing normality of distribution. As suggested recently by Linder the fractile graphical analysis of

Mahalanobis has been tried out for testing normality of distribution and some interesting results obtained. The χ^2 test contributed by Pearson has found several uses. In dealing with the problem of truncated distribution we have used the formulae provided by Fisher extended for our work. An alternative approach to the problem of comparing means of truncated populations by a simple analysis of variance has also been found useful. Use has been made of regression lines in dealing with secular trend and correlation coefficients in studying associated variables. Among the numerous graphs we present there are some which look like 'control charts' used by industrial quality controllers, and in Chapter X we have dealt with community, age and year of recruitment somewhat in the manner of a factorial experiment originally applied in agricultural problems. The statistical analysis has been voluminous and more extensive than anything attempted before in this particular field.

CHAPTER II DISTRIBUTION OF STATURE

2.1. Form of distribution

It is well-known that the frequency distribution of carefully recorded measurements of stature on homogeneous groups of men is of the normal form. G.M. Morant who perhaps can claim to have had the widest experience of the statistical treatment of human body measurements has recorded (1939) that "It can be stated categorically that the distributions of measurements for the vast majority of samples that occur in anthropological practice tend to conform closely to the normal curve. Quetelet's (1871) suggestion that this is so has been confirmed by data relating to numerous series of living people and skeletons from all parts of the world".

In this chapter we present detailed figures relating to the frequency distribution of stature for the sample as a whole and also in each of ten age groups of the twenty-four communities we shall be concerned with in later chapters. The extent of conformity of these distributions to the normal form is studied by calculating the values g_1 and g_2 (see Fisher (1948)) for each distribution. The evidence that we come across of departures from normality in many cases reduces to some extent the suitability of our samples to represent the populations from which they come. Because of this and other limitations of the present data, our conclusions can only be regarded as tentative. They have to be confirmed or disproved by further work using better quality data whenever these become available.

One important consideration in this connection is that the effect of non-normality on the numerous analyses of variance which we carry out is to reduce the significance of our test results. Hence these results as far as they go may be on safe ground. There has been a great deal of investigation of this matter. See for instance Pearson (1931) and Cochran (1947).

2.2. Errors of rounding off

One useful purpose that can be readily served by a frequency distribution of any series of measurements is to provide some idea of the magnitude of errors of rounding off. Measurements of stature were recorded in the rough rolls correct to the nearest quarter of an inch except for 32 out of the total of 147066 recruits. For convenience of numerical work these 32 measurements were rounded off to the nearest quarter of an inch even though apparently they were measured correct to the nearest one eighth of an inch. The frequency of different readings without any further rounding off can be seen from Table 2.1 which also shows the percentage distribution of values ending in different fractions.

If the measurements had all been really correct to a quarter of an inch we should have expected equal frequencies corresponding to inch, $\frac{1}{4}$ inch, $\frac{1}{2}$ inch and $\frac{3}{4}$ inch or roughly one quarter of the total to be distributed in each of these columns. Actually the column headed 'inch' has 47.2% of the total frequency which is much more than its due share. Thus there is a strong tendency on the part of those who measure the stature of recuits to round off to the nearest inch. Measurements ending in $\frac{1}{2}$ inch constitute 31.6% of the total. This again indicates a bias in the measurements. Measurements ending in $\frac{1}{4}$ inch and $\frac{3}{4}$ inch have much less than expected frequency.

The bias in measurements noted above has necessitated small corrections in mean values of communities when calculated from grouped frequencies so as to tally with similar values obtained by direct summation.

Table 2.1 Distribution of stature of 147066 recruits

stature (in)	number of measurements ending in					percentage				
	inch	¼ in	½ in	¾ in	total	inch	¼ in	½ in	¾ in	total
55	-	-	1	-	1	-	-	0.00	-	0.00
56	3	2	2	-	7	0.00	0.01	0.00	-	0.00
57	7	1	5	1	14	0.01	0.01	0.01	0.01	0.01
58	23	1	17	1	42	0.03	0.01	0.04	0.01	0.03
59	63	2	59	10	134	0.09	0.01	0.13	0.07	0.09
60	618	71	518	103	1310	0.89	0.43	1.11	0.71	0.89
61	1532	254	1406	348	3540	2.21	1.53	3.03	2.38	2.41
62	3113	585	2794	805	7297	4.49	3.53	6.01	5.51	4.96
63	5807	1453	4763	1662	13685	8.37	8.76	10.25	11.38	9.31
64	10738	2551	7823	2670	23782	15.47	15.38	16.83	18.29	16.17
65	10874	2936	8403	2834	25047	15.67	17.70	18.08	19.41	17.03
66	14204	3385	8430	2576	28595	20.47	20.41	18.14	17.64	19.44
67	9571	2466	5963	1824	19824	13.79	14.87	12.83	12.49	13.48
68	6324	1607	3418	1047	12396	9.11	9.69	7.35	7.17	8.43
69	3563	820	1722	470	6575	5.13	4.94	3.70	3.22	4.47
70	1780	314	747	173	3014	2.56	1.89	1.61	1.18	2.05
71	776	120	336	61	1293	1.12	0.72	0.72	0.41	0.88
72	286	11	46	11	354	0.41	0.07	0.10	0.08	0.24
73	79	6	20	4	109	0.11	0.04	0.04	0.03	0.07
74	24	1	3	-	28	0.03	0.01	0.01	0.00	0.02
75	10	-	-	1	11	0.01	-	-	0.01	0.01
76	-	-	1	-	1	-	-	0.00	-	0.00
77	1	1	-	-	2	0.00	0.01	-	-	0.00
78	1	1	1	1	4	0.00	0.01	0.00	0.01	0.00
79	-	-	1	-	1	-	-	0.00	-	0.00
total	69397	16588	46479	14602	147066	99.97	100.03	99.99	100.01	99.99

Histograms of the five percentage distributions in Table 2.1 are shown in Chart 2.1 and the means, variances, g_1 and g_2 are given in Table 2.2.

Table 2.2 Statistics from the distribution of measurements ending in different fractions

measurements ending in	number	mean	variance	g_1	g_2
inch	69397	65.60	4.9326	0.0955	0.2095
$\frac{1}{2}$ inch	46479	65.70	4.6208	0.0648	0.1204
$\frac{1}{4}$ inch	16588	65.87	4.0881	0.0608	0.1326
$\frac{3}{4}$ inch	14602	65.90	4.0571	0.1368	0.1016
total	147066	65.69	4.6937	0.0954	0.1848

There are significant differences among the distributions though the absolute magnitudes of the differences in g_1 and g_2 are not large. The measurements ending in $\frac{1}{4}$ inch and those ending in $\frac{3}{4}$ inch appear to have practically the same distribution except perhaps for a slightly greater positive skewness in the latter. The measurements ending in whole inches have the lowest mean and largest variance; the measurements correct to a quarter inch (ending in $\frac{1}{4}$ or $\frac{3}{4}$ inch) have the highest means and lowest variance. The measurements ending in $\frac{1}{2}$ inch have mean and variance in between the extremes. It would appear that a part at least of the differences is due to different recruiting centres adopting different standards of accuracy. This would account for the similarity of the measurements ending in $\frac{1}{4}$ inch and $\frac{3}{4}$ inch as both series would be produced by those attempting an accuracy of $\frac{1}{8}$ inch.

This would also account for the higher variance of the measurements ending in inches and half inches as these would be contributed by a larger number of recruiting centres than those ending in quarter or three quarter inches. The differences in means may also have a similar explanation.

From the values of g_1 and g_2 it can be seen that the distributions are very nearly of normal shape. However the differences between the observed and the normal values are quite significant, and the distributions are therefore slightly skew and 'leptokurtic'.

2.3. Distribution in communities and age groups.

Turning now to communities and ages the 240 frequency distributions separately for each age group of the twenty-four different communities (excluding 'other') are given in Table 2.2 (Appendix 2A). That many of these distributions are not normal can be seen from Table 2.4 (Appendix 2B) in which the values of g_1 and g_2 are shown along with those of mean and variance.

Histograms of the distributions in the different communities are given in Charts 2.2 to 2.7. One limitation of our data becomes evident even from a cursory glance at some of these charts. The army has laid down standards of minimum stature for each community which has resulted in curtailment of frequency below these standards. If these standards were adhered to uniformly for every recruit we should have had 'truncated' distributions in which the left hand tail is cut off at the point representing the minimum standard of stature laid down. However for non-combatants these standards are relaxable and our data also include rejected candidates. Hence we get only a partial truncation. The effect of this truncation on some of our calculations will be investigated in Chapter III.

2.4. Normality of distribution

Against the values of g_1 and g_2 in Table 2.4 star marks (* for 5% and ** for 1%) are given to indicate significance of departures from the normal values 0 and 0. The method used to test significance was to calculate the quantities

$$\omega_1 = g_1 \sqrt{\frac{(N-2)(N+1)(N+3)}{6N(N-1)}}$$

$$\omega_2 = g_2 \sqrt{\frac{(N-3)(N-2)(N+3)(N+5)}{24\,N(N-1)^2}}$$

which can be treated as approximate normal deviates. The twenty-four communities show significant departures from normality either in respect of g_1 (symmetry) or g_2 (kurtosis) or both. Four communities, namely, Ahir, Gujar, Punjabi, Hindu and Sikh (Other) have symmetrical distributions with g_1 not differing significantly from zero and for two others, namely, Jat and J&K Hindu g_1 is not significant at 1% level. g_2 is insignificantly different from 0 only for Bengali and Garhwali and for Bihari the difference is not significant at 1% level.

For distributions in individual age groups of which we have 240, g_1 is significant at 5% level in 140 cases of which in 91 cases it is also significant at 1% level. g_2 is significant at 5% level in 106 cases of which in 89 cases it is also significant at 1% level.

It is evident from the above results that there are significant departures from normality in the series of measurements of stature we are dealing with. However, as we have remarked earlier the analysis of variance test would err on the safe side.

Table 2.5 Distribution of g_1 and g_2

g_1	g_2																				total
	-0.7-	-0.5-	-0.3-	-0.1-	0.1-	0.3-	0.5-	0.7-	0.9-	1.1-	1.3-	1.5-	1.7-	1.9-	2.1-	2.3-	2.7-	2.9-	3.9-		
-0.5-	-	-	-	-	-	-	-	1	-	1	1	-	-	1	-	-	-	-	-		4
-0.3-	1	-	-	-	4	1	2	4	2	-	2	1	-	-	2	-	-	-	-		19
-0.1-	-	-	2	4	8	9	7	5	4	2	1	3	2	1	-	-	-	-	-		48
0.1-	-	2	-	10	20	24	8	8	12	5	1	-	1	-	-	1	-	-	-		92
0.3-	-	1	-	1	13	7	16	7	2	2	2	-	-	-	-	-	-	1	-		52
0.5-	-	1	1	-	-	3	3	5	2	-	1	2	-	-	1	1	-	-	-		20
0.7-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	1		3
0.9-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-		2
total	1	4	3	15	45	44	36	31	22	10	8	6	3	3	3	2	1	2	1		240

As an interesting bye-product of our analysis we give in Table 2.5 the joint distribution of g_1 and g_2 for the 240 pairs of values. It is easy to see from this table that except for a small percentage of cases the magnitude of the deviations from the normal values are not large.

2.5. Survey of soldiers in 1951-52

In an anthropometric survey of Indian soldiers conducted in 1951-1952 measurements of stature were made on 4,000 soldiers. The distribution of these measurements which happens to be as near to normal as one might expect is reduced in Table 2.6.

Table 2.6 Distribution of stature from the army anthropometric survey 1951-52.

stature (in)	frequency	stature (in)	frequency
1	2	3	4
57.0-	1	67.0-	474
58.0-	4	68.0-	400
59.0-	12	69.0-	205
60.0-	50	70.0-	113
61.0-	117	71.0-	49
62.0-	191	72.0-	13
63.0-	490	73.0-	6
64.0-	558	74.0-	2
65.0-	609		
66.0-	706	total	4000

This sample is made up of 200 soldiers each from 20 groups which have distinctive features, racial, religious and geographical. The measurements

were taken originally in millimetres using a specially constructed instrument known as an anthropometer by a trained measuring team. It is remarkable that in spite of the hetegogeneity present in the sample the distribution of stature should be normal (g_1 = 0.0825, g_2 = -0.0313). We shall use this data later in connection with the correlation of stature and other physical and physiological characters.

2.6. Other series from India

We shall now present a few other series of stature collected in India and elsewhere generally bearing out the proposition that in a homogeneous population adult stature may be expected to be distributed normally or nearly normally.

Three important collections of anthropometric data relating to Indians and available in a published form are those due to Risley (1891); Mahalanobis, Majumdar and Rao (1949); and Majumdar and Rao (1958).

The distribution of the statures recorded by Risley are reproduced in Table 2.7 from Mathew (1963a). The data for Bengal, Chittagong Hills, Darjeeling Hills, Chotanagpur Hills and Bihar had to be converted from centimeters to inches and certain corrections had to be made in the remaining data as explained in the paper referred to above.

The records of stature of 2,813 men published in the monumental work by Mahalanobis and others (1949) is presented in the form a frequency distribution in Table 2.8. The data relate to 22 caste and tribal groups from the United Provinces (present Uttar Pradesh) which are represented by 57 to 197 individuals in the total series. The original measurements are recorded up to millimeters. These were classified into intervals of one centimetre each and the frequencies obtained manually.

Table 2.7 Distribution Risley's data on stature

stature (in)	Punjab	NWP&O	Bengal	Chittagong hills	Darjeeling hills	Chotanagpur hills	Bihar	total
1	2	3	4	5	6	7	8	9
55-	-	-	-	-	1	-	-	1
56-	-	1	2	-	-	1	-	4
57-	-	1	7	-	5	8	-	21
58-	-	8	8	5	4	18	6	49
59-	-	16	41	10	30	57	25	179
60-	2	57	72	29	31	74	26	291
61-	4	102	140	62	61	155	86	610
62-	18	183	158	31	43	142	109	684
63-	25	227	242	60	79	200	74	907
64-	50	331	214	40	58	152	151	996
65-	66	354	111	19	29	64	69	712
66-	90	269	108	20	23	58	82	650
67-	82	139	45	2	9	10	37	324
68-	50	72	41	2	10	4	25	204
69-	35	37	5	-	2	1	10	90
70-	10	13	3	-	-	2	4	32
71-	11	5	1	-	-	-	-	17
72-	4	1	1	-	-	-	1	7
73-	4	-	-	-	-	-	-	4
74-	-	1	-	-	-	-	-	1
75-	1	-	-	-	-	-	-	1
total	452	1817	1199	280	385	946	705	5784

Table 2.8 Distribution of stature of 2,813 men from U.P. 1941.

stature (cm)	frequency	stature (cm)	frequency	stature (cm)	frequency
1	2	3	4	5	6
142-	1	158-	152	172-	47
145-	4	159-	151	173-	30
146-	11	160-	194	174-	17
147-	10	161-	191	175-	20
148-	12	162-	195	176-	12
149-	15	163-	181	177-	8
150-	7	164-	170	178-	5
151-	25	165-	159	179-	1
152-	48	166-	157	180-	3
153-	59	167-	145	181-	1
154	76	168-	120	182-	3
155-	101	169-	88	183-	1
156-	121	170-	73		
157-	136	171-	63	total	2813

Majumdar and Rao (1958) have published measurements of stature of 2020 non-muslims and 1,659 muslims from undivided Bengal. The distribution of these is given in Table 2.9.

Table 2.9. Distribution of stature from Bengal

stature (cm)	number of non-muslims	number of Muslims	total	stature (cm)	number of non-muslims	number of Muslims	total
1	2	3	4	5	6	7	8
133-	1	-	1	161-	108	107	215
136-	-	1	1	162-	111	120	231
137-	1	-	1	163-	108	117	225
138-	3	-	3	164-	114	110	224
140-	0	-	0	165-	103	105	208
141-	1	1	2	166-	121	89	210
142-	4	1	5	167-	73	82	155
143-	3	1	4	168-	73	61	134
144-	4	2	6	169-	67	47	114
145-	7	6	13	170-	66	31	97
146-	17	8	25	171-	43	31	74
147-	8	8	16	172-	50	21	71
148-	15	14	29	173-	30	24	54
149-	26	8	34	174-	27	9	36
150-	20	14	34	175-	15	9	24
151-	24	17	41	176-	11	10	21
152-	45	23	68	177-	8	3	11
153-	52	36	88	178-	5	3	8
154-	68	41	109	179-	7	2	9
155-	85	65	150	180-	5	3	8
156-	74	67	141	181-	1	3	4
157-	88	77	165	182-	1	-	1
158-	92	88	180	183-	1	-	1
159-	123	84	207	186-	1	-	1
160-	110	110	220	total	2020	1659	3679

Means, variances and values of g_1 and g_2 for the distributions in

Tables 2.6 to 2.9 are given in Table 2.10.

Table 2.10 Statistics from the distribution of stature

series	number	mean stature (in)	variance	g_1	g_2
1	2	3	4	5	6
Army anthropometric survey 1951-52	4000	65.94	5.5508	.0825	-.0313
Risley (1891)	5784	64.16	6.0442	.1468	.1579
Mahalanobis and others (1949)	2813	64.00	5.3391	.0388	.0705
Majumder and Rao (1958)					
non-muslims	2020	63.86	7.5469	.1221	.1537
muslims	1659	63.87	5.7840	0.1200	.4464
total	3679	63.86	6.7520	0.1226	.3020

All the series in Table 2.10 are made up of many distinct groups and yet the value of g_1 is small in each case, and the values of g_2 are near about the normal value in all except the muslims of Bengal.

2.7. Measurements of stature from Britain

As a further illustration of the normality of distribution of stature we give in Table 2.11 data relating to 91.161 British males reported by Martin (1949). All these men were between the ages of twenty and twenty-one years. The group represents the first series of measurements covering Britain as a whole. The measurements were made in 1939 when British subjects had to register for military training.

Table 2.11 Distribution of stature of British males aged 20-21.

stature (in)	number	stature (in)	number
1	2	3	4
48-	1	66-	13,316
52-	2	67-	14,159
53-	2	68-	12,817
54-	4	69-	10,256
55-	12	70-	7,031
56-	10	71-	3,914
57-	22	72-	2,284
58-	75	73-	1,134
59-	126	74-	439
60-	402	75-	120
61-	981	76-	46
62-	2,110	77-	17
63-	4,036	78-	8
64-	7,317	81-	1
65-	10,519	total	91,161

The mean stature is 67.5 and standard deviation is 2.61. The values of g_1 and g_2 worked out by us are 0.0000 and 0.3042 respectively. That conformity with the normal distribution in this case is very close in spite of the significantly high value of g_2 can be seen from Chart 2.9 which is taken from Morant (1952).

2.8. The fractile graph method

Linder (1963) has suggested a new approach to the problem of testing normality of distribution. The method uses the fractile graph introduced by Mahalanobis (1958, 1960). We have tried out this method on four typical cases taken from different age groups of Sikh (M & R) one in which g_1 and g_2 agree with normal values and three others in which respectively g_1 and g_2 and both differ from normal. From an examination of the fractile graphs it appeared that departures from normality even in the three latter cases were not very material. In the last of the four cases g_1 was 0.79 and g_2 was 3.92. However, the fractile graph revealed only a mild departure from normality at the upper extreme. A scrutiny of the original data and the calculations leading to g_1 and g_2 was therefore undertaken which revealed that the departure from normality was due to one outlying value equal to 78" the next smaller value being 72". When the outlying value was discarded g_1 and g_2 came down to 0.26 and 0.22 respectively. The fractile graph method is thus seen to be free from the undue influence of outlying values.

The four fractile graphs referred to above are given in charts 2.10 to 2.13. In each graph the coloured area is bounded by lines representing two subsamples into which the total sample was divided randomly. For each subsample the fractile means were plotted against similar means of a standard normal distribution. The fractile means in this case were obtained by arranging the sample concerned in ascending order of stature and working out the ten means corresponding to the shortest ten per cent individuals, the next ten per cent individuals and so on up to the tallest ten per cent.

A straight line fitted to the fractile means of the combined sample by the method of least squares is also shown in each graph. If this straight line is entirely within the coloured area then the distribution may be considered normal. The separation between the straight line and the line representing the combined sample gives an indication of the extent of departure from normality. The coloured area between the two subsample lines may be regarded as analogous to sampling error against which the significance of this separation may be assessed.

The fractile graph provides a visual aid to locate regions where sources of non-normality may be sought for. The method has to be explored further and some mathematics worked out before it can be regarded as a completed tool.

CHART 2.1 FREQUENCY DISTRIBUTION OF STATURE OF RECRUITS

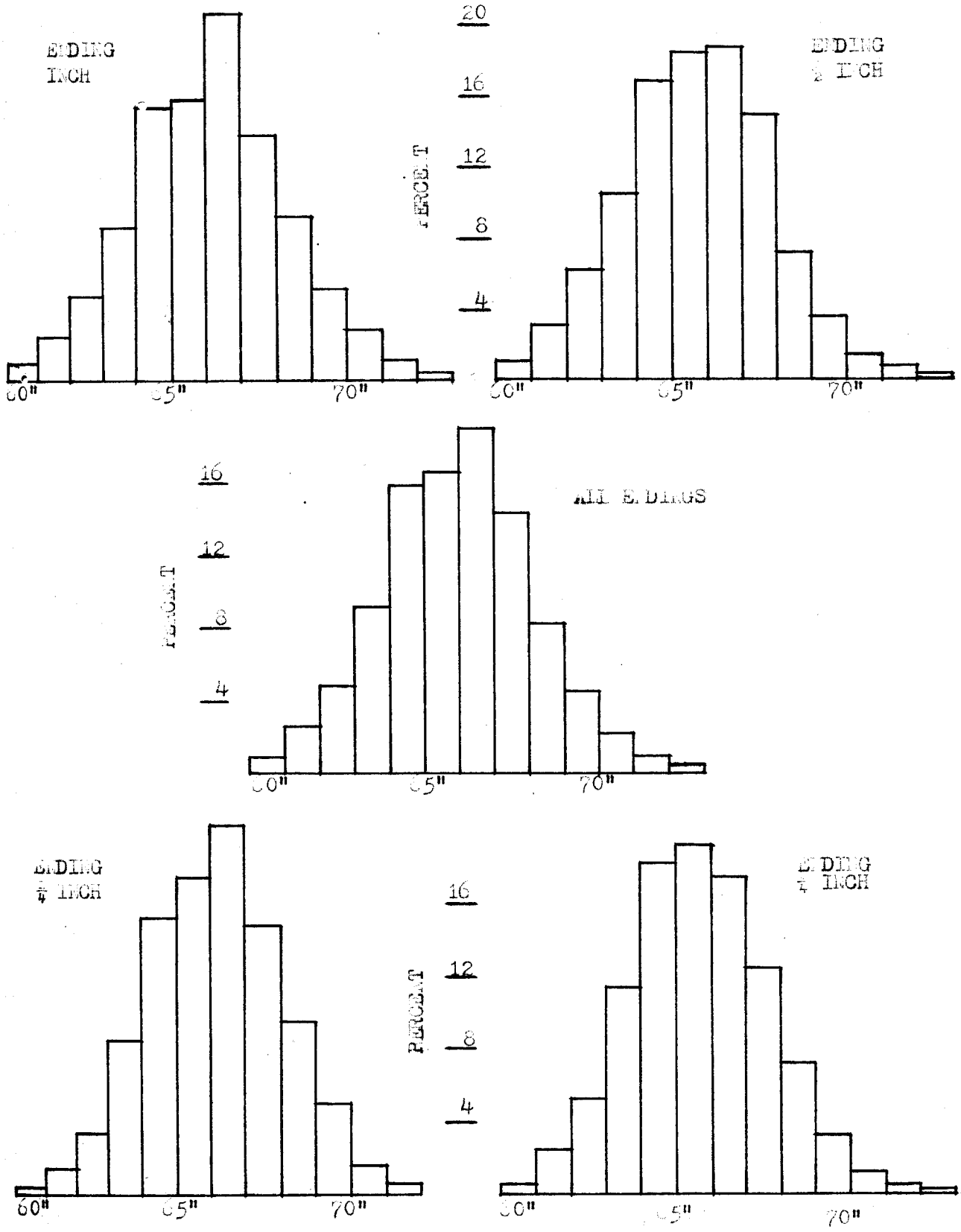
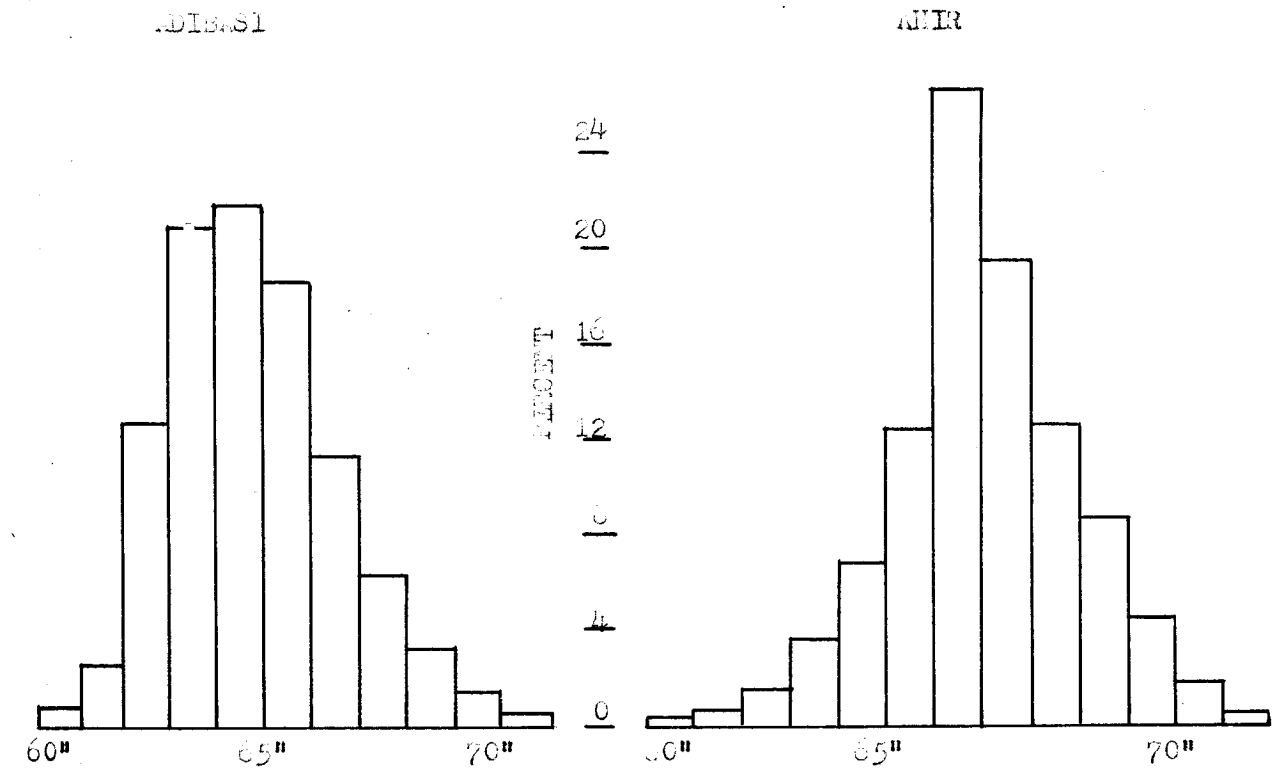


CHART 2.2 DISTRIBUTION OF STATURE IN COMMUNITIES



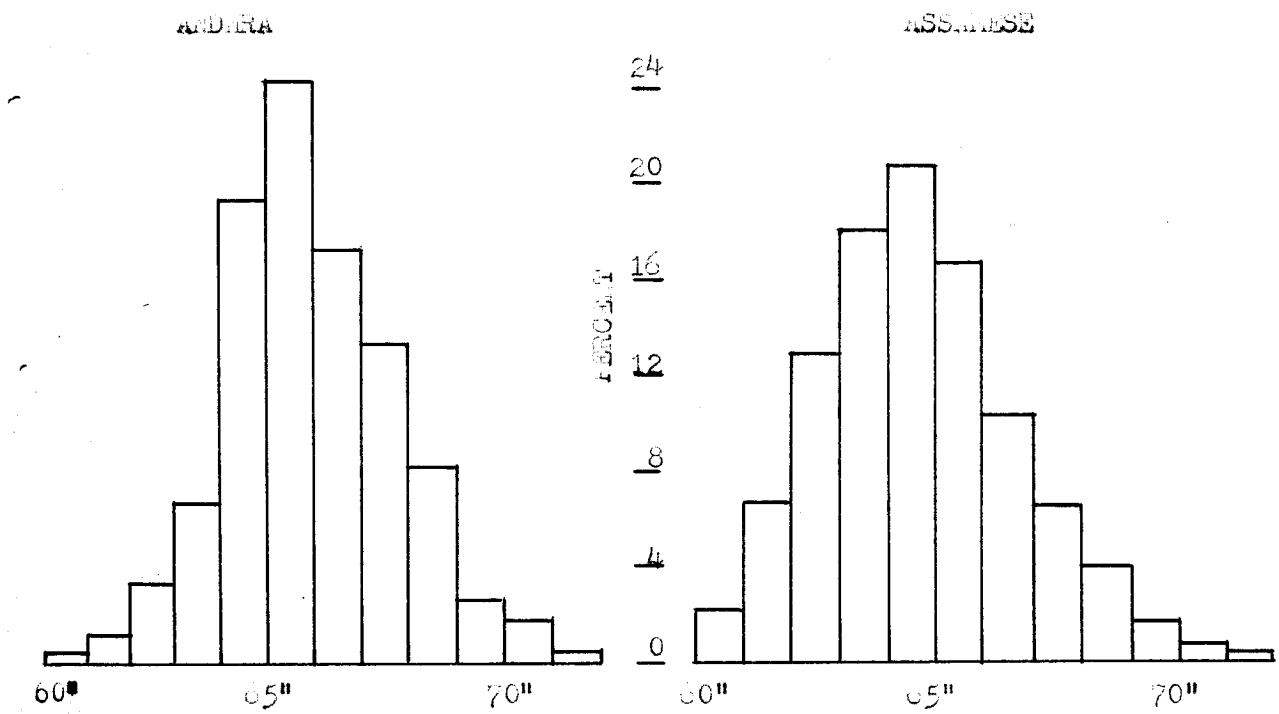
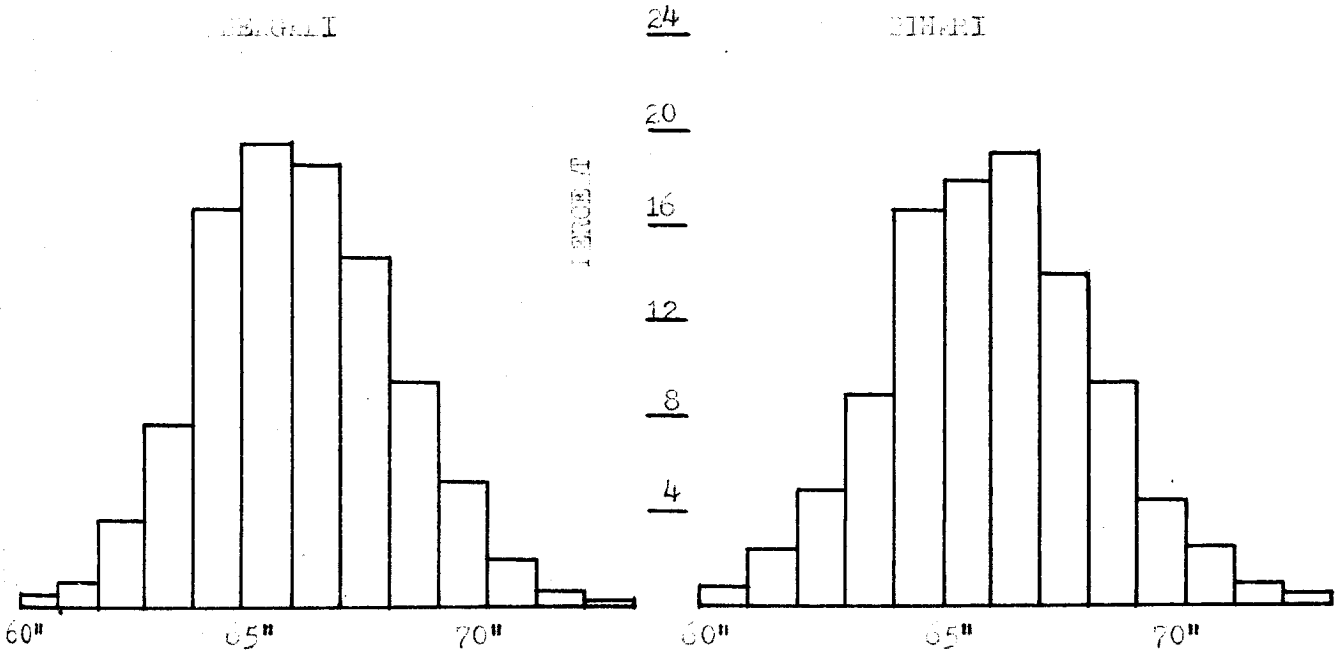


CHART 2.3 DISTRIBUTION OF STATURE IN COMMUNITIES



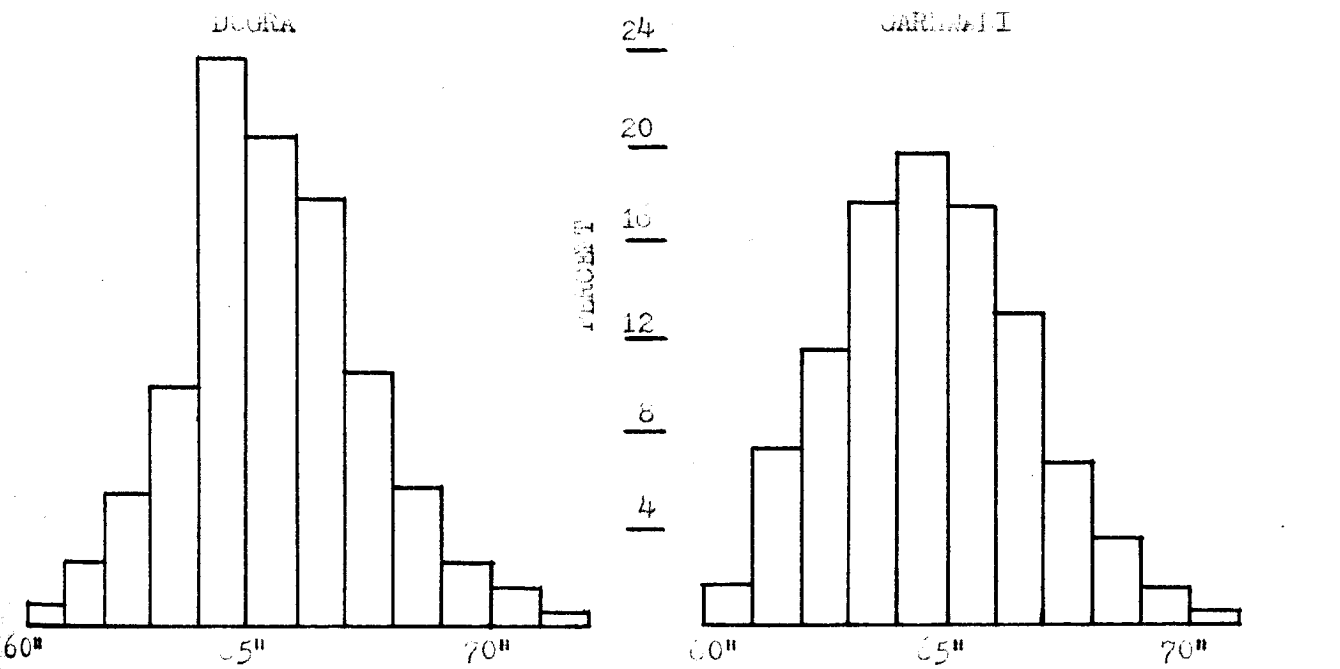


CHART 2.4 DISTRIBUTION OF STATURE IN CENTIMETRES

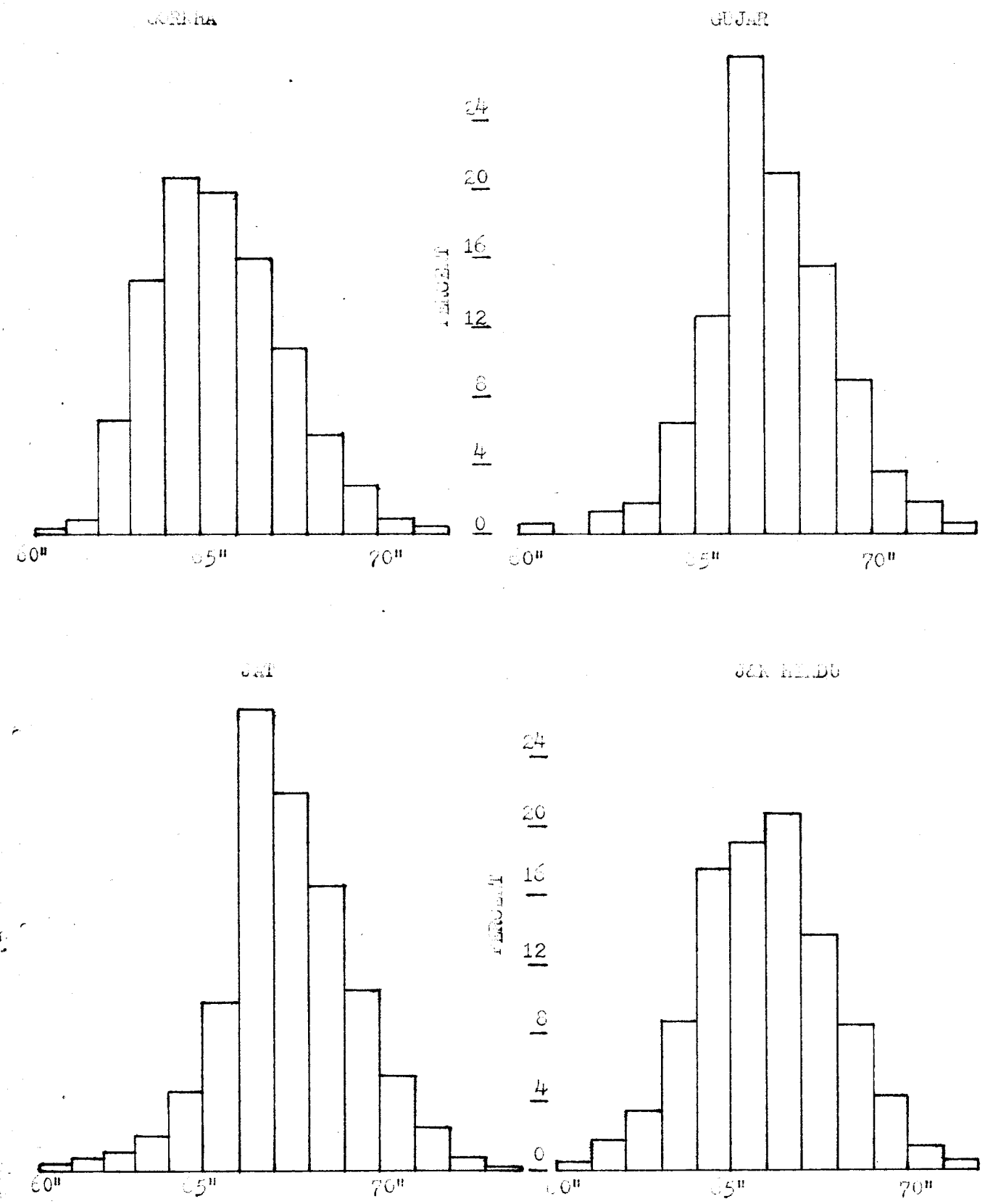


CHART 2.5 DISTRIBUTION OF STATURE IN COMMUNITIES

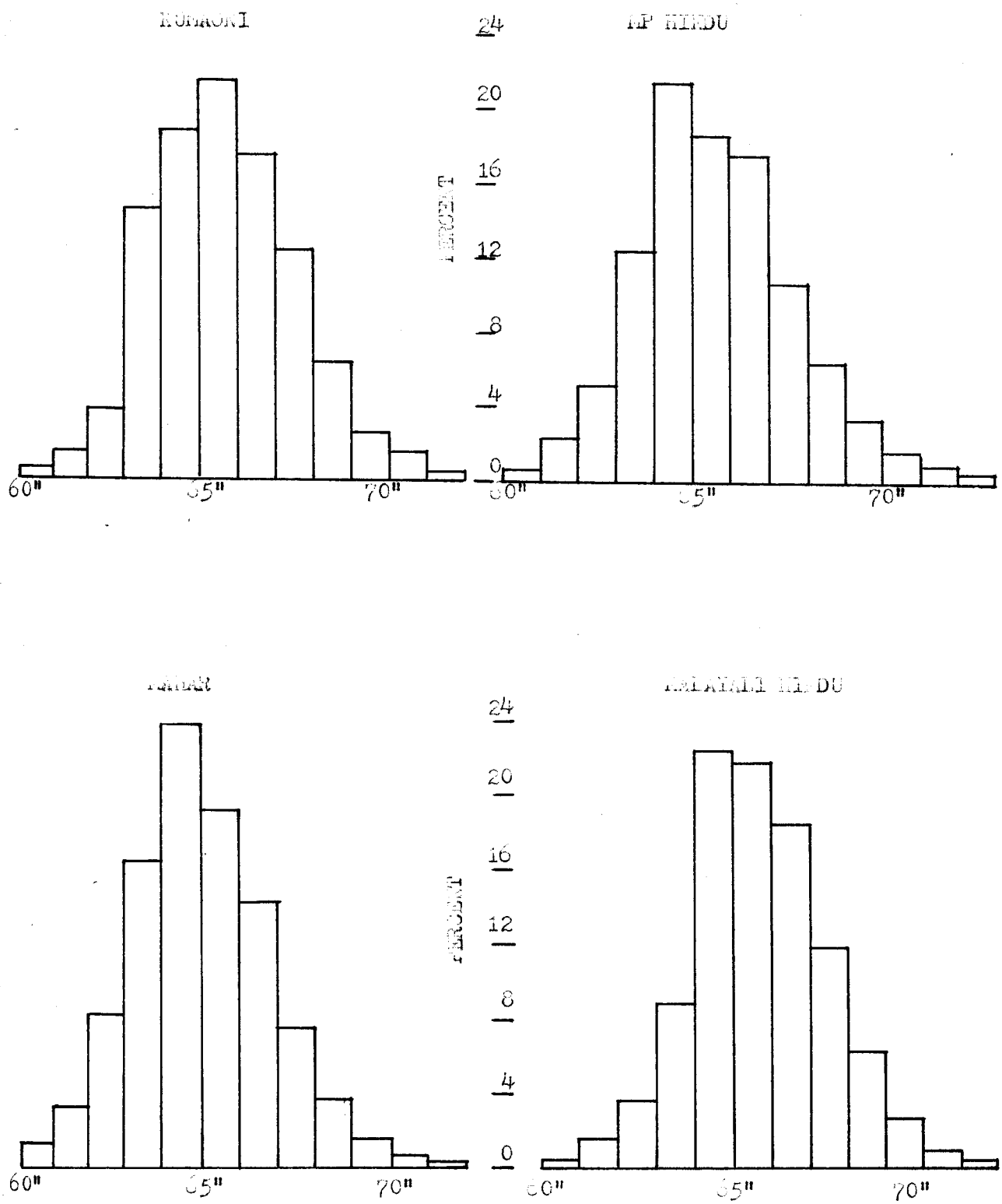
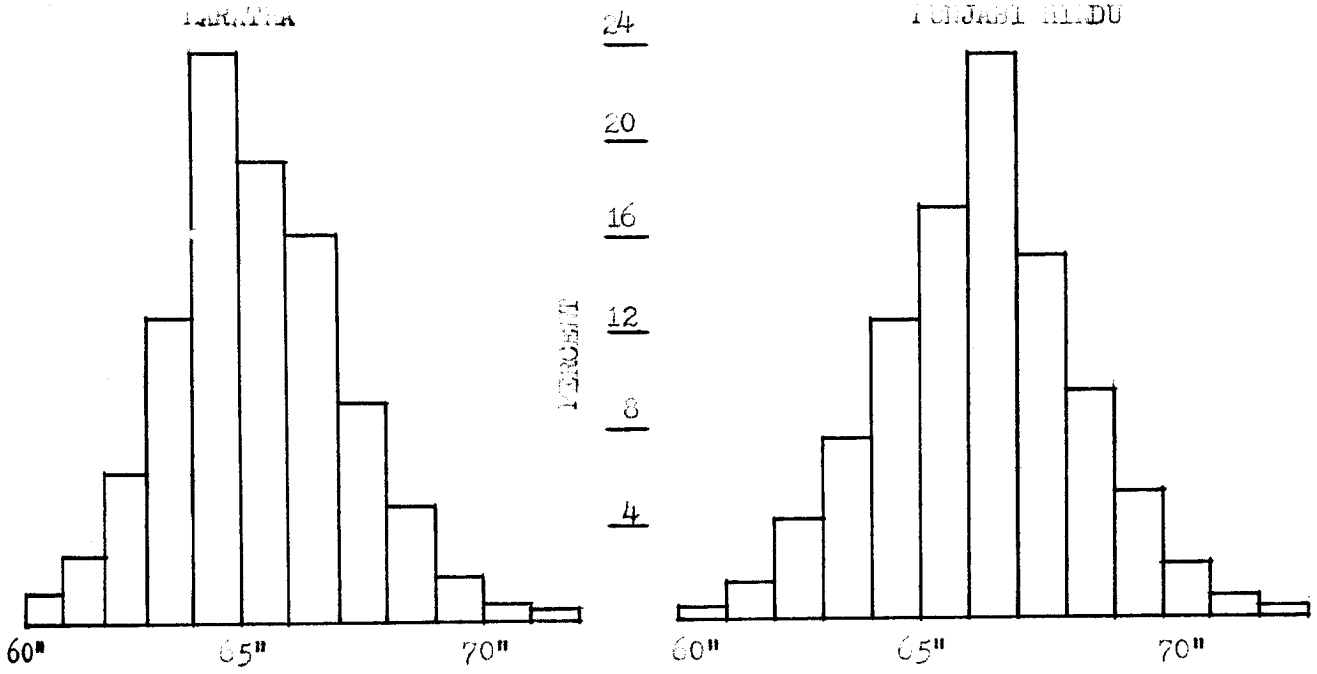


CHART 2.6 DISTRIBUTION OF STATURE IN COMMUNITIES



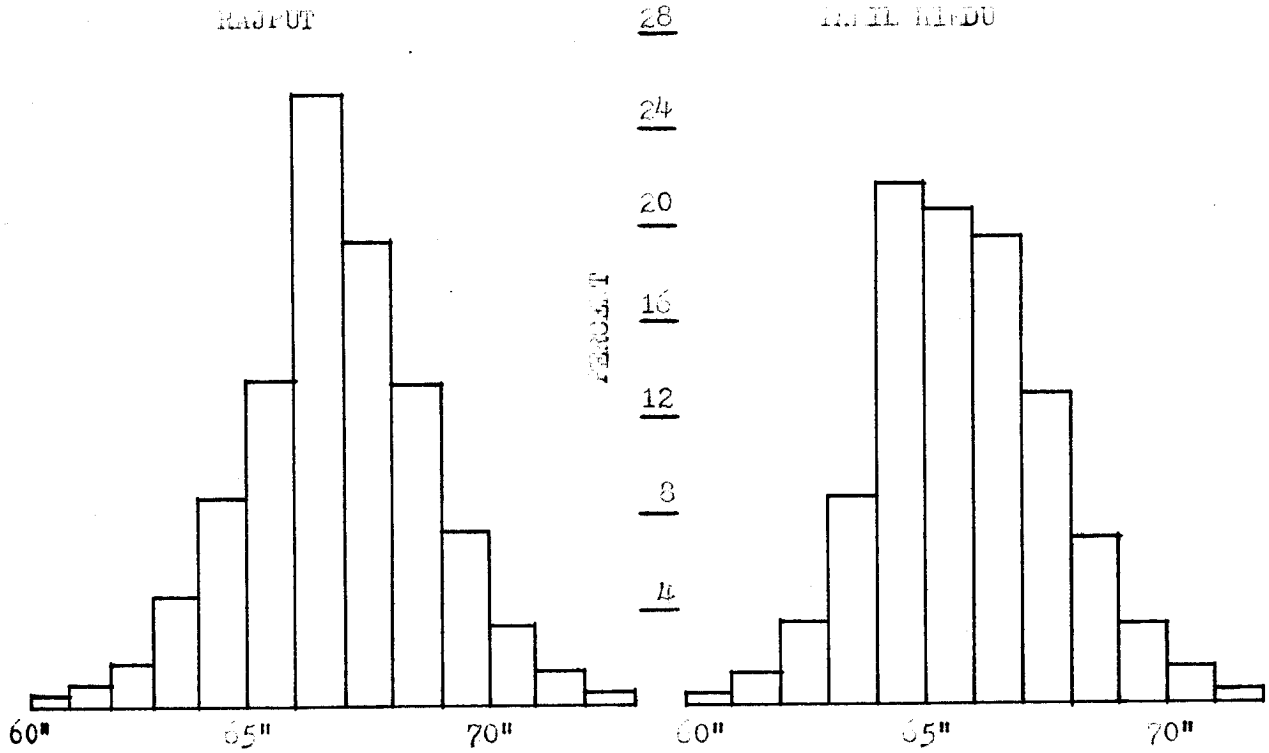
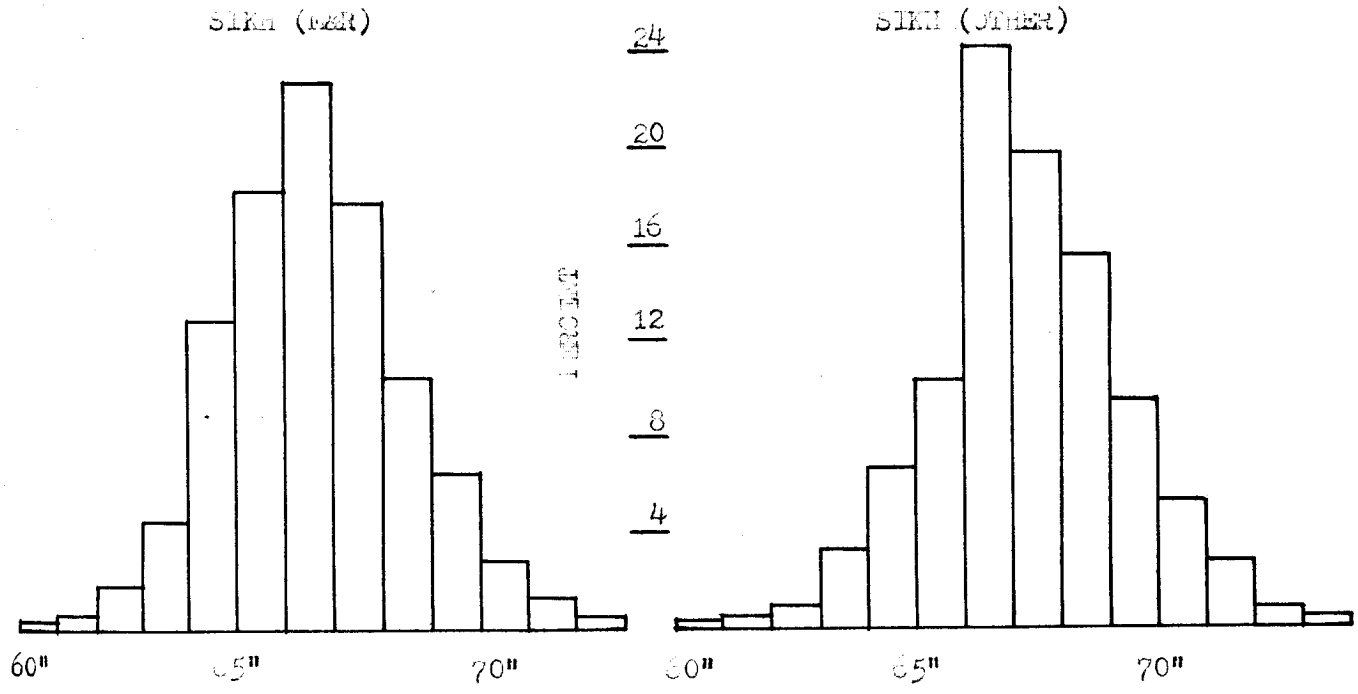


CHART 2.7 DISTRIBUTION OF STATURE IN COMMUNITIES



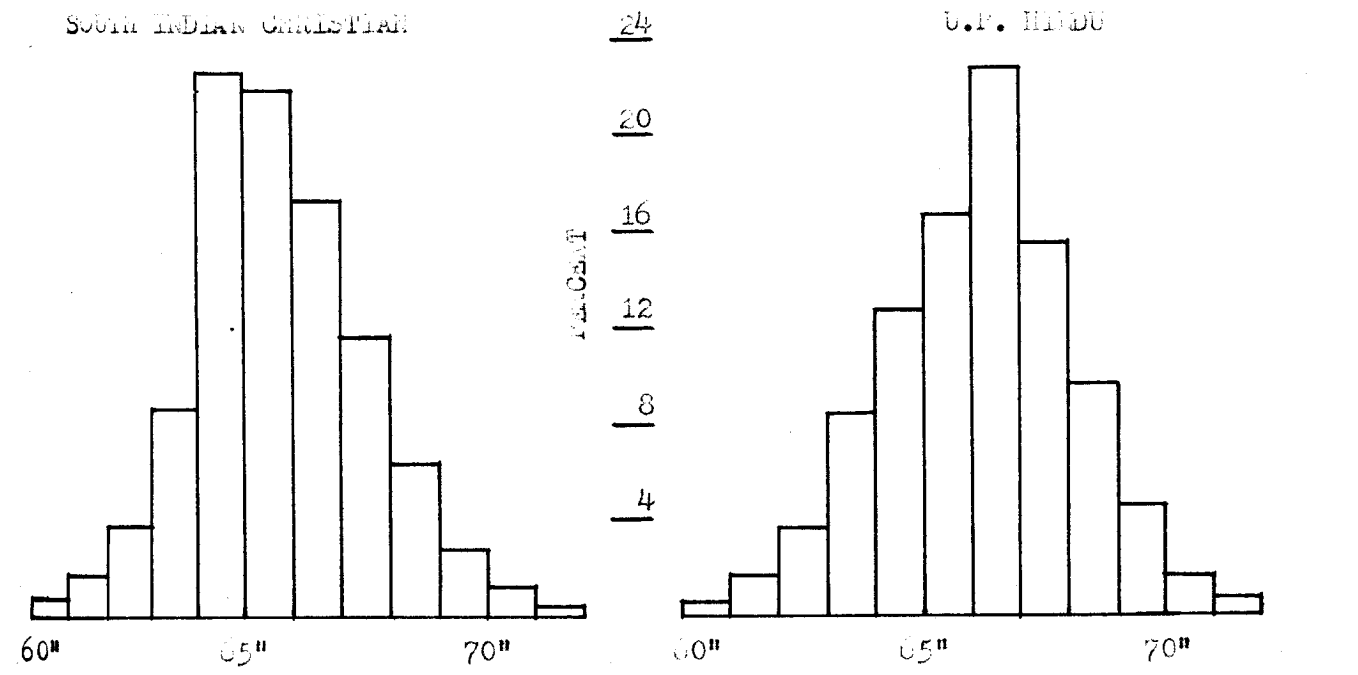


Chart 2.8. Distribution of stature of 4000 soldiers measured in 1951-52

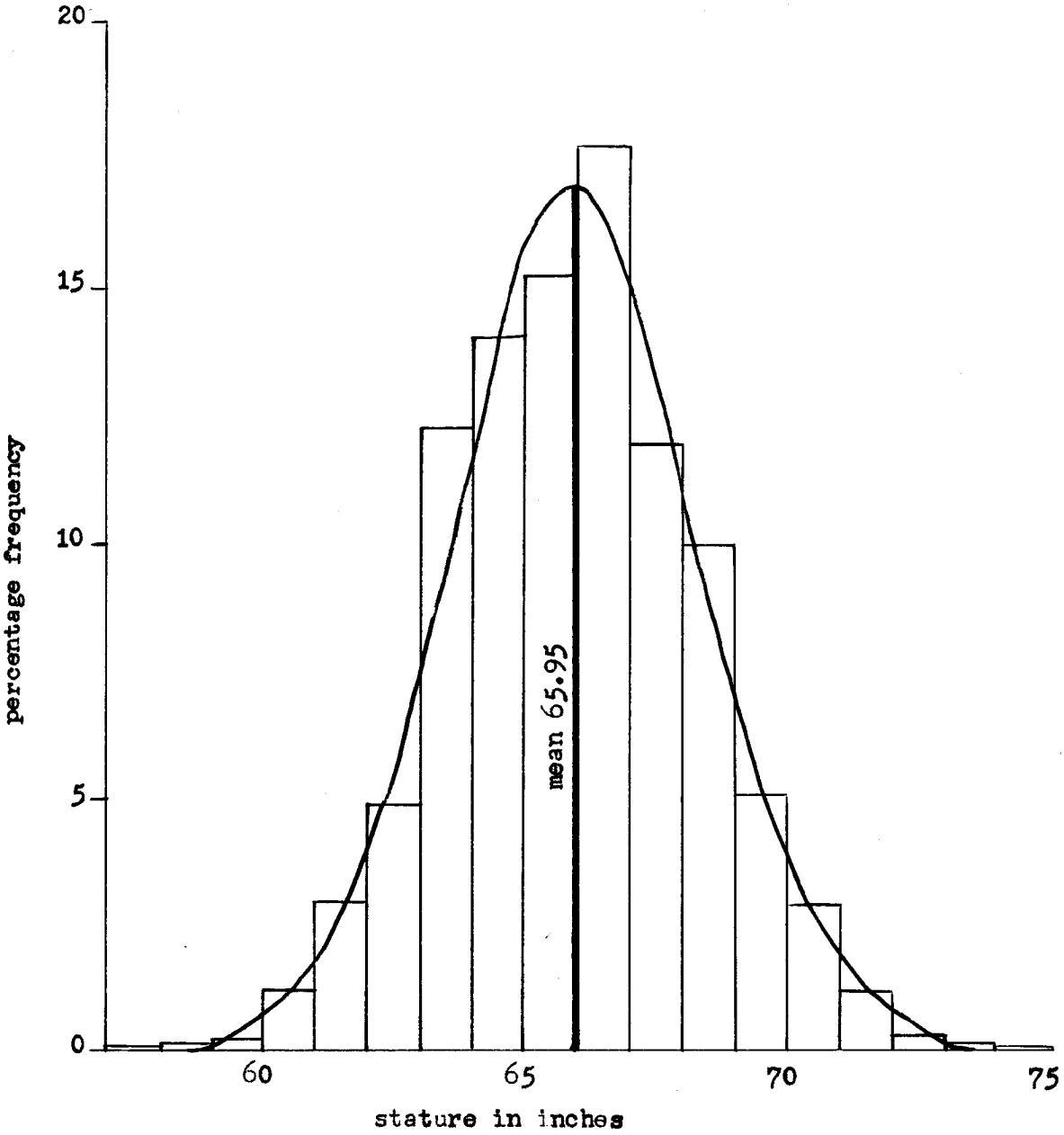


Chart 2.9. Distribution of stature of 91,161 British men aged 20.

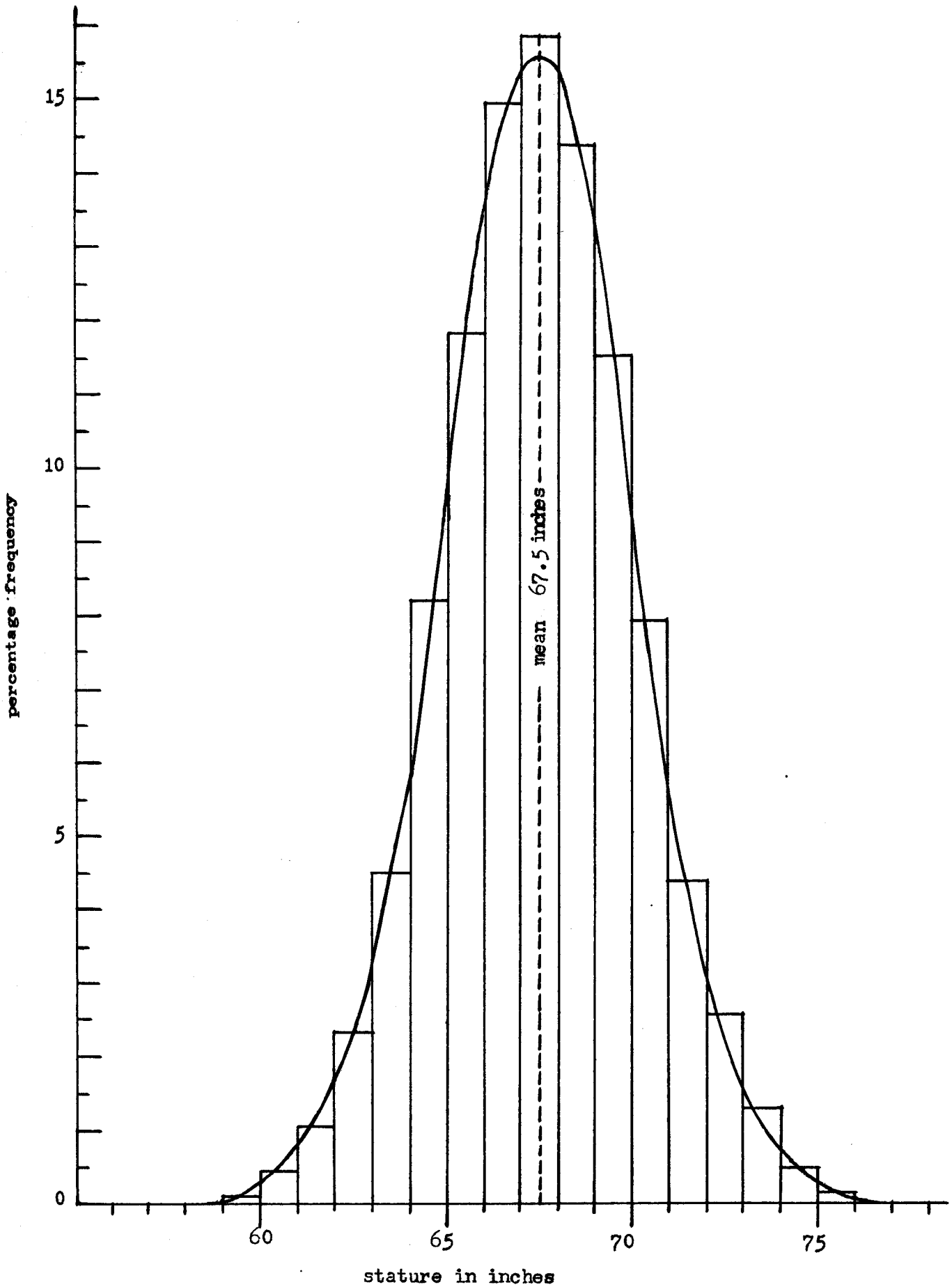


Chart 2.10 Fractile graph for testing normality of distribution
(Sikh (M&R); age group 17; n = 620; g_1 = 0.79**; g_2 = 3.92**)

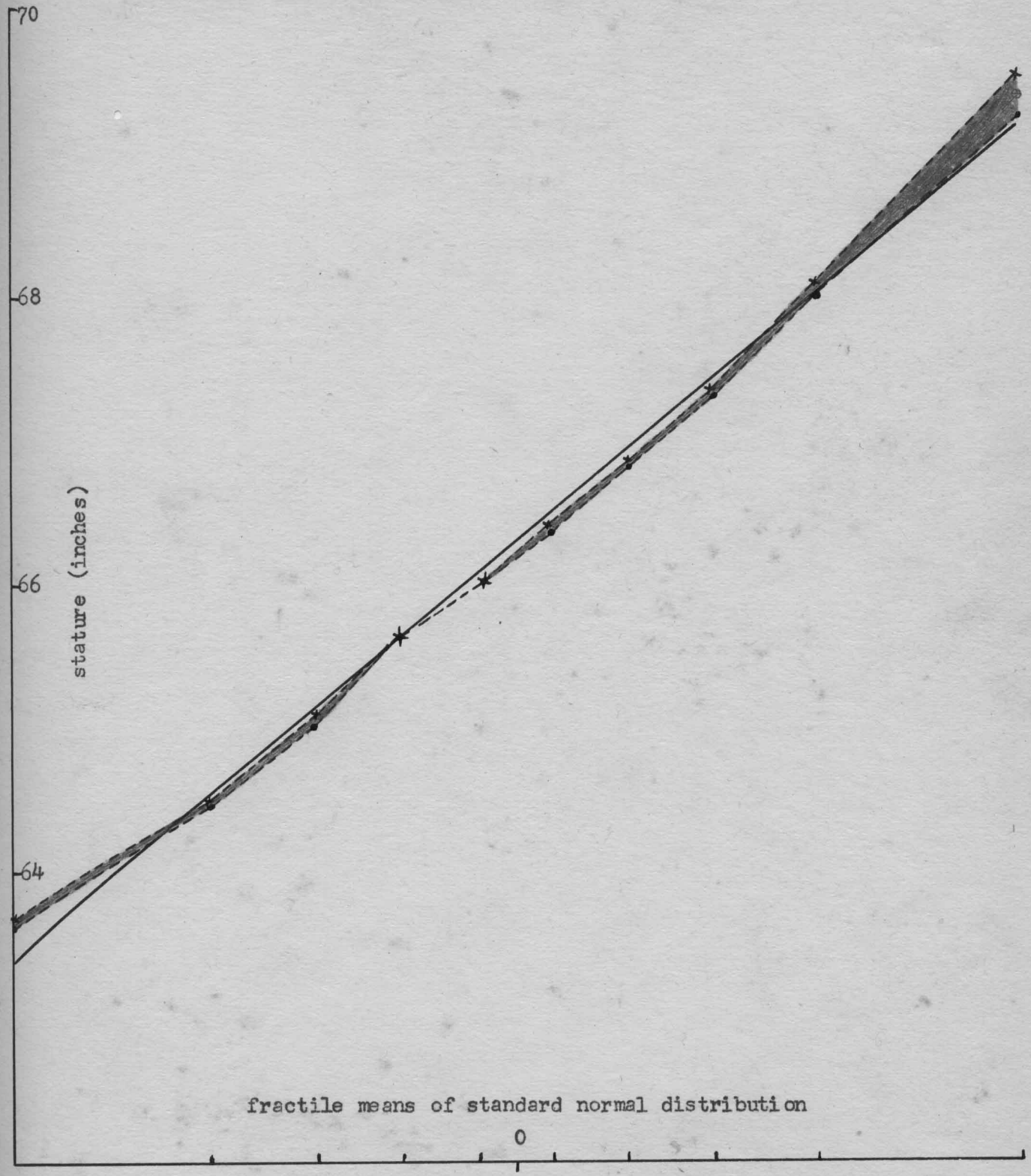


Chart 2.11 Fractile graph for testing normality of distribution

(Sikh (M&R); age group 19; n = 665; $g_1 = 0.37^{**}$; $g_2 = 0.05$)

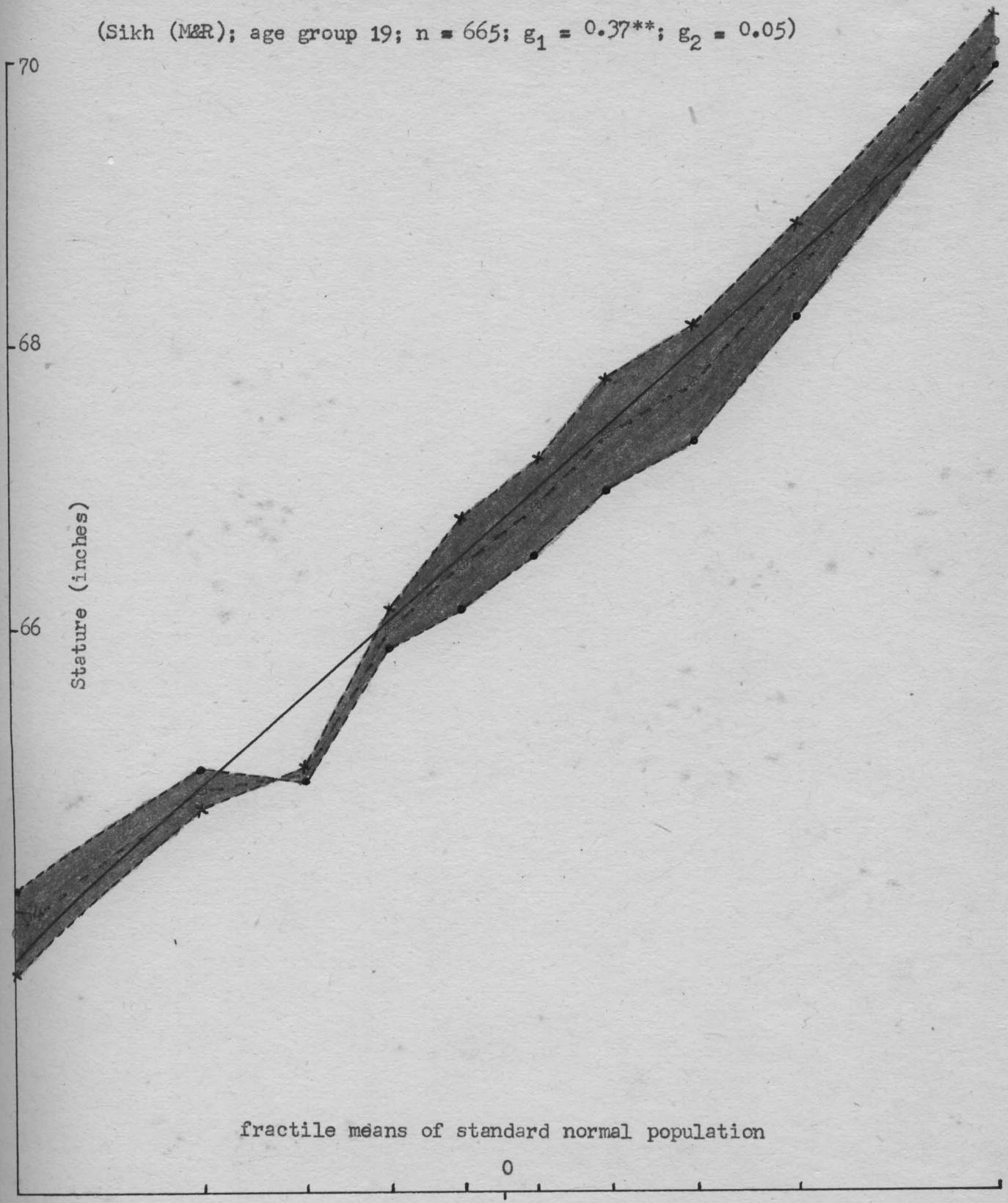


Chart 2.12 Fractile graph for testing normality of distribution

(Sikh (M&R); age group 22; n = 530; g_1 = 0.05; g_2 = 0.87**)

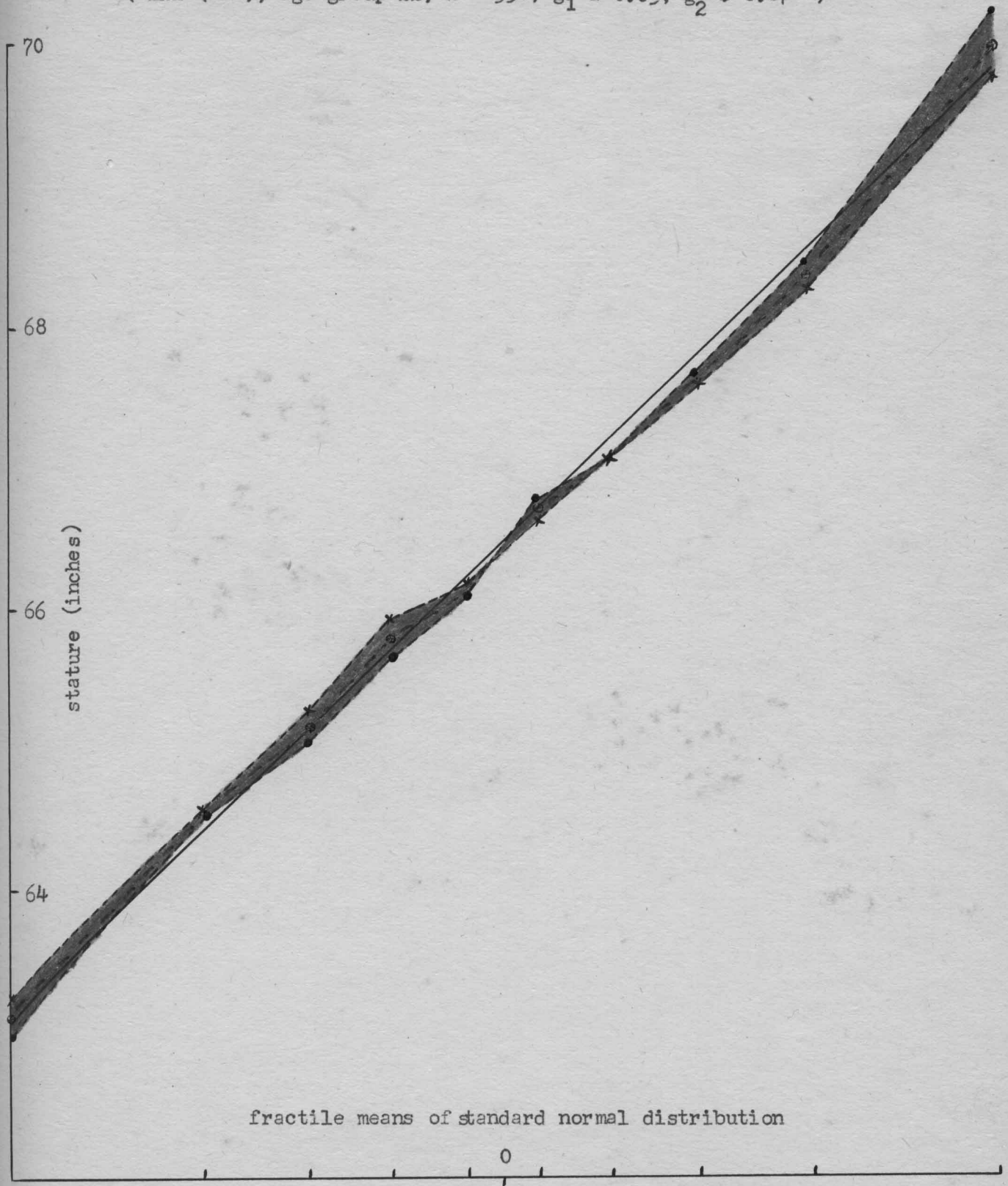
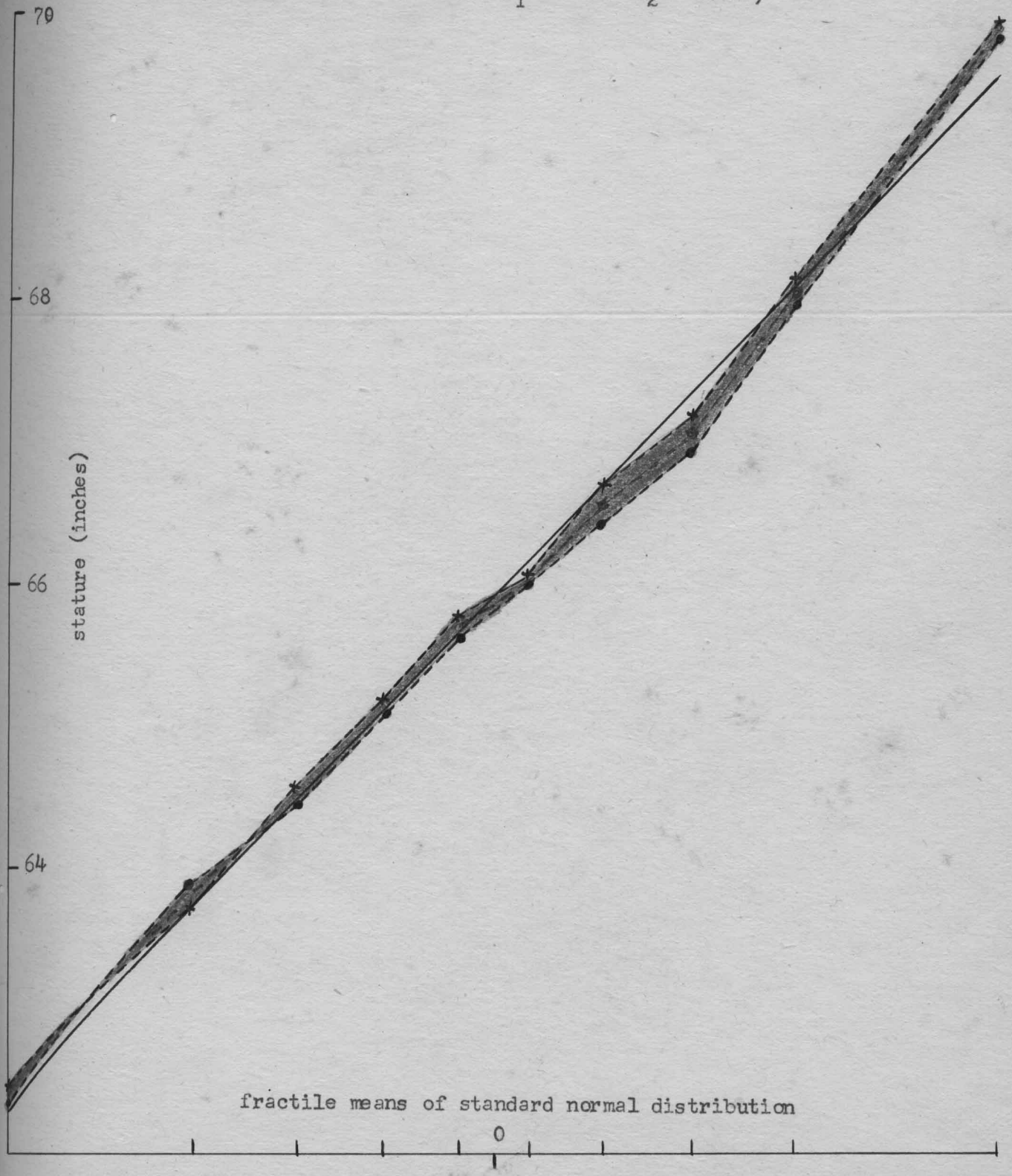


Chart 2.13 Fractile graph for testing normality of distribution

(Sikh (M&R); age 24-25; n = 473; g_1 = 0.19; g_2 = 0.02)



CHAPTER III. THE EFFECT OF RECRUITMENT STANDARDS

3.1. Partial truncation of frequencies

It can be seen from the frequency distributions and histograms for the different communities given in Chapter II that the standards of minimum stature prescribed for recruits into the army has had some effect in 'truncating' a portion of the frequencies in the lower values of stature. As the standards are observed only for combatants and as our data include also non-combatants and rejected candidates the truncation is only partial. The recruitment standards vary among communities from 66" for Jats and other tall statured groups to 60" for Assamese and Gorkhas. The standards for the different communities are shown in col 2 of Table 3.1.

As a certain proportion of the population who do not come up to the standard stature are excluded the likely effect is to increase the apparent mean values and reduce the standard deviations. We have reconstructed the means and standard deviations of the original untruncated populations using the formulae provided by R.A. Fisher (1951). The observed and estimated mean values are given in Table 3.1 cols 5 and 6 respectively and the difference between these in col 7. There is no evidence of exaggeration in the apparent mean stature in the low statured communities like Garhwali, Assamese and Gorkha presumably because the point of truncation representing the standard minimum stature is well below the mean of the community. The difference is small and negative also for Bihari Hindu and negative though not negligible for U.P. Hindu. The maximum difference (1".26) is for Ahir. For the remaining communities the difference ranges between 0".05 and 0".90.

Table 3.1 Showing the observed means and standard deviations and also those estimated after eliminating the effect of truncation.

community	standard stature	number all	number above standard	mean stature (in) obsvd.	mean stature (in) estd.	mean stature (in) diff (5-6)	standard deviation obsvd.	standard deviation estd.	standard deviation diff (8-9)
1	2	3	4	5	6	7	8	9	10
Jat	66.00	8001	4527	67.19	66.35	0.84	1.84	2.32	-0.48
Sikh (Other)	66.00	10399	8104	67.04	66.22	0.82	2.01	2.45	-0.44
Gujar	66.00	1215	946	66.91	66.32	0.59	1.78	2.12	-0.34
Ahir	66.00	6263	4698	66.83	65.57	1.26	1.96	2.55	-0.59
Rajput	66.00	8150	5745	66.59	66.06	0.53	1.93	2.19	-0.26
Sikh (M & R)	64.00	5558	5181	66.38	65.97	0.41	1.92	1.76	0.16
Punjabi Hindu	64.00	7990	6904	66.00	65.88	0.12	2.03	1.64	0.39
U.P. Hindu	64.00	7892	6728	65.90	66.28	-0.38	2.02	1.92	0.10
Bengali Hindu	64.00	5244	4560	65.85	65.80	0.05	1.99	2.20	-0.21
J & K Hindu	64.00	5067	4337	65.77	65.72	0.05	1.98	2.14	-0.16
Bihari Hindu	64.00	7122	5932	65.71	65.72	-0.01	2.13	2.30	-0.17
Andhra Hindu	64.00	1163	1025	65.70	65.28	0.42	1.87	2.24	-0.37
Tamil Hindu	64.00	7615	6587	65.60	65.15	0.45	1.85	2.22	-0.37
Malayali Hindu	64.00	7822	6656	65.45	64.99	0.46	1.84	2.21	-0.37
Kumaoni	63.00	6506	6139	65.42	65.28	0.14	1.87	2.13	-0.26
S.I. Christian	64.00	7256	6155	65.42	64.95	0.47	1.85	2.21	-0.36
M.P. Hindu	64.00	957	766	65.41	64.51	0.90	2.05	2.67	-0.62
Dogra	64.00	8306	6763	65.25	64.65	0.60	1.91	2.32	-0.41
Maratha	64.00	7547	5776	65.02	64.35	0.67	1.93	2.35	-0.42
Mahar	64.00	6265	4432	64.75	64.05	0.70	1.88	2.30	-0.42
Adibasi	62.00	2337	2257	64.52	64.34	0.18	1.81	2.13	-0.32
Garhwali	61.00	6968	6840	64.49	64.53	-0.04	1.98	2.14	-0.16
Assamese	60.00	4563	4558	64.39	64.54	-0.15	2.04	2.16	-0.12
Gorkha	60.00	5295	5223	63.26	63.29	-0.03	1.92	2.12	-0.20

The apparent standard deviations are (with three exceptions) smaller than the estimates corrected for truncation. This is what one should expect as the effect of truncation is to increase the concentration of values in a part of the range.

The corrections for truncation in mean stature are not negligible in some cases when compared to the differences due to communities, age groups, geographical regions, and to secular trend with which we shall be concerned in later chapters. To correct all the mean values involved in our comparisons, for the effect of truncation, will not be easy and will be of doubtful value.

3.2. Effect on communal comparisons

It is reasonable to expect that comparisons in which the communal contributions are more or less equalised will not be seriously vitiated by truncation. Comparisons among communities stand on a different footing. As a test check we have carried out a corrected comparison of the differences among three communities, namely, Jat, Sikh (Other), and Gujar which are the three tallest communities and which have the same minimum standard. The formulae used are set forth in Appendix 3A. In this case X^2 for testing the significance of differences among the three mean values of stature comes out as 191.7 which for two degrees of freedom is highly significant. Thus we see that the differences among communities may not be attributable solely to varying amounts of correction for truncation.

3.3. Effect on comparisons over time

A similar test was carried out for secular trend within the community Jat and also within the community Sikh (Other). The values of X^2 were 9.8 and 3.1 respectively. The degrees of freedom in either case was 7, there being eight

years of recruitment. From this it would appear that the differences in mean stature from year to year are not large enough for statistical significance.

3.4. Analysis of variance

A different approach to the same problem would be to carry out an analysis of variance between and within years of recruitment after omitting for each year all measurements below the point of truncation. This was done for the combined data for Jat and Ahir which have beteween them 11.339 measurements above 66". Table 3.2 shows the frequency distribution of these measurements in different years and Table 3.3 gives the analysis of variance.

Table 3.2 Distribution of stature of Jat and Ahir above 66"

stature in inches	year of recruitment								total
	1948	1949	1950	1951	1952	1953	1954	1955	
66	492	501	486	499	454	439	475	435	3781
67	378	393	390	347	383	388	345	351	2975
68	259	317	250	233	260	230	252	286	2087
69	169	197	205	151	176	173	148	148	1367
70	77	96	99	81	77	97	78	78	683
71	36	49	41	35	31	38	45	42	317
72	1	10	24	8	10	16	5	13	87
73	5	3	6	3	2	6	-	4	29
74	1	-	2	3	-	1	1	-	8
75	-	1	-	-	2	-	-	-	3
78	-	-	-	-	-	-	-	1	1
80	-	-	-	1	-	-	-	-	1
total	1418	1567	1503	1361	1395	1388	1349	1358	11.339
mean	67.37	67.49	67.54	67.38	67.42	67.51	67.39	67.48	67.45

Table 3.3 Analysis of variance of data in Table 3.1

source of variation	df	ss	ms	F
regression	1	.208	.208	0.10
deviations	6	42.455	7.076	3.37**
between years	7	42.663	6.095	2.91**
within years	11331	23775.391	2.098	
total	11338	23818.054		

regression coefficient = .0019

** significant at 1% level

It is evident from the analysis that though the between year variance is significant there is no evidence of a secular trend. This result contradicts some of the findings in Chapter VIII where a definite secular trend is observed. One interesting possibility is that the trend may be confined to the measurements below 66" which we have left out from the above analysis. In Tables 3.4 and 3.5 we have repeated the same analysis for measurements below 66". It can be seen that in this case the secular trend as represented by the linear regression is highly significant.

This shows that the increase in stature from year to year is not due to a uniform gain in stature by all members of the population but to gain by the shorter individuals. In other words low statured individuals become relatively less frequent as the years go by. This should result incidentally in a lowering of the standard deviation from year to year. Such a result has in fact been observed and will be reported in Chapter X.

We therefore conclude that the partial truncation due to recruitment standards has not vitiated our findings.

Table 3.4 Distribution of stature of Jat and Ahir below 66"

stature in inches	year of recruitment								total
	1948	1949	1950	1951	1952	1953	1954	1955	
57	-	-	1	-	-	-	-	-	1
59	-	-	-	-	-	-	-	3	3
60	8	6	4	2	9	2	2	4	37
61	22	13	7	5	2	5	7	8	69
62	47	23	15	16	9	10	17	14	151
63	90	47	41	57	26	20	49	41	371
64	149	106	100	126	73	46	97	63	760
65	229	142	214	273	233	169	139	134	1533
total	545	337	382	479	352	252	311	267	2925
mean	64.40	64.46	64.76	64.84	64.92	64.92	64.59	64.54	64.67

Table 3.5 Analysis of variance of data in Table 3.4

source of variation	df	ss	ms	F
regression	1	19.409	19.409	15.51***
deviations	6	95.037	15.839	12.66***
between years	7	114.446	16.349	13.08***
within years	2917	3650.797	1.252	
total	2924	3765.243		

regression coefficient = .0359

*** significant at 0.1% level.

CHAPTER IV. DIFFERENCE IN STATURE BETWEEN ACCEPTED AND REJECTED CANDIDATES

In selecting our sample no distinction was made between accepted and rejected candidates for recruitment. Entries relating to these two categories occurred in the rough rolls mixed up probably in the order in which they came up before the Recruiting Officer. We merely extracted data relating to the required number of individuals from each of the communities starting from the first entry and rejecting cases, if any, only after the quota of 100 for a community was filled up. It is thus quite legitimate to regard our data as a representative from the population from which individuals offer themselves for recruitment. We have already remarked that this population will not necessarily be representative of the general population of India. It may not be representative of the general population of soldiers either. Our conclusions apply strictly only to the restricted population from which recruits come. If this is kept in view we need not for the main purpose of the present study be concerned with the possible difference between accepted recruits on the one hand and rejected candidates for recruitment on theother.

However, as a possible source of heterogeneity in our data, this difference is of some interest. We have examined it separately for the nine states from which we have more than 5,000 individuals in our sample and for all the remaining states lumped together. In Table 4.1 (Appendix 4A) we give for each state the frequency distribution of stature separately for accepted and rejected individuals and also the corresponding percentage distributions. To test whether these distributions are similar values of X^2 were calculated and are presented in Table 4.2 together with the average stature of the accepted and rejected.

Table 4.2 Comparison of accepted and rejected candidates

state	number		mean stature				X^2
	accepted	rejected	acc.	rej.	diff	df	value
1	2	3	4	5	6	7	8
Bihar	4469	4203	65.40	65.64	-0.24	11	45.08
Bombay	4372	7996	65.06	64.82	0.24	10	53.65
J & K	3224	1399	65.88	65.53	0.35	12	58.28
Kerala	7504	2393	65.54	65.39	0.15	11	24.25
Madras	7110	3386	65.56	65.46	0.10	12	53.08
Punjab	18834	11683	66.51	66.46	0.05	12	14.97
Rajasthan	3202	2338	66.99	66.81	0.18	13	22.30
U.P.	13888	11605	65.62	65.65	-0.03	14	37.90
West Bengal	3409	1348	65.59	65.95	-0.36	11	36.88
Other states	8920	5853	64.63	64.87	-0.24	13	91.63
total	74932	52204	65.73	65.65	0.08	15	106.60

In Bihar and West Bengal the average stature of accepted candidates is considerably lower than that of the rejected, possibly because of a greater readiness to accept some of the short statured classes like Gorkhas and hill tribes rather than the plains men. The value of X^2 is highly significant for both these states and the pattern of positive and negative signs in column 6 of Table 4.1 is also indicative of the comparative deficiency of tall mean in the accepted group. In Punjab and U.P. there appears to be hardly any difference between the accepted group and the rejected group. It is only in Bombay, Jammu and Kashmir, Kerala, Madras and Rajasthan that the accepted are somwhat taller than the rejected. In the composite group of other states the accepted have a lower average stature of 64".63 compared to 64".87 for the rejected. When all states are put together

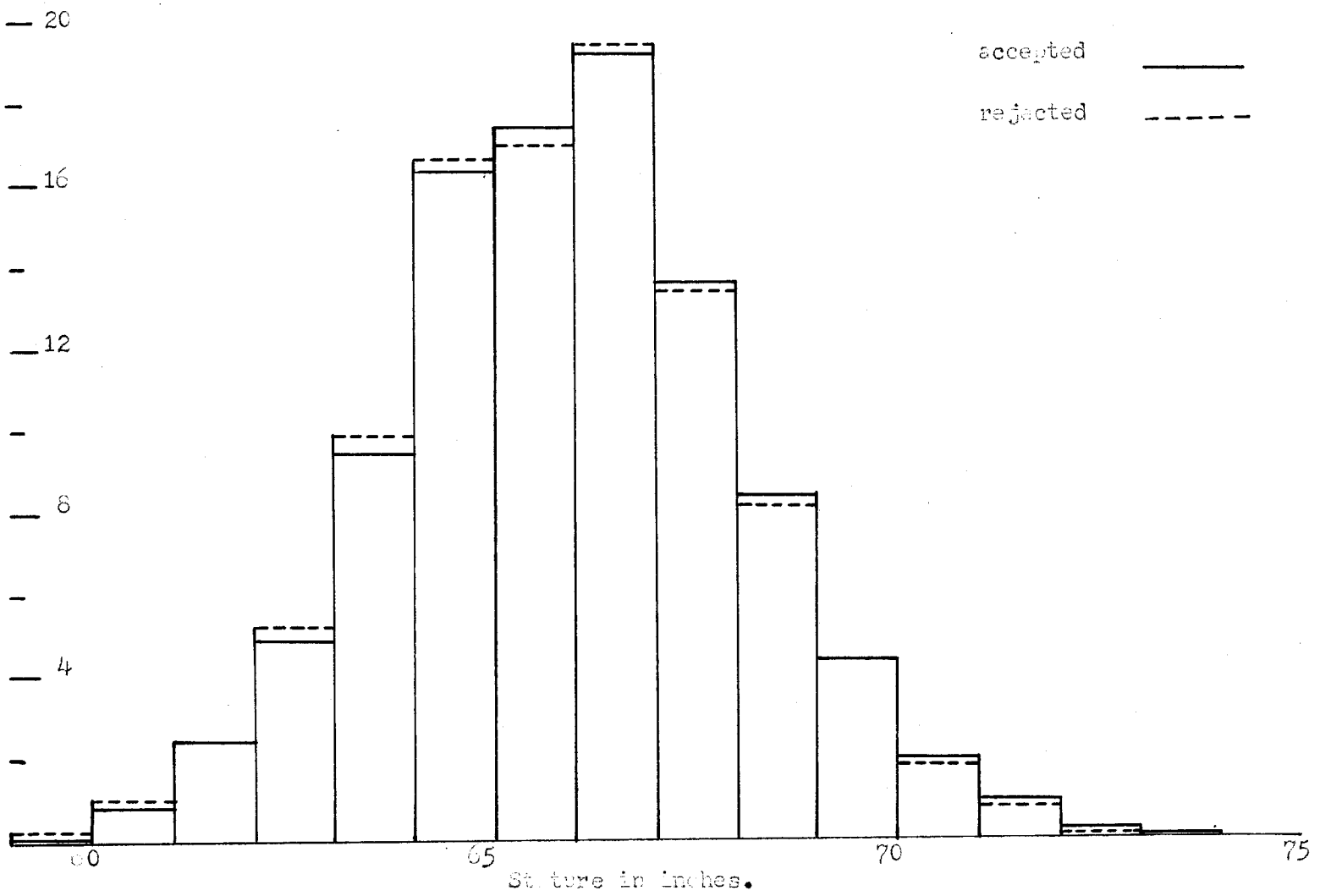
we get an average of 65".73 for the accepted and 65".65 for the rejected. The difference is statistically significant, but is extremely small in magnitude. For all states together the histograms of the distribution of stature for accepted and rejected are shown in Chart 4.1 and the corresponding frequency distributions are in Table 4.3.

In further analysis we shall not distinguish between accepted recruits, rejected candidates, and those for whom acceptance or rejection was not recorded.

Table 4.3 Distribution of stature of accepted and rejected candidates - all states.

stature	number		percentage		difference
	accepted	rejected	accepted	rejected	a - r
1	2	3	4	5	6
Upto 59.9	53	118	0.1	0.2	-0.1
60.0-	624	521	0.8	1.0	-0.2
61.0-	1805	1269	2.4	2.4	-0.0
62.0-	3614	2741	4.8	5.3	-0.5
63.0-	7023	5035	9.4	9.6	-0.2
64.0-	12204	8697	16.3	16.7	-0.4
65.0-	13114	8762	17.5	16.8	0.7
66.0-	14270	10097	19.0	19.3	-0.3
67.0-	10181	6872	13.6	13.2	0.4
68.0-	6289	4261	8.4	8.2	0.2
69.0-	3308	2263	4.4	4.3	0.1
70.0-	1526	987	2.0	1.9	0.1
71.0-	661	412	0.9	0.8	0.1
72.0-	188	113	0.3	0.2	0.1
73.0-	51	37	0.1	0.1	-0.0
74.0-	21	19	0.0	0.0	-0.0
total	74932	52204	100.0	100.0	

Chart 4.1 Distribution of stature of accepted and rejected candidates



CHAPTER V. VARIATIONS DUE TO AGE

5.1. Significant differences in stature

Our data covers age groups from 17 to 35. It was thought at first that stature during this period of life would be more or less constant, so that other comparisons such as those among communities, and among districts would be free from the effect of variations due to age. However, it was decided to test this assumption; for this purpose analysis of variance between age groups was carried out for the data from one state. The results showed a significant component of variation associated with age groups and the significance persisted even in individual communities within the state. The analysis was therefore carried out for all the states from which we have 5,000 recruits or more. The results are summarised in Table 5.1.

Table 5.1 Analysis of variance of stature between and within age group for different states.

state	df			ss			ms		F
	B	W	T	B	W	T	B	W	
1	2	3	4	5	6	7	8	9	10
Bihar	9	9789	9798	1931.29	42252.87	44184.16	214.54	4.32	49.67***
Bombay	9	13145	13154	1014.23	47545.30	48559.53	112.69	3.62	31.13***
J & K	9	5674	5683	264.67	22079.28	22343.95	29.41	3.89	7.56***
Kerala	9	11124	11133	1482.89	37137.02	38619.91	164.77	3.34	49.33***
Madras	9	11164	11173	1097.73	37624.03	38771.76	121.97	3.37	36.19***
Punjab	9	38461	38470	1428.42	168229.37	109657.79	158.71	4.37	36.32***
Rajasthan	9	6780	6789	328.97	25288.34	25617.31	36.55	3.73	9.80***
U.P.	9	28298	28307	2148.67	122672.95	124821.62	238.74	4.34	55.01***
West Bengal	9	5341	5350	354.66	21784.30	22138.96	39.41	4.08	9.66***
Other states	9	17190	17199	3764.86	82425.69	86190.55	418.32	4.79	87.24***
total	9	147056	147065	7531.14	679164.65	686695.79	836.79	4.62	181.20***

(In Table 5.1 and other similar tables the following abbreviations and signs are used: df, degrees of freedom; ss, sum of squares; ms, mean square; B, between groups; W, within groups; T, total; F, ratio of mean squares; *, significant at 5% level; **, significant at 1% level; ***, significant at 0.1% level.)

It can be seen from Table 5.1 that in all the nine states considered the variation in stature between age groups is highly significant. This significance is evident also (see Table 5.2 in Appendix 5A) in most of the individual communities within the states. The exceptions are Rajputs of Bihar for whom the age group variation is significant only at 5% level, Dogras and Sikh (Others) of Jammu and Kashmir, Ahirs and Gujars of Punjab and Gorkhas of West Bengal. In these exceptions the total numbers are comparatively small except for Ahirs of Punjab.

5.2. Decline after age 23

Mean values of stature in each state and for all India separately for each age group are given in Table 5.3 and represented graphically in Chart 5.1. It is evident that at the age of 17 the subjects are still in the growing period which continues to some stage between the age 19 and 23. This is followed by a short period during which stature remains stationary in most cases. As age advances further there is a decline in stature which continues in most states into later age groups. In West Bengal and Bihar the decline begins at the age of 19. In Rajasthan, Punjab and Jammu and Kashmir there is no continued decline noticeable after the age group 24-25. In Bihar there is a steady decline from the age group 19 onwards. In the other states varying patterns of downward trend are indicated.

Table 5.3 Mean values of stature in different age groups

state	age groups										total
	17	18	19	20	21	22	23	24-25	26-30	31-35	
	number in the sample										
Bihar	613	1101	1030	1157	1024	1122	1000	1027	1033	692	9799
Bombay	972	1464	1514	1568	1355	1362	1239	1268	1335	1078	13155
J & K	464	813	742	745	483	526	421	600	615	275	5684
Kerala	790	1115	1182	1283	1280	1229	1137	1207	1025	886	11134
Madras	1012	1135	1090	1138	1080	1061	1159	1170	1208	1121	11174
Punjab	3244	5451	4509	4505	3783	3599	3073	3612	4050	2645	38471
Rajasthan	475	875	664	750	720	666	707	737	659	537	6790
U.P.	2413	3287	3040	3256	2999	2898	2518	2788	2863	2246	28308
West Bengal	442	577	633	646	647	570	504	531	481	320	5351
Other states	1720	2660	2527	2381	1809	1687	1171	1307	1292	646	17200
total	12145	18478	16931	17429	15180	14720	12929	14247	14561	10446	147066
	mean value of stature										
Bihar	65.56	65.82	65.95	65.87	65.82	65.63	65.26	65.20	64.78	64.53	65.48
Bombay	64.11	64.76	65.04	65.01	65.16	65.15	65.18	65.02	64.86	64.70	64.93
J & K	65.23	65.73	65.92	65.98	65.94	65.91	65.86	65.82	65.50	65.87	65.78
Kerala	64.37	65.69	65.69	65.79	65.63	65.69	65.69	65.41	65.20	65.22	65.49
Madras	64.86	65.59	65.91	65.85	65.73	65.72	65.76	65.39	65.17	65.33	65.53
Punjab	66.20	66.50	66.69	66.66	66.65	66.53	66.45	66.19	66.20	66.29	66.46
Rajasthan	66.30	66.74	66.98	66.96	67.17	67.05	67.15	66.77	66.79	66.85	66.89
U.P.	65.24	65.40	65.75	65.92	65.89	65.94	65.92	65.70	65.27	65.30	65.65
West Bengal	65.38	65.93	66.10	65.96	65.79	65.75	65.80	65.71	65.26	65.35	65.74
Other states	63.56	63.95	64.34	64.69	64.85	65.07	64.94	64.89	64.71	64.71	64.46
total	65.14	65.62	65.81	65.89	65.91	65.89	65.86	65.66	65.47	65.49	65.69

5.3. Figures from Britain and Canada

Though it is well-known to those who are familiar with work in this field that human stature decreases after attaining its maximum in adult individuals and that the stature at age fifty is at least one inch less than that at age thirty, it is likely that some others will look upon this finding with a measure of sceptic-ism. We therefore quote below some results of previous work on the changes in stature with increasing age. Table 5.4 gives figures from Kemsley (1950) and relates to a section of workers in England surveyed in 1943.

Table 5.4 Age and stature in England 1943.

age	number of men	average stature in inches
1	2	3
17.5	1,280	66.31
18.5	786	66.74
19.5	591	66.94
20.5	467	66.92
21.5	460	67.34
22.5	477	67.04
23.5	368	66.83
24.5-29.5	1,962	66.76
29.5-34.5	3,139	66.73
34.5-39.5	3,414	66.64
39.5-44.5	3,557	66.09
44.5-49.5	2,528	65.89
49.5-54.5	2,123	65.69
54.5-59.5	1,246	65.55
59.5-64.5	625	65.07
64.5-69.5	193	64.67
69.5-74.5	42	64.64
74.5 and over	12	63.83

The decline in stature in Table 5.4 starts after the age group 21-22 which is quite consistent with what we have observed for India.

In an earlier publication by Cathcart and others (1935) based on a survey of some 13,600 males aged 14 years and upwards from different places and social groups in England and Scotland, data on stature and other measurements is given for different ages. It is found that in all the groups stature attains a maximum round about the age 23 and then starts decreasing. The graphs of stature very closely resemble those given in Chart 5.1.

Pett and Ogilvie (1956) give results from a random sample survey of Canadians conducted after the population census of 1951. We have extracted in Table 5.5 figures for the age groups from 16-17 to 65 and over. The entire sample consisted of 22,000 persons but the authors do not state the numbers of men in individual age groups.

Table 5.5 Age and stature in Canada 1951.

age	average stature in inches
1	2
16-17	66.7
18-19	68.0
20-24	67.9
25-29	68.3
30-34	68.0
35-44	67.5
45-54	66.9
55-64	66.0
65 and over	65.4

Ruger and Stoessiger (1927) in their analysis of data on 7,000 men collected by Galton in (1884) present 'smoothed values of stature' which remain constant at

67".62 from age 21.5 to age 62.5 and then gradually declines to 66".20 at age 79.5. Perhaps those who visited Galton's "first anthropometric laboratory" where the data was collected belonged to a social stratum in which the decline in stature is not very marked, or the decline itself may be a phenomenon of recent origin. In India part of the decline is accountable as due to the indirect effect of secular trend which we shall discuss in Chapter VIII.

5.4. Reasons for decline in stature

Morant (1950) after a full inquiry into this subject has stated: "The normal situation is that the age curve for height for any community at a particular time shows a rise to a maximum somewhere between 18 and 30 years of age, followed immediately by a gradual decline which continues at a constant rate to the end of the age range. The rate of decline in adult years - of the order of 1 inch for 22 years of age - can be supposed the same for the British series of all periods. The decline following the attainment of skeletal maturity can be attributed to a normal shrinkage of the length of the body with advancing age. It is probably due principally to shrinkage of the intervertebral discs, but it may also be due partly to changes in joints and muscles affecting the erect posture. An attractive hypothesis explaining the decline as due to a secular change in the population - older men being shorter because they were born earlier - is not acceptable in view of all the evidence. The hypothesis that the decline may be due wholly or partly to a selective death-rate - taller men being supposed to be more prone to die at younger ages - is also unacceptable".

Morant's rejection of secular change as an explanation for the shorter stature of older men must perhaps be based on his finding that the stature of adult British men has remained unchanged during the last hundred years. In India

as we shall see later there is good evidence of a secular change taking place in recent years.

Whatever may be the reason for the change of stature with age our primary concern in the present study is to note the existence of significant change. We have to keep this fact in view in our further analysis and try to exclude the age effect from our comparisons.

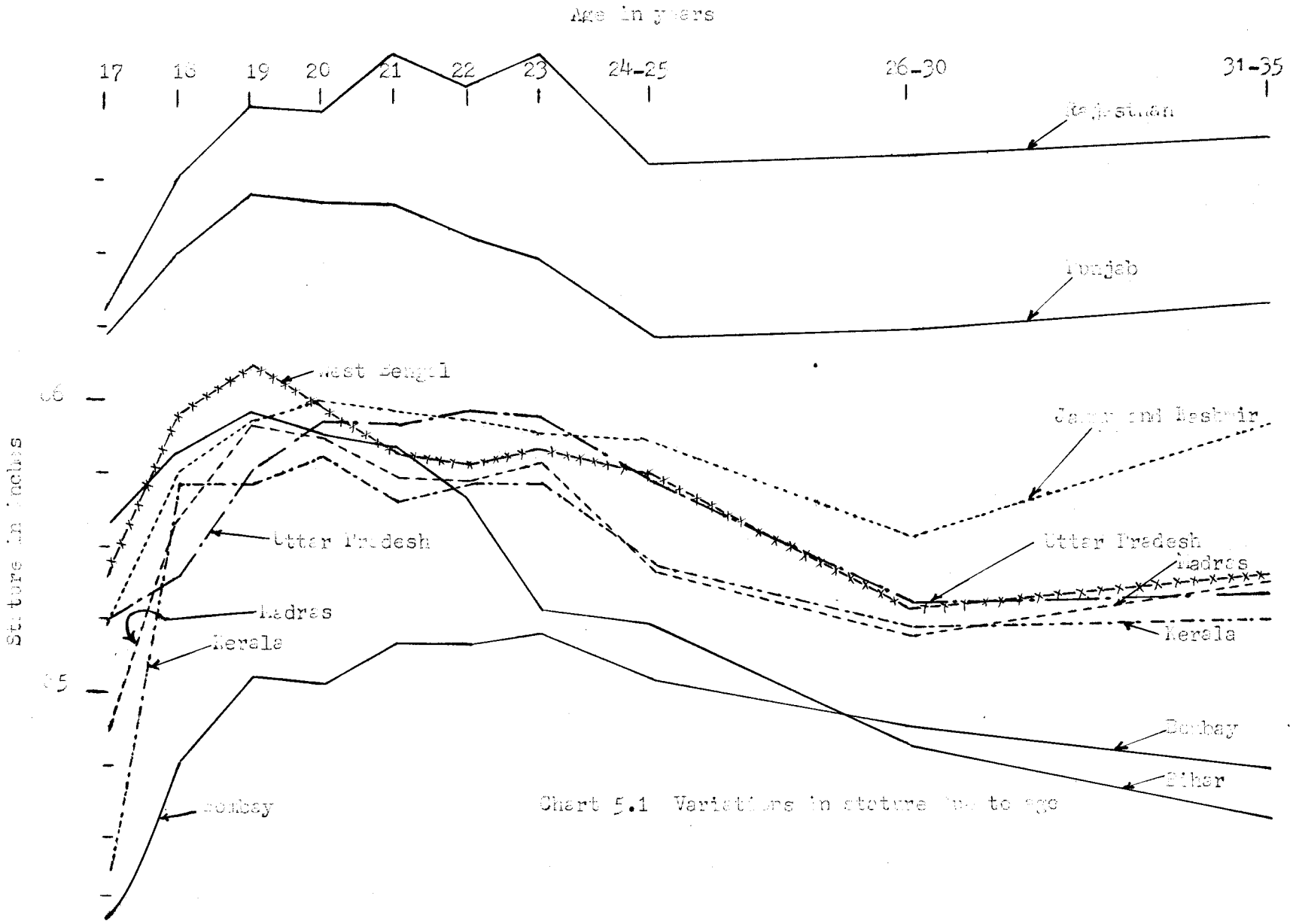


Chart 5.1 Variations in stature due to age

CHAPTER VI DIFFERENCES AMONG COMMUNITIES

6.1. Communities and states

Traditionally the Indian army conducted its recruitment on the basis of a number of 'classes'. This was necessary and convenient in view of the widely varying food habits, language, religion and social customs in different regions and groups. At first the recognised classes were more or less racial groups like Ahir, Jat and Rajput. In more recent times a number of territorial classes were added such as Assamese, Bihari and South Indian. Even though at present recruitment is open to all citizens, these classes are still distinguishable in the records. In extracting data from the rough rolls we have used the entries about classes to distinguish twenty-five groups which we call 'communities'. Most of these communities are also classes in the army but some are not. It can be seen from Table 6.1 giving the numbers we have from different states and communities that each community is concentrated in one or a few states. Hence the differences among communities will be partly or wholly attributable to states and vice versa. To a certain extent we have tried to separate these two sources of variation by analysing the communities within the major states.

The territorial communities of Andhra, Assamese, Bengali, Bihari Hindu, Jammu and Kashmir Hindu, Punjabi Hindu, and U.P. Hindu are mostly recruited from the respective states to which their names correspond. Tamil Hindu is from Madras. Madhya Pradesh Hindu comes from Bombay and from Madhya Pradesh which we have included under 'other states'. South Indian Christian is from Kerala and Madras forming linguistically and culturally two distinct groups. Malayali Hindu is from Kerala and is similar in many ways to South Indian Christian from Kerala.

Table 6.1 Number of recruits by communities and states

Sl No	community	states										total
		Bihar	Bombay	J&K	Kerala	Madras	Punjab	Rajasthan	U.P.	West Bengal	Others	
1	2	3	4	5	6	7	8	9	10		12	13
1	Adibasi	1908	29	-	-	-	-	2	-	1	397	2337
2	Ahir	495	34	-	-	-	2643	740	2211	-	140	6263
3	Andhra Hindu	-	4	-	2	30	-	-	2	-	1125	1163
4	Assamese	-	4	-	-	-	-	-	-	-	4559	4563
5	Bengali Hindu	47	5	-	-	-	-	2	104	5068	18	5244
6	Bihari Hindu	7100	1	-	1	-	-	-	9	11	-	7122
7	Dogra	-	2	366	-	-	7082	4	212	-	640	8306
8	Garhwali	-	1	-	-	-	-	-	6963	4	-	6968
9	Gorkha	5	6	2	-	-	28	1	62	258	4933	5295
10	Gujar	-	-	-	-	-	215	683	277	-	40	1215
11	Jat	-	6	6	-	-	4102	1252	2400	-	235	8001
12	J & K Hindu	2	-	5050	2	-	-	-	-	-	13	5067
13	Kumaoni	-	533	-	-	-	-	-	5960	-	13	6506
14	M.P. Hindu	1	328	-	-	-	-	1	-	-	627	957
15	Mahar	-	5381	-	-	-	-	1	20	-	863	6265
16	Malayali Hindu	2	1	1	7721	23	29	-	2	-	43	7822
17	Maratha	2	6605	-	2	1	-	1	49	1	886	7547
18	Punjabi Hindu	-	1	12	-	-	7837	54	9	2	75	7990
19	Rajput	193	139	1	2	-	823	4007	2388	-	597	8150
20	Sikh (M & R)	-	-	10	-	-	5527	2	7	-	12	5558
21	Sikh (Other)	2	4	236	1	1	10029	21	105	-	-	10399
22	S. I. Christian	1	1	-	3297	3522	-	-	2	-	433	7256
23	Tamil Hindu	-	5	-	64	7543	-	-	3	-	-	7615
24	U.P. Hindu	32	3	-	-	-	10	6	7497	4	340	7892
25	Other	9	62	-	42	54	146	13	26	2	1211	1565
26	total	9799	13155	5684	11134	11174	38471	6790	28308	5351	17200	147066

Table 6.2 Mean stature of recruits by communities and states

sl No.	community	states										total
		Bihar	Bombay	J & K	Kerala	Madras	Punjab	Rajasthan	U.P.	West Bengal	Others	
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Adibasi	64.53	65.10	-	-	-	-	67.15	-	65.50	64.41	64.52
2	Ahir	65.31	64.93	-	-	-	67.29	67.52	66.49	-	65.70	66.83
3	Andhra Hindu	-	63.65	-	64.65	65.75	-	-	60.50	-	65.72	65.70
4	Assamese	-	65.88	-	-	-	-	-	-	-	64.39	64.39
5	Bengali Hindu	66.26	64.96	-	-	-	-	66.65	65.49	65.85	67.56	65.85
6	Bihari Hindu	65.71	68.50	-	65.00	-	-	-	66.72	65.57	-	65.71
7	Dogra	-	64.00	66.00	-	-	65.24	65.58	65.28	-	64.92	65.25
8	Garhwali	-	61.00	-	-	-	-	-	64.49	65.38	-	64.49
9	Gorkha	64.80	64.75	64.00	-	-	63.05	63.80	65.12	63.79	63.21	63.26
10	Gujar	-	-	-	-	-	67.15	66.97	66.66	-	66.33	66.91
11	Jat	-	67.27	66.18	-	-	67.36	67.16	67.01	-	66.24	67.19
12	J & K Hindu	64.00	-	65.77	66.75	-	-	-	-	-	65.74	65.77
13	Kumaoni	-	65.57	-	-	-	-	-	65.41	-	65.75	65.42
14	M.P. Hindu	66.50	65.16	-	-	-	-	68.00	-	-	65.53	65.41
15	Mahar	-	64.70	-	-	-	-	68.00	66.65	-	65.01	64.75
16	Malayali Hindu	65.80	64.00	64.00	65.48	65.35	66.30	-	65.50	-	64.24	65.45
17	Maratha	65.75	65.02	-	66.35	63.80	-	62.00	67.00	67.00	64.91	65.02
18	Punjabi Hindu	-	62.50	65.81	-	-	66.02	66.08	65.93	65.50	63.95	66.00
19	Rajput	66.44	65.43	66.30	64.75	-	66.53	66.70	66.53	-	66.50	66.59
20	Tamil Hindu	-	63.38	-	65.52	65.60	-	-	62.67	-	-	65.60
21	Sikh (M & R)	-	-	64.26	-	-	66.38	67.70	66.78	-	67.69	66.38
22	Sikh (Other)	66.75	67.65	65.81	66.00	68.00	67.08	66.69	66.44	-	-	67.04
23	S.I. Christian	64.50	68.00	-	65.51	65.38	-	-	67.65	-	65.05	65.42
24	U.P. Hindu	66.36	65.17	-	-	-	65.58	65.93	65.90	64.50	65.89	65.90
25	Other	65.25	65.97	-	65.59	64.90	66.90	65.29	68.56	65.50	65.06	65.33
26	total	65.48	64.93	65.78	65.49	65.53	66.46	66.89	65.65	65.74	64.46	65.69

The remaining communities, namely, Adibasi, Ahir, Dogra, Garhwali, Gorkha, Gujar, Jat, Kumaoni, Mahar, Maratha, Sikh (M & R) and Sikh (Other) may be considered to be racial groups. However each group may have several castes and sub-castes within it which are mutually nonintermarrying.

6.2. Photographs and descriptions

Photographs of typical soldiers from fifteen of the groups are given in Appendix 1A together with brief notes about racial origin and geographical spread and some other particulars about the groups.

6.3. Mean values of stature

Table 6.2 gives the mean values of stature for each community separately for the major states as well as for all states together, based on the numbers shown in the corresponding cells of Table 6.1.

There is a difference of nearly four inches in stature between the tallest community namely Jat (67".19) and Gurkha (63".26) which is the shortest. Between these two extremes the decline in stature is by small steps when the communities are arranged in descending order of stature. Chart 6.1 shows this gradation. The communities with above average stature are Jat (67".19), Sikh (Other) (67".04), Gujar (66".91), Ahir (66".83), Rajput (66".59), Sikh (M & R) (66".38), Punjabi Hindu (66".00), U.P. Hindu (65".90), Bengali Hindu (65".85), J & K Hindu (65".77), Bihari Hindu (65".71) and Andhra (65".70).

Continuing the series in descending order of stature we have the following communities below the average level :- Tamil (65".60), Malayali Hindu (65".45), South Indian Christian (65".42), Kumaoni (65".42), M.P. Hindu (65".41), Dogra (65".25), Maratha (65".02), Mahar (64".75), Adibasi (64".52) Garhwali (64".49), Assamese (64".39) and Gorkha (63".26).

6.4. Regression towards state mean

We can observe some interesting differences in stature among members of the same community belonging to different states. For many communities the stature in any state is low when the general average of that state is low and high when the general average of that state is high. In other words there is a 'regression' towards the state average in the sense in which Galton originally used the term regression. In Table 6.3 we have reproduced the average values in all cases where a community is represented in two or more states by more than 25 recruits. It will be seen that the above law of regression holds for Ahir, Malayali Hindu, Maratha, Punjabi Hindu, Rajput and Sikh (Other).

The case of 'South Indian Christian' which does not conform to this rule is easily explicable as this community in Kerala and Madras have nothing in common except their religion. These two groups were formed by conversion to christianity from among the respective local populations. The Christians of Madras are not the result of migration from Kerala nor vice versa. They are really two different communities with two different languages and cultures. Another exception is provided by the Kumaoni of Bombay, who is taller than the Kumaoni of U.P. This again is an artificial exception as there are really no genuine Kumaonis domiciled in Bombay. The recruits in this case probably belong to a group of plain dwellers who claim some connection with Kumaon.

For Bengali of U.P., Gujar of Punjab, Tamil Hindu of Kerala and U.P. Hindu of Bihar the numbers are small and the departures from the law of regression may be due to sampling error. Dogra and Jat of Punjab constitute important exceptions. For Gorkha the numbers are small in all states and

Table 6.3 Comparison of stature of communities in different states

community	state	number of recruits		mean value of stature	
		community in col 1	rest of state in col 2	community in col 1	rest of state in col 2
1	2	3	4	5	6
Ahir	Rajasthan	740	6050	67.52	66.81
	Punjab	2643	35828	67.29	66.40
	U.P.	2211	26097	66.49	65.58
	Bihar	495	9304	65.31	65.49
Bengali Hindu	Bihar	47	9752	66.26	65.48
	West Bengal	5068	283	65.85	63.77
	U.P.	104	28204	65.49	65.65
Dogra	J & K	366	5318	66.00	65.76
	U.P.	212	28096	65.28	65.65
	Punjab	7082	31389	65.24	66.74
Gorkha	U.P.	62	28246	65.12	65.65
	West Bengal	258	5093	63.79	65.84
	Punjab	28	38443	63.05	66.46
Gujar	Punjab	215	38256	67.15	66.46
	Rajasthan	683	6107	66.97	66.88
	U.P.	277	28031	66.66	65.64
Jat	Punjab	4102	34369	67.36	66.35
	Rajasthan	1252	5538	67.16	66.83
	U.P.	2400	25908	67.01	65.52

1	2	3	4	5	6
Kumaoni	Bombay	533	12622	65.57	64.90
	U.P.	5960	22348	65.41	65.71
Malayali Hindu	Punjab	29	38442	66.30	66.46
	Kerala	7721	3413	65.48	65.51
Maratha	U.P.	49	28259	67.00	65.65
	Bombay	6605	6550	65.02	64.84
Punjabi Hindu	Rajasthan	54	6736	66.08	66.90
	Punjab	7837	30634	66.02	66.57
Rajput	Rajasthan	4007	2783	66.70	67.16
	Punjab	823	37648	66.53	66.46
	U.P.	2388	25920	66.53	65.57
Sikh (Other)	Punjab	10029	28442	67.08	66.24
	J & K	236	5448	65.81	65.78
S. I. Christian	Kerala	3297	7837	65.51	65.48
	Madras	3522	7652	65.38	65.60
Tamil Hindu	Madras	7543	3631	65.60	65.38
	Kerala	64	11070	65.52	65.49
U.P. Hindu	Bihar	32	9767	66.36	65.48
	U.P.	7497	20811	65.90	65.56

it must be noted that the stature of Indian Gorkhas is greater than that of Nepalese Gorkhas which fact agrees with the law of regression.

It will be of interest to determine whether this law of regression towards the state mean is due to a tendency for a community transplanted into new surroundings to conform to gradually the stature of the local population, or merely to the fact that the state-wise sections of a community like, say, Ahir were recruited from the local populations. A similar phenomenon has been observed in other parts of the world also. For instance, Jews who migrated from Europe to America showed in their second generation an average stature nearer that of the average American than that of the average European. Morant and Samson (1936) draws attention to the findings of Boaz (1912) and Fishberg (1905) in connection with the direct effect of environment on stature and other anthropometric characters.

6.5. Analysis of variance between communities

If the law of regression does represent an anthropological reality then we must expect that if two or more communities live for a number of generations in the same environment they will tend to equality of stature. This is in fact what we observe in J & K, Kerala and Madras from Table 6.4 (Appendix 6A) which gives the results of analysis of variance of stature between and within communities in different age groups. In these states the communities have lived side by side for generations and acquired (or never departed from) common food habits. The variance between communities is not significant in Kerala and J&K. In Madras it is not significant in most of the age groups. On the other hand in Punjab, U.P., Bihar, and West Bengal some at least of the communities included in our study live in distinct and separate regions. They have probably not yet had time to evolve a common level of stature.

The variance ratios in individual age groups of Table 6.4 are classified in Table 6.5 according to the level of statistical significance.

Table 6.5 Number of variance ratios (between and within communities) at different levels of significance.

level of significance	Bihar	Bombay	J & K	Kerala	Madras	Punjab	Rajasthan	UP	West Bengal	total
1	2	3	4	5	6	7	8	9	10	11
5%	1	2	9	9	8	0	3	0	2	34
5%	0	2	0	1	0	0	0	0	0	3
1%	1	1	1	0	1	0	1	0	1	6
0.1%	8	5	0	0	1	10	6	10	7	47
total	10	10	10	10	10	10	10	10	10	90

Thirty-four out of 90 variance ratios are insignificant and fifty-three are significant at 1% level. The contrast between J & K, Kerala and Madras on the one hand and Punjab, U.P. and Bihar on the other is quite remarkable. Of course in the latter group of states we have much larger numbers of recruits but this may not be the whole reason for the differences observed.

6.6. Individual states

We shall now consider the states one by one.

Bihar. The two main communities we have from Bihar are Bihari Hindu and Adibasi. Ahir and Rajput as also Hindu from the adjoining states of U.P. and Bengal are represented by smaller though not negligible numbers. The differences in stature among communities are highly significant in all age groups except 17. Rajput with an average stature of 66".44 is the tallest community in the state. U.P. Hindu (66".36) and Bengali Hindu (66".26) come next in order of stature. Bihari Hindu (65".71) and Ahir (65".31) are shorter and Adibasi (64".53) are the shortest.

Bombay. Maratha and Mahar are represented by fairly large numbers. Other communities to be considered are in order of numbers Kumaoni, M.P. Hindu, Rajput, Ahir and Adibasi. Differences in stature are not significant in the age groups 17 and 21 and are only significant at the 5% level in age groups 18 and 23. In the remaining age groups the level of significance is 1% or above. Among the communities mentioned above the tallest is Kumaoni (65".57) followed by Rajput (65".43), M.P. Hindu (65".16), Adibasi (65".10) and Maratha (65".02). The two shortest communities are Ahir (64".93) and Mahar (64".70).

Jammu and Kashmir. The communities with non-negligible numbers in this state are J & K Hindu, Dogra and Sikh (Other). The differences are not significant except in age group 22. The mean values of stature are :- Dogra, 66".00; Sikh (Other), 65".81 and J & K Hindu 65".77.

Kerala. There is no significant difference between the two main communities, namely, South Indian Christian, 65".51 and Malayali Hindu 65".48.

Madras. The difference between the two main communities namely Tamil Hindu 65".60 and South Indian Christian 65".38 is statistically significant due to differences in the age groups 23 and 31-35 only.

Punjab. There are six communities with numbers running into thousands, namely, Sikh (Other), Punjabi Hindu, Dogra, Sikh (M&R), Jat and Ahir. Rajput and Gujar are also represented by considerable numbers. Communal differences in stature in this state are highly significant. The mean values of stature in descending order of magnitude are :- Jat, 67".36; Ahir, 67".29; Gujar, 67".15; Sikh (Other), 67".08; Rajput, 66".53; Sikh (M&R), 66".38; Punjabi Hindu, 66".02; Dogra, 65".24.

Rajasthan. The communities to be considered are Rajput, Jat, Ahir, Gujar and Punjabi Hindu. Differences in stature are highly significant except in age groups 23, 26-30 and 31-35. The mean values in descending order of stature are :- Ahir, 67".52; Jat, 67".16; Gujar, 66".97; Punjabi Hindu 66".08.

Uttar Pradesh. There are twelve communities in this state which are well represented in our sample, six of them with more than 2,000 recruits. Differences in stature are highly significant in all age groups. The mean values of stature are :- Jat, 67".01; Maratha, 67".00; Gujar, 66".66; Rajput, 66".53; Ahir, 66".49; Sikh (Other) 66".44; U.P. Hindu, 65".90; Bengali, 65".49; Kumaoni, 65".41; Dogra 65".28; Gorkha 65".12 and Garhwali, 64".49.

West Bengal. There are only two important communities in this state, namely, Bengali Hindu and Gorkha, none of the other communities having more than 11 individuals in the sample. Differences between communities are significant in all age groups except 17 and 18. The mean values of stature are:- Bengali Hindu, 65".85; Gorkha, 63".79.

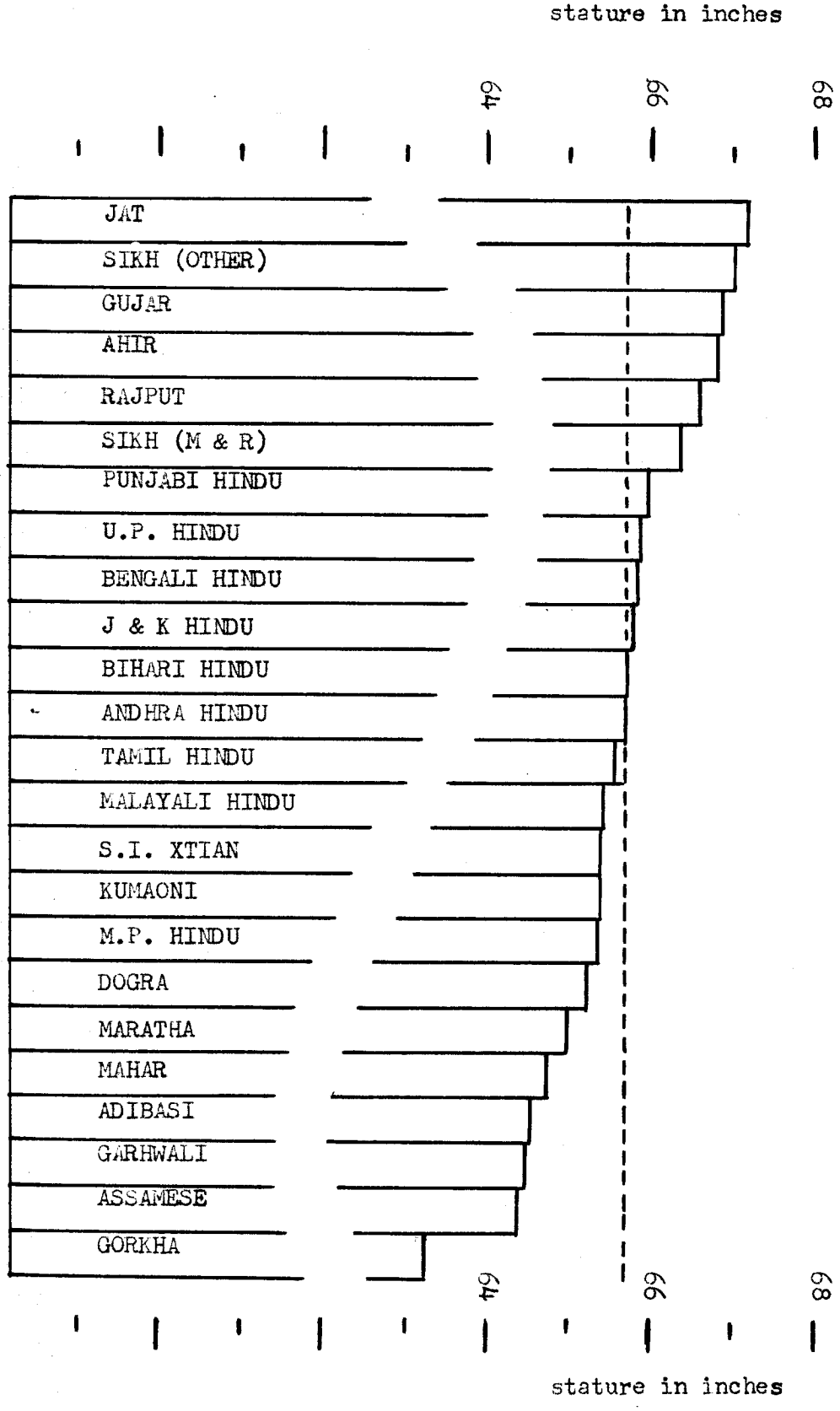


Chart 6.1 Mean stature of different communities

CHAPTER VII REGIONAL VARIATIONS OF STATURE

7.1. Racial and other groups

In anthropometric studies the prime motive force has generally been interest in the discovery and analysis of differences and similarities among racial groups. When Karl Pearson (1926) formulated a statistical tool for dealing with physical differences in men, he called it the "coefficient of racial likeness". Mahalanobis (1930) while writing on his well-known D^2-Statistic referred to 'group' divergence implying that groups other than racial may also be of interest. Risley (1891) in his anthropometric survey of North India worked out averages for various castes and tribes separately for the different states. Though he has recorded the districts in his tables giving the original data he has not worked out any district averages. The same is true of later surveys like Mahalanobis and others (1949). However it appears to be a fact that regional differences among different states in India and even among different districts within a state may be no less important than racial or communal differences. In the present chapter we study this question in relation to stature.

7.2. Range of variation in stature

The frequency distribution of all the 1,47,06[illegible] measurements we have can be seen from Table 2.1. The lowest height is 55 inches and highest is 79 giving a range of 25 inches. If we leave out frequencies accounting for less than 1% of the total (adding up to 2.2% in all) we can curtail this range to 10 inches from 61 to 70 inches. A slightly wider range of 14 inches from 59 to 72 will leave out only 0.23% of the total frequency.

This range may perhaps be regarded as defining the 'normal' Indian male, anybody outside this range being exceptional as far as stature is concerned.

The average stature in our sample is 65.69 inches and the standard deviation 2.17 inches. Thus the 'three sigma' limits are from 59".18 to 72".20 agreeing well with the limits actually found above. The standard deviation observed in our sample is about half an inch lower than corresponding values for Europe and America, but it is in good agreement with what has been found by other workers for Indian series.

It is easy to analyse the total variation into a portion arising from differences among the major geographical regions (states), and a portion which would remain even if the averages for different states were identical. The 'within' variation is equivalent to a standard deviation of 2".02 as against the total standard deviation of 2".17. The standard deviation of the mean values for different states is 0.90, the range of variation being from 63".15 in Nepal to 66".89 in Rajasthan. The analysis of variance into between and within states is given in Table 7.1 which shows that the variation between states is highly significant. The mean values in the different states are given in Table 7.2 in which states are arranged in descending order of stature.

Table 7.1 Analysis of variance between states

source	df	ss	ms	F
1	2	3	4	5
between states	19	83487	4395.05	1071.96***
wit in states	147046	602685	4.10	
total	147065	686172		

Table 7.2 Mean stature in different states

serial number	state	number of recruits	mean stature (in)
1	2	3	4
1	Rajasthan	6790	66.89
2	Punjab	38471	66.46
3	Delhi	743	66.42
4	Jammu and Kashmir	5684	65.78
5	Andhra	1316	65.76
6	West Bengal	5351	65.74
7	Tripura	13	65.73
8	Uttar Pradesh	28308	65.65
9	Madras	11174	65.53
10	Kerala	11134	65.49
11	Bihar	9799	65.48
12	Madhya Pradesh	1814	65.38
13	Mysore	1894	65.08
14	Himachal Pradesh	765	64.98
15	Bombay	13155	64.93
16	Orissa	1057	64.82
17	Manipur	50	64.53
18	Assam	4858	64.31
19	Sikkim	19	63.51
20	Nepal	4671	63.15
	total	1,47,066	65.69

7.3. Variation among states

People from Rajasthan have on the average the tallest stature of nearly 66.9 inches. Punjab and Delhi come next with 66.4 inches. Jammu and Kashmir on the one hand and Andhra Pradesh on the other though widely separated geographically have both stature nearly equal to 65".8. West Bengal and Tripura are both 65".7. Uttar Pradesh is 65".6. Madras and Kerala are adjoining states with the same average stature of 65".5. Bihar and Madhya Pradesh are also adjoining states with stature 65".5 and 65".4 respectively. Mysore and Bombay which are near each other and Himachal Pradesh which is far away from either have stature between 65".1 and 64".9. Orissa is next lower in stature with 64.8 inches. Manipur, Assam and Sikkim come next in stature with 64.5, 64.3 and 63.5 inches respectively. Sikkim is not significantly different from Nepal with 63.2 inches. The difference between the tallest and shortest state is 3.74 inches.

7.4. Variation among districts

When we come to districts the variation in average stature is much larger partly of course due to larger sampling fluctuations arising from the smaller numbers going into the averages, but mainly due to real differences in the stature of the inhabitants of different districts. The 1,47,066 recruits considered in this study come from 317 of the districts in India not counting cases in which the district of origin was not recorded. The numbers coming from individual districts range from 1 to 6,731, and the mean stature for districts vary from 62".0 to 71".0. In Table 7.3 we give

a two way frequency distribution of district means and the numbers on which the means are based.

Table 7.3 Frequency distribution of districts according to the number of recruits and mean stature.

n	district mean in inches								total
	'62.0-'63.0-	'64.0-	'65.0-	'66.0-	'67.0-	'69.0-	71.0-		
1	2	3	4	5	6	7	8	9	10
0-499	15	15	50	99	63	15	1	1	259
500-999	-	5	9	12	8	1	-	-	35
1000-1499	-	-	1	8	2	3	-	-	14
1500-1999	-	-	1	3	-	1	-	-	5
2000-2499	-	-	2	3	2	-	-	-	7
2500-2999	-	-	-	1	2	-	-	-	3
3000-3499	-	-	-	-	1	-	-	-	1
3500-3999	-	-	-	-	3	-	-	-	3
4000-4499	-	-	-	1	-	1	-	-	2
5500-5999	-	-	-	2	-	-	-	-	2
6500-6999	-	-	1	-	-	-	-	-	1
total	15	20	64	129	81	21	1	1	332

It can be seen from Table 7.3 that from the large majority of districts the sample is less than 500 though from a few districts we have several thousands in the sample. For all except two of the districts (from either of which we have only one recruit) the range of district mean stature is from 62 to 67 inches.

The stature for individual districts are given in Table 7.4 (Appendix 7A). We have already seen that the state means differ significantly, the question whether districts belonging to the same state differ significantly among themselves will be of further interest. This has been tested somewhat thoroughly for the districts of nine states from each of which we have more than 5000 recruits and the results are given in Table 7.5 and 7.6.

The variation between districts is highly significant in all the nine states and is particularly significant in Punjab, U.P., Bihar and West Bengal all of which are in the belt of high stature immediately below the hilly regions of the north.

Table 7.5 Analysis of variance of stature between districts in each of nine states.

state	df			ss			ms		ratio
	B	W	T	B	W	T	B	W	b/w
1	2	3	4	5	6	7	8	9	10
Bihar	18	9780	9798	2947.21	41236.95	44184.16	163.73	4.22	38.80***
Bombay	38	13116	13154	777.87	47781.66	48559.53	20.53	3.54	5.80***
J & K	12	5671	5683	386.39	21957.56	22343.95	32.20	3.87	8.32***
Kerala	7	11126	11133	237.59	38382.32	38619.91	33.94	3.45	9.84***
Madras	12	11161	11173	279.85	38491.91	38771.76	23.32	3.45	6.76***
Punjab	23	38447	38470	15745.49	153912.30	169657.79	684.59	4.00	171.15***
Rajasthan	25	6764	6789	816.08	24801.23	25617.31	32.64	3.67	8.89***
U.P.	51	28256	28307	17156.16	107665.46	124821.62	336.40	3.81	88.29***
West Bengal	16	5334	5350	1158.77	20980.19	22138.96	72.42	3.93	18.43***

That the variation observed among districts is not due to differences in age composition can be seen from Table 7.6 (Appendix 7B) in which we give the analysis of variance separately for each of the age groups in the nine

states included in Table 7.5. Of the ninety variance ratios in Table 7.6 thirty-nine are significant at the 1% level and another seventeen are significant at the 5% level. This clearly shows that even when the effect of age composition is eliminated there is significant variation among districts.

The variance ratios which are not significant are mostly in J & K, Madras, Bombay and Kerala. In these states the range of variance among district means is comparatively small in magnitude and the numbers of observations are not large enough to make the test of significance decisive. The situation can be seen in Table 7.7 where we have arranged the states in ascending order of significance.

Table 7.7 Significance of differences in stature between districts

state	number of age groups in which variation is		average number of recruits in age groups	difference between tallest and shortest districts with n 25
	not significant at 5% level.	significant at 1% level		
1	2	3	4	5
J & K	8	2	568	1.03
Madras	6	2	1117	1.03
Bombay	5	4	1316	1.25
Kerala	4	6	1113	0.53
West Bengal	2	7	535	2.84
Rajasthan	1	7	679	1.36
Bihar	1	8	980	1.96
U.P.	0	10	2831	2.41
Punjab	0	10	3847	2.45

For the state of Punjab from which we have the largest number of recruits and for the states of Uttar Pradesh, West Bengal and Kerala

which are spread out in different regions, the analysis of variance between and within districts has been carried out separately for each community. The results are given in Table 7.8. In two communities of Punjab, namely, Sikh (M&R) and Gujar the variance between districts is not significant. The number of Gujars is small but the number of Sikh (M&R) is fairly large. Perhaps the Sikh (M&R) in the different districts form one homogeneous group as far as stature is concerned. In Kumaoni of U.P. and Gorkha of West Bengal also there are no significant differences between districts. In all other communities the variance between districts is highly significant. This shows that even though a portion of the variance between districts may be due to communal differences all the inter-district differences cannot be explained away in that way.

7.5. The pattern of geographical variation

The geographical variation in stature for the country as a whole can be seen from Map 1 where the districts have been coloured to denote four different ranges of average stature. These ranges are defined by the median and the two quartiles (Q_1 65.00; M 65.79; Q_3 66.23).

Broadly, it is possible to recognize four distinct regions into which the country can be divided on the basis of variations in human stature. In the far north there is the Himalayan region from Kashmir to the borders of Burma which is a continuous area of low stature. Below this we have the Indo-gangetic plain comprising Punjab, Rajasthan, U.P., Bihar and West Bengal in which most of the districts have stature above average. In Punjab, Rajasthan and some adjoining districts of neighbouring states, we have the highest stature observed in India. Below this region there is another broad band running across the country roughly in line with the Vindhya mountains

Table 7.8 Analysis of variance of stature between and within districts for different communities in four states.

community	df			ss			ms		F
	B	W	T	B	W	T	B	W	
1	2	3	4	5	6	7	8	9	10
Kerala									
Malayali Hindu	7	7713	7720	192.70	26470.46	26663.16	27.53	3.43	8.03***
South Indian Christian	7	3289	3296	72.46	11599.54	11672.00	10.35	3.53	2.93**
Other	6	109	115	16.27	266.68	282.95	2.71	2.45	1.11
total	7	11126	11133	237.59	38382.32	38619.91	33.94	3.45	9.84***
Punjab									
Dogra	20	7061	7081	550.57	25863.98	26414.55	27.53	3.66	7.52***
Punjabi	21	7815	7836	784.82	31549.47	32334.29	37.37	4.04	9.25***
Sikh (M&R)	20	5506	5526	106.42	20308.16	20414.58	5.32	3.69	1.44
Sikh (Other)	21	10138	10159	249.64	40805.50	41055.14	11.89	4.02	2.96***
Jat	17	4084	4101	341.11	14056.46	14397.57	20.06	3.44	5.83***
Rajput	21	801	822	447.23	2976.60	3423.83	21.30	3.72	5.73***
Ahir	16	2626	2642	246.60	8924.04	9170.64	15.41	3.40	4.53***
Gujar	11	203	214	30.13	585.02	615.15	2.74	2.88	0.95
total	23	38447	38470	15745.49	153912.30	169657.79	684.59	4.00	171.15***
U.P.									
Dogra	44	167	211	95.87	149.74	245.61	2.18	0.90	2.42***
Jat	29	2370	2399	246.14	7405.98	7652.12	8.49	3.12	2.72***
Garhwali	6	6971	6977	72.08	27840.50	27912.58	12.01	3.99	3.01**
Kumaoni	11	5948	5959	25.10	21142.93	21168.03	2.28	3.55	0.64
Ahir	47	2163	2210	438.98	6864.63	7303.61	9.34	3.17	2.95***
Rajput	51	2336	2387	508.22	7606.72	8114.94	9.97	3.26	3.06***
U.P. Hindu	51	7445	7496	622.13	31167.55	31789.68	12.20	4.19	2.91***
Gujar	19	257	276	150.26	733.08	883.34	7.91	2.85	2.78***
Other	43	341	384	335.72	1024.67	1360.39	7.81	3.00	2.60***
total	51	28256	28307	17156.16	107665.46	124821.62	336.40	3.81	88.29***
West Bengal									
Bengali	15	5052	5067	154.27	19943.76	20098.03	10.28	3.95	2.60***
Gorkha	5	252	257	36.15	855.01	891.16	7.23	3.39	2.13
total	16	5334	5350	1158.77	20980.19	22138.96	72.43	3.93	18.43***

and Chota Nagpur hills which is again a region of low stature. The rest of the peninsula is a region of medium stature with districts belonging to the low as well as high groups. Only three districts in this region have "very low" stature.

The broad pattern of geographical variation of stature in India is described by Majumdar (1961). "As we proceed from the Punjab to Bengal and Peninsular India, there is a gradual lowering of stature and physical build. The average stature in the Punjab is 168.4 cms. It falls to 165.5 in the U.P., 164.0 in Bihar, 163 in Bengal and 161.05 in the Darjeeling hills and 159.2 in the Chittagong hill tracts. Guha estimates the average stature in U.P. as 166.86 which is lowered to 163.89 in Maharashtra, 164.46 in Gujarat, 165.97 in Bengal and 163.74 in South India. This progressive lowering of stature is partly racial and must partly be due to nutritional standards which are different in different provinces".

From the present study it would appear that the peak stature in India may be in Rajasthan rather than in Punjab and that the downward gradient towards the east and south may not be as smooth and steady as the above figures may lead one to imagine.

7.6. Hills and plains

One conclusion that seems to emerge from the geographical distribution of stature as represented in Map 1 is that in mountainous and hilly tracts the inhabitants are of lower stature compared to their neighbours in the plains. Several theories can be advanced to explain this phenomenon. One such theory is that the original inhabitants of India were a people of low stature. The invaders who came in from the North West from

time to time were tall people who drove the original inhabitants into the hills and less favoured areas. The concentration of high stature in Punjab stature in Punjab and Rajasthan, and its dilution as we proceed eastwards lends support to this theory.

Another theory is that short stature in the hills is the result of natural selection, operating over a long period. Low stature is associated with low body weight which is always an advantage when moving along the ups and downs of hilly regions. Thus the force of gravity will be contributing in an imperceptible way to pull tall and heavy bodies down the slopes. This theory of natural selection in preference to the theory of migration is supported by the presence of people of high stature in the Rajasthan desert region into which also presumably the original inhabitants were pushed by the invaders from the north. In the desert low stature is of no particular advantage. On the other hand, high stature may be advantageous for moving about long distances in search of the necessities of life and in increasing the range of vision.

The difference in stature between hills and plains was noticed by Risley (1908) who states:- "In India, as in Europe, the dwellers in the hills are generally shorter than the people of the plains, and within the hill region it may in either case be observed that stature is often greater at high than at moderate altitudes - a fact which has been ascribed to the influence of a rigorous climate in killing off all but vigorous individuals. In India the prevalence of malaria in the lower levels and the less healthy conditions of life wouldprobably tend to bring about the same result. On the whole however the distribution of stature in India seems to suggest that race differences play a larger

part than they do in Europe. The tallest statures are massed in Baluchistan, the Punjab and Rajputana, and a progressive decline may be traced down the valley of the Ganges until the lowest limits are reached among the mongoloid people of the hills bordering on Assam. In the south of India the stature is generally lower than in the plains of the north".

These findings agree with our own except that we have not investigated the difference between high altitudes and low altitudes in the hills.

7.7. Climate

Whether climatic factors like temperature humidity or rainfall have made any contribution to the stature of the population will be an interesting question to explore. From Map 1 it may be seen that regions of high rainfall are also regions of low stature. Can it be that rain washes away from the soil certain elements which help in the growth of stature or is the connection between rainfall and low stature only due to the effect of malaria which used to be prevalent in rainy tracts and which Risley has suggested as a factor contributing to low stature?

7.8. Nutritional level

Some correlation between stature and value of milk consumed can be seen from Table 7.9. In the states with high stature expenditure on milk is high. The figures of food expenditure in this table are taken from the National Sample Survey for the fourteenth round 1958-59. The relation, if any, between stature and consumption of cereals or meat fish etc is not as pronounced as that between stature and milk consumption.

Table 7.9 Average stature and average expenditure on items of food

stature	average stature	average expenditure in rupees on		
		total food grains	milk & milk products	meat fish and eggs
1	2	3	4	5
1 Rajesthan	66.89	10.65	3.10	0.06
2 Punjab	66.46	7.01	3.97	0.28
3 J & K	65.78	11.56	2.61	0.80
4 Andhra	65.76	8.19	0.42	0.68
5 West Bengal	65.74	10.53	0.79	1.01
6 U.P.	65.65	8.90	1.53	0.22
7 Madras	65.53	8.03	0.34	0.83
8 Kerala	65.49	6.26	0.30	0.55
9 Bihar	65.48	10.26	1.01	0.41
10. M.P.	65.38	8.98	1.09	0.22
11. Mysore	65.08	6.35	0.93	0.31
12. Bombay	64.93	6.68	1.07	0.37
13. Orissa	64.82	7.50	0.23	0.51
14. Assam	64.31	13.70	0.60	1.14

CHAPTER VIII. SECULAR CHANGES IN STATURE

8.1. A complex problem

It is well-known that in Europe and America human stature has increased in the past century. It will be of great interest and scientific importance to know whether the population in India is undergoing any such change. To provide an answer to this question was in fact the principal goal of the present investigations. The number of years for which we have collected data is too small for establishing any unassailable conclusions even though our analysis of stature of recruits seems to yield certain results which are of high statistical significance. These results point to the desirability of further work covering a longer period of time.

The variation within our series will be the resultant of contributions attributable to age, district, community and possibly many other factors in addition to secular change. The analysis we have carried out is not detailed enough to isolate these different effects without overlap. The nearest we can get to a study of secular trend without embarking on prohibitively laborious calculations is through a comparison of the mean values for different years of recruitment. This we have done separately for nine different states from each of which we have more than 5,000 recruits.

8.2. Analysis of variance

For each state analysis of variance of stature between and within years of recruitment has been carried out separately for each age group and, to the extent that number of recruits permitted, also separately for major communities. Linear

regression of stature on years of recruitment has been studied and the regression coefficients tested for statistical significance. Mean stature for each age group for each year of recruitment has been calculated. All these results are presented in Tables 8.1 to 8.4 (Appendices 8A to 8D) in alphabetical order of states.

The analysis of variance shows overwhelming evidence of significant differences between years of recruitment. For all age groups put together the variance ratio is significant at the 0.1% level in all the states considered except Jammu and Kashmir for which the ratio is not very significant. Out of the 90 variance ratios in individual age groups 57 are significant at 0.1% level, 72 at 1% level and 79 at 5% level. Only for 11 variance ratios is the level of significance below 5%.

In individual communities within states, for which we have 31 variance ratios it is found that only four are less than what is required for significance at 5% level. Of the remaining 27 as many as 24 are significant at 0.1% level. The significance is strongest in Uttar Pradesh, Punjab, Kerala and Bombay. In Jammu and Kashmir it is doubtful whether there is any significant component of variation associated with years of recruitment. For this state significant variance ratios are actually fewer than what may be expected due to chance. Bihar, Madras, Rajasthan and West Bengal come in between these extremes.

8.3. Linear regression

Having observed the existence of significant variation between years of recruitment the next step is to find out whether there is any steady trend. This has been investigated by fitting linear regression lines and testing the significance of the components of variance accounted for by linear regression for each

age group within each state and also for all age groups put together. The regression for all ages put together is highly significant in all states except Jammu and Kashmir. The regression coefficient is positive in all states except West Bengal where $\hat{\beta}$ is negative.

Taking the regression coefficient as a measure of the secular growth rate it can be seen that the growth is most rapid in Kerala and Bombay amounting to about one inch in ten years. The average of the regression coefficients for the seven states where it is significant and positive comes to 0.0723 or one inch in about fourteen years. The negative trend in West Bengal is at the rate of one inch in about eighteen years.

Table 8.5 Significance of variance ratios.

level of significance	Bihar	Bombay	Jammu & Kashmir	Kerala	Madras	Punjab	Rajasthan	Uttar Pradesh	West Bengal	total
1	2	3	4	5	6	7	8	9	10	11
					in age groups					
$\not<$ 5%	1	1	6	0	1	0	1	0	1	11
5%	0	1	2	1	0	0	1	0	2	7
1%	2	0	2	0	4	1	3	0	3	15
0.1%	7	8	0	9	5	9	5	10	4	57
total	10	10	10	10	10	10	10	10	10	90
					in communities					
$\not<$ 5%	0	0	2	0	0	0	0	0	1	3
5%	1	0	1	0	0	0	1	0	0	3
1%	0	0	0	0	0	0	1	0	0	1
0.1%	3	2	0	2	2	7	1	6	1	24
total	4	2	3	2	2	7	3	6	2	31
					due to linear regression in age groups					
$\not<$ 5%	2	2	9	1	3	4	5	3	5	34
5%	2	0	1	1	0	2	1	0	3	10
1%	2	0	0	0	3	1	1	0	0	7
0.1%	4	8	0	8	4	3	3	7	2	39
total	10	10	10	10	10	10	10	10	10	90

The significance of the variance ratios discussed above is summarised in Table 8.5. The mean values in individual years of recruitment together with the linear regression lines are shown in Charts 8.1 to 8.3.

8.4. Individual states

Some remarks on the results for different states are given below:

Bihar. The total number of recruits is 9,799. The numbers in individual years of recruitment vary from 760 to 1,685 and in age groups from 613 to 1,157. In the cells representing age x year combinations the numbers range from 0 to 311. Cell numbers exactly equal to 100 must be due to the entire quota of Bihari Hindus selected happening to be from Bihar state.

Analysis of variance between and within years of recruitment shows significance in all age groups except 17. In age group 17 there are no recruits in 1949 and only two in 1948 so that effectively the analysis is based on six years' data. Looking at the mean values in this age group for the years 1950 to 1955 a downward trend in stature is noticeable. The corresponding linear regression coefficient is negative and is significant at the 5% level. The regression coefficient is negative also in age groups 18, 19 and 20 though it is significant at 1% level only in age group 18, and in age group 19 it is not significant even at 5% level. This negative trend which is noticed in the adjoining state of West Bengal also is difficult to explain when in all other states and even in Bihar the overall trend is unmistakably positive. The overall regression coefficient in Bihar is 0.0631 corresponding to a secular growth rate of one inch in about sixteen years.

We have sizable numbers from four communities in Bihar. Analysis of variance reveals significant secular trend in each of these communities. This confirms the findings based on the analysis in age groups.

Bombay. There are 1,3155 recruits from Bombay. The numbers in individual years of recruitment vary from 1074 to 2,119 and in age groups from 972 to 1,568. In age x year cells there are from 15 to 305 recruits.

Variance between years of recruitment is significant at 0.1% level in all age groups except 31-35 where it is not significant, and 26-30 where it is significant at 5% level. The two important communities are Maratha and Mahar. For both these groups the variance between years of recruitment is highly significant. The linear regression coefficient is positive in all age groups and significant in all age groups except 26-30 and 31-35. The regression coefficient for all age groups together is 0.0993 indicating a secular growth rate of one inch in about ten years.

Jammu and Kashmir. There are 5,684 recruits from this state. The numbers in individual years of recruitment vary from 408 to 1,089 and in age groups from 275 to 813. In age x year cells the numbers vary from 0 to 260.

The variation between years of recruitment cannot be considered significant either in age groups except age 21 or communities. There is hardly any evidence of secular trend. The linear regerssion is positive in six age groups and negative in four.

Kerala. There are 1,1,134 recruits from Kerala. The numbers in didividual years vary from 1,254 to 1,547 and in age groups from 790 to 1,283. In age x year cells the numbers vary from 2 to 267.

In all age groups the variance between years of recruitment is significant at 0.1% level except in age group 26-30 where it is significant at 5% level. Analysis of variance within the main communities, namely, Malayali Hindu and South Indian Christian confirms the significance of between year variation. Linear regression coefficient is positive in all age groups and significant at 0.1% level except in age group 17 where it is not significant and age group 26-30 where it is significant at 5% level. The overall regression coefficient is 0.1017 indicating a secular growth rate of one inch in about ten years.

Madras. There are 1,1,174 recruits from Madras State. The numbers in individual years of recruitment vary from 826 to 1,571 and in age groups from 1,012 to 1,208. In age x year cells the numbers vary from 1 to 183.

The variance between years of recruitment is highly significant in all age groups except 17 and in the two main communities. Linear regression is highly significant in the seven age groups 18 through 23 and 24-25, and the regression coefficient is positive in all these groups. In age groups 17 and 26-30 the regression coefficient is negative but not significant. The overall regression coefficient is 0.0634 indicating a secular growth rate of one inch in about sixteen years.

Punjab. This is the state from which we have the largest number of recruits. The total number is 3,8,471. In indivudual years of recruitment the number varies from 3,591 to 8,769 and in age groups from 2,645 to 5,451. In age x year cells the numbers vary from 24 to 1,819.

Variation between years of recruitment is highly significant in all age groups and in all major communities. Linear regression is significant at 0.1% level in age groups 18, 20 and 22, at 1% level in age group 19, and at 5% level in age groups 17 and 23. The coefficient of regression is positive in all age groups. The overall coefficient is .0406 indicating a growth rate of one inch in about 25 years.

In the anthropometric data published by Risley (1891), there are records of stature of 452 men from Punjab. The average of these 452 values is 66".24. Even though this average relating to the period 1886-88 is lower than the average of 66".46 in the present study, the difference is not statistically significant.

Rajasthan. The total number of recruits is 6,790, varying from 382 to 1,611 in different years of recruitment and from 475 to 875 in different age groups. In age x year cells the numbers range from 9 to 263.

Variation between years of recruitment is significant in all age groups except 31-35. In five age groups it is significant at 0.1% level, in three others it is significant at 1% level and in one age group it is significant at 5% level. In the main communities also the variation between years is significant, the significant level being 0.1% for Rajputs, 1% for Jats and 5% for Ahirs.

The linear regression coefficient is positive in all age groups and significant in five age groups in three of which the level of significance is 0.1%. The overall coefficient of regression is 0.0723 indicating a secular growth rate of one inch in about 14 years.

Uttar Pradesh. The total number of recruits is 2,8,308, varying from 2,571 to 3,969 in different years of recruitment and from 2,246 to 3,287 in different age groups. In age x year cells the numbers vary from 18 to 527.

This is the state in which the significance of variation between years of recruitment is perhaps most pronounced. The variance ratio is highly significant in all age groups and in all communities. Linear regression is highly significant in seven age groups and positive in all age groups except 26-30 where overall coefficient of linear regression is 0.0656 which is less than in Kerala and Bombay and indicates a secular growth rate of one inch in about fifteen years.

West Bengal. There are 5,351 recruits from West Bengal of whom 5,068 are Bengalis, 258 are Gorkhas and the rest are other groups. For 1948, 1950 and some age groups of 1949 the numbers are scanty. The largest number in any age x year cells is 162 and the marginal totals vary from 22 to 1115 for years and from 320 to 647 for age groups.

West Bengal is peculiar in having a negative trend of stature in all age groups where the regression is significant. The variation between years is significant at 0.1% level in four age groups, at 1% level in three age groups, and at 5% level in two age groups. This variation is not significant for Gorkhas but is highly significant for Bengalis.

The linear regression coefficient is negative in seven out of ten age groups and where it is positive it is not significant. The overall regression coefficient is -0.0568 indicating a decline in stature at the rate of one inch in about eighteen years.

It is not easy to unravel the causes behind the secular trend in stature. Possibly changes in nutritional levels are important. Can it be that while there has been a general improvement in nutritional levels in most states there has been a decline in West Bengal? It is note-worthy that Bengal is theonly state where a serious famine occurred in recent times.

8.5. Data from other countries

G.M. Morant (1939) is one of the writers who have assembled evidence on the increase of human stature. In Chapter V of his book on "The Races of Central Europe" Morant states:- "For several European countries and for Japan there is good evidence to show that the average height of adults has been increasing steadily since about 1860. Data for some of the countries of Central Europe show the same tendency, and it has probably been general throughout the continent. English records have established the fact that in recent times sons are taller than their fathers, on the average. The secular rate of increase seems to have been fairly uniform in the different countries for which good statistics are available, and it is nearly one cm in ten years, or nearly one inch in twenty-five years."

The conclusion regarding sons being taller than their fathers in England refers only to the stature at the adolescent stage before the full height is attained. From an inquiry involving comparisons of records of stature of British adolescents and adults during the period from 1845-1948 covering in all more than two million men, the numbers being largest for the ages 18-25, mostly candidates for recruitment into the army, Morant (1950) concludes that "The best estimate that can be given for the maximum mean height of the general population of British men is 67".5 and this appears to have remained unchanged in the past 100 years. There are clear differences between the values for different classes of the community and these also appear to have remained unchanged ..... The conclusions are that the British people today are taller on the average at all adolescent ages than their ancestors were two generations back. But they become fully grown at a younger age and their maximum height is the same as their ancestors who matured more slowly".

Karpinos (1961) in a study of some 273,000 candidates for recruitment (including those disqualified as well as those inducted) into the United States army during the period January 1957 through September 1958 has concluded that :- "The recruit of today is on an average 0.5 inch taller than the recruit of World War II and about 1.2 inches taller than the recruit of World War I." In reaching these conclusions Karpinos has taken care of differences in age distributions of the populations compared by means of a technique of 'standardisation'.

In a note published (1944) by the Metropolitan Life Insurance Company in their Statistical Bulletin, it is stated that "stature shows distinct signs of increase in the present generation. The average height of men in the ages 20 to 29 examined at induction stations for the armed service in May 1943 was 68.15 inches (without shoes). This figure is about two-thirds of an inch more than

the average of 67.49 inches for the first million draftees of ages 21 to 30 examined at mobilization camps in the last World War in 1917. The figure cited for 1943 is based upon an analysis of data recently published by the office of the Surgeon General of the Army". The rate of increase in stature of American recruits is thus quite comparable to what was noticed in Europe by Morant during the middle of the last century and what was indicated for Indian recruits in the present study.

A comparison of the average stature of insurance policy holders in America (Society of Actuaries, 1959) during the periods 1885-1908 and 1935-54 is given in Table 8.6.

Table 8.6 Average stature of insurance policy holders in America

age	average stature (in inches) of men		number of policies in col 3
	1835-1908	1935-1954	
1	2	3	4
15-16	65.6	67.4	5600
17-19	67.8	69.4	13043
20-24	68.4	69.5	92476
25-29	68.5		
30-34	68.5	69.2	96065
35-39	68.5		
40-44	68.5	68.6	59827
45-49	68.5		
50-54	68.5	68.2	19671
55-59	68.4		
60-64	68.4	68.1	2192
65-69	68.5		

It can be seen that during the fifty years separating the two periods compared in Table 8.6 the age group 15-16 increased in stature by 1.8 inches, the age group 17-19 by 1.6 inches, the age group 20-29 by 1.1 inches, the age group 30-39 by 0.7 inches and the age group 40-49 by 0.1 inches. In the higher age groups there has been a small decrease in stature. The numbers of cases on which the averages in column 2 are based were not available in the publication. The general conclusion seems to be that during the present century average stature has been increasing at about the same rate as observed in Europe fifty years earlier.

Data given in the Pocket Year Book 1961 (Table 32, page 18) published by the Netherlands Central Bureau of Statistics relating to the Dutch army is reproduced in Table 8.7.

Table 8.7 Average stature of conscripts in the Dutch Army.

Year	Number of conscripts	Average stature in cms.
1	2	3
1900	38,669	169
1920	44,214	170
1940	82,994	173
1960	81,790	176
1961	77,950	176

The average age of conscripts as stated in the Pocket Book is 18.5 years. It appears that there has been an increase of 7 cms in average stature during the first sixty years of this century. Of this 6 cms were gained during the forty years from 1920 to 1960. This is a higher rate of increase than noticed elsewhere.

Schreider (1960) in Chapter 13 Table VI of his book 'La Biometrie' gives comparative data about gain in stature in a number of countries. This is reproduced in Table 8.8.

Table 8.8 Increase in height

country	period	duration	initial and final in cms	gain total	gain per decade
1	2	3	4	5	6
Poland	1881-1894	13	164.8-165.6	0.8	0.6
Japan	1897-1917	20	155.3-156.9	1.6	0.8
Netherlands	1865-1923	58	164.1-170.8	6.7	1.1
Denmark	1854-1925	71	165.4-169.5	4.1	0.6
France	1790-1870	80	155.5-165.0	9.5	1.2
Sweden	1840-1926	86	165.4-173.0	7.6	0.9
Italy	1791-1916	125	161.7-169.7	8.0	0.6
France	1801-1953	153	169.2-174.5	5.3	0.4
Norway	1741-1939	195	168.5-173.7	5.2	0.3

During the short time that I had access to Schreider's book written in French I could not make out the source of the data or the number of observations that have gone into the averages. The two sets of figures for France which are not quite in agreement with each other must have come from different sources. The increase recorded for Japan tallies well with the rates noticed elsewhere.

8.6 Conclusion

From the preceding paragraphs it is evident that adult human stature has increased at one period or other in most countries for which data is available. England seems to be an exception but probably the period of growth in that country

was earlier than the period for which stature has been studied. The fact that this phenomenon of growth has been observed elsewhere lends support to our conclusion that growth is taking place in India.

Admittedly the period covered by our study is short, and our data is subject to various limitations. Some of these limitations have been circumvented in a study reported in Chapter X in which the statistical significance of the secular trend in stature is confirmed. And a way of increasing the period covered is indicated in an investigation reported in Chapter X.

A speculative explanation of the changes in adult stature can be provided by relating it to betterment of living conditions and particularly to improvement in the quality and quantity of food. Undoubtedly the increase in human stature in Europe and other industrialized regions has been accompanied or preceded by a significant amelioration of living standards and economic well-being.

Perhaps in India also the same considerations are relevant. Living standards are rising and the people are now being fed better. It is note-worthy that growth rate is steepest in Kerala and the West Coast where standards were low and are now rapidly changing. On the other hand in Punjab where nutrition was comparatively better even in the past and the people were taller already the growth rate is slower. The decline of stature in West Bengal may perhaps be connected with the severe famine in 1942 and the influx of refugees after division of the country in 1947, the increase in population, and the decline in standard of living as the consequence of all this.

If there be any substance in the above speculations then a study of secular trend of stature would cease to be of mere academic interest and would assume practical importance as an index from the long range point of view of the results of economic improvement programmes.

Chart 8.1. Secular trend in stature

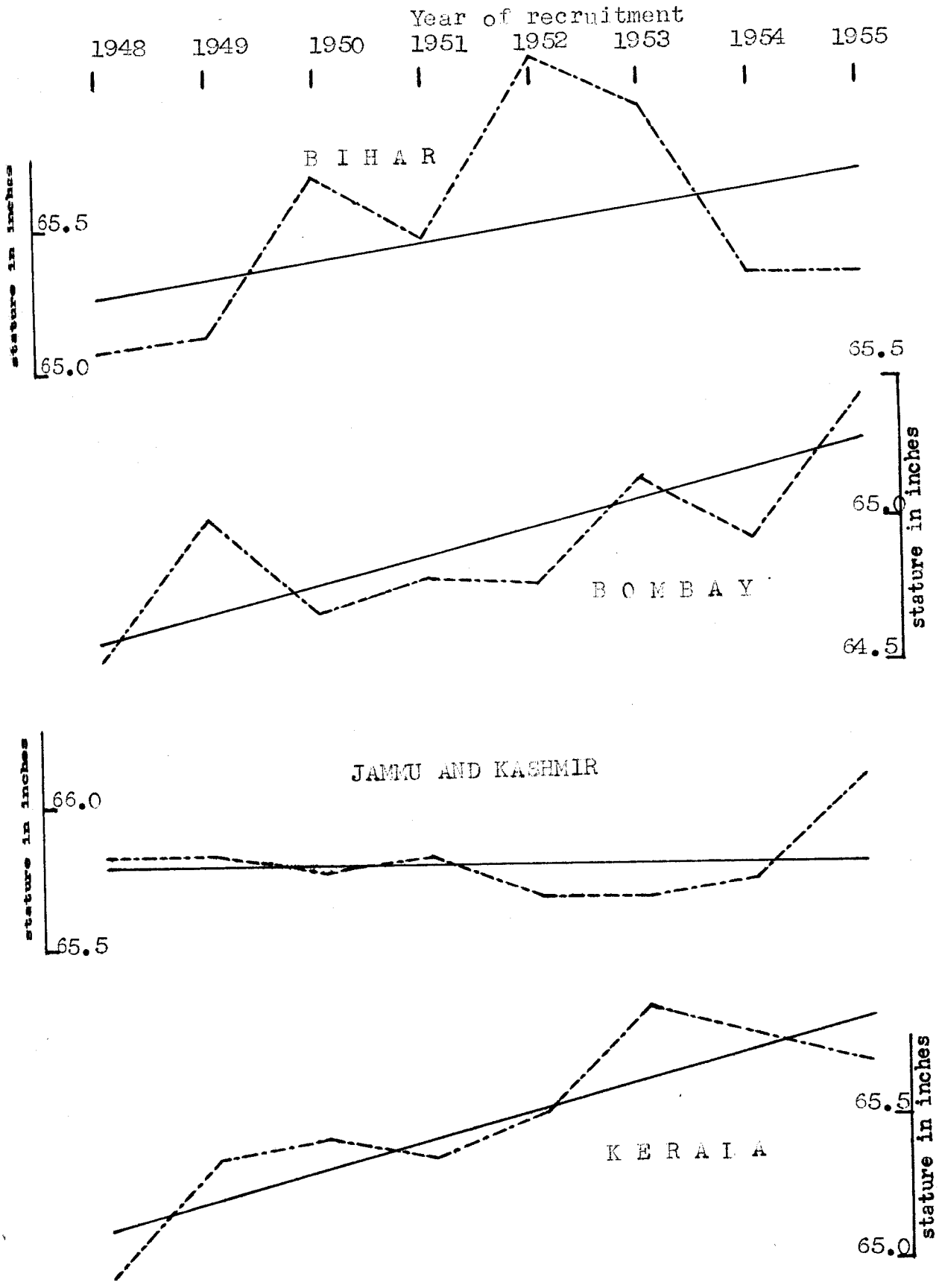


Chart 8.2. Secular trend in stature

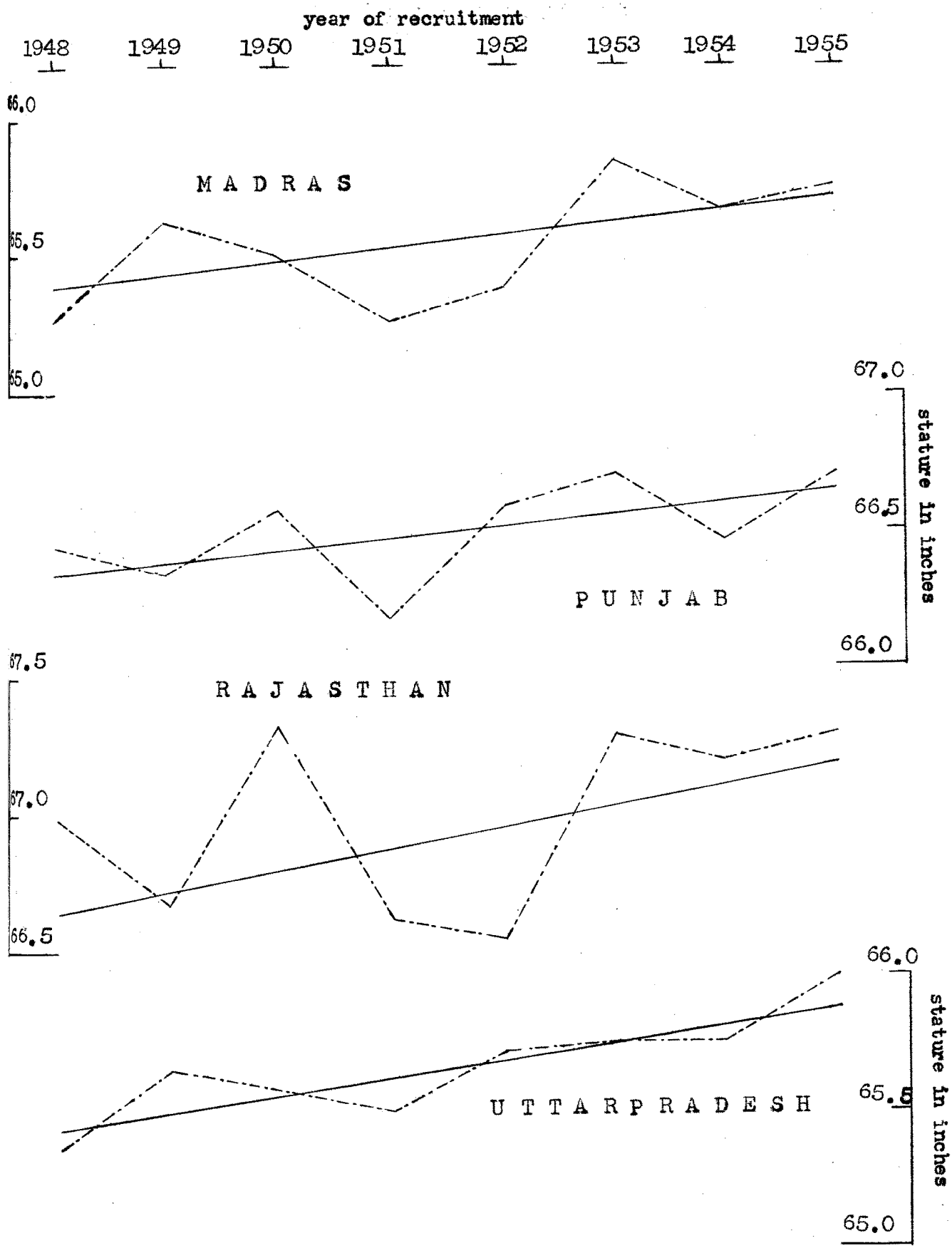
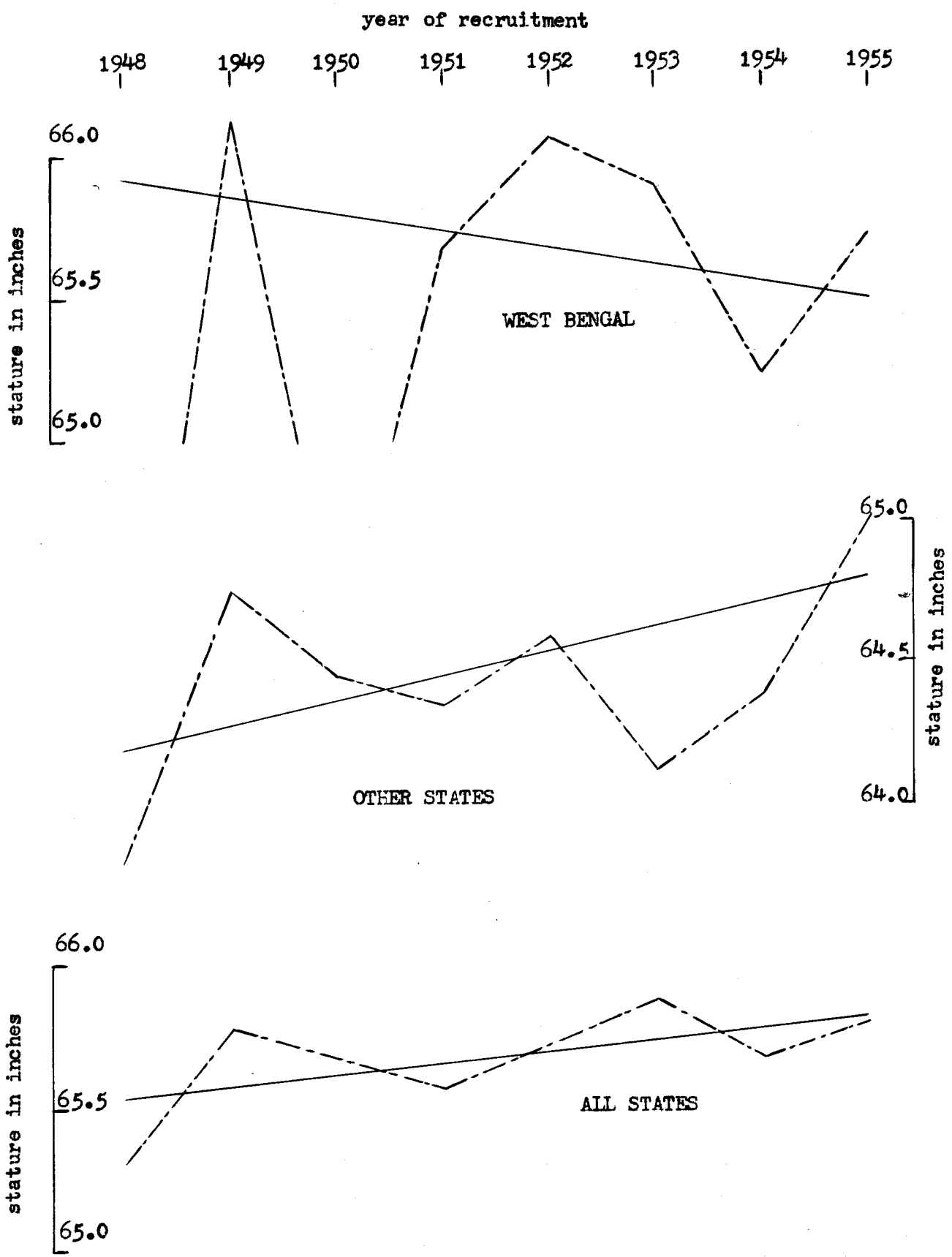


Chart 8.3. Secular trend in stature



CHAPTER IX TREND OF STATURE OVER HUNDRED YEARS

9.1 Old long rolls

We have remarked that the period of eight years from 1948 to 1955 for which we have collected data from rough rolls is not long enough for a satisfactory study of secular trend. As rough rolls prior to 1948 were not available we have to search elsewhere for earlier data. Some of the Regimental Centres have preserved records of stature along with other particulars of soldiers in 'long rolls'. These long rolls constitute probably the only available source of data on human stature in India relating to the past. Some isolated records go back a hundred years or even more.

We managed to collect all old long rolls from one Regimental Centre near Delhi and extracted all available data. We got 24,134 soldiers enlisted during the period from 1844 to 1947 distributed very unevenly in these years, starting with just one soldier in 1844 and increasing in numbers in later years to a few hundreds per year (see Table 9.1). The communities and religions represented are 'Other Hindu', Maratha, Jat, Ahir, Rajput, Gujar, Sikh, Muslim, Christian and Jew.

We are not in a position to say how representatives are these soldiers of the general population of the communities to which they belong. We do not have a random sample. We have merely copied out what happened to be available in certain old records. The people who have custody of these documents now are not able to throw any light on the representativeness of these soldiers.

9.2 'Control charts'

In Table 9.2 we give the mean values corresponding to the numbers in Table 9.1. These mean values for all communities together and for five other communities are shown in charts 9.1 and 9.2. These charts show also the grand mean as a central line and two dotted lines on either side of it representing the 3-sigma limits calculated from successive differences of the means in different years.

From the chart for 'all communities' it can be seen that from around 1863 to 1895 there is an increasing trend in the mean values, from 1895 to 1916 there is a decline and from 1916 to 1939 there is again a steady increase. From 1939 to 1943 there is a sharp decline followed by a quick recovery from 1943 to 1947 which must be due to relaxation of standards during the war when large-scale recruitment took place and the subsequent upgrading of standards when the recruitment tapered off.

The same pattern of changes is visible in the different communities also. It would appear that there are some long term cyclical changes in the average stature of these populations depending possibly on economic conditions or other factors.

10.1 Non-orthogonality

One criticism that may be levelled against our findings in regard to the secular trend is that the observed differences might conceivably be partly or wholly due to the effect of age differences or differences among communities or both. The same criticism is applicable to the significant components of variation associated with age and communities. This criticism derives its strength from the fact that for different years of recruitment we have unequal numbers belonging to different ages and communities.

10.2 Factorial design

The original design was to have equal numbers in each cell representing a particular year, age and community and also for the marginal totals. However that design got distorted in practice as the required numbers were not forthcoming from all the cells. Something of the original design could, however, be salvaged by retaining only such of the communities, years and age groups as have exactly 100 recruits from each of the cells included among them. In Table 10.1 we give all the mean values of stature thus salvaged. We have retained ten communities, six age groups and all years of recruitment except 1949. Thus we are left with 420 mean values each based on a sample of 100 recruits.

10.3 Analysis of variance

The obvious thing now is to carry out an analysis of variance treating the data as the result of a three-factor experiment with 10, 6 and 7 levels of the respective factors. This has been carried out

Table 10.1 Mean stature by communities, age groups and years of recruitment.

(each entry is based on a sample of 100 recruits)

age	year of recruitment						
	1948	1950	1951	1952	1953	1954	1955
				Bihari Hindu			
18	66.9	66.7	66.1	66.8	66.1	65.6	66.4
19	67.0	67.0	66.0	66.8	66.6	65.6	66.9
20	66.9	66.6	66.3	66.8	66.4	65.7	66.5
21	65.5	67.1	65.9	66.6	66.5	66.0	66.8
22	66.3	66.9	65.8	66.3	66.5	66.0	66.3
23	65.4	66.9	65.2	66.0	66.2	65.4	65.8
				Jat			
18	67.2	67.3	67.2	67.3	67.2	67.7	67.3
19	67.4	67.2	67.4	67.1	67.3	67.9	67.6
20	67.5	67.5	67.4	67.3	67.8	67.9	68.0
21	67.8	67.6	67.0	67.6	67.5	67.5	67.9
22	67.0	67.6	67.2	67.6	67.5	68.2	67.9
23	67.4	68.2	67.1	67.3	67.6	67.5	67.9
				Malayali Hindu			
18	65.0	65.6	65.9	64.6	66.2	65.8	66.4
19	65.5	65.8	66.1	65.7	66.2	65.3	66.5
20	65.5	65.5	66.2	66.1	66.2	66.2	65.3
21	65.2	65.4	66.0	66.3	66.2	66.1	66.4
22	65.2	65.9	65.8	66.2	66.1	66.3	66.0
23	65.3	65.9	65.6	66.1	66.1	66.4	66.0

age	year of recruitment						
	1948	1950	1951	1952	1953	1954	1955
				Maratha			
18	64.2	65.1	65.0	64.7	65.9	65.6	65.8
19	64.8	65.1	65.1	65.0	65.9	65.6	66.2
20	64.9	65.6	65.3	64.5	65.6	65.5	66.4
21	65.1	64.6	65.4	65.1	65.4	66.0	66.2
22	65.0	65.1	65.2	65.6	65.6	65.7	66.0
23	65.1	65.0	65.3	65.3	66.1	65.6	66.0
				Punjabi Hindu			
18	65.4	66.5	66.4	66.3	67.1	66.3	66.2
19	66.2	67.0	66.6	66.8	66.7	66.7	66.4
20	66.3	65.6	66.6	66.6	67.0	66.8	66.8
21	66.1	66.6	66.6	66.5	66.6	66.3	66.4
22	66.0	66.6	66.1	66.1	66.9	66.4	66.6
23	66.3	66.2	65.8	66.3	66.7	66.0	66.0
				Rajput			
18	66.7	66.9	66.3	66.6	67.0	67.3	67.1
19	67.0	67.1	66.8	66.8	66.9	67.4	67.8
20	66.9	66.8	66.9	66.9	67.1	67.4	67.6
21	67.0	66.3	66.8	67.1	67.4	67.6	67.4
22	66.3	66.7	66.7	66.9	67.6	67.7	67.5
23	66.9	66.9	66.9	67.2	67.6	67.5	67.5

age	year of recruitment						
	1948	1950	1951	1952	1953	1954	1955
				Sikh (Other)			
18	67.3	67.1	67.8	67.8	67.8	67.0	67.7
19	67.3	67.4	67.4	68.0	67.8	66.6	67.7
20	66.5	67.8	66.6	67.9	67.8	67.2	67.8
21	67.5	68.0	67.1	67.9	67.9	67.6	67.8
22	67.5	67.7	67.3	67.9	67.9	67.6	67.7
23	66.4	67.6	67.9	67.9	67.8	67.7	67.7
				South Indian Christian			
18	65.4	65.8	65.7	65.7	66.1	66.2	66.3
19	65.1	66.1	66.1	66.1	65.9	66.0	66.6
20	65.2	66.2	66.0	65.7	66.5	66.3	66.0
21	65.0	65.5	65.6	65.9	66.1	66.1	66.3
22	65.3	65.8	65.7	66.0	66.0	66.1	66.3
23	65.6	65.7	65.7	66.0	66.2	66.1	66.2
				Tamil Hindu			
18	65.7	66.9	65.8	65.8	66.4	66.1	66.1
19	66.0	66.2	65.9	66.1	66.7	66.1	66.3
20	65.8	65.6	66.1	66.3	66.3	66.0	66.6
21	65.7	65.6	65.9	65.9	66.4	65.8	66.1
22	65.6	65.7	66.1	65.7	66.8	66.1	66.1
23	65.7	66.2	65.9	66.1	66.8	66.0	66.2
				U.P. Hindu			
18	65.8	65.8	66.5	65.8	66.7	66.5	66.2
19	65.8	66.2	66.3	66.2	67.0	67.0	67.2
20	66.1	65.7	66.9	66.1	66.2	66.5	66.8
21	66.2	65.6	66.1	66.2	66.8	66.7	66.5
22	65.6	66.3	66.3	65.9	67.0	66.6	66.9
23	65.8	66.4	66.1	66.1	66.5	66.5	66.4

and the results are presented in Table 10.2. It can be seen from this table that the three 'main effects' as well as the first order interactions CA and CY are significant at the 1% level. The first order interaction AY is significant at the 5% level.

Table 10.2 Analysis of variance of mean stature

source of variation	df	ss	ms	F
main effects				
community (C)	9	194.0	21.56	280.00***
age (A)	5	1.3	0.26	3.38***
year (Y)	6	19.9	3.32	43.12***
interactions				
CA	45	5.1	0.11	1.43**
CY	54	18.5	0.34	4.42***
AY	30	3.2	0.11	1.43*
error	270	20.9	0.077	
total	419	262.9		

The significance of the communal and age differences is understandable and perhaps in accordance with what one expects. What is of greater interest is the finding that the secular trend reflected in the mean values for different years of recruitment is not merely an apparent effect attributable to differences in community or age.

The significant interaction CA shows that the pattern of change with age is different for different communities. Similarly the significant interaction CY shows that the secular trend also differs among the different communities. The interaction AY which is not easy to interpret may perhaps be a chance effect as it is not significant at the 1% level.

10.4 Mean values of stature

In Tables 10.3, 10.4 and 10.5 we present marginal mean values of stature respectively for communities, age groups and years of recruitment.

Table 10.3 Mean values of stature in samples of 4200 from each community

community	mean stature in inches
Sikh (Other)	67.52
Jat	67.52
Rajput	67.07
Punjabi Hindu	66.41
UP Hindu	66.33
Bihari Hindu	66.31
Tamil Hindu	66.08
South Indian Christian	65.91
Malayali Hindu	65.86
Maratha	65.39
total	66.44

The 'critical difference' at the 5% level for the mean values in Table 10.3 is 0.085. Judging against this standard the communities Sikh (Other) and Jat are not different in stature. So also the difference between the Hindus of UP and Bihar which are adjoining states is not significant. South Indian Christian comes in between Tamil Hindu and Malayali Hindu and is not significantly different from either. The remaining differences are all statistically significant. The communities except for those with insignificant

mutual differences occur in the same relative order in Table 10.3 as when their mean stature based on the entire data we have is considered. This shows that the indirect effect of age and year of recruitment may not have affected our analysis of stature among different communities.

Table 10.4 Mean values of stature in samples of 7000 from each group

age group	mean stature in inches
18-	66.34
19-	66.51
20-	66.47
21-	66.45
22-	66.46
23-	66.40
total	66.44

The critical difference in this case is 0.067. It can be seen that the significant differences are between age group 18 and perhaps also age group 23 and the rest of the age groups as a whole.

Table 10.5 Mean values of stature in samples of 6000 from each year of recruitment

year of recruitment	mean stature in inches
1948	66.07
1950	66.39
1951	66.26
1952	66.40
1953	66.71
1954	66.52
1955	66.72
total	66.44

As the critical difference for the means in Table 10.5 is 0.071, all the successive differences are significant. An increasing trend is noticeable.

10.5 Secular trend in stature

To obtain a confirmation of the secular trend discussed in chapter VIII we have calculated the coefficients of regression of mean stature on years of recruitment separately for each age group of each community considered in this chapter. The results are given in Table 10.6.

Table 10.6 Regression coefficients of stature on years of recruitment by communities and age group

community	age groups						average
	18-	19-	20-	21-	22-	23-	
Bihari Hindu	-0.121	-0.084	-0.096	0.090	-0.032	-0.010	-0.042
Jat	0.035	0.055	0.081	0.010	0.137	0.022	0.057
Malayali Hindu	0.159	0.071	0.033	0.170	0.121	0.121	0.112
Maratha	0.220	0.189	0.146	0.184	0.145	0.146	0.172
Punjabi Hindu	0.104	0.015	0.130	0.018	0.074	-0.015	0.054
Rajput	0.082	0.092	0.106	0.129	0.208	0.111	0.121
Sikh (Other)	0.034	0.005	0.137	0.031	0.033	0.170	0.068
S.I. Christian	0.126	0.143	0.111	0.183	0.129	0.098	0.132
Tamil Hindu	0.018	0.048	0.106	0.066	0.098	0.070	0.068
U.P. Hindu	0.091	0.207	0.090	0.112	0.171	0.082	0.125
average	0.075	0.074	0.084	0.099	0.108	0.080	0.087

It can be seen from this table that for Bihari Hindu the regression is negative except in age group 21. This negative regression was noticed in the analysis in chapter VIII also.

In all the other cases the regression coefficients are positive except for one value for Punjabi Hindu in age group 23. There is therefore no doubt that the secular trend is statistically significant.

The average regression coefficient varies considerably among communities. The largest value is for Maratha and the smallest positive value is for Punjabi Hindu. It appears as if the shorter populations are growing in stature comparatively faster.

The rate of secular change of stature (as represented by the regression coefficient) increases with age up to the age of 22. In the next age group there is a decrease.

10.6 Study of standard deviations

We remarked in Chapter III while dealing with the effect of recruitment standards on the distribution of stature, that if the increasing secular trend was confined to the lower half of the range

Table 10.8 Analysis of variance of standard deviation

source of variation	df	ss	ms	F
main effects				
community (C)	9	4.242	0.4713	14.069***
age (A)	5	1.883	0.3766	11.242***
year (Y)	6	1.304	0.2173	6.487***
interactions				
CA	45	1.795	0.0399	1.191
CY	54	2.412	0.0447	1.334
AY	30	0.917	0.0306	0.901
error	270	9.050	0.0335	
total	419	21.603		

of stature then we must expect a decreasing trend in standard deviation. For testing whether this is in fact the case we can use the

standard deviations in the different samples of which the means are given in Table 10.1. We give these 420 standard deviations in Table 10.7 and the analysis of variance in Table 10.8. The main effects of community, age and year are significant but the interactions are not.

Our immediate interest is in years of recruitment. The average standard deviations in different years are given in Table 10.9 from which it can be seen

Table 10.9 Average standard deviations in each year of recruitment

year of recruitment	average standard deviation
1948	1.882
1950	1.875
1951	1.882
1952	1.877
1953	1.743
1954	1.803
1955	1.767
total	1.833

that there is a marked lowering of standard deviation during the period 1953-55 as compared to the period 1948-52.

From Table 10.10 giving average standard deviations at different ages it can be seen that as age advances the standard deviation becomes larger.

Table 10.7 Standard deviations by communities, age groups and years of recruitment.

(each entry is based on a sample of 100 recruits)

age	year of recruitment						
	1948	1950	1951	1952	1953	1954	1955
				Bihari Hindu			
18	2.1	2.2	2.1	1.9	1.8	1.8	1.6
19	1.9	2.1	2.0	1.9	2.1	1.9	2.2
20	1.7	2.3	2.3	2.1	1.9	2.0	1.9
21	2.6	2.0	2.1	2.0	1.8	2.0	1.9
22	2.1	1.8	1.9	1.6	2.0	2.2	2.0
23	2.4	2.0	2.1	2.4	2.2	1.9	1.7
				Jat			
18	1.4	1.8	1.4	1.6	1.7	1.6	1.6
19	1.9	1.7	1.7	1.7	1.7	1.8	1.6
20	1.8	1.7	1.6	1.8	1.4	1.8	1.6
21	2.0	1.8	1.5	1.8	1.7	1.8	1.6
22	1.7	2.0	1.9	1.6	1.8	1.0	1.8
23	2.3	1.8	1.7	1.7	1.6	1.6	1.8
				Malayali Hindu			
18	1.9	1.6	1.8	2.0	1.9	1.8	1.8
19	1.7	1.9	1.8	2.0	1.6	1.8	1.8
20	1.6	1.8	1.7	1.7	1.7	1.8	1.6
21	2.3	1.7	1.7	1.8	1.7	1.7	1.7
22	1.8	1.7	1.6	1.9	1.6	1.8	1.7
23	1.8	1.6	1.7	1.6	1.6	1.6	1.7

age	year of recruitment						
	1948	1950	1951	1952	1953	1954	1955
				Maratha			
18	1.7	1.5	2.0	1.7	1.9	1.6	1.6
19	2.0	1.8	1.9	2.0	1.6	1.7	1.6
20	1.8	1.5	2.2	2.1	1.4	1.6	1.7
21	1.9	1.8	1.8	2.0	1.5	1.9	1.8
22	2.3	2.2	2.0	2.4	1.4	2.0	1.9
23	2.1	1.9	2.0	2.0	1.6	1.5	1.8
				Punjabi Hindu			
18	1.7	1.7	2.0	1.7	1.8	1.8	1.8
19	1.8	2.2	1.9	1.8	2.0	2.1	2.1
20	1.9	1.9	1.8	1.9	2.2	2.1	1.7
21	1.8	2.2	2.2	2.1	1.9	2.0	1.8
22	2.1	2.1	2.1	2.0	2.0	2.6	1.8
23	1.9	1.9	2.1	1.9	1.9	2.3	1.8
				Rajput			
18	1.5	1.5	2.0	1.8	1.3	1.4	1.1
19	1.8	1.8	1.8	1.3	1.7	1.6	1.6
20	1.9	1.5	1.9	1.7	1.6	1.6	1.8
21	1.7	1.8	2.0	2.0	1.8	1.6	2.0
22	1.7	2.1	1.8	2.1	1.8	1.8	2.0
23	1.7	2.2	2.0	2.0	1.5	1.9	1.7

age	year of recruitment						
	1948	1950	1951	1952	1953	1954	1955
				Sikh (Other)			
18	2.0	1.8	1.9	1.5	1.4	1.9	1.4
19	1.7	2.0	1.9	1.8	1.6	2.0	2.0
20	1.6	2.0	2.3	1.8	1.8	2.1	1.8
21	2.0	1.8	1.9	2.4	1.9	1.7	2.2
22	2.2	1.8	2.1	2.4	1.8	2.2	2.0
23	1.7	2.1	1.9	2.0	2.2	2.2	1.8
				South Indian Christian			
18	1.8	1.7	1.7	2.0	1.2	1.8	1.7
19	1.6	1.6	1.9	1.7	1.6	1.8	1.8
20	1.9	1.7	1.6	1.6	1.9	1.7	1.7
21	2.0	1.9	1.8	1.7	1.7	1.6	1.7
22	2.0	1.6	1.8	1.7	1.6	1.8	1.8
23	1.5	2.0	1.8	1.7	2.0	1.8	2.0
				Tamil Hindu			
18	1.5	1.6	1.6	1.8	1.8	1.4	1.7
19	1.6	1.8	1.7	1.9	1.7	1.5	1.6
20	1.6	2.1	1.9	2.0	1.5	1.8	1.7
21	2.1	2.0	1.6	2.1	1.6	1.6	1.5
22	1.9	2.1	1.8	1.8	2.0	1.7	1.9
23	1.9	2.0	1.9	1.9	1.9	1.6	1.7
				U.P. Hindu			
18	1.9	1.7	1.6	1.7	1.7	2.1	1.5
19	2.0	1.8	1.6	1.9	1.6	1.3	1.7
20	1.8	1.9	2.2	1.9	1.7	2.0	1.9
21	2.1	2.3	2.1	1.9	1.6	1.8	1.7
22	2.1	2.0	1.9	1.8	2.1	1.9	2.0
23	2.1	2.1	2.3	2.0	2.0	1.9	2.0

Table 10.10 Average standard deviation at different ages

age	average standard deviation
18-	1.713
19-	1.794
20-	1.816
21-	1.873
22-	1.907
23-	1.893
total	1.833

This phenomenon (which can also be noticed in many of our tables giving 'within' variance at different ages) may be due to the same reason as the decrease in standard deviation noticed in Table 10.9. Younger age groups having comparatively fewer short people have a lower standard deviation.

The average standard deviations for different communities are shown in Table 10.11.

Table 10.11 Average standard deviations in different communities

community	average standard deviation
Bihari Hindu	2.012
Punjabi Hindu	1.962
Sikh (Other)	1.919
UP Hindu	1.886
Maratha	1.826
Tamil Hindu	1.771
Malayali Hindu	1.752
South Indian Christian	1.750
Rajput	1.748
Jat	1.700
total	1.833

The standard deviation varies from 1.700 for Jats to 2.012 for Bihari Hindus. The factors, if any, behind these differences are not clear.

CHAPTER XI. CORRELATION BETWEEN STATURE AND OTHER CHARACTERS

11.1. Army anthropometric survey

In this chapter we shall consider the correlation between stature and some physical and physiological characters. The statistics used for this purpose are taken from an anthropometric survey of Indian soldiers conducted during 1951-52. The correlation with weight and chest girth will be studied in the next chapter on the more plentiful data we have collected from recruiting centres and which constitute the main basis of the present work.

During 1951-52 an investigation was conducted by the Army Statistical Organisation in which a number of body measurements were made on each of a sample of some 4,600 soldiers from the Indian army. From this, data relating to 4,000 soldiers was subjected to statistical analysis to determine specifications for uniforms. During the course of this analysis correlations among the body measurements had to be studied along with means, standard deviations etc. All this analysis was in pursuit of two 'key measurements' on the basis of which uniforms of different 'sizes' may be classified. After a great deal of calculation stature and weight were found to be the most suitable key measurements, in the sense that these were correlated to the remaining measurements to a greater extent than any other pair of measurements.

11.2. Correlations

From among the correlations produced in this manner those with stature as one of the variables are collected together and presented in Tables 11.1 and 11.2 (Appendix 11B). The average stature for the series of 4,000 soldiers was 167.5 cms and the standard deviation was 6.0 cms.

Table 11.1 Showing for body characteristics the means, standard deviations and correlations with stature

S.No.	Character	Mean	SD	Correlation with stature
1	2	3	4	5
1	Weight	(lb) 126	(lb) 12	0.51
		(mm)	(mm)	
2	Cervicale height	144.5	5.7	0.97
3	Neck base height	143.8	5.6	0.97
4	Shoulder point height	138.7	5.5	0.96
5	Elbow height	106.2	4.3	0.91
6	Wrist level height	80.5	3.6	0.85
7	Sternale height	139.0	5.3	0.97
8	Arm scye level height	126.9	5.2	0.96
9	Post upper arm	38.0	1.9	0.74
10	Sleeve length	65.7	3.0	0.76
11	Waist height	108.0	5.0	0.93
12	Hip height	87.1	4.3	0.87
13	Knee height	46.7	2.7	0.87
14	Crotch height	78.3	4.3	0.88
15	Depth of scye	17.9	1.8	0.32
16	Waist to hip	21.6	2.1	0.42
17	Neck girth	38.8	1.7	0.29
18	Normal chest girth	90.0	4.2	0.25
19	Arm scye girth	41.6	1.9	0.40
20	Upper arm girth	26.9	1.8	0.07
21	Elbow girth	24.9	1.2	0.32
22	Lower wrist girth	16.7	0.8	0.37
23	Across back	18.7	1.3	0.28
24	Waist girth	72.1	4.4	0.19
25	Thigh girth	49.1	2.9	0.20
26	Knee girth	33.0	1.7	0.45
27	Small girth	30.5	1.5	0.30
28	Calf girth	32.7	1.7	0.16
29	Minimum leg girth	20.7	1.1	0.24
30	Ankle girth	25.7	1.2	0.31
31	Hip girth	89.0	4.4	0.31
32	Front of scye	30.0	2.0	0.19
33	Post hip arc	21.7	2.0	0.36
34	Post waist length	38.4	2.0	0.44
35	Ant. waist length	33.0	1.9	0.26
36	Shoulder length	12.4	1.1	0.35
37	Over shoulder	40.4	2.2	0.37
38	Front shoulder	29.2	1.5	0.33
39	Front over shoulder	28.8	1.6	0.32
40	Total crotch	71.8	4.1	0.39
41	Ant. chest arc	21.4	1.5	0.34
42	Ant. waist arc	20.7	1.8	0.09

For individual communities the average and standard deviation of stature are given in Table 11.2. Brief notes on the measurements are given in Appendix 11A.

In Table 11.1 forty-two characters are listed. The statistics given against each character are based on 4,000 observations. The first character is weight which has a correlation of 0.51 with stature. This value is in good agreement with the general experience of investigators who have correlated stature and weight. In particular this value agrees with the results we have presented in the next chapter.

11.3. Vertical measurements

The fifteen characters from S. No. 2 to S. No. 16 are measured vertically as segments of stature. An interesting relationship seems to exist between the correlation of these measurements with stature and the average magnitude of these measurements. The relationship is represented in Chart 11.1 in which a freehand curve is drawn to indicate the manner in which the correlation increases from low values to unity as the vertical measurement increases from a small fraction of stature to the whole of total stature. If 'waist level height' for instance had varied proportionately with total stature, we should have expected a correlation coefficient approximately unity and not 0.85 as actually observed. It looks as if every segment of total stature has an element of independent variability not determined wholly by the variability in stature.

11.4. Girths

The remaining characters are either girths or sections the correlation of stature with which varies from 0.07 to 0.45. There appears

to be no note-worthy law connecting the correlations with the magnitude of the characters unlike in the case of vertical measurements.

In Table 11.2 the correlations along with means and standard deviations are shown separately for twenty different communal groups which were distinguished in the anthropometric survey of 1951-52. Each of these communal groups can be identified with one or other of the twenty-five communities we have been dealing with, except 'Biharis and UP' which is a combination of Bihari Hindus and UP Hindus. The statistics in Table 11.2 are based on 200 soldiers for each group.

We are not here concerned with the differences among these communities in respect of the means and standard deviations of the characters, though this will certainly be an interesting topic to investigate. In the correlations with stature the differences noticed are within limits of sampling fluctuations except in the case of weight.

In the correlation between stature and weight there appears to be significant communal differences. Ahirs who are the tallest group have the least correlation between stature and weight and Assamese who are the shortest have the highest correlation. With some exceptions low correlations are to be found among tall groups and high correlations among short groups.

11.5. Blood group and blood pressure

Two publications one dealing with the relation between stature and blood group and the other referring inter alia to the relation between blood pressure and stature are added to this chapter. Data for these two papers are from the same survey of soldiers which forms the basis of the correlations we have presented in this chapter. The blood group paper covers 543 soldiers more than the 4,000 in the

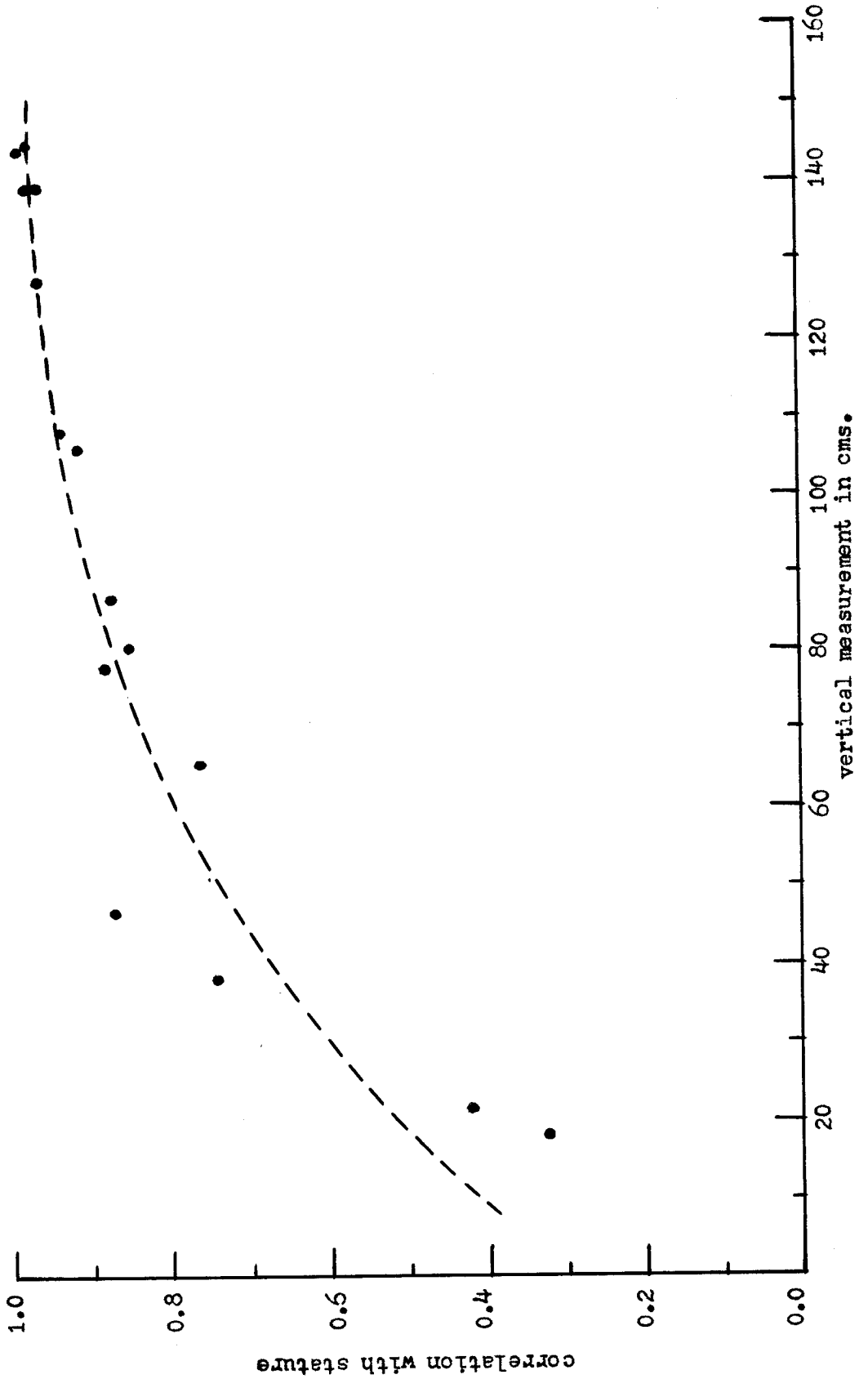
preceding analysis, and the blood pressure data was collected only from 2,562 soldiers in all.

In the paper on blood groups it is shown by analysis of variance that the variation in stature between blood groups is significant in relation to the variation within blood groups. Persons of blood group B are slightly taller than persons of other blood groups. The magnitude of the difference, however, is small - eight millimeters between the tallest and shortest blood groups. Differences of this order could not have been detected without the comparatively large number of measurements we have made. This probably explains why this result was not noticed hitherto.

The superior stature of blood group B persists even when the data is analysed separately for each state. Similarly an analysis for different communities also confirms the finding.

In the paper on blood pressure the correlation between stature and systolic as well as diastolic blood pressure is studied separately for different age groups and for different communities. The general conclusion is that there is hardly any evidence of significant correlation between stature and blood pressure. This is in contrast to the correlation between weight and blood pressure which though small in magnitude (0.0740 systolic and .0989 diastolic) is statistically significant.

Chart 11.1 Vertical measurements and their correlation with stature



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RELATION BETWEEN STATURE AND BLOOD GROUP AMONG INDIAN SOLDIERS

By N. T. MATHEW
Army Headquarters, India

SUMMARY. This paper analyses blood group data relating to 4543 soldiers of the Indian army surveyed in 1952-53. It is seen that there are significant differences in stature among the different blood groups. Group B is the tallest and group A the shortest. These differences persist even when the data are considered separately for different states and communities. Analysis of the gene frequencies in different states and communities reveal certain interesting group affinities.

1. Introduction

An important source of interest in the study of blood group frequencies is the light that they throw on anthropological differences. Anthropometrists had been using in their work measurements of body dimensions for a long time even before they started analysing blood groups. But no attempt seems to have been made to correlate blood groups and body measurements. Some indications that blood groups are related to physical traits such as proneness to contract certain diseases are referred to by Mourant (1954). The data used in the present paper reveal significant variation in stature among persons of different blood groups. This does not appear to have been noticed before.

2. The sample

The present data relate to 4543 soldiers of the Indian Army who formed part of a somewhat larger sample of soldiers selected for a survey of body measurements carried out in 1952-53. The primary object of the survey was the collection of data for standardization of clothing sizes. A medical officer, Capt. D. N. Bhattacharya, who was in charge of the field work found time for blood group determinations while his measuring team was busy on the body measurements.

Soldiers of the Indian Army cannot be regarded as a random sample of the general population of the country. The volunteers, who come forward for recruitment belong in varying proportions to different economic, social and regional strata. The actual recruits are further selected to conform to certain standards of height, weight and other physical characteristics.

The 4543 soldiers considered here do not constitute a random sample of soldiers. They were chosen from units located at the time of survey in Delhi and some

other stations, so as to obtain 200 soldiers from each of a number of 'army classes' which had to be studied separately for clothing sizes.

However, these considerations may not affect conclusions about blood group frequencies as blood group did not influence the selection in any way.

The 'states' referred to in this paper are the pre-reorganization states which existed in India at the time of the survey plus Nepal which is outside India. The communities are either tribes (e.g. Adibasis, Ahirs) or linguistic-territorial groups (e.g. Bengalees, Biharis, Tamilians) or religious groups (Muslims, Sikhs, Christians). None from these three religious groups are included in any of the tribal or linguistic or territorial groups. Statements made by the subjects at the time of the survey form the basis of grouping. 'Sikhs (M & R)' stand for Mazhabi and Ramdasia Sikhs who are supposed to have belonged originally to low caste Hindus. 'Syrian Christians' are an indigenous group whose connection with Syria is not racial.

3. DIFFERENCES IN STATURE

The main object of this paper is to invite attention to differences among the average values of height in persons belonging to the four ABO blood groups. In Table 1 we give the analysis of variance of height between and within blood groups.

TABLE 1. ANALYSIS OF VARIANCE OF HEIGHT (cm^2)

source of variation	*d.f.*	*s.s.*	*m.s.*	*F*
between blood groups	3	467	155.6	4.37
within blood groups	4539	161607	35.6	
total	4542	162074		

The ratio of variances which comes out as 4.37 exceeds the one per cent level of significance. The mean height for each blood group is given in Table 2.

TABLE 2. MEANS AND STANDARD ERRORS OF HEIGHT IN CMS

blood groups	O	A	B	AB	total
number of observations	1480	1242	1406	415	4543
mean	167.6	167.2	168.0	167.3	167.5
standard error of mean	0.16	0.17	0.16	0.29	0.09

It would appear that the 'B' group is taller than the other phenotypes. Second in order of height comes 'O', third is 'AB' and the shortest is 'A'.

The significance of the variance ratio of Table 1 may possibly be due to the total sample being a mixture of individuals from different parts of India with different proportions of the O, A, B, AB phenotypic frequencies and different average heights. The individuals are classified by state and communities for a closer study in the following section.

Similar analysis for weight as well as blood pressure did not reveal any significant differences. The averages of age for the four groups were also found to be nearly equal, being 26.7, 26.6, 26.6 and 26.7 respectively for O, A, B and AB. Even for height the magnitude of the difference is so small that significance could not have been achieved in smaller series of observations. This probably explains why such differences were not noticed before.

Analysis of variance was carried out separately for the twenty states and thirtytwo communities considered in this paper. The total numbers in these states and communities vary from 4 to 970. Only in one case did the variance ratio prove significant.

4. States and communities

The effect, if any, of blood group on height must be regarded as superimposed on the effect of environmental and racial differences. These two latter factors may to some extent be reflected in the differences between states (Table 3) and communities (Table 4).

TABLE 3. AVERAGE HEIGHT BY BLOOD GROUPS AND STATES

state	frequency				total	average height in cm				total
	O	A	B	AB		O	A	B	AB	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Assam	78	84	42	5	209	160.8	161.1	161.7	160.9	161.1
Bihar	61	84	82	42	269	167.1	166.8	166.3	166.2	166.6
Bombay	116	104	117	36	373	165.7	165.8	166.0	166.1	165.8
Coorg	5	1	4	2	12	167.0	166.5	167.9	170.5	167.8
Delhi	8	6	8	–	22	170.5	172.5	176.6	–	173.3
Himachal Pradesh	7	9	8	2	26	168.2	169.1	170.0	171.5	169.3
Hyderabad	5	2	3	1	11	166.1	167.0	165.7	160.5	165.6
Jammu and Kashmir	67	83	97	28	275	168.5	169.3	168.4	169.0	168.7
Madhya Bharat	3	–	5	1	9	167.2	–	169.3	166.0	168.2
Madhya Pradesh	20	17	19	7	63	167.6	166.9	165.6	165.0	166.5
Madras	229	109	171	34	543	167.5	166.8	167.0	167.5	167.2
Mysore	6	3	2	3	14	163.8	164.3	168.5	171.0	166.1
Orissa	5	1	3	1	10	166.8	158.5	165.3	160.5	164.9
PEPSU	62	41	51	21	175	171.7	169.6	171.4	169.5	170.8
Punjab	291	262	329	88	970	170.1	170.3	170.5	169.3	170.2
Rajasthan	110	54	80	14	258	170.5	170.5	171.1	169.5	170.6
Travancore-Cochin	86	56	50	7	199	167.3	165.5	166.9	165.4	166.6
Uttar Pradesh	200	217	240	100	757	167.2	166.3	167.1	166.1	166.8
West Bengal	50	48	49	11	158	167.3	167.1	167.4	166.0	167.2
Nepal	71	61	46	12	190	161.0	162.3	162.2	163.0	161.9
total	1480	1242	1406	415	4543	167.6	167.2	168.0	167.3	167.5
number of group averages greater than the state averages			observed				9	7	16	7
			expected				10	9.5	10	9.5

It will be seen from Table 3 that among states the average height varies by 12.2 cms from 161.1 cms in Assam to 173.3 cms in Delhi. Yet in 16 out of 20 states the average height of B is greater than the general average for the state. Due to chance only 10 out of 20 states can be expected to have B taller than the average. The difference between the numbers observed and expected can be seen to be statistically significant.

TABLE 4. AVERAGE HEIGHT BY BLOOD GROUPS AND COMMUNITIES

community	frequency				total	average height in cms				total
	O	A	B	AB		O	A	B	AB	
Adibasis (Bihar)	27	37	41	21	126	163.4	164.7	164.5	163.4	164.1
Adibasis (Other)	8	12	10	2	32	164.7	163.8	165.8	160.5	164.4
Ahirs	77	62	74	24	237	171.5	171.4	172.5	171.2	171.8
Andhras	36	21	29	7	93	167.5	164.8	165.7	167.0	166.3
Assamese	76	38	81	5	200	160.5	161.0	160.8	160.9	160.8
Balmikis	4	5	17	4	30	163.4	168.8	166.7	159.0	165.6
Bengalees	53	53	57	12	175	168.0	166.9	167.5	165.3	167.3
Biharis	22	29	27	18	96	171.1	170.0	169.1	170.4	170.3
Christians (Syrian)	37	22	23	2	84	167.2	165.4	167.3	169.3	166.8
Christians (Tamil)	19	13	29	6	67	167.3	168.7	166.7	164.1	167.0
Christians (Other)	5	1	5	–	11	163.0	170.5	162.9	–	163.7
Coorgs	5	1	4	1	11	167.0	166.5	167.9	172.0	167.7
Dogras	59	97	74	38	268	168.1	168.2	168.8	168.4	168.4
Garhwalis	40	75	57	24	196	162.5	163.0	163.9	163.0	163.2
Gurkhas	73	64	49	14	200	160.9	162.4	162.4	162.9	161.9
Gujjars	62	48	79	11	200	170.8	170.0	171.0	171.0	170.7
Hindus (U.P.)	17	19	23	19	78	167.8	170.2	165.1	167.4	167.5
Jats	51	31	46	9	137	171.5	171.7	171.7	173.6	171.8
Jammu Hindus	50	55	77	18	200	168.4	168.2	168.1	169.5	168.3
Kanarese	3	2	1	2	8	171.7	166.0	171.5	170.8	170.0
Kumaonis	50	64	57	29	200	166.7	166.6	165.7	165.2	166.2
Lingayats	8	4	4	2	18	165.4	167.6	167.8	169.5	166.9
Mahars	64	51	64	21	200	164.4	163.9	164.6	165.8	164.5
Marathas	63	64	63	18	208	167.0	167.5	167.1	165.9	167.1
Malayalees	105	69	53	13	240	167.2	166.3	167.4	167.0	167.0
Muslims (U.P.)	15	9	20	4	48	166.0	166.2	169.7	165.0	167.5
Oriyas	1	–	2	1	4	163.0	–	164.3	160.5	163.0
Punjabis	38	33	39	14	124	168.9	170.7	170.5	168.5	169.8
Rajputs	126	67	105	22	320	170.0	170.9	170.0	168.8	170.1
Sikhs (M & R)	66	52	67	17	202	167.6	167.6	168.5	167.0	167.9
Sikhs (Other)	100	59	88	21	268	172.6	173.1	173.0	171.1	172.7
Tamilians	120	42	84	16	262	167.6	166.7	167.3	168.1	167.4
total	1480	1242	1406	415	4543	167.6	167.2	168.0	167.3	167.5
number of group averages greater than the community average			observed			13.5	12	22		14
			expected			16	15.5	16		15.5

Similarly it can be seen from Table 4 that the average height varies from 160.8 among Assamese to 172.7 among Sikhs (Other). But here also against an

expected number of 16 communities we have actually 22 communities in which the 'B' group is taller than the average. The difference can be seen to be significant at the 5 per cent level.

From the evidence considered above, it seems likely that there are significant though small differences in stature associated with blood groups. Group 'B' has the highest average stature and probably 'A' the lowest. It is not easy to explain why this should be so. This is unlikely to be the result of intermixture with a tall race which came into India bringing with it also a high percentage of the B gene. It is found that some of the primitive tribes of India have high proportion of B. Though it is true that the races of Central Asia have comparatively higher frequency of B, we have no evidence that they were also tall. The 'Aryans' are believed to have come into India from the direction of Persia. But the Aryans probably had a low frequency of B as is the case with present day populations in some Western European countries.

The only tenable theory would be to regard a contribution to stature as the effect of the B gene itself or some closely linked gene. Height is known to be the result of a large number of genes. Perhaps one or two of these are linked to the B gene.

5. Gene frequencies

In Tables 5 and 6 gene frequencies estimated by Bernstein's method are given respectively for the states and for the communities. Only such states and communities are shown as are represented by more than 25 individuals in our sample. Charts 1 and 2 give graphical representations of the gene frequencies in Tables 5 and 6 by means of trilinear coordinates.

TABLE 5. DISTRIBUTION OF BLOOD GROUPS BY STATES

state	frequency of phenotype				total	gene percentage			χ^2 1 d.f.
	O	A	B	AB		p	q	r	
Assam	78	84	42	5	209	24.55	12.12	63.30	6.79**
Bihar	61	84	82	42	269	26.91	26.41	46.67	0.71
Bombay	166	104	117	36	373	20.27	23.21	55.82	0.00
Himachal Pradesh	7	9	8	2	26	24.35	21.82	53.81	0.37
Jammu and Kashmir	67	83	97	28	275	22.97	26.37	50.65	1.54
Madhya Pradesh	20	17	19	7	63	21.21	23.24	55.54	0.18
Madras	229	109	171	34	543	14.16	21.08	64.76	0.12
Nepal	71	61	46	12	190	21.60	16.71	61.69	0.33
PEFSU	62	41	51	21	175	19.40	23.00	57.58	3.03
Punjab	291	262	329	88	970	20.12	24.58	55.30	1.10
Rajasthan	110	54	80	14	258	14.20	20.29	65.50	0.08
Travancore-Cochin	86	56	50	7	199	17.45	15.63	66.91	1.99
Uttar Pradesh	200	217	240	100	757	23.65	25.66	50.66	1.27
West Bengal	50	47	49	12	158	20.97	21.78	57.24	0.67
other states	32	14	25	7	78	14.38	23.00	62.60	1.03
total	1480	1242	1406	415	4543	20.30	22.60	57.11	0.00

**significant at 1% level

TABLE 6. DISTRIBUTION OF BLOOD GROUPS BY COMMUNITIES

community	frequency of phenotype				total	gene percentage			χ^2 1 d.f.
	O	A	B	AB		p	q	r	
Adibasis (Bihar)	27	37	41	21	126	26.33	28.51	45.16	0.45
Adibasis (Other)	8	12	10	2	32	25.51	21.37	53.08	1.12
Ahirs	77	62	74	24	237	20.12	23.35	56.53	0.22
Andhras	36	21	29	7	93	16.37	21.68	61.95	0.03
Assamese	76	81	38	5	200	24.80	11.54	63.64	5.52*
Balmikis	4	5	17	4	30	16.49	45.66	37.84	0.14
Bengalees	53	52	57	13	175	20.89	22.73	56.37	1.32
Biharis	22	29	27	18	96	28.05	26.64	45.28	1.82
Christians (Syrian)	37	22	23	2	84	15.64	16.35	68.01	1.76
Christians (Tamil)	19	13	29	6	67	15.40	30.97	53.64	0.04
Dogras	59	97	74	38	268	29.53	23.68	46.79	0.02
Garhwalis	40	75	57	24	196	29.91	23.61	46.47	0.93
Gujjars	62	48	79	11	200	16.23	26.15	57.60	3.48
Gurkhas	73	64	49	14	200	21.95	17.27	60.78	0.15
Hindus (U.P.)	18	19	23	19	79	26.94	30.42	42.51	5.80*
Jammu Hindus	49	55	77	18	199	20.66	28.02	51.31	1.99
Jats	52	31	46	9	138	15.77	22.50	61.73	0.10
Kumaonis	49	64	57	29	199	26.84	24.49	48.67	0.57
Marathas	63	64	63	18	208	22.27	21.96	55.76	0.46
Mahars	64	51	64	21	200	19.93	24.08	55.99	0.30
Malayalees	105	69	53	13	240	18.88	14.86	66.26	0.02
Muslims (U.P.)	15	9	20	4	48	14.62	29.32	56.06	0.00
Punjabis	38	33	39	14	124	21.10	24.22	54.67	0.24
Rajputs	126	67	105	22	320	15.02	22.33	62.65	0.01
Sikhs (M & R)	66	52	67	17	202	18.90	23.62	57.48	0.11
Sikhs (other)	100	59	88	21	268	16.22	22.94	60.84	0.10
Tamilians	120	42	84	16	262	11.72	21.28	67.00	0.96
other communities	22	9	16	5	52	14.34	22.52	63.12	1.22
total	1480	1242	1406	415	4543	20.30	22.60	57.11	0.00

*significant at 5% level

The last column in Tables 5 and 6 gives value of χ^2 (one degree of freedom) for testing the agreement between the observed numbers of phenotypes, and the expected numbers calculated from the estimated values of p, q and r. The agreement is satisfactory except for Assamese and for U.P. Hindus.

RELATION BETWEEN STATURE AND BLOOD GROUP

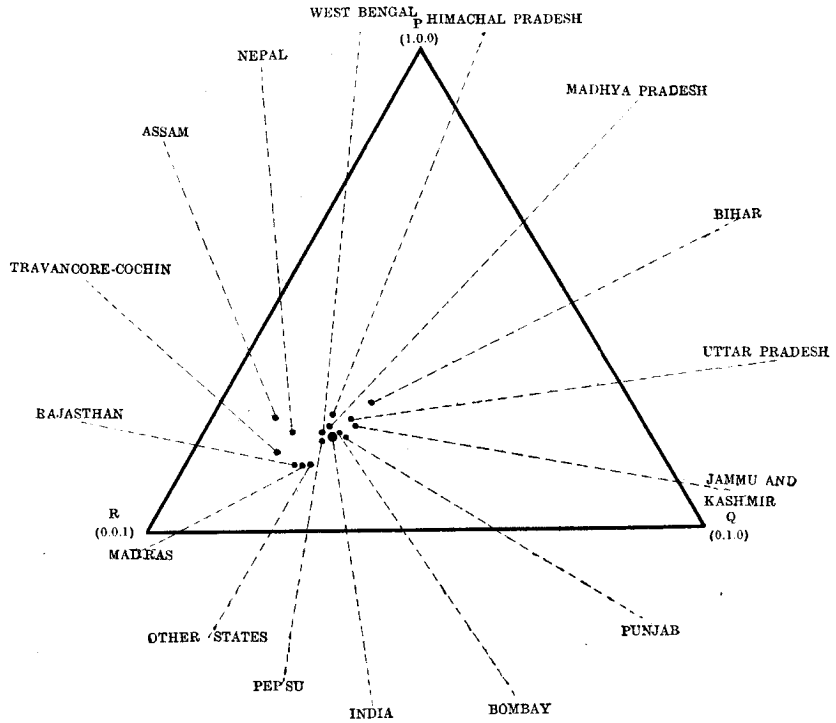

Chart 1. Blood group gene frequencies in different states.

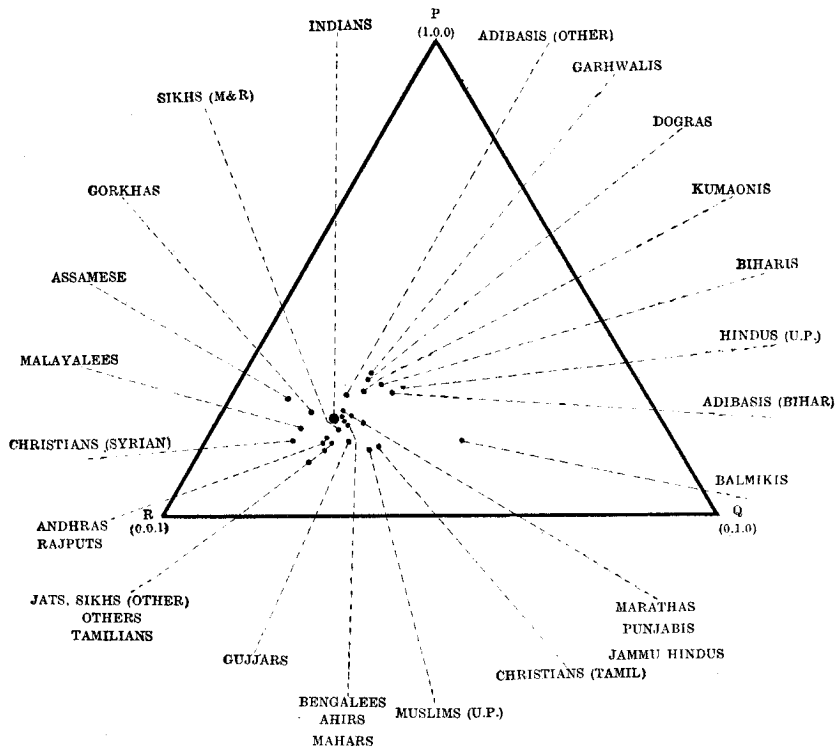

Chart 2. Blood group gene frequencies in different communities.

It is seen from Chart 1 that the populations of the States of Jammu and Kashmir, Punjab, PEPSU, Himachal Pradesh, Uttar Pradesh, West Bengal, Bombay and perhaps Bihar form a homogeneous group. Geographically, this group of states forms a fairly compact region stretching across North and Central India. Assam, Nepal and Travancore-Cochin are distinct from this group and from each other but all are on the side of low 'B' gene frequency. Rajasthan and Madras are surprisingly close to each other.

Chart 2 shows that some of the primitive tribes of India are comparatively rich in 'B' genes. Balmikis constitute a notable illustration with the highest percentage of 'B' genes and lowest O. The lowest frequency of B is among Assamese, Gorkhas and Malayalees. The Malayalee Hindus and Malayalee Syrian Christians appear to be racially close to each other, whereas the distance between the Tamil Hindus and Tamil Christians is considerable. The U.P. Muslims and U.P. Hindus also seem to be distinct though the percentage of the 'B' genes in both groups is nearly same.

Detailed figures of blood group is given in Table 7. We have not calculated gene frequencies from the detailed figures in Table 7 as the total numbers are small in most cases.

TABLE 7. DISTRIBUTION OF SOLDIERS ACCORDING TO BLOOD GROUP BY COMMUNITIES WITHIN EACH STATE

state	community	frequencies				total
		O	A	B	AB	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Assam	Assamese	76	81	38	5	200
	Bengalees	2	3	4	–	9
	total	78	84	42	5	209
Bihar	Adibasis (Bihar)	27	37	41	21	126
	Adibasis (Other)	5	11	9	2	27
	Ahirs	3	3	2	–	8
	Bengalees	1	1	1	1	4
	Biharis	22	29	27	18	96
	Gurkhas	–	–	1	–	1
	Rajputs	2	3	1	–	6
	Sikhs (Other)	1	–	–	–	1
	total	61	84	82	42	269
Bombay	Balmikis	–	–	1	–	1
	Kanarese	–	1	–	–	1
	Lingayats	6	4	4	2	16
	Mahars	54	41	57	19	171
	Marathas	55	56	55	15	181
	Punjabis	–	1	–	–	1
	Rajputs	–	1	–	–	1
	Sikhs (Other)	1	–	–	–	1
	total	116	104	117	36	373

TABLE 7. DISTRIBUTION OF SOLDIERS ACCORDING TO BLOOD GROUP BY COMMUNITIES WITHIN EACH STATE *(Continued)*

state	community	frequencies				total
		O	A	B	AB	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Coorg	Coorgs	5	1	4	1	11
	Kanarese	–	–	–	1	1
	total	5	1	4	2	12
Delhi	Ahirs	1	2	2	–	5
	Balmikis	1	–	–	–	1
	Gujjars	–	2	–	–	2
	Jats	1	–	4	–	5
	Punjabis	4	1	1	–	6
	Rajputs	–	1	–	–	1
	Sikhs (Other)	1	–	1	–	2
	total	8	6	8	–	22
Himachal Pradesh	Dogras	5	9	8	2	24
	Punjabis	1	–	–	–	1
	Rajputs	1	–	–	–	1
	total	7	9	8	2	26
Hyderabad	Andhras	2	–	–	1	3
	Christians (Tamil)	–	1	2	–	3
	Lingayats	1	–	–	–	1
	Mahars	1	1	1	–	3
	Tamilians	1	–	–	–	1
	total	5	2	3	1	11
Jammu & Kashmir	Dogras	15	24	14	9	62
	Jats	–	1	1	–	2
	Jammu Hindus	50	55	77	18	200
	Punjabis	–	1	–	–	1
	Rajputs	–	1	2	–	3
	Sikhs (other)	2	1	3	1	7
	total	67	83	97	28	275
Madhya Bharat	Ahirs	–	–	–	1	1
	Gujjars	1	–	1	–	2
	Muslims (U.P.)	–	–	1	–	1
	Rajputs	2	–	3	–	5
	total	3	–	5	1	9
Madhya Pradesh	Adibasis	1	–	–	–	1
	Bengalees	–	–	3	1	4
	Christians (Tamil)	1	–	–	–	1
	Gujjars	1	–	–	–	1
	Mahars	8	9	6	2	25
	Marathas	8	8	7	3	26
	Punjabis	1	–	1	–	2
	Rajputs	–	–	2	1	3
	total	20	17	19	7	63

TABLE 7. DISTRIBUTION OF SOLDIERS ACCORDING TO BLOOD GROUP BY COMMUNITIES WITHIN EACH STATE (*Continued*)

state	community	frequencies				total
		O	A	B	AB	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Madras	Andhras	31	20	28	5	84
	Christians (Other)	5	1	5	–	11
	Christians (Syrian)	6	2	4	1	13
	Christians (Tamil)	18	11	26	6	61
	Kanarese	3	–	1	–	4
	Malayalees	52	36	24	7	119
	Marathas	–	–	1	–	1
	Tamilians	114	39	82	15	250
	total	229	109	171	34	543
Mysore	Andhras	1	1	–	1	3
	Kanarese	–	1	–	1	2
	Lingayats	1	–	–	–	1
	Mahars	1	–	–	–	1
	Tamilians	3	1	2	1	7
	total	6	3	2	3	14
Orissa	Adibasis	2	1	1	–	4
	Andhras	2	–	–	–	2
	Oriyas	1	–	2	1	4
	total	5	1	3	1	10
PEPSU	Ahirs	24	12	20	7	63
	Dogras	–	1	–	–	1
	Gujjars	2	1	3	–	6
	Jats	9	4	3	2	18
	Punjabis	1	1	1	2	5
	Rajputs	2	6	10	1	19
	Sikhs (M & R)	8	12	8	6	34
	Sikhs (Other)	16	4	6	3	29
	total	62	41	51	21	175
Punjab	Ahirs	25	28	34	8	95
	Balmikis	1	3	6	3	13
	Dogras	39	63	52	27	181
	Gurkhas	–	1	–	–	1
	Gujjars	18	16	28	4	66
	Jats	30	16	24	5	75
	Punjabis	30	27	34	11	102
	Rajputs	11	14	16	2	43
	Sikhs (M & R)	58	40	59	11	168
	Sikhs (Other)	79	54	76	17	226
	total	291	262	329	88	970

RELATION BETWEEN STATURE AND BLOOD GROUP

TABLE 7. DISTRIBUTION OF SOLDIERS ACCORDING TO BLOOD GROUP BY COMMUNITIES WITHIN EACH STATE (*Continued*)

state	community	frequencies				total
		O	A	B	AB	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Rajasthan	Ahirs	8	5	7	2	22
	Balmikis	–	–	1	–	1
	Bengalees	1	–	–	–	1
	Gujjars	23	19	28	3	73
	Hindus (U.P.)	–	1	–	–	1
	Jats	11	8	12	1	32
	Rajputs	67	21	32	8	128
	total	110	54	80	14	258
Travancore & Cochin	Bengalees	–	–	1	–	1
	Christians (Syrian)	31	20	19	1	71
	Christians (Tamil)	–	1	1	–	2
	Malayalees	53	33	29	6	121
	Tamilians	2	2	–	–	4
	total	86	56	50	7	199
U.P.	Ahirs	16	12	9	6	43
	Balmikis	2	2	9	1	14
	Bengalees	–	2	–	–	2
	Garhwalis	40	75	57	24	196
	Gurkhas	1	1	2	1	5
	Gujjars	17	10	19	4	50
	Hindus (U.P.)	17	18	23	19	77
	Jats	–	2	2	1	5
	Kumaonis	50	64	57	29	200
	Muslims (U.P.)	15	9	19	4	47
	Punjabis	1	2	2	1	6
	Rajputs	41	20	39	10	110
	Sikhs (Other)	–	–	2	–	2
	total	200	217	240	100	757
West Bengal	Andhras	–	–	1	–	1
	Bengalees	49	47	48	10	154
	Gurkhas	1	1	–	1	3
	total	50	48	49	11	158
Nepal	Gurkhas	71	61	46	12	190
grand total		1480	1242	1406	415	4543

6. COMPARISON WITH PREVIOUSLY PUBLISHED DATA

Mourant (1954) has quoted figures of blood group frequencies supplied by House and Mahalanobis (1953) for a number of groups based on data collected from the Indian Army during the 1939-45 War. Some of these groups are comparable with corresponding groups in the present paper. Relevant figures are given in Table 8. Majumdar and Bahadur (1952) have listed a large number of Indian groups for which blood group data have been published. The groups, Jats and Rajputs, quoted

by these authors appear to be comparable with corresponding groups in the present paper. These figures are also shown in Table 8.

TABLE 8. COMPARISON OF GENE PERCENTAGES

group	source of data	number tested	gene percentages		
			p	q	r
(1)	(2)	(3)	(4)	(5)	(6)
Punjab Hindus	present paper	124	21.10	24.22	54.67
	House and Mahalanobis	615	18.05	25.94	56.01
Rajputs	present paper	320	15.02	22.33	62.65
	House and Mahalanobis	111	17.18	25.76	57.06
	Malone and Lahiri	118	19.60	25.22	55.18
U. P. Hindus	present paper	79	26.94	30.42	42.51
	House and Mahalanobis	838	19.12	23.94	56.94
U. P. Muslims	present paper	48	14.62	29.32	56.06
	House and Mahalanobis	109	17.98	26.16	55.87
Jats	present paper	138	15.77	22.50	61.73
	Malone and Lahiri	277	17.28	24.14	58.58

The agreement between comparable gene percentages seem to be tolerably good except perhaps in the U.P. Hindus. The number of U.P. Hindus in the present sample is small and, moreover, there are a large number of castes in U.P. all of which may not have been represented in our sample. Majumdar and Rao (1958) give blood group data for a number of Bengal groups. The gene frequencies given by these authors in Table 9, p. 321 of their paper are consistent with the frequencies given in our Tables 6 and 7 for West Bengal and Bengalees.

I must thank Dr. C. R. Rao for many helpful suggestions in the preparation of this paper.

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FACTORS AFFECTING BLOOD PRESSURE OF INDIAN SOLDIERS

By N. T. MATHEW

Army Statistical Office, New Delhi

SUMMARY. Blood pressure measurements made in 1952-53 on 2562 soldiers of the Indian Army show that the average values (105.1 mm. systolic and 55.1 mm. diastolic) are lower than those generally used by medical practitioners in India. Further, Indian blood pressure appears to be lower than that of Chinese and Americans. During the period from age 18 to age 39, it is observed that blood pressure increases by about half a millimeter per year. There is a small positive correlation between weight and blood pressure and perhaps a smaller correlation between height and diastolic pressure. Blood pressure of soldiers is found to vary significantly among arms, geographical regions, communities, and between vegetarians and nonvegetarians. The southern States of India constitute a compact region of low blood pressure whereas in the north the blood pressure is higher.

INTRODUCTION

The chief value of blood pressure measurements is in the indication that they provide regarding the physical condition of the persons measured. Blood pressure is considered an important element of even routine medical examinations. Medical practitioners have certain standards against which observed readings in any particular case may be compared. These standard values do indeed take account of certain progressive changes that are supposed to take place as age increases, but do not usually depend on any other factor that may have relation to blood pressure. For instance, in India no distinction in standards is made for the different geographical regions, or for the different racial communities.

The present paper which is based on a survey of soldiers of the Indian Army throws some light on these regional and racial differences, as well as on differences due to age, height, weight, vegetarianism and marital status.

THE DATA

Measurements of blood pressure used in this paper were recorded during the course of a survey primarily intended to obtain certain body measurements needed for use in standardisation of clothing sizes. A medical officer (Capt. D. N. Bhattacharya) was in charge of the measuring team. While the body measurements were in progress, he was able to find time for taking readings of blood pressure as well as certain other physiological observations. Readings of both systolic and diastolic pressure were taken on right as well as left arms with the subject in a sitting posture. All measurements were made using a standard mercury sphygmomanometer, the same instrument being used in every case. The systolic reading is the pressure at which 'the first rhythmic sounds appear' and the diastolic reading denotes the pressure at which 'the clear sound becomes muffled.'

The results of investigation into a number of cases of extremely low blood pressure found in this series were reported in a previous paper (1957). It was shown therein that the low values were not likely to be due to errors of measurement as a re-check after the lapse of three years by a second observer confirmed the general accuracy of the original measurements.

Blood pressure measurements were taken in all on 2598 soldiers. As there were only small numbers at ages above 39 and below 18, totalling altogether 36, these were left out from further analysis. Measurements on the remaining 2562 soldiers are dealt with in this paper.

The above 2562 soldiers do not constitute a random sample of soldiers of the Indian Army, much less of the general population in India. Recruits to the Indian Army are in the first place all volunteers. It is reasonable to expect that such volunteers will not be a fully representative cross-section of the general population, but will come in varying proportion from different economic, social and regional strata. In the second place, even amongst the volunteers only such individuals are selected as come up to certain standards of height, weight and other physical characteristics.

From the army itself, selection was in such a way that (a) not less than 100 people belonging to certain 'army classes' (some of which are more or less arbitrary groupings depending on regional and other considerations) were obtained and (b) the units to be surveyed were located at the time of the survey in or around Delhi (31 October 1952 to 24 December 1952) or around Ambala (19 March 1953 to 1 June 1953). A few units were selected also in Jammu and Kashmir (13 June 1953 to 11 July 1953) and some other places (16 July 1953 to 30 August 1953).

We have, therefore, to bear in mind these limitations in the selection of the sample while drawing any conclusions from the data.

ACCURACY OF MEASUREMENTS

Though the measuring instrument was graduated to indicate multiples of two millimeters of mercury and a few readings were recorded correct even to millimeters, it is evident from the data that a margin of error of at least five millimeters on either side of the reading is likely. This can be seen from the frequency distribution of blood pressures given in Table 1.

TABLE 1. FREQUENCY DISTRIBUTION OF BLOOD PRESSURE

blood pressure	frequency	blood pressure	frequency
diastolic		systolic	
30—34	7	75— 79	3
35—39	7	80— 84	63
40—44	392	85— 89	52
45—49	75	90— 94	366
50—54	853	95— 99	184
55—59	75	100—104	666
60—64	682	105—109	211
65—69	47	110—114	559
70—74	336	115—119	86
75—79	16	120—124	261
80—84	61	125—129	32
85—89	1	130—134	61
90—94	10	135—139	7
		140—144	10
		145—149	—
		150—154	1
total	2562	total	2562

The heaping up in the intervals including multiples of ten clearly indicates a tendency to record in round numbers readings which should have been spread over a range of ten millimeters about the round numbers. This tendency is much more pronounced in diastolic pressure than in systolic pressure.

Another similar limitation on accuracy of measurement is seen from Table 2 in which all the readings are sorted out according to the digit in the units place.

TABLE 2. FREQUENCY OF DIGITS IN THE UNITS PLACE

digit	number of readings		digit	number of readings	
	systolic	diastolic		systolic	diastolic
(1)	(2)	(3)	(1)	(2)	(3)
0	1416	2065	5	1	5
1	0	0	6	282	124
2	105	24	7	0	0
3	0	0	8	292	92
4	466	252	9	0	0
total	2562	2562		...	...

Zero is the most frequent digit. Nearly 57 percent of systolic readings and 81 percent of diastolic readings end in zero and are correct only to the nearest tens. Except for six readings ending in 5 none of the readings ends in an odd digit. This shows that even the readings which were not rounded off to the nearest tens were rounded off to even numbers. This latter is understandable as the instrument was graduated to show only even numbers but the abundance of zeros indicates a more serious lack of precision. However, as all the readings used in this paper were made by a single observer this lack of precision will not materially affect the comparisons we make. It may have the effect of slightly increasing the variance and hence of making the differences appear less significant than they really are.

Right arm and left arm

The question whether the arm (right or left) on which blood pressure is measured makes any difference in the reading may be of some interest. We have parallel measurements on both arms of 2317 soldiers. Table 3 gives the frequency distribution of right minus left for systolic and diastolic pressures.

The difference ranges from -28 to $+26$. Some at least of the extreme values may be due to clerical errors, or even to slips on the part of the observer. The values outside the range -15 to $+15$ number only about half percent of the total. Fluctuations of 15 millimeters can occur without any particular reason even within a short interval of time.

The large majority of differences are either zero or nearly zero but the t-test shows that the mean values are significantly different from zero.

The means for the right arm are higher by 1.81 mm. for systolic pressure and 0.78 mm. for diastolic pressure. As the right hand measurement in every case was

taken first and left hand measurement later, it is possible that these differences are entirely due to the initial nervousness of the subject. In any case, differences of this magnitude are of no practical importance.

TABLE 3. DIFFERENCE BETWEEN RIGHT ARM AND LEFT ARM

right minus left in mm.	frequency		right minus left in mm.	frequency	
	systolic	diastolic		systolic	diastolic
(1)	(2)	(3)	(1)	(2)	(3)
−28	—	1	5	—	1
−20	—	1	6	160	101
−14	1	6	8	64	19
−10	10	27	10	69	84
− 8	7	11	12	12	2
− 6	19	26	14	14	9
− 5	—	2	15	1	2
− 4	30	39	16	8	4
− 2	30	35	18	4	1
0	1340	1741	20	2	4
2	167	47	22	1	—
4	377	152	24	—	1
			26	1	1
total	2317	2317		...	...
mean	1.81	0.78		...	...
s.d.	3.52	3.00		...	...
t	24.8**	13.00**		...	...

** Significant at 1% level.

The coefficients of correlation between right and left come out as 0.92 for systolic and 0.93 for diastolic. These values show that when the measurement of blood pressure on either arm is known, a further measurement on the other arm can supply very little additional information.

In the rest of this paper, we shall deal only with blood-pressure measurements on the right arm.

RELATION BETWEEN BLOOD PRESSURE AND AGE

Table 4 gives in columns 3 to 6 the observed mean values and standard deviations for each age from 18 to 39. There is no doubt that systolic as well as diastolic pressure increases somewhat as age advances. The maximum difference between high and low in either pressure is only about 8 millimeters (less than half a millimeter per year), and the increase is by no means steady from age to age. Further, the figures in columns 5 and 6 show that the standard deviations are of the order of 8 to 13 millimeters at different ages, the overall standard deviations being 11.3 mm. for systolic pressure and 10.4 mm. for diastolic pressure. In view of the wide margin of variation, it is doubtful whether for the period considered here there is any need to make allowances for age in clinical standards of blood pressure.

To test the significance of the different components of variation relevant figures are given in Table 5. It can be seen that variation between ages is highly significant compared to the variation within ages. Further, in systolic pressure

polynomial terms of the first three degrees are significant whereas in diastolic pressure straight line is good enough to represent the age trend. In Figures 1 and 2 the observed averages are shown along with the first and third degree polynomials for systolic pressure, and the straight line for diastolic pressure. Between the ages 18 to 25 there is a steeper increase in systolic pressure than at later ages. For diastolic pressure, the increase per year is more or less the same for the entire period from 18 to 39. Polynomial values are shown in columns 7 to 9 of Table 4.

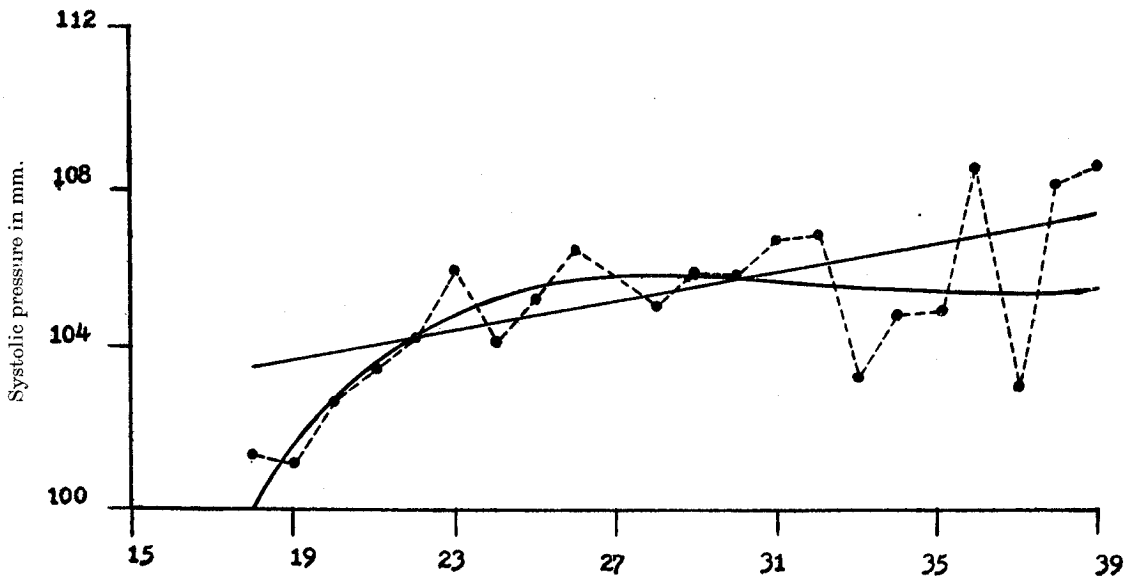

Figure 1. Age trend of systolic blood pressure

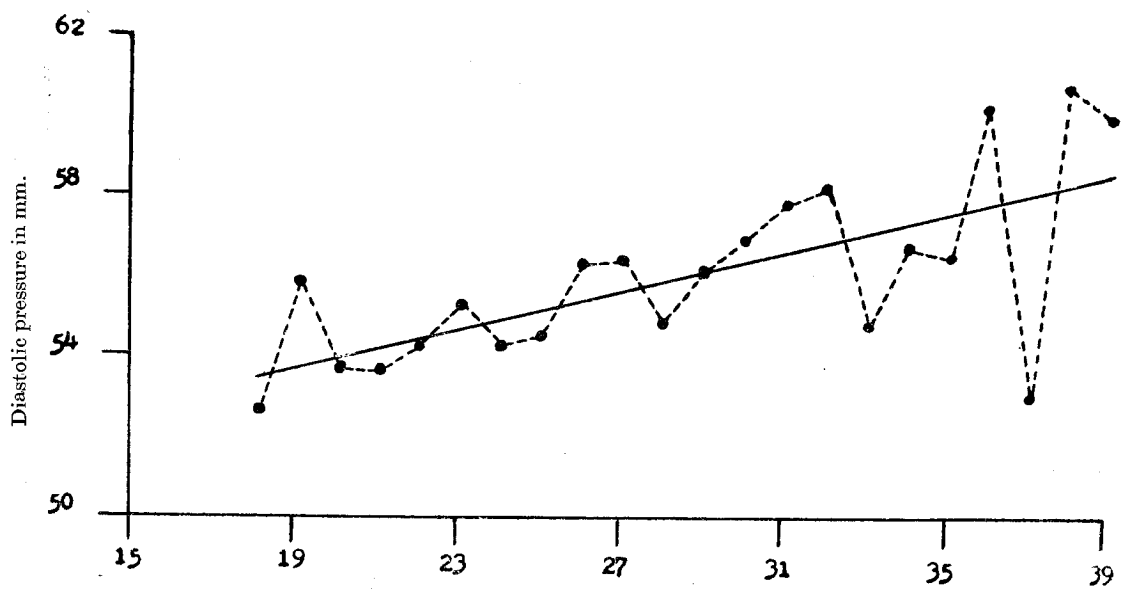

Figure 2. Age trend of diastolic blood pressure

TABLE 4. MEAN VALUES AND STANDARD DEVIATIONS OF BLOOD PRESSURE (mm.) AT DIFFERENT AGES

age in years	number of soldiers	observed mean		standard deviation		values calculated from polynomials		
		systolic	diastolic	systolic	diastolic	systolic first degree	systolic third degree	diastolic first degree
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
18	34	101.4	52.7	8.7	8.6	103.5	100.3	53.5
19	63	101.1	55.9	9.9	11.5	103.7	101.7	53.8
20	120	102.7	53.7	11.0	9.7	103.9	102.8	54.0
21	175	103.5	53.7	11.1	9.9	104.1	103.7	54.2
22	195	104.3	54.3	10.9	9.1	104.3	104.4	54.5
23	215	106.0	55.3	11.1	10.1	104.4	104.9	54.7
24	171	104.2	54.3	10.6	9.6	104.6	105.3	55.0
25	219	105.2	54.5	11.2	10.3	104.8	105.6	55.2
26	159	106.4	56.3	11.6	10.1	105.0	105.7	55.4
27	157	105.8	56.4	11.2	10.6	105.2	105.8	55.7
28	172	105.1	54.9	10.6	9.9	105.4	105.8	55.9
29	176	105.9	56.1	11.2	10.4	105.5	105.8	56.1
30	176	105.9	56.9	11.6	10.3	105.7	105.7	56.4
31	137	106.7	57.8	11.3	10.7	105.9	105.6	56.6
32	99	106.8	58.2	12.5	12.0	106.1	105.6	56.8
33	87	103.3	54.7	11.4	10.2	106.3	105.5	57.1
34	63	104.9	56.7	11.7	11.4	106.5	105.5	57.3
35	47	104.9	56.4	12.6	11.4	106.6	105.5	57.5
36	41	108.5	60.2	13.4	13.4	106.8	105.4	57.8
37	25	103.1	53.0	11.9	10.4	107.0	105.4	58.0
38	14	108.1	60.7	13.2	10.9	107.2	105.4	58.2
39	17	108.6	59.9	10.3	13.1	107.4	105.3	58.5
total	2562	105.1	55.5	11.3	10.4			

TABLE 5. ANALYSIS OF VARIANCE OF BLOOD PRESSURE

	d.f.	*s.s.*	*m.s.*	*f*
(1)	(2)	(3)	(4)	(5)
		systolic pressure		
first degree	1	1657.83	1657.83	13.05**
second degree	1	1234.74	1234.74	9.72**
third degree	1	559.75	559.75	4.41*
residual between ages	18	2033.72	112.98	0.89
within ages	2540	322678.24	127.04	
total	2561	328164.28		
		diastolic pressure		
first degree	1	2911.02	2911.02	27.12**
second degree	1	180.77	180.77	1.68
residual between ages	19	2970.16	156.32	1.46
within ages	2540	272647.83	107.34	
total	2561	278709.78		

* Significant at 5% level.

** Significant at 1% level.

FACTORS AFFECTING BLOOD PRESSURE OF INDIAN SOLDIERS

CORRELATION WITH HEIGHT AND WEIGHT

Excessive body weight is usually regarded as one of the factors likely to contribute towards abnormally high blood pressure. Standards of normal weight vary with height. It will, therefore, be interesting to know to what extent weight and height are related to blood pressure in normal healthy and active individuals. In Table 6 (columns 3 to 6) we give for each age the coefficients of correlation of blood pressure with height and weight.

TABLE 6. CORRELATION OF BLOOD PRESSURE WITH HEIGHT AND WEIGHT FOR EACH AGE

age	N	height and systolic	height and diastolic	weight and systolic	weight and diastolic	systolic and diastolic	height and weight
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
18	34	0.4514	0.4487	0.4416	0.3705	0.8939	0.7480
19	63	−0.0767	0.1565	−0.0558	0.1621	0.7506	0.7225
20	120	0.0137	0.1103	0.0880	0.0681	0.8082	0.6311
21	175	0.0466	0.1515	0.0418	0.0682	0.8557	0.5140
22	195	−0.0472	0.0375	0.1190	0.1184	0.7524	0.5795
23	215	0.0338	0.0512	0.0585	−0.0026	0.8297	0.5987
24	171	0.1995	0.3375	0.2777	0.2768	0.8435	0.5030
25	219	−0.1312	0.0137	−0.0659	0.0052	0.8468	0.4131
26	159	0.0698	0.1657	0.1258	0.1103	0.8386	0.5013
27	157	−0.1460	−0.0491	0.1081	0.0571	0.8477	0.5613
28	172	−0.1308	−0.0963	0.0533	0.0261	0.8538	0.4373
29	176	−0.0362	0.0406	0.0388	0.0221	0.8750	0.4701
30	176	0.0003	0.0549	0.0897	0.0094	0.8166	0.5082
31	137	0.0940	0.1896	0.2393	0.2525	0.8594	0.4437
32	99	−0.0211	0.0411	0.1044	0.1225	0.8858	0.5614
33	87	0.0633	0.1033	0.2177	0.0596	0.7607	0.3216
34	63	−0.0893	−0.1178	−0.0349	−0.1964	0.8538	0.4302
35	47	0.2267	0.2901	0.2175	0.1232	0.8790	0.5480
36	41	0.0833	0.1754	0.1702	0.3178	0.8695	0.6337
37	25	0.0820	0.2442	0.3242	0.4756	0.9158	0.4589
38	14	−0.4228	−0.1419	−0.2204	−0.0780	0.8083	0.7049
39	17	0.1112	0.1375	0.0085	0.2484	0.8233	0.1495
total	2562	−0.0103	0.0740	0.0989	0.0927	0.8340	0.5065

It will be seen that with the exception of those at age 18 and one or two other ages most of the correlations of height and weight with blood pressure are small in magnitude. None of these at individual ages is statistically significant.

For the series as a whole the correlations with weight are significant as also the correlation between height and diastolic pressure. Further, it must be noted that out of the 22 correlations for individual ages between weight and systolic pressure only three are negative. This is significantly different from what should have been the number of negative values if these correlations were due to chance. Similar considerations apply also to the correlations between weight and diastolic pressure and between height and diastolic pressure.

It is, however, likely that the mixing up of different communities had an effect on the values of the correlation coefficient. In Table 7 we present the correlations separately for different communities.

TABLE 7. CORRELATION OF BLOOD PRESSURE WITH HEIGHT AND WEIGHT FOR EACH COMMUNITY

community	N	height and systolic	height and diastolic	weight and systolic	weight and diastolic	systolic and diastolic	height and weight
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ahirs	173	−0.1096	−0.0595	0.1414	0.0584	0.7809	0.3767
Andhras	70	−0.1371	−0.0699	0.1286	0.0368	0.8482	0.4305
Assamese	98	−0.0132	−0.0322	−0.0167	−0.0097	0.9017	0.6999
Bengalees	106	−0.0145	−0.0486	0.1398	0.1432	0.8020	0.5485
Biharis	58	−0.2976	−0.1200	−0.0885	0.0179	0.8223	0.4359
Bihar Adibasis	44	0.0316	0.1219	0.0382	0.1010	0.8649	0.7153
Dogras	158	−0.0060	−0.0166	0.0468	0.0328	0.8140	0.5937
Garhwalis	98	0.0089	0.0197	−0.0596	−0.0097	0.8915	0.4404
Gorkhas	190	0.1929	0.1859	0.1261	0.1419	0.8893	0.6277
Gujars	99	0.0300	−0.0416	0.0180	−0.0674	0.9447	0.6426
Jats	75	−0.0685	−0.0645	0.1401	0.0338	0.8082	0.5018
Jammu and Kashmir Hindus	98	−0.0265	0.0061	0.1626	0.1323	0.8769	0.4716
Kumaonis	176	0.0961	0.0781	0.1355	0.0570	0.8823	0.6364
Mahars	100	0.0017	0.0483	0.0171	0.0337	0.8569	0.6570
Mahrathas	105	0.0272	−0.0563	0.1940	0.1340	0.8317	0.4652
Malayalee Hindus	96	−0.1134	−0.0818	−0.0255	−0.0434	0.8767	0.3731
Punjabis	60	0.0531	0.1530	0.2295	0.3124	0.8750	0.5275
Rajputs	203	0.0138	0.0600	0.1737	0.1845	0.7547	0.5853
Sikhs (M & R)	99	0.0098	0.0119	0.1818	0.1874	0.8999	0.3617
Sikhs (other)	104	0.0655	−0.0458	0.1457	0.2489	0.6700	0.5560
Syrian Christians	33	−0.0091	0.0879	−0.1977	−0.2220	0.8756	0.4693
Tamil Christians	41	0.1546	0.0753	0.0410	0.0040	0.9072	0.4551
Tamil Hindus	138	−0.0570	−0.0385	−0.0640	−0.1544	0.8734	0.4886
U.P. Hindus	56	0.2354	0.4669	0.0787	0.1765	0.9021	0.5622
U.P. Muslims	26	0.1239	0.0412	−0.0032	−0.1307	0.8579	0.6293
others	58	−0.3969	−0.4047	−0.0384	−0.0843	0.9198	0.6030
total	2562	−0.0103	0.0740	0.0989	0.0927	0.8340	0.5065

It can be seen from Table 7 that the positive and negative values observed at the individual ages could have arisen by chance even if there is no correlation between blood pressure and height or weight.

The correlations between systolic and diastolic pressure (column 7) and that between height and weight (column 8) are of the usual order of magnitude both in Table 6 and in Table 7.

FUNCTIONAL GROUPS IN THE ARMY

Soldiers of the Indian army belong to one or other of a certain number of 'arms' which are functional groupings each with a distinct role in operations. A soldier recruited into one arm remains a member of it throughout his career in the army except for inter-arm transfers which are very infrequent. These arms are open to enrolment for any citizen of India. However, it so happens that the distribution of the different communities among the arms is not uniform or random. Hence, it is

likely that communal differences may be reflected as part of the differences between the arms. Some part of the differences may also possibly be due to the nature of work and life in the different arms. In Table 8 we give the average blood pressure in the different arms, and also the average age, height and weight.

TABLE 8. MEAN BLOOD PRESSURE IN DIFFERENT ARMS, SHOWING ALSO MEAN AGE, HEIGHT AND WEIGHT

arms	number of soldiers	blood pressure in mm. systolic	blood pressure in mm. diastolic	age (years)	height (cms)	weight (lbs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
artillery	702	102.6	55.3	27.1	169.7	126.2
signals	131	104.0	53.7	27.1	166.2	123.8
infantry	1517	105.1	54.9	26.0	166.5	125.8
ordnance	73	112.3	58.1	27.7	165.4	123.5
MDSC	87	114.9	64.3	29.9	167.8	126.1
guards	45	115.2	63.7	26.0	174.7	136.8
others	7	105.1	56.6	25.4	169.0	131.1
total	2562	105.1	55.5	26.5	167.6	125.9

It is evident from Table 8 that blood pressure as well as height and weight vary materially among the different arms. The range is 12.6 mm. in systolic pressure from 102.6 mm. in the Artillery to 115.2 in the Guards; and in diastolic pressure 10.6 mm. from 53.7 in the Signals to 64.3 in the MDSC. The range in height is 9.3 cms and in weight 13.3 lbs. These variations cannot be attributed to differences in age as the high values occur in association with low as well as high age.

In Table 9 we give the results of analysis of variance between and within arms for blood pressure as well as height and weight. "Other" arms having in all only 7 soldiers in our survey have been left out of these calculations.

TABLE 9. ANALYSIS OF VARIANCE WITHIN AND BETWEEN ARMS

character		total	within arms	between arms
(1)	(2)	(3)	(4)	(5)
	d.f.	2554	2549	5
systolic pressure (mm.)	*s.s.*	327525.4	306377.9	21147.5
	m.s.		120.1	4229.5
	ratio			35.2**
diastolic pressure (mm.)	*s.s.*	278048.6	265489.1	12559.5
	m.s.		104.1	2511.9
	ratio			24.1**
height (cms)	*s.s.*	93864.2	86042.3	7821.9
	m.s.		33.7	1564.4
	ratio			46.4**
weight (lbs)	*s.s.*	366682.4	360189.3	6493.1
	m.s.		141.3	1298.6
	ratio			9.2*

* Significant at 5% level.

** Significant at 1% level.

All the four variance ratios are significant. The apparent differences among arms in respect of blood pressure as well as height and weight cannot therefore be due to chance fluctuations.

SOLDIERS FROM DIFFERENT STATES

In Table 10 we give mean values, separately for twelve pre-reorganisation States in India, as well as lumped figures for other States which have frequencies less than 25, and also for Nepal.

TABLE 10. MEAN VALUES BY STATES

state	N	blood pressure in mm.		age	height (cms)	weight (lbs)
		systolic	diastolic			
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Nepal	181	112.8	60.4	26.6	161.8	126.6
West Bengal	95	109.8	57.3	24.9	167.6	122.6
Jammu and Kashmir	142	108.9	57.7	27.2	169.0	126.4
Bihar	135	108.6	57.1	25.0	167.3	123.2
Punjab	483	107.6	59.0	26.4	170.3	128.2
Madhya Pradesh	27	106.2	53.3	25.3	166.4	122.4
PEPSU	105	106.0	58.9	26.4	171.1	127.9
Travancore-Cochin	77	103.1	54.9	28.6	167.1	122.3
Uttar Pradesh	510	102.8	53.3	26.2	166.9	126.6
Bombay	192	102.6	51.3	27.5	166.1	124.9
Rajasthan	155	101.3	55.7	26.2	170.7	127.6
Madras	298	100.6	52.2	27.8	167.2	124.2
Assam	106	99.9	49.8	24.5	161.9	123.0
other states	56	106.2	57.9	27.5	168.8	125.6
total	2562	105.1	55.5	26.5	167.6	125.9

It will be seen from Table 10 that blood pressure is lowest for Assamese and highest for Nepalese. The range of variation is 12.9 mm. for systolic pressure and 10.6

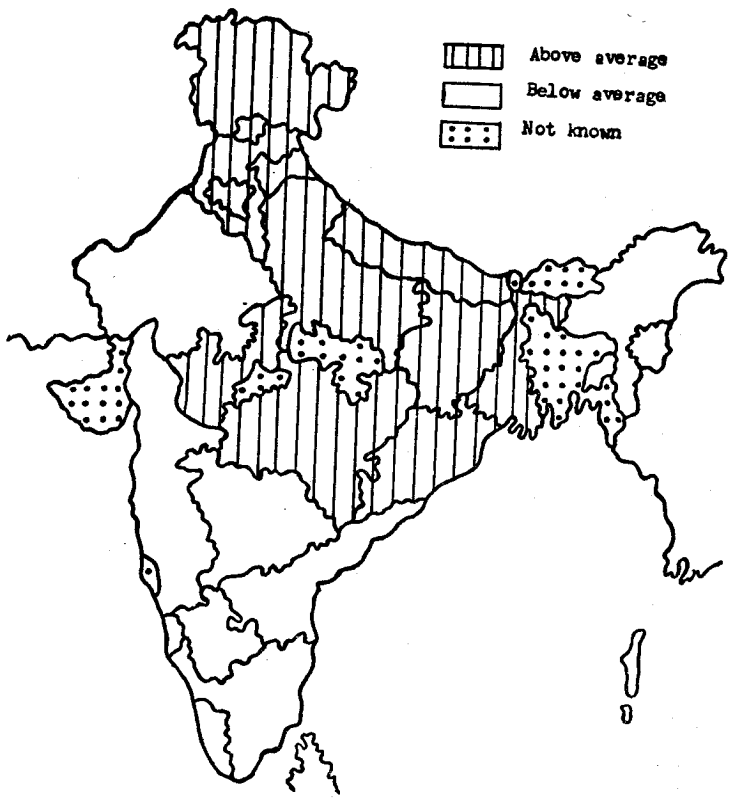

Figure 3. Regions of high and low systolic pressur

mm. for diastolic pressure which are more or less the same as noticed among the arms. Assam, Bombay, Madras and Travancore-Cochin appear to be regions of low blood pressure while Nepal, West Bengal, Punjab, PEPSU, Jammu and Kashmir and Bihar are regions of high blood pressure. These regional differences are not dependent n age or other physical characteristics.

Looking at Figures 3 and 4 in which the map of India is shaded to distinguish regions of high and low blood pressure, it is difficult to resist the conclusion that there is a compact region of low blood pressure in the south of the sub-continent with a pocket of low also in Assam and that regions of higher blood pressure are in the North. (For Uttar Pradesh we have taken the value for Hindus only as there are no Muslims in our sample except from U.P.). Perhaps the explanation may be that the original inhabitants of this country were a people of low blood pressure who were driven south and east by invaders from the north west. Or it may be that the rice-eaters of the South and East have lower blood pressure than wheat-eaters. The high blood pressure of Bengal does not fit in with this theory. Uttar Pradesh and Madhya Pradesh are in the region of high systolic pressure and of low diastolic pressure. In Rajasthan the systolic pressure is low and the diastolic pressure high.

An analysis of variance to test the significance of the differences among States is given in Table 11. It is evident that the differences are highly significant in respect of blood pressure as well as in height and weight.

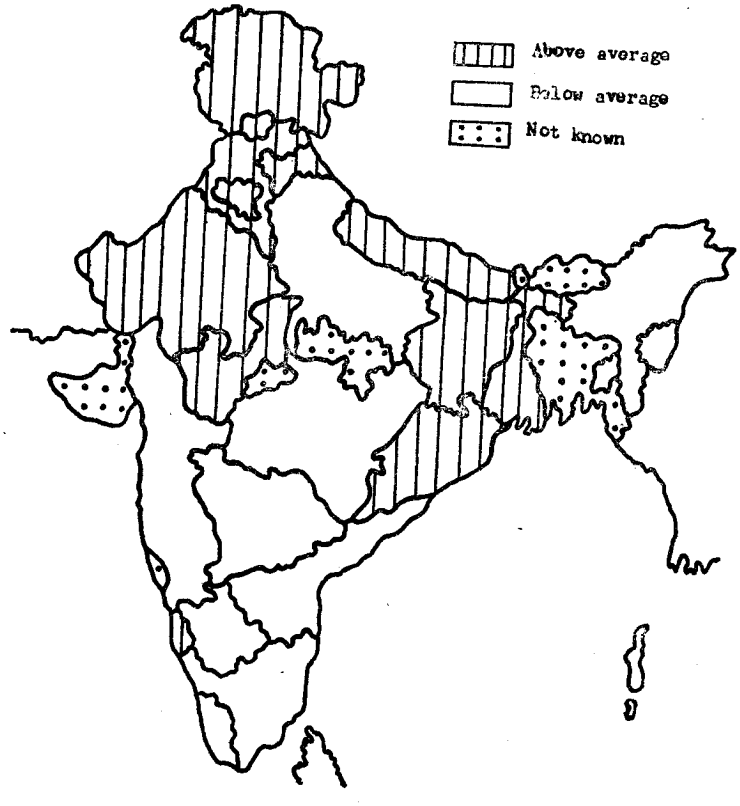

Figure 4. Regions of high and low diastolic pressure

TABLE 11. ANALYSIS OF VARIANCE WITHIN AND BETWEEN STATES

character		total	within states	between states
(1)	(2)	(3)	(4)	(5)
	d.f.	2561	2548	13
systolic pressure (mm.)	*s.s.*	328164.3	292833.7	35330.6
	m.s.		114.3	2717.6
	ratio			23.8**
diastolic pressure (mm.)	*s.s.*	288709.8	252902.9	25806.9
	m.s.		99.2	1985.2
	ratio			20.0**
height (cms)	*s.s.*	94077.1	76878.7	17198.4
	m.s.		30.2	1323.0
	ratio			43.4**
weight (lbs)	*s.s.*	368651.9	359399.3	9352.6
	m.s.		141.0	711.7
	ratio			5.1**

** Significant at 1% level.

COMMUNITIES

Of the many ways of classifying the Indian population none is perhaps more meaningful from the biological point of view than the grouping into communities. We use the term 'community' in a rather loose sense to denote any group that does not generally inter-marry with any other. This definition will, therefore, separate tribes, castes, religions and sometimes territorial groups. A very large number of such communities exist in India, but in Table 12 we have listed only those which are represented in our sample by not less than 25 individuals. These have been arranged in descending order of systolic blood pressure.

TABLE 12. MEAN VALUES BY COMMUNITIES

community	*N*	blood pressure in mm.		age in years	height in cms	weight in lbs
		systolic	diastolic			
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Gorkhas	190	113.0	60.6	26.5	161.8	126.6
Sikhs (Other)	104	111.3	64.5	26.3	173.8	136.5
Sikhs (M & R)	99	110.7	58.7	29.0	168.0	131.3
Punjabis	60	109.2	57.4	26.1	168.8	128.8
Bengalees	106	109.1	56.4	25.1	167.9	122.8
Jammu and Kashmir Hindus	98	108.9	56.2	27.2	168.4	126.6
Dogras	158	108.7	59.7	26.0	168.3	122.3
Bihar Adibasis	44	108.1	54.5	25.9	163.8	118.6
Biharis	58	108.0	56.4	23.5	170.7	127.1
Jats	75	106.8	58.6	25.0	172.3	128.4
U.P. Hindus	56	106.1	53.9	26.2	167.2	122.6
Mahars	100	105.1	53.1	26.7	164.1	121.4
Ahirs	173	105.1	59.3	26.6	171.5	125.2
Malayalee Hindus	96	103.5	55.5	28.4	167.5	123.6
Garhwalis	98	103.1	51.1	27.1	162.9	124.2
Kumaonis	176	102.9	52.9	26.3	166.2	128.4
Andhras	70	101.7	52.1	28.2	166.4	125.6
Syrian Christians	33	101.5	53.2	27.9	166.9	122.7
Rajputs	203	100.8	57.1	24.2	170.0	125.3
Tamil Christians	41	100.5	51.1	27.5	168.8	122.0
Gujars	99	100.4	50.0	27.8	171.2	133.5
Mahrathas	105	100.2	49.3	27.9	167.4	126.9
Assamese	98	99.5	49.5	24.6	161.3	122.6
Tamil Hindus	138	98.9	51.1	27.5	167.3	122.7
U.P. Muslims	26	92.7	45.6	27.2	167.2	130.1
others	58	105.3	57.3	28.4	166.9	123.4
total	2562	105.1	55.5	26.5	167.6	125.9

Analysis of variance for testing the significance of differences between communities is given in Table 13.

TABLE 13. ANALYSIS OF VARIANCE WITHIN AND BETWEEN COMMUNITIES

character		total	within communities	between communities
(1)	(2)	(3)	(4)	(5)
	d.f.	2561	2536	25
systolic pressure	*s.s.*	328164.3	277333.4	50830.9
(mm.)	*m.s.*		109.3	2033.2
	ratio			18.6**
diastolic pressure	*s.s.*	278709.8	235599.9	43109.9
(mm.)	*m.s.*		92.9	1724.4
	ratio			18.6**
height (cms)	*s.s.*	94077.1	67110.8	26966.3
	m.s.		26.5	1078.7
	ratio			40.7**
weight (lbs)	*s.s.*	368651.9	32946.9	35705.0
	m.s.		131.0	1428.2
	ratio			10.9**

** Significant at 1% level.

The differences between communities in respect of blood pressure as well as in physical characters are significant beyond any doubt.

VEGETARIANISM

Some communities (especially orthodox Hindus) have religious objection to anything but vegetarian food. Others though not strictly vegetarian may not take mutton or beef or some other kind of meat. Some object to hens' eggs but may take ducks' eggs. Thus there are varying degrees of vegetarianism. The definition of a vegetarian adopted for the present survey was any person who does not eat meat and fish.

A comparison between vegetarians and non-vegetarians may in fact only reflect the effect of communal differences. In recent times more and more people are discarding the taboo against non-vegetarian food. Hence the communal nature of the dietary difference may be somewhat blurred now.

A comparison of mean values for vegetarians and non-vegetarians is given in Table 14.

TABLE 14. MEAN VALUES FOR VEGETARIANS AND NON-VEGETARIANS

character	vegetarians	non-vegetarians	test for difference
(1)	(3)	(3)	(4)
N	408	1910	
systolic pressure	106.5	105.2	*
diastolic pressure	56.8	55.1	**
age	26.2	26.9	*
height (cms)	169.7	166.7	**
weight (lbs)	126.0	125.8	

* Significant at 5% level ** Significant at 1% level.

For 244 of the soldiers diet was not recorded. Among the rest, the vegetarians form only about one sixth. In the general population the proportion of vegetarians must be much higher. Army life probably has an effect either in changing the food habits of vegetarians or in attracting more non-vegetarians than vegetarians for enrolment. It appears that vegetarians are taller, stouter and of higher blood pressure than non-vegetarians. The t-test shows that difference in weight is not significant, but height as well as blood pressure are significantly higher for vegetarians than for non-vegetarians.

MARITAL STATUS

Another question worth looking into is whether married persons are significantly different in blood pressure from unmarried persons. We have information about marital status for only 1255 of the soldiers in our sample. Of these 399 are single and 856 are married. Mean values for the two groups are given in Table 15.

TABLE 15. MEAN VALUES FOR MARRIED AND SINGLE PERSONS

character	married	single	test for difference
(1)	(2)	(3)	(4)
N	856	399	
systolic pressure	103.1	103.0	
diastolic pressure	51.8	52.0	
age	28.0	24.1	**
height (cms)	166.4	166.4	
weight (lbs)	126.0	124.1	**

** Significant at 1% level

Apart from age the only significant difference is in weight. The married persons are slightly stouter than the unmarried. This can easily be due to the higher age of the married.

PULSE PRESSURE

The difference between the systolic and diastolic pressure is known as 'pulse pressure'. This gives some indication of the stress under which the heart is functioning and hence is considered to be of great value in assessing the soundness of the circulatory system. From Table 16 giving the distribution of pulse pressure, it can be seen that it ranges from 20 mm. to 70 mm.

TABLE 16. DISTRIBUTION OF PULSE PRESSURE

pulse pressure in mm.	frequency	cumulative percentage	pulse pressure in mm.	frequency	cumulative percentage
(1)	(2)	(3)	(1)	(2)	(3)
20	1	0.04	47	1	24.40
22	1	0.04	48	134	29.63
24	3	0.20	50	1102	72.64
26	2	0.27	51	1	72.68
28	10	0.66	52	88	76.11
30	26	1.68	53	2	76.19
32	3	1.80	54	239	85.52
34	22	2.65	55	4	85.68
35	1	2.69	56	112	90.05
36	22	3.55	58	51	92.04
38	24	4.49	60	172	98.75
40	193	12.02	62	3	98.87
42	38	13.51	64	9	99.22
44	131	18.62	66	7	99.49
45	3	18.74	68	5	99.69
46	144	24.36	70	8	100.00
total	2562			...	

The mean pulse pressure is 49.48 mm. and standard deviation 6.27 mm. Setting off two standard deviations on either side of the mean we get a range from 37 to 62 which may perhaps be taken as the limits below or above which one should look for abnormal conditions.

Conclusions

The average blood pressure for the present sample of Indian soldiers comes out as 105.1 systolic and 55.5 diastolic. The variation in individual soldiers is from 75 to 154 systolic and from 30 to 94 diastolic, the standard deviations being 11.3 for systolic and 10.4 for diastolic. Averages in age groups vary from 101.4 and 52.7 at age 18 to 108.6 at age 39 for systolic and 60.7 at age 38 for diastolic. Averages for different States vary from 99.9 and 49.8 for Assam to 112.8 and 60.4 for Nepal. Among communities the average varies from 92.7 and 45.6 for U.P. Muslims to 113.0 and 60.6 for Gorkhas.

The average level of blood pressure revealed by the present data is much lower than the average used by medical practitioners in India. In *A Pocket Guide to Medical Life Assurance* by Jehangir J. Cursetji (1932) the averages given increase from 118 and 78 at age 20 to 127 and 86 at age 40. These figures, however relate to the 'insuring population' who come from a social stratum different in many ways from that of soldiers. The average blood pressure of more than 2000 inmates of prisons in Bengal (worked out at the Indian Statistical Institute in 1947) was 108.7 systolic and 71.1 diastolic. The present figures for Bengalees are 109.1 systolic and 56.4 diastolic. While there is good agreement between the two figures of systolic pressure, the level of diastolic pressure is much lower in the present sample than for the ISI sample. The reasons

may be either differences in techniques of measurement, or perhaps something in army life which is conducive to lower diastolic pressure. To investigate this matter it is proposed to conduct another survey. Meanwhile it is recommended that the figures of diastolic pressure given in this paper may be treated with caution.

Ling (1936) gives figures for Chinese blood pressure. The averages vary from 111.4 and 72.4 at age 17 to 117.2 and 77.3 at age 37, which are higher than the present figures for India.

Robinson and Brucer (1939) give figures of blood pressure in the USA which also range from 118.3 and 68.2 at age 17 to 117.2 and 74.0 at age 37. Indian blood pressure is thus lower than the blood pressure of Americans and Chinese. The blood pressure of U.P. Muslims may possibly be among the lowest in the world.

There appears to be no correlation between systolic blood pressure and height, and the correlation, if any, between diastolic pressure and height must be small. Even between weight and blood pressure the correlation, though significant, is only of the order of 0.1 or less.

The lower blood pressure of non-vegetarians as compared to vegetarians may be considered surprising as it is generally held that a diet rich in proteins contributes to higher blood pressure. This lower blood pressure of non-vegetarians was observed also in the unpublished data relating to Bengalees referred to above.

Perhaps the most interesting result presented in this paper is the geographical distribution of high and low blood pressure in India. In the South of India there is a solid block of comparatively low blood pressure regions and in the North the blood pressure is generally higher. It will be interesting to investigate whether this is due to dietary, racial or climatic reasons.

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CHAPTER XII. CORRELATION OF STATURE WITH WEIGHT AND CHEST-GIRTH

In addition to records of stature those of weight, maximum chest girth and minimum chest girth were also extracted from the rough rolls for each recruit in the sample. Work is in progress on this material which will be published later. Priority was given to the compilation of tables of correlation between stature and weight separately for each of the nine states having not less than 5000 recruits, for other states put together, and for all states. These correlation tables are of interest as they embody more data than have gone into similar tables compiled in India before. They are reproduced in full in Appendix 12A. For convenience of presentation the class intervals of weight have been increased to 10 lbs though the tables were compiled with 5 lb intervals and used to calculate correlation coefficients. These correlation coefficients together with the corresponding means and standard deviations are given in Table 12.2.

All the inter correlations among the four variables (stature, weight, max. chest and min. chest) were calculated for four states namely Assam, Bihar, Punjab and Kerala selected to represent different regions. These correlations are shown in Table 12.3 and the corresponding correlation tables are also given in Appendix 12A.

To study the changes, if any, with age of the correlation between stature and weight the data for one state, namely, Punjab was analysed separately for each age group. The results are given in Table 12.4.

Table 12.2 Correlation between stature and weight in different states

state	number of recruits	stature (in)		weight (lb)		correlation coefficient
		mean	s.d.	mean	s.d.	
1	2	3	4	5	6	7
Bihar	9799	65.48	2.14	118.20	10.40	0.579
Bombay	13155	64.93	1.93	112.63	10.15	0.500
J & K	5684	65.78	1.99	118.61	9.80	0.526
Kerala	11134	65.49	1.88	123.55	9.10	0.530
Madras	11174	65.53	1.87	115.15	9.10	0.502
Punjab	38471	66.46	2.11	122.38	11.00	0.559
Rajasthan	6790	66.89	1.95	122.40	9.90	0.522
U.P.	28308	65.65	2.12	119.26	9.85	0.559
W. Bengal	5351	65.74	2.05	119.16	11.30	0.410
other states	17200	64.77	2.23	116.22	10.25	0.491
total	147066	65.93	2.17	118.62	10.70	0.561

Table 12.3 Correlation of stature, weight and chest girth in four states

statistic	Assam	Bihar	Kerala	Punjab
1	2	3	4	5
number of recruits	4858	9799	11134	38471
mean value				
stature (in)	64.64	65.48	65.49	66.46
weight (lb)	117.00	118.20	123.55	122.38
maximum chest girth (in)	34.67	35.52	34.00	35.07
minimum chest girth (in)	32.62	32.46	31.94	32.87
standard deviation				
stature (in)	2.07	2.14	1.88	2.11
weight (lb)	9.15	10.40	9.10	11.00
maximum chest girth (in)	1.14	1.27	1.11	1.30
minimum chest girth (in)	1.09	1.25	1.08	1.27
correlation				
stature and weight	0.434	0.579	0.530	0.559
stature and max. ch. girth	0.231	0.328	0.312	0.343
stature and min. ch. girth	0.236	0.318	0.309	0.316
weight and max. ch. girth	0.553	0.662	0.691	0.695
weight and min. ch. girth	0.557	0.656	0.693	0.680
max. and min. ch. girth	0.960	0.980	0.968	0.938

Table 12.4 Correlation between stature and weight in different age groups in Punjab

age group	number of recruits	mean		st. deviation		correlation
		stature (in)	weight (lb)	stature (in)	weight (lb)	
1	2	3	4	5	6	7
17	3244	66.20	117.90	2.02	9.45	0.566
18	5451	66.50	121.10	1.92	8.83	0.546
19	4509	66.69	122.67	1.97	9.60	0.565
20	4505	66.66	123.23	2.08	10.91	0.570
21	3783	66.65	123.65	2.02	10.55	0.557
22	3599	66.53	123.66	2.16	11.20	0.586
23	3073	66.45	123.66	2.19	12.55	0.529
24-25	3612	66.18	122.32	2.22	12.55	0.554
26-30	4050	66.20	122.51	2.26	12.70	0.551
31-35	2645	66.29	123.25	2.28	13.02	0.531
total	38471	66.46	122.38	2.11	11.00	0.559

From Table 12.2 it can be seen that the correlation between stature and weight varies from 0.410 in West Bengal to 0.579 in Bihar the overall value for all states being 0.561. Though because of the large numbers involved these differences cannot be due to sampling fluctuations the magnitude of the differences are small and it may not be very easy to search for interpretations. In chapter XI we have seen that the correlation between stature and weight in a sample of 4000 soldiers was 0.51 and that the value varied from 0.39 to 0.69 in different communities. The values of correlation we have obtained are quite comparable to those observed in England by Ruger (1932-3) and Kemsley (1950).

From Table 12.3 it can be seen that the correlation of stature not only with weight but also with chest girth, and further the correlations between weight and chest girth vary considerably among

different states. Assam where people are short statured has the lowest correlations and Punjab has in some cases the highest.

Table 12.4 shows that the variation due to age in the range of age from 17 to 35 is not very pronounced.

CHAPTER XIII. POSSIBILITIES OF FURTHER WORK

It is generally recognized that reliable information on the average body weight of different sections of a population (taking sex, age and stature into account) will throw valuable light on the nutritional level. The findings of the present study suggest further that variations in average stature over time may reflect the influence of improving socio-economic conditions. Viewed merely from this standpoint a regular periodic survey of human stature on a scale large enough to provide estimates for important regional and social groups appears justifiable. The Canadian survey of 1951 may be regarded as a precedent. Apart from the immediate practical value of the results the data from such a series of surveys would provide a basis for studying some of the questions we have touched upon in the present investigation e.g. changes of stature with age, racial and territorial groups, geographical regions, climate, altitude, nutritional levels etc. A comprehensive and well designed sample survey of human stature in India appears to be necessary.

If the sample survey is organised on a household basis with measurements of all members of biological families very valuable work can be done on the hereditary element in stature. This is one aspect on which there is no objective information relating to the Indian population.

One of our main findings is the existence of secular trend in stature. To explore this matter further it is highly desirable to collect and analyse the data available in the various regimental centres and record offices of the army. These records go back fifty or hundred years or more back into the past.

The data on weight and chest girth which we have collected along with that of stature needs be subjected to a more detailed analysis than has been

carried out by us. Norms of weight and chest girth for different combinations of age and stature would be of practical interest from the point of view of health and nutrition. Further the variation in these measurements with community, geographical region etc will be of great interest.

We have taken up only data for eight years. More years have been added since the work started. Analysis of all the data for a longer period of, say, 15 years would be a worthwhile project which can be undertaken in 1965 or so.

If we extend the survey to anthropometric measurements other than those considered the value of the results will be increased but the difficulties of field work will also increase. An anthropometric survey will have to be restricted to a manageable number of subjects but it has to be carefully considered whether resources could be found for a survey on a more adequate scale than attempted hitherto.

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Appendix 1A

NOTES ON COMMUNITIES

Adibasi As their name indicates the Adibasis were the original inhabitants of India before the invasions from outside. They are now found in the hilly tracts throughout the country but Adibasis recruited into the Indian army are mostly from the Chota Nagpur region of Bihar and the neighbouring areas. Most of them are either Christians or Animists and few are Hindus. They are generally short-statured and dark in colour. They have many tribes like Mundas, Oraons, Santhals, Kharias etc. They eat rice and wheat and have no inhibitions about any kind of food.

Ahir The origin of the Ahirs is somewhat obscure. They were a pastoral tribe their name being derived from the Sanskrit "Abhira" or milkman. Possibly, they are of Tartar stock. There is not much difference in appearance between Jats, Gujars and Ahirs who will all eat and smoke together. Ahirs are split up into three main divisions, namely, Jadubansi, Nandbansi and Gwalbansi. Roughly speaking, the Ahirs of Rajasthan, Punjab and Western U.P. are Jadubansi those of central UP are Nandbansi and those of Eastern UP and Bihar are Gwalbansi. Each of these divisions has many clans or 'gots' within them. Ahirs like Jats are good cultivators. Their staple food is wheat. The unspoilt Ahir is nearly always vegetarian.

Assamese The inhabitants of Assam belong to two main divisions, namely, the plainsmen and the hill tribes. The plainsmen are similar to east Bengali with perhaps a little more of Mongolian blood and some differences in language.

They are all rice eaters, rarely vegetarian and have leisurely habits. Recruits to the army are generally from the hill tribes who are all Mongolian people akin to Nepalese and Burmese. Their main tribes are Khasi, Garo, Naga and Lushai, each of which consists of many different clans and groups. They are all sturdily built though short-statured. Rice is the staple food. The women are more active than men in agricultural and domestic work. Almost all the tribal people of Assam except a section of Nagas have adopted the Christian religion. They have a large number of different languages.

Dogra Dogras inhabit Jammu and Kashmir and the hill districts of Punjab. Their racial origin can be traced perhaps to the Aryan invaders of India mingled with a liberal admixture of local blood. They are a class of Kshatria Hindus and originally must have had war and adventure as chief occupation. The term 'Dogra' was geographical and not ethnical, meaning the people of Dugar or the Jammu state. There are a large number of different castes or class in this community, all of whom are regarded as good fighting material for the army. They are handsome in appearance with a fine bearing though often short in stature. Their language is Dogri but they understand Punjabi or Urdu. They are mostly non-vegetarians though there are vegetarians also among them. Their occupation is mostly agriculture.

Garhwali The Garhwalis take their name from the district of Garhwal in the Kumaon division of Uttar Pradesh. They are similar in racial origin to their neighbours the Kumaonis but the Garhwalis are shorter in stature. The two communities were constantly fighting each other till recent times. The majority of Garhwalis belong to the Khasa or Khasiya tribe and speak a dialect of Hindi akin to Rajasthani.

Staple food is rice but wheat is also taken. The percentage of vegetarians which was small is becoming less.

Gorkha The Gorkhas come mainly from Nepal though considerable numbers are settled in the adjoining areas of UP and Bengal and also Sikkim. They have Mongolian features and physique and are short-statured and sturdily built. Their origin must be from some Turanian tribe on whom successive instrusions from India of Brahmins as well as warlike groups have produced changes. Their religion at present is Hinduism with perhaps some Buddhism still lingering in some places. Their staple food is rice and they have no prejudices against meat or fish. There are a large number of tribes among the Gorkhas of which the chief are Gurung, Magar, Thakur, Rai and Limbu. The bulk of the recruits are Gurungs and Magars. They are noted for their courage and power of endurance and are very good soldiers. Their language is known as Khaskura.

Gujar The origin of the Gujar is like that of the Jat, Aryo-Scythian but the Gujar probably sprang from a different tribe. Though they settled in Kashmir and the north to begin with they gradually moved southwards until they reached Saurashtra which is now called Gujerat. The name Gujerat must have originated form Gujar though the modern Gujerati has become racially quite distinct from the Gujar. The Gujars escaped severe oppression, conversion to Islam etc and have preserved much of their original Tartar independence of character. Though they hold land of fairly large areas they are of somewhat unsettled habits with pastoral ideas. They have very good physique. Their religion is Hinduism which they must have adopted at the same time as the Jats. They are now to be found in Punjab, Rajasthan and Uttar Pradesh. Their staple food is wheat. They are almost entirely vegetarian.

Hindu The Hindu community constitutes about 85% of the population of India, with members in all states and also in Nepal and other countries. The religion was either brought into India by the Aryan invaders from the north-west some centuries before Christ or was evolved in India by a fusion of Aryan and earlier religions. Being generally of a tolerant and hospitable attitude it received and absorbed many influences such as those of the Greeks and Scythians from outside India and of Buddhism and Jainism from within the country. The religion absorbed practically all the original inhabitants of the land such as the Dravidians who are now to be found in the southern part of the country, the Mongoloid peoples among the Himalayas and the aborginal tribes in the other hilly regions. The Sikhs and some other groups are converts away from Hinduism, as also the large majority of Indian Muslims, Indian Christians and Indian Buddhists.

Within the Hindu community there are several thousands of endogamous groups, some old, many of comparatively recent origin and several still in the process of formation. The racial groups in our list of communities such as Ahir, Dogra, Jat, Rajput are all major divisions of the Hindu community. Those not specifically included in our list form the residual group which we have divided into territorial communities according to their state of domicile.

Among these Andhra Hindu, Malayali Hindu and Tamil Hindu, though differing among themselves, are almost entirely of Dravidian origin without any appreciable admixture of Aryan blood. They speak a Dravidian group of languages which are quite distinct from those spoken in the north. All these groups have many castes and sub-castes among them arranged as regards social status in the common heirarchical pattern of Hindu society. They are all rice eaters and vegetarianism which was prevalent among Brahmins and other higher castes is now disappearing.

Coming northwards we have Madhya Pradesh Hindus who are partly Dravidian like the three groups considered above and partly 'Aryo-Dravidian' like Uttar Pradesh Hindus and Bihari Hindus. These Aryo-Dravidians speak different dialects of Hindi which is the common language of the north. They eat wheat and rice and have about 30% vegetarians among them.

Bengali Hindus are Mongolo-Dravidian with some Aryan blood added on. They inhabit West Bengal in India, East Pakistan and portions of Assam with some outlying colonies in Bihar, UP and other places in north India. Caste prejudices are not very strong and inter caste marriages are frequent among Bengalis though the Hindu heirarchy still persists. The Bengali language is similar to Hindi. The Bengalis are a rice eating people very fond of fish. Very few are vegetarians. The majority are poor and underfed and not of very active habits.

The Hindus of Punjab and Jammu and Kashmir are according to Risley 'Indo-Aryans'. The Punjabi Hindu is of vigorous and active habits staple food being wheat. A considerable proportion are vegetarians. In physical appearance and social customs they resemble their neighbours the Rajputs, Jats and Ahirs. At present they are mostly concentrated in Punjab and Western UP in India, the Hindu inhabitants of West Pakistan having come away after the division of India in 1947. Kashmiri Hindus are generally of very fair complexion. Unlike the Punjabis they are rice eaters and non-vegetarians.

Jat Jats and Rajputs most probably belong to the same ethnic stock though their respective forefathers may have entered India in two separate waves of immigration. According to some authorities the common stock is Aryo-Scythian but it is certain that the race contains not a few tribes of aboriginal descent. They are to be found mostly in Punjab, Rajasthan and Uttar Pradesh and neighbouring places and are cultivators now. They were Hindus from about the 10th century AD.

Some were converted to Islam in the 15th and 16th centuries and a good proportion of Sikhs are Jats converted in the 16th and 17th centuries. There are several tribes and clans among the Hindu Jats. Vegetarianism is not very strong among them. Physically, they are tall and well-built.

Kumaoni Kumaonis have their homeland in the hill district of Almora and its neighbourhood but they can be found in many stations of UP and other states where they come for empplyment usually as domestic servvants. The original inhabitants were Doms; but successive waves of invaders at first Scythian or Aryan and later warriors from the plains have conquered and assimilated the native population. At present there are four racial divisions, namely, the Khasiyas, the Doms and the recent immigrants from the plains. They are all Hindus by religion. Kumaonis are short-statured and in appearance they are more Aryan than Mongolian. The poorer classes eat millets and rice and the better off eat rice and wheat. There are no vegetarians. Their language is Kumaoni but they also speak Hindustani.

Mahar The Mahars inhabit the same territory as the Marathas but the former are of inferior social status. Their soldierly qualities have been discovered only recently.

Maratha The Marathas are a comparatively short-statured people inhabiting Western and Central India, roughly in the present state of Maharashtra and its neighbourhood. Their origin goes back to some centuries BC and according to Risley they are Scytho-Dravidian. Their migration to the south west must have taken place after the Aryans had settled in the Indogangetic plain. The Marathas rose to widespread political power under the great leader Shivaji and his successors who conquered a greater part of India and have left some remnants

in many places. The Marathas can be divided into two territorial groups the Konkani of the coastal region who are fairer and taller, and the Deccani of the interior who are shorter and darker. They are all Hindu Kshatriyas. Staple food is mainly rice but they also eat wheat. Meat is eaten only on certain festivals and other occasions. They speak the Mahrashtrian language which is allied to Hindi. There are many castes and clans among them. They are proud of their past martial traditions and fighting qualities.

Rajput The Rajputs belonged to the original Aryan stock and now constitute a section of the upper strata of Hindus in Punjab, UP, Rajasthan, Bihar, Gujerat and some other areas. They are generally regarded as descendants of rulers of early times and their warrior kinsmen, though throughout the centuries plenty of intermixture with local blood must have taken place. They speak Hindi and are generally free from caste prejudices. They are a people with great fighting qualities and traditions brought up to regard the profession of arms as their legitimate occupation.

Sikh (M & R) Mazhabi and Ramdasia are 'depressed' classes among the Sikhs whom the Indian army have found to be good soldiers. Originally they belonged to sweeper and shoemaker castes among the Hindus. Even as Sikhs they continue the same professions.

Sikh (other) The Sikhs are generally tall and well-built with a healthyand forceful appearance which is distinctive because of the long hair and beard enjoined on them by religion. Their homeland is Punjab where at present they are mostly concentrated. They are an enterprising community and have migrated to other states in India and also to foreign countries. A mass migration took place

after the division of India in 1947 when the Sikhs and other non-muslims came away from Pakistan and settled in the Indian portion of Punjab and also Uttar Pradesh and some other states. There are several sects and castes among the Sikhs though the Sikh religion discourages caste. The Sikhs speak the Punjabi language. They are mostly non-vegetarians and their staple food, in common with other Punjabi communities, is wheat. Their chief occupation is agriculture but they have also made their mark in industry.

The Sikh religion founded by Guru Nanak (1469-1539) has a history of over 400 years. The Sikhs were drawn from many castes of Hindus and also from Muslims. The higher strata of the Sikh community consist mostly of Jats and Khatris, who adopted the new faith. Craftsmen like carpenters and balcksmiths came from the corresponding castes among Hindus and are known as Ramgarias.

South Indian Christian There are two main divisions of South Indian Christian; one belonging to Kerala and known as Syrian Christian who speak Malayalam and who have a long history going back to the early centuries of the Christain era and the other found in the rest of South India who speak Tamil, Kanarese or Telugu and are recent converts to christianity from the local populations. Racially, it is doubtful whether the Syrian Christians are any different from the Nairs or other upper-class Hindus of Kerala. They are an endogamous group. They pursue agriculture, trade and other occupations including the learned professions. They are non-vegetarians. The staple food is rice.

ADIBASI

AHIR

ASSAMESE

BENGALI

BIHARI

DOGRA

GARHWALI

GORKHA

GUJAR

JAT

KUMAONI

MAHRATTA

MAHAR

RAJPUT

SIKH

Appendix 2A - Frequency distribution of stature

Table 2.3.1 Adibasi

stature (in)	frequency in age group										total
	17	18	19	20	21	22	23	24-25	26-30	31-35	
56-	1	-	-	-	-	-	-	-	-	-	1
60-	-	-	1	1	2	-	7	2	5	1	19
61-	1	1	4	5	4	8	8	8	17	4	60
62-	8	36	27	44	23	30	28	38	40	23	297
63-	8	57	49	73	42	61	57	51	59	33	490
64-	5	64	53	72	58	56	64	62	46	28	508
65-	4	56	70	53	41	65	42	45	31	25	432
66-	4	27	29	38	38	43	24	20	29	13	265
67-	8	14	14	21	15	24	17	16	11	5	145
68-	2	7	13	8	7	10	5	8	11	1	72
69-	1	2	6	4	6	3	3	3	3	-	31
70-	1	3	2	3	-	-	2	2	-	-	13
71-	-	-	-	-	-	1	-	-	1	-	2
72-	-	1	-	-	-	-	-	-	-	1	2
total	43	268	268	322	236	301	257	255	253	134	2337

Table 2.3.2 Ahir

stature (in)	frequency in age group										total
	17	18	19	20	21	22	23	24-25	26-30	31-35	
57-	-	-	-	-	-	-	-	1	-	-	1
60-	1	2	2	2	3	1	2	1	-	7	21
61-	3	-	2	1	2	3	11	4	5	10	41
62-	6	3	4	1	5	8	4	18	14	23	86
63-	10	15	9	11	18	18	32	32	36	36	217
64-	33	31	24	33	42	37	59	64	58	49	430
65-	98	89	75	80	86	49	70	56	90	76	769
66-	180	252	236	209	207	154	103	119	119	88	1667
67-	129	187	181	181	123	101	90	92	104	49	1237
68-	64	110	100	110	90	66	68	61	74	44	787
69-	49	61	79	75	76	53	52	54	38	23	550
70-	23	35	28	38	39	36	17	22	28	15	281
71-	14	10	12	14	19	14	7	12	15	6	123
72-	-	4	4	4	9	3	-	6	4	2	36
73-	-	-	3	2	-	1	-	3	2	1	12
74-	-	-	-	-	-	4	-	-	-	-	4
80-	-	-	-	-	-	-	-	1	-	-	1
total	610	799	759	761	709	548	515	546	587	429	6263

Table 2.3.3 Andhra

stature (in)	frequency in age group										total
	17	18	19	20	21	22	23	24-25	26-30	31-35	
59-	-	-	-	-	-	-	-	1	-	-	1
60-	-	-	1	-	-	-	-	3	1	-	5
61-	2	-	1	2	1	-	2	2	2	1	13
62-	4	1	5	4	2	1	1	7	8	5	38
63-	6	9	4	14	10	6	7	2	14	9	81
64-	22	27	19	20	21	24	11	27	35	21	227
65-	21	31	35	41	40	32	13	20	29	20	282
66-	15	25	23	26	22	19	7	16	28	21	202
67-	20	10	20	19	22	15	4	8	16	11	153
68-	8	15	15	11	8	15	9	5	6	5	97
69-	2	6	6	5	2	3	1	4	2	2	33
70-	1	1	4	5	2	4	3	1	1	1	23
71-	-	-	1	1	-	-	1	2	1	-	6
72-	-	-	-	-	-	-	1	-	-	-	1
74-	-	-	-	-	-	-	-	-	1	-	1
total	101	133	134	148	130	119	60	98	144	96	1163

Table 2.3.4 Assamese

stature (in)	frequency in age group										total
	17	18	19	20	21	22	23	24-25	26-30	31-35	
56-	1	-	-	-	-	-	-	-	-	-	1
58-	-	1	-	-	-	-	-	-	-	-	1
59-	1	1	-	1	-	-	-	-	-	-	3
60-	15	19	13	20	5	5	4	1	11	1	94
61-	31	56	54	56	33	24	13	15	19	7	308
62-	62	122	89	104	60	52	31	34	30	7	591
63-	86	143	152	125	97	73	48	48	42	5	819
64-	92	151	132	145	131	110	67	54	51	11	944
65-	56	100	132	116	104	91	54	44	37	13	747
66-	38	52	62	81	61	60	42	28	32	11	467
67-	14	44	46	50	42	43	13	21	14	11	298
68-	12	28	27	30	18	22	16	9	11	5	178
69-	6	9	7	11	13	14	2	1	3	-	66
70-	5	4	3	2	2	2	3	1	2	1	25
71-	1	3	2	3	-	-	2	2	-	-	13
72-	1	2	1	1	-	2	1	-	-	-	8
total	421	735	720	745	566	498	296	258	252	72	4563

Table 2.3.5 Bihari

stature (in)	frequency in age group										total
	17	18	19	20	21	22	23	24-25	26-30	31-35	
57-	-	-	-	-	-	-	-	-	-	1	1
59-	-	-	-	-	-	-	-	-	1	-	1
60-	2	7	4	6	3	2	13	7	5	12	61
61-	7	11	10	16	18	14	14	20	23	18	151
62-	31	20	14	12	26	17	41	68	71	49	349
63-	47	46	42	47	44	66	78	69	118	70	627
64-	112	80	114	110	114	147	123	119	152	98	1177
65-	105	130	135	128	127	148	132	130	130	83	1248
66-	113	194	150	165	156	147	120	120	111	65	1341
67-	63	141	123	134	117	115	83	96	62	35	969
68-	43	82	95	103	92	78	49	46	42	20	650
69-	16	29	37	47	40	32	37	35	14	16	303
70-	10	15	26	27	10	20	15	10	15	3	151
71-	1	4	14	9	12	7	6	7	4	1	65
72-	2	2	2	3	2	2	2	1	2	1	19
73-	-	2	-	1	2	1	-	-	1	-	7
74-	-	-	1	-	-	-	1	-	-	-	2
total	552	771	767	808	763	796	714	728	751	472	7122

Table 2.3.6 Bengali

stature (in)	frequency in age group										total
	17	18	19	20	21	22	23	24-25	26-30	31-35	
59-	-	-	-	1	-	-	-	-	1	-	2
60-	5	1	-	1	2	2	2	2	3	1	19
61-	9	2	3	4	4	4	4	5	9	10	54
62-	18	18	12	18	12	21	29	17	39	16	200
63-	55	43	35	29	36	47	39	49	51	26	409
64-	89	94	82	103	85	92	85	85	98	67	880
65-	95	125	125	115	119	105	78	114	85	60	1021
66-	70	106	140	126	115	110	104	93	63	43	970
67-	69	87	106	104	87	93	73	67	58	31	775
68-	31	63	70	62	63	47	38	48	40	27	489
69-	12	29	31	42	33	26	28	29	22	18	270
70-	6	7	17	13	17	9	16	13	6	2	106
71-	1	5	1	4	3	7	4	-	2	5	32
72-	1	-	-	2	3	3	2	3	-	-	14
73-	-	-	1	-	1	-	-	-	-	-	2
74-	-	-	-	-	-	-	-	-	1	-	1
total	461	580	623	624	579	566	502	525	478	306	5244

Table 2.3.7 Dogra

stature (in)	frequency in age group										total
	17	18	19	20	21	22	23	24-25	26-30	31-35	
55-	-	-	-	-	-	1	-	-	-	-	1
57-	1	-	-	-	-	-	-	-	-	-	1
58-	-	-	-	1	-	-	-	-	-	-	1
59-	-	-	-	1	-	2	1	-	2	2	8
60-	18	10	11	9	2	7	1	4	11	5	78
61-	18	26	15	21	5	11	21	28	38	24	207
62-	36	55	32	48	26	42	34	57	73	24	427
63-	66	104	76	87	59	69	70	106	121	62	820
64-	163	296	200	242	176	216	159	196	219	102	1959
65-	114	257	194	231	173	150	125	146	182	110	1682
66-	91	218	179	184	170	143	106	141	158	80	1470
67-	39	108	118	94	98	104	56	80	104	52	853
68-	19	61	59	62	60	49	35	38	48	31	462
69-	13	23	29	24	18	22	13	19	25	12	198
70-	-	13	12	12	16	12	10	12	9	4	100
71-	1	1	2	4	6	2	2	3	3	1	25
72-	1	1	3	3	-	2	-	-	2	2	14
total	580	1173	930	1023	809	832	633	820	995	511	8306

Table 2.3.8 Garhwali

stature (in)	frequency in age group										total
	17	18	19	20	21	22	23	24-25	26-30	31-35	
57-	-	-	1	-	-	-	-	-	-	1	2
58-	1	-	-	-	-	-	-	-	1	1	3
59-	1	3	-	-	1	2	-	-	-	1	8
60-	18	12	11	7	7	11	10	11	14	14	115
61-	71	89	39	43	37	42	24	45	60	50	500
62-	91	135	88	69	78	76	47	71	74	74	803
63-	126	184	169	126	124	94	100	92	113	101	1229
64-	95	196	160	183	149	142	87	108	132	106	1358
65-	59	151	167	151	143	134	88	89	117	103	1202
66-	52	89	105	120	114	115	74	72	80	78	899
67-	22	36	55	56	48	74	49	33	53	47	473
68-	13	16	25	33	47	34	19	23	20	14	244
69-	4	3	14	8	23	10	9	6	7	6	90
70-	1	-	2	3	2	3	6	6	1	4	28
71-	2	1	3	1	2	-	-	-	1	1	11
72-	-	-	-	-	-	2	-	-	-	-	2
73-	-	-	-	-	-	1	-	-	-	-	1
total	556	915	839	800	775	740	513	556	673	601	6968

Table 2.3.9 Gorkha

stature (in)	frequency in age group										total
	17	18	19	20	21	22	23	24-25	26-30	31-35	
55-	-	-	-	-	-	2	-	-	-	-	2
56-	-	-	-	-	-	1	-	-	-	-	1
57-	3	-	-	-	-	-	-	-	-	-	3
58-	6	1	2	1	1	1	-	3	-	-	15
59-	22	10	6	7	1	1	1	-	2	1	51
60-	106	80	43	29	26	5	15	14	26	8	352
61-	203	194	103	84	53	19	19	37	35	32	779
62-	182	264	178	131	77	70	37	60	48	36	1083
63-	111	244	186	181	101	66	43	41	56	14	1043
64-	56	189	140	161	89	56	26	55	44	29	845
65-	23	92	123	101	63	38	23	47	45	14	569
66-	4	40	57	53	48	22	10	29	35	13	311
67-	2	10	26	27	27	16	12	12	12	9	153
68-	2	4	5	6	8	7	3	6	5	2	48
69-	-	1	4	8	5	2	1	5	4	1	31
70-	-	-	1	-	1	1	-	2	-	-	5
71-	1	1	-	1	-	-	-	1	-	-	4
total	721	1130	874	790	500	307	190	312	312	159	5295

Table 2.3.10 Gujar

stature (in)	frequency in age group										total
	17	18	19	20	21	22	23	24-25	26-30	31-35	
60-	-	2	-	-	-	-	1	2	-	-	5
61-	-	-	-	-	-	-	-	-	-	1	1
62-	1	1	2	1	-	1	-	1	6	1	14
63-	-	6	-	3	1	2	3	2	4	3	24
64-	5	13	9	9	5	-	3	9	11	12	76
65-	20	19	16	18	8	14	5	12	19	18	149
66-	26	68	50	45	24	25	17	27	24	26	332
67-	12	65	20	31	17	16	18	19	28	27	253
68-	5	31	19	21	22	16	13	17	23	18	185
69-	4	20	14	18	8	9	8	6	10	10	107
70-	1	7	7	4	-	7	2	7	3	4	42
71-	-	2	-	4	1	4	1	1	2	5	20
72-	-	2	-	2	-	1	1	-	1	-	7
total	74	236	137	156	86	95	72	103	131	125	1215

Table 2.3.11 Jat

stature (in)	frequency in age group										total
	17	18	19	20	21	22	23	24-25	26-30	31-35	
59-	-	-	-	-	-	-	-	3	-	-	3
60-	3	1	2	1	-	1	2	5	-	1	16
61-	3	5	-	-	-	3	5	5	2	5	28
62-	10	6	6	-	3	5	3	13	9	10	65
63-	17	16	7	9	11	13	9	35	24	13	154
64-	29	40	35	25	27	21	19	53	43	38	330
65-	86	80	64	66	70	52	60	83	111	92	764
66-	199	292	248	248	197	230	211	178	191	120	2114
67-	149	221	198	198	183	167	183	143	162	134	1738
68-	88	159	123	157	134	145	117	138	130	109	1300
69-	43	77	82	106	99	69	104	82	81	74	817
70-	24	38	43	48	46	39	43	40	48	33	402
71-	10	16	24	17	20	17	22	22	21	25	194
72-	4	4	3	4	6	9	3	5	6	7	51
73-	-	-	1	3	4	2	3	1	3	-	17
74-	1	-	-	1	-	-	-	1	-	1	4
75-	-	-	-	-	-	-	-	-	-	3	3
78-	-	-	-	-	-	-	1	-	-	-	1
total	666	955	836	883	800	773	785	807	831	665	8001

Table 2.3.12 J&K Hindu

stature (in)	frequency in age group										total
	17	18	19	20	21	22	23	24-25	26-30	31-35	
56-	-	-	-	-	-	5	-	-	-	-	5
59-	-	1	-	1	-	1	-	-	-	-	3
60-	5	3	2	2	2	1	1	-	3	1	20
61-	10	9	9	8	0	7	12	7	18	10	90
62-	27	21	11	25	12	16	8	24	21	10	175
63-	35	55	54	58	40	36	34	44	55	26	437
64-	93	150	119	93	74	70	75	86	90	31	881
65-	96	164	112	131	85	84	75	107	75	31	960
66-	85	155	165	134	102	111	65	96	95	42	1050
67-	58	87	81	92	75	59	53	80	62	39	686
68-	16	59	64	68	41	43	29	40	35	24	419
69-	-	19	39	25	17	27	25	28	20	17	217
70-	3	8	6	18	3	7	13	10	5	4	77
71-	1	7	4	8	3	3	1	3	2	3	35
72-	1	1	1	3	-	1	-	1	-	1	9
73-	-	-	-	-	-	1	-	-	-	-	1
74-	-	-	1	-	-	-	1	-	-	-	2
total	430	739	668	666	454	472	392	526	481	239	5067

Table 2.3.13 Kumaoni

stature (in)	frequency in age group										total
	17	18	19	20	21	22	23	24-25	26-30	31-35	
55-	-	-	-	-	-	-	-	-	2	-	2
57-	-	-	1	-	-	-	-	-	-	-	1
58-	-	-	3	-	-	-	-	-	-	-	3
59-	2	-	-	-	-	-	-	-	-	-	2
60-	6	2	3	-	4	4	5	2	2	1	29
61-	6	3	7	8	4	8	13	16	15	10	90
62-	49	20	17	13	19	15	16	34	26	31	240
63-	126	135	102	86	107	73	61	68	112	76	946
64-	143	140	140	129	115	136	96	103	109	113	1224
65-	132	178	177	162	138	123	126	130	114	107	1387
66-	108	110	121	147	150	109	92	96	96	84	1113
67-	60	90	80	112	97	91	71	63	67	62	793
68-	26	40	41	50	36	52	49	38	38	30	400
69-	9	8	16	18	23	20	19	20	15	18	166
70-	3	6	7	8	9	7	13	9	9	14	85
71-	-	3	1	3	4	3	2	2	2	2	22
72-	-	-	-	-	-	-	-	1	-	-	1
73-	-	-	1	-	1	-	-	-	-	-	2
total	670	735	717	736	707	641	563	582	607	548	6506

Table 2.3.14 M.P. Hindu

stature (in)	frequency in age group										total
	17	18	19	20	21	22	23	24-25	26-30	31-35	
60-	-	-	-	3	-	1	-	-	1	1	6
61-	5	3	2	1	3	-	1	1	3	1	20
62-	1	8	4	15	2	2	-	2	12	3	49
63-	9	19	17	27	9	11	5	5	5	9	116
64-	12	36	40	38	16	19	14	13	5	10	203
65-	4	33	26	29	21	18	12	12	14	7	176
66-	6	16	31	25	27	15	8	23	10	5	166
67-	7	14	13	21	10	13	10	9	4	2	103
68-	-	6	12	7	8	10	5	5	4	1	58
69-	-	2	5	3	4	4	5	4	3	2	32
70-	2	1	4	2	-	3	1	2	-	-	15
71-	-	1	1	2	1	-	-	1	1	-	7
72-	-	-	2	1	-	1	-	1	1	-	6
total	46	139	157	174	101	97	61	78	63	41	957

Table 2.3.15 Mahar

stature (in)	frequency in age group										total
	17	18	19	20	21	22	23	24-25	26-30	31-35	
56-	-	-	-	-	-	-	-	1	-	-	1
58-	3	-	1	-	-	-	-	-	1	-	5
59-	-	2	1	1	2	2	-	1	3	1	13
60-	11	11	7	7	5	6	4	7	11	9	78
61-	29	23	21	19	22	11	24	20	23	18	210
62-	82	58	37	49	43	51	34	45	58	49	506
63-	99	123	124	109	88	99	84	90	109	95	1020
64-	126	198	173	198	153	148	141	135	127	100	1499
65-	71	149	161	145	132	121	109	111	104	91	1194
66-	39	105	104	101	105	110	90	95	71	62	882
67-	27	48	66	46	65	53	48	47	37	33	470
68-	11	15	21	32	28	24	33	31	28	6	229
69-	1	8	8	16	16	17	14	12	6	7	105
70-	-	2	4	3	6	8	3	5	2	1	34
71-	-	1	1	-	2	1	3	2	6	-	16
72-	-	-	-	-	-	-	-	1	-	-	1
73-	2	-	-	-	-	-	-	-	-	-	2
total	501	743	729	726	667	651	587	603	586	472	6265

Table 2.3.16 Malayali

stature (in)	frequency in age group										total
	17	18	19	20	21	22	23	24-25	26-30	31-35	
58-	1	1	-	-	-	-	-	-	-	-	2
59-	4	-	-	-	-	-	1	-	-	1	6
60-	14	4	3	3	3	5	3	4	5	2	46
61-	39	9	4	9	8	6	5	16	24	5	125
62-	69	23	22	18	23	21	18	37	34	34	299
63-	84	65	52	57	65	51	61	94	73	86	688
64-	132	190	200	170	190	152	162	208	191	160	1755
65-	114	180	173	196	191	191	209	159	155	135	1703
66-	65	144	156	209	172	143	157	170	100	121	1437
67-	28	99	115	121	99	109	102	92	89	65	919
68-	17	53	66	60	58	65	53	56	35	34	497
69-	9	25	19	28	28	26	22	34	19	12	222
70-	3	11	10	10	12	6	5	6	13	6	82
71-	1	5	7	2	6	1	2	1	3	2	30
72-	-	-	2	1	3	1	2	-	-	-	9
73-	-	1	-	1	-	-	-	-	-	-	2
total	580	810	829	885	858	777	802	877	741	663	7822

Table 2.3.17 Maratha

stature (in)	frequency in age group										total
	17	18	19	20	21	22	23	24-25	26-30	31-35	
55-	-	-	-	-	1	-	-	-	-	-	1
57-	2	-	-	-	-	-	-	-	-	-	2
58-	1	1	-	1	-	-	-	-	-	-	3
59-	4	-	1	3	-	-	-	1	1	-	10
60-	16	9	8	11	9	12	6	3	17	6	97
61-	32	21	24	13	15	20	26	25	24	22	222
62-	60	60	41	31	26	41	34	45	74	66	478
63-	115	110	87	107	83	79	84	88	103	102	958
64-	157	216	178	205	201	180	161	194	179	132	1803
65-	90	158	179	183	159	118	171	137	139	112	1446
66-	81	137	141	140	135	141	130	128	116	83	1232
67-	33	63	84	72	63	84	86	82	65	54	686
68-	10	38	41	36	47	36	38	36	57	26	365
69-	2	7	16	19	15	20	13	17	21	16	146
70-	1	4	4	8	8	9	4	6	8	5	57
71-	1	3	1	5	3	7	7	5	1	2	35
72-	-	-	-	1	-	1	2	1	-	-	5
73-	-	-	-	-	-	-	-	-	1	-	1
total	605	827	805	835	765	748	762	768	806	626	7547

Table 2.3.18 Punjabi Hindu

stature (in)	frequency in age group										total
	17	18	19	20	21	22	23	24-25	26-30	31-35	
58-	-	-	1	-	-	-	-	-	-	-	1
59-	-	-	-	-	2	-	-	1	1	1	5
60-	7	-	4	2	3	3	3	4	2	5	33
61-	17	19	4	4	13	5	13	15	14	13	117
62-	38	31	24	32	17	31	30	37	51	40	331
63-	59	61	55	51	51	60	60	71	77	54	599
64-	125	111	85	98	100	94	93	97	113	78	994
65-	131	173	152	143	140	126	109	131	166	94	1365
66-	148	269	227	247	202	166	165	184	179	97	1884
67-	93	165	161	148	135	128	102	96	109	74	1211
68-	50	106	100	108	94	70	71	51	70	39	759
69-	27	53	53	60	44	49	25	48	34	28	421
70-	8	16	35	27	18	14	15	14	18	11	176
71-	3	3	9	13	9	14	5	8	8	-	72
72-	2	1	-	1	3	1	5	-	3	-	16
73-	-	-	1	-	-	-	-	-	1	-	2
74-	-	-	-	-	-	-	-	1	-	-	1
75-	-	-	-	-	-	1	-	1	-	-	2
77-	-	-	-	-	-	1	-	-	-	-	1
total	708	1008	911	934	831	763	696	759	846	534	7990

Table 2.3.19 Rajput

stature (in)	frequency in age group										total
	17	18	19	20	21	22	23	24-25	26-30	31-35	
56-	-	-	-	-	-	-	-	-	1	-	1
58-	-	-	-	-	-	-	-	1	-	-	1
59-	-	-	-	-	-	-	1	-	-	-	1
60-	3	5	1	2	3	2	2	6	1	2	27
61-	4	4	1	5	5	4	3	10	11	8	55
62-	11	17	9	14	8	11	12	28	25	19	154
63-	36	34	32	30	33	34	27	41	59	45	371
64-	54	73	61	62	59	69	64	91	99	64	696
65-	117	130	125	125	91	81	91	129	134	76	1099
66-	174	302	218	258	235	214	172	205	183	130	2091
67-	115	190	188	191	175	180	152	142	125	101	1559
68-	82	119	109	135	115	103	142	120	94	77	1096
69-	23	50	81	64	81	60	81	70	45	36	591
70-	10	22	25	28	37	35	26	25	31	22	261
71-	4	3	7	15	12	14	10	12	15	10	102
72-	-	4	3	8	3	6	4	4	2	2	36
73-	-	-	1	-	1	1	1	3	1	-	8
74-	-	-	-	-	-	-	-	1	-	-	1
total	633	953	861	937	858	814	788	888	826	592	8150

Table 2.3.20 Tamil Hindu

stature (in)	frequency in age group										total
	17	18	19	20	21	22	23	24-25	26-30	31-35	
57-	-	1	-	-	-	-	-	-	-	-	1
58-	1	-	-	-	-	-	-	1	-	-	2
59-	5	-	-	-	-	-	-	-	-	-	5
60-	9	-	1	3	1	1	2	5	5	3	30
61-	34	7	3	2	4	7	5	9	13	11	95
62-	48	11	13	18	15	24	22	22	49	25	247
63-	89	35	41	39	48	52	55	113	106	70	648
64-	142	189	148	165	182	150	165	184	178	154	1657
65-	103	177	165	171	161	185	151	151	172	140	1576
66-	99	160	167	190	153	122	172	132	134	142	1471
67-	49	104	118	122	112	110	108	102	75	87	987
68-	32	51	70	47	47	61	61	47	43	53	512
69-	15	22	25	27	26	29	33	24	21	15	237
70-	8	5	8	14	10	10	18	11	5	7	96
71-	1	3	4	5	3	1	6	3	3	8	37
72-	1	-	-	1	1	2	1	2	1	-	9
73-	-	-	-	3	-	-	1	1	-	-	5
total	636	765	763	807	763	754	800	807	805	715	7615

Table 2.3.21 Sikh (M&R)

stature (in)	frequency in age group										total
	17	18	19	20	21	22	23	24-25	26-30	31-35	
60-	-	1	-	2	2	5	-	3	1	3	17
61-	1	-	1	2	-	3	5	3	2	2	19
62-	7	5	4	8	5	7	11	21	16	17	101
63-	17	15	21	19	23	15	41	32	37	20	240
64-	96	106	68	66	73	66	59	70	58	55	717
65-	116	128	123	112	111	92	91	93	81	58	1005
66-	167	166	150	155	148	114	98	97	100	74	1269
67-	106	128	133	138	121	111	60	66	77	58	998
68-	69	83	75	78	68	57	40	37	48	37	592
69-	30	38	49	50	42	35	28	28	23	21	344
70-	5	18	25	24	11	13	17	17	13	9	152
71-	4	7	13	10	9	8	4	5	3	5	68
72-	1	2	3	4	5	3	3	1	2	-	24
73-	-	1	-	1	2	1	-	-	2	1	8
74-	-	1	-	1	-	-	-	-	-	-	2
75-	-	1	-	-	-	-	-	-	-	-	1
78-	1	-	-	-	-	-	-	-	-	-	1
total	620	700	665	670	620	530	457	473	463	360	5558

Table 2.3.22 Sikh (Other)

stature (in)	frequency in age group										total
	17	18	19	20	21	22	23	24-25	26-30	31-35	
57-	-	-	-	-	-	-	-	-	3	-	3
58-	-	1	-	-	1	-	-	-	1	1	4
59-	-	1	-	-	-	-	-	1	1	-	3
60-	3	5	-	4	3	-	1	2	7	3	28
61-	4	4	2	5	3	1	5	3	10	3	40
62-	2	7	11	7	3	8	13	19	17	16	103
63-	19	36	21	33	21	24	18	65	59	36	332
64-	41	82	66	83	54	60	54	90	108	68	706
65-	75	160	117	110	85	69	80	129	162	89	1076
66-	188	428	286	277	243	194	215	257	274	157	2519
67-	193	365	235	238	183	178	182	191	185	122	2072
68-	95	244	190	203	152	149	148	160	160	112	1613
69-	55	167	121	124	94	95	94	85	86	50	971
70-	28	72	63	86	63	45	52	48	59	30	546
71-	8	20	33	30	34	29	28	29	24	24	259
72-	4	3	7	7	7	3	11	7	12	11	72
73-	1	5	4	6	2	8	4	1	-	4	35
74-	-	-	1	2	3	1	-	2	-	-	9
75-	1	-	-	2	-	-	-	-	-	-	3
76-	-	-	-	-	-	-	-	-	2	-	2
77-	-	-	-	-	-	-	-	-	-	2	2
78-	-	-	-	-	-	-	-	1	-	-	1
total	717	1600	1157	1217	951	864	905	1090	1170	728	10399

Table 2.3.23 South Indian Christian

stature (in)	frequency in age group										total
	17	18	19	20	21	22	23	24-25	26-30	31-35	
58-	2	1	-	-	1	-	-	-	-	-	4
59-	1	-	-	-	-	1	-	2	-	1	5
60-	17	2	3	3	4	2	6	3	2	6	48
61-	42	11	10	6	7	8	3	15	22	12	136
62-	62	9	16	17	27	15	20	29	42	46	283
63-	67	39	45	49	48	50	65	74	85	103	625
64-	99	179	168	177	161	172	167	184	201	153	1661
65-	127	166	168	171	197	168	177	176	138	110	1598
66-	90	132	130	168	148	148	112	140	90	104	1262
67-	60	77	125	79	96	87	117	78	65	69	853
68-	29	29	53	67	48	53	52	45	47	37	460
69-	19	25	24	36	15	25	29	12	21	11	217
70-	5	10	10	9	16	10	7	6	4	2	79
71-	1	2	3	1	3	2	4	2	1	-	19
72-	1	1	-	-	-	1	1	-	-	1	5
73-	-	--	-	1	-	-	-	-	-	-	1
total	622	683	755	784	771	742	760	766	718	655	7256

Table 2.3.24 U.P. Hindu

stature (in)	frequency in age group										total
	17	18	19	20	21	22	23	24-25	26-30	31-35	
56-	-	-	-	-	-	-	-	-	-	1	1
58-	-	-	-	1	-	-	-	-	-	-	1
59-	-	-	-	1	1	-	-	1	1	-	4
60-	6	4	3	8	6	3	3	9	9	9	60
61-	8	8	8	11	10	12	18	14	28	19	136
62-	17	34	16	26	26	30	28	32	53	43	305
63-	62	66	37	50	46	60	54	92	106	84	657
64-	81	98	85	101	100	94	95	117	146	102	1019
65-	101	152	127	159	131	108	122	130	183	122	1335
66-	128	232	250	204	199	185	182	177	143	107	1807
67-	97	152	141	143	133	145	97	135	109	88	1240
68-	59	62	86	114	82	79	78	92	60	42	754
69-	22	28	55	50	37	46	33	31	22	30	354
70-	12	14	9	20	14	18	19	15	6	5	132
71-	3	3	5	18	11	10	9	11	2	4	76
72-	-	3	1	1	1	2	-	1	-	-	9
73-	-	-	-	1	-	-	1	-	-	-	2
total	596	856	823	908	797	792	739	857	868	656	7892

Appendix 2B

Table 2.4 Statistics from the distribution of stature in age groups of each community

age	number	mean	variance	g_1	g_2
1	2	3	4	5	6
			Adibasi		
17	43	64.73	6.6306	-0.4195*	1.2405
18	268	64.57	2.9304	1.0235**	1.7352**
19	268	64.80	3.1724	0.5302**	0.2477
20	322	64.51	3.0816	0.6784**	0.3399
21	236	64.73	3.0474	0.3277*	-0.0077
22	301	64.73	2.9894	0.3728**	-0.0137
23	257	64.35	3.2978	0.4192**	0.5386
24-25	255	64.39	3.2372	0.6284**	0.4044
26-30	253	64.17	3.8538	0.5698**	0.1333
31-35	134	64.13	2.7289	0.9957**	3.2279**
total	2337	64.52	3.2756	0.5177**	0.5445**
			Ahir		
17	610	66.80	3.0244	0.1363	0.7288**
18	799	66.09	2.6340	0.1844*	1.0464**
19	759	67.11	2.8382	0.1961*	1.5505**
20	761	67.16	2.9411	0.2021*	0.9344**
21	709	67.01	3.7979	0.1513	0.5054**
22	548	67.05	4.3635	0.2353*	0.7709**
23	515	66.49	4.2952	-0.2240*	-0.1131
24-25	545	66.62	5.1881	0.0225	0.3106
26-30	587	66.59	4.5786	0.1967*	0.0041
31-35	429	65.91	5.4082	0.0634	0.0221
total	6263	66.83	3.8600	0.0100	0.6881**

age	number	mean	variance	g_1	g_2
1	2	3	4	5	6
		Andhra Hindu			
17	101	65.64	3.1216	-0.0580	-0.2215
18	133	65.91	2.6843	0.3362	-0.6039
19	134	66.06	3.6895	0.0345	0.2975
20	148	65.80	3.5839	0.3617*	0.1938
21	130	65.70	2.4886	0.2399	0.3122
22	119	65.99	2.9032	0.5262*	-0.2844
23	60	65.89	5.5156	0.5161	0.0230
24-25	98	65.25	4.9676	0.0844	0.7618
26-30	144	65.30	3.6649	0.8211**	3.0387**
31-35	96	65.40	2.8671	0.1893	0.0372
total	1163	65.70	3.5044	0.2904**	0.6181**
		Assamese			
17	421	64.07	4.4206	0.5731**	1.1724**
18	735	64.14	4.3867	0.6705**	0.6573**
19	720	64.31	3.9048	0.4982**	0.3117
20	745	64.34	4.3643	0.4022**	0.0648
21	566	64.55	3.5861	0.3422**	-0.0780
22	498	64.78	4.0620	0.3981**	0.1932
23	296	64.69	4.0192	0.5794**	0.8502**
24-25	258	64.49	3.6744	0.5387**	0.3611
26-30	252	64.30	4.3711	0.2323	0.2438
31-35	72	64.95	4.7677	-0.1746	0.6644
total	4563	64.39	4.1685	0.4528**	0.2991**

age	number	mean	variance	g_1	g_2
1	2	3	4	5	6
		Bengali Hindu			
17	461	65.43	3.7752	0.1229	0.1494
18	580	65.95	3.4425	0.1841*	-0.1828
19	623	66.20	3.1970	0.1588	0.0603
20	624	66.14	3.7019	0.0940	0.2813
21	579	66.17	3.8423	0.2591*	0.2820
22	566	65.92	3.9465	0.2773**	0.2262
23	502	65.89	4.3839	0.2134*	-0.1114
24-25	525	65.85	3.9379	0.2676*	0.0227
26-30	478	65.39	4.5389	0.2846*	0.0885
31-35	306	65.54	4.5043	0.2885*	-0.0818
total	5244	65.85	3.9498	0.1809**	0.0598
		Bihari Hindu			
17	552	65.53	3.6914	0.2683*	0.2120
18	771	66.07	3.7602	-0.1181	0.8228**
19	767	66.23	4.2517	0.1581	0.2895
20	808	66.24	4.3498	-0.0481	0.2270
21	763	66.03	4.3698	0.0641	0.2668
22	796	65.87	3.9997	0.2729*	0.1746
23	714	65.50	4.8976	0.2335*	0.1954
24-25	728	65.39	4.7428	0.1565	-0.2260
26-30	751	64.98	4.4279	0.5408**	0.4384*
31-35	472	64.73	4.4760	0.2274*	0.2912
total	7122	65.71	4.5253	0.1342**	0.1273*

age	number	mean	variance	g_1	g_2
1	2	3	4	5	6
		Dogra			
17	580	64.77	3.5837	-0.0245	0.9205**
18	1173	65.23	3.1979	0.1811*	0.5214**
19	930	65.52	3.5845	0.1417	0.5538**
20	1023	65.32	3.5900	0.2372**	0.8535**
21	809	65.67	3.1871	0.3893**	0.3937**
22	832	65.37	3.7689	0.0593	1.1468**
23	633	65.17	3.5683	0.3143**	0.3093
24-25	820	65.10	3.7761	0.3056**	0.0910
26-30	995	65.05	4.0441	0.1957*	0.1956
31-35	511	65.13	4.0878	-0.0602	0.4099
total	8306	65.25	3.6656	0.1766**	0.5404**
		Garhwali			
17	556	63.80	3.9472	0.5828**	0.3614
18	915	64.02	3.1173	0.2573**	-0.0734
19	839	64.59	3.5923	0.3077**	0.3641*
20	800	64.73	3.3926	0.1777*	-0.0554
21	775	64.85	4.0539	0.2685**	-0.2088
22	740	64.84	4.1984	0.1549	0.1831
23	513	64.77	4.0634	0.2188*	-0.2204
24-25	556	64.45	4.1511	0.3230**	-0.1993
26-30	673	64.40	3.9248	0.1399	-0.2736
31-35	601	64.38	4.2141	0.1267	-0.0136
total	6968	64.49	3.9248	0.2535**	-0.0102

age	number	mean	variance	g_1	g_2
1	2	3	4	5	6
		Gorkha			
17	721	62.01	2.3571	0.6835**	2.4296**
18	1130	62.93	2.6608	0.4527**	0.4779**
19	874	63.45	3.3136	0.3084**	0.0067
20	790	63.64	3.3715	0.3767**	0.4628**
21	500	63.81	4.0124	0.2992**	-0.2176
22	307	63.78	4.0944	-0.1370	2.1291**
23	190	63.51	3.9344	0.4157*	-0.2564
24-25	312	63.82	4.7206	0.4156**	0.2515
26-30	312	63.68	4.3979	0.2269	-0.5193*
31-35	159	63.39	4.2027	0.5192**	-0.5392
total	5295	63.26	3.6991	0.4255**	0.3405**
		Gujar			
17	74	66.31	1.8056	0.4396	1.0503
18	236	66.93	2.9261	-0.2516	1.9465**
19	137	66.89	2.5737	0.1116	-0.0251
20	156	67.07	3.1746	0.3712*	0.3892
21	86	67.06	2.0520	-0.1105	-0.0101
22	95	67.37	3.5056	0.2610	0.0675
23	72	67.11	3.5739	-0.4873	1.9853**
24-25	103	66.76	3.8560	-0.4838*	1.2192*
26-30	131	66.68	3.8549	-0.1210	0.1165
31-35	125	66.85	3.6622	0.0927	0.1475
total	1215	66.91	3.1795	-0.0361	0.8050**

age	number	mean	variance	g_1	g_2
1	2	3	4	5	6
			Jat		
17	666	66.81	3.2636	-0.0000	1.5137**
18	955	67.06	2.7789	-0.5096	1.1370**
19	836	67.24	2.9209	0.1581*	0.8689**
20	883	67.31	2.6952	0.3692**	0.8422**
21	800	67.42	3.0527	0.3050**	0.3978*
22	773	67.29	3.0954	0.1155	1.2275**
23	785	67.39	3.3326	0.1878*	2.4610**
24-25	807	66.95	4.6257	-0.3072**	0.7013*
26-30	831	67.11	3.7236	0.1571*	0.1942
31-35	665	67.21	4.4778	0.1650	0.8583**
total	8001	67.19	3.3990	0.0566*	1.1280**
			J&K Hindu		
17	430	65.22	3.1251	-0.0610	0.7468**
18	739	65.68	3.3516	0.2535**	0.6790**
19	668	65.95	3.5881	0.2261*	0.4506*
20	666	65.96	4.2114	0.1938*	0.1954
21	454	65.90	3.1110	0.0828	0.0142
22	473	65.96	5.0457	-0.5372**	3.0075**
23	391	65.82	4.2320	0.1448	-0.2404
24-25	526	65.84	3.8372	0.2101*	-0.1195
26-30	481	65.48	4.1158	0.0245	-0.2399
31-35	239	65.91	5.1994	-0.0284	-0.3733
total	5067	65.77	3.9393	0.0624*	0.6263**

age	number	mean	variance	g_1	g_2
1	2	3	4	5	6
		Kumaoni			
17	670	64.94	3.0704	0.1698*	0.0882
18	735	65.31	2.8745	0.4566**	0.1982
19	717	65.38	3.3149	0.0481	1.5086**
20	736	65.69	2.9781	0.2411**	0.0181
21	707	65.59	3.4315	0.3382**	0.4968*
22	641	65.62	3.4611	0.1820*	-0.0174
23	563	65.65	3.9490	0.1023	0.0054
24-25	582	65.42	3.9300	0.2616*	0.0540
26-30	607	65.24	4.0705	-0.0491	1.3990**
31-35	548	65.40	3.9105	0.4287**	0.0480
total	6506	65.42	3.5082	0.2105**	0.4279**
		M. P. Hindu			
17	46	64.76	4.4710	0.4891	0.2739
18	139	65.05	3.1177	0.5849**	0.7882
19	157	65.64	4.1130	0.7847**	0.7595
20	174	65.10	4.2776	0.5601**	0.7625*
21	101	65.67	3.2865	0.0673	0.4484
22	97	65.85	4.2208	0.3880	0.2430
23	61	65.92	3.5522	0.2424	-0.4976
24-25	78	66.05	4.0284	0.5080*	0.7842
26-30	63	65.05	6.2392	0.4822	0.1186
31-35	41	64.63	3.6121	0.4526	0.5172
total	957	65.41	4.1907	0.4580**	0.4412**

age	number	mean	variance	g_1	g_2
1	2	3	4	5	6
		Mahar			
17	501	64.03	3.4668	0.5396**	2.0254**
18	743	64.61	2.9571	0.1206	0.5698**
19	729	64.84	3.0576	0.1111	0.6002**
20	726	64.83	3.1672	0.2772**	0.3048
21	667	65.02	3.6626	0.1904*	0.2531
22	651	64.98	3.5965	0.2975**	0.3051
23	587	65.00	3.6869	0.3034**	0.1546
24-25	603	64.92	3.9658	0.1753	0.7419**
26-30	586	64.59	4.1074	0.3603**	0.6456**
31-35	472	64.45	3.1952	0.1416	0.0912
total	6265	64.75	3.5428	0.2448**	0.5286**
		Malayali Hindu			
17	580	64.34	3.9641	0.1635	0.2975
18	810	65.56	3.3904	0.3249**	0.8051**
19	829	65.70	3.1715	0.4378**	0.6021**
20	885	65.75	2.9507	0.2317**	0.7778**
21	858	65.65	3.3300	0.4661**	0.7037**
22	777	65.69	3.0503	0.0907	0.3245
23	802	65.61	2.8471	0.2631**	0.8555**
24-25	877	65.38	3.3749	0.1855*	-0.0889
26-30	741	65.24	3.7028	0.3229**	0.2957
31-35	663	65.22	3.0477	0.3440**	0.3573
total	7822	65.45	3.3948	0.2112**	0.5046**

age	number	mean	variance	g_1	g_2
1	2	3	4	5	6
		Maratha			
17	605	64.23	3.4510	-0.1511	0.7324**
18	827	64.89	3.2317	0.5613**	0.5129**
19	805	65.14	3.3226	-0.0200	0.2049
20	835	65.14	3.5397	0.2358**	1.0998**
21	765	65.21	3.4303	0.0584	1.4020**
22	748	65.25	4.1036	0.2371**	0.3876**
23	762	65.23	3.6469	0.2725**	0.7324**
24-25	768	65.14	3.6696	0.3226**	0.4259*
26-30	806	64.96	4.3287	0.2144*	0.0291
31-35	626	64.81	3.9022	0.3819**	-0.0137
total	7547	65.02	3.7334	0.1794**	0.5481**
		Punjabi Hindu			
17	708	65.55	4.0116	0.0347	0.1745
18	1008	66.09	3.4278	0.1797*	0.1247
19	911	66.34	3.8074	-0.0782	0.3365*
20	934	66.34	3.7556	0.0141	0.0640
21	831	66.18	3.9172	-0.0850	0.4929**
22	763	66.14	4.3995	0.3477**	1.1249**
23	696	65.91	4.2334	0.0885	0.2086
24-25	759	65.82	4.4876	0.1874*	0.5745**
26-30	846	65.75	4.3156	0.2048*	0.2083
31-35	534	65.52	4.5108	-0.0576	-0.3698
total	7990	66.00	4.1185	0.0346	0.3165**

age	number	mean	variance	g_1	g_2
1	2	3	4	5	6
		Rajput			
17	633	66.25	2.9987	-0.2368*	0.6083**
18	953	66.48	2.9819	-0.2230**	1.1309**
19	861	66.75	3.1026	0.0459	0.3587*
20	937	66.75	3.3960	0.0245	0.7798**
21	858	66.84	3.5402	-0.1189	0.5693**
22	814	66.78	3.7241	0.0224	0.5153**
23	788	66.87	3.7126	-0.2351**	0.4779
24-25	888	66.45	4.5522	-0.0715	0.5901**
26-30	826	66.24	4.4805	0.0264	0.4349*
31-35	592	66.34	4.5052	-0.0540	-0.1130
total	8150	66.59	3.7335	-0.0894**	0.5787 * *
		Sikh (M & R)			
17	620	66.26	2.8231	0.7894**	3.9249**
18	700	66.46	3.2110	0.6357**	1.3204**
19	665	66.67	3.3308	0.3729**	0.0531
20	670	66.67	3.6121	0.2584**	0.7259**
21	620	66.51	3.4195	0.4233**	0.8434**
22	530	66.46	3.7963	0.0459	0.8661**
23	457	66.10	4.1573	0.3309**	-0.0038
24-25	473	66.00	4.2444	0.1863	0.0172
26-30	463	66.15	4.0440	0.2744*	0.3626
31-35	360	66.09	4.3352	0.2455*	0.1732
total	5558	66.38	3.6708	0.2999**	0.7392**

age	number	mean	variance	g_1	g_2
1	2	3	4	5	6
		Sikh (Other)			
17	717	66.92	3.1505	0.0907	1.7787**
18	1600	67.04	3.1404	-0.1638	1.3492**
19	1157	67.21	3.5172	0.1886*	0.3860**
20	1217	67.22	4.1168	0.0980	0.7520**
21	951	67.26	3.9638	0.0633	0.9321**
22	864	67.26	3.8981	0.1863*	0.3795*
23	905	67.22	4.0284	0.0224	0.4638**
24-25	1090	66.77	4.4507	0.2201**	0.8922**
26-30	1170	66.64	4.9044	-0.1159	1.2238**
31-35	728	66.82	5.2035	0.2626**	0.9336**
total	10399	67.04	4.0414	0.0424	0.9774**
		South Indian Christian			
17	622	64.81	4.9553	0.0000	0.0230
18	683	65.55	3.0004	0.3632**	1.2110**
19	755	65.71	3.1234	0.1584	0.2584
20	784	65.73	3.1247	0.3209**	0.3695*
21	771	65.58	3.1444	0.1907*	0.8522**
22	742	65.64	3.0912	0.2954**	0.5623**
23	760	65.64	3.3089	0.2806**	0.3203
24-25	766	65.28	3.0481	0.1133	0.5598**
26-30	718	65.09	3.4606	0.3442**	-0.0447
31-35	655	65.01	3.4318	0.1856*	-0.0002
total	7256	65.42	3.4347	0.1473**	0.4174**

age	number	mean	variance	g_1	g_2
1	2	3	4	5	6
		Tamil Hindu			
17	636	64.85	4.5019	0.1399	0.2223
18	765	65.70	2.6445	0.1872*	1.0891**
19	763	65.92	2.7988	0.2446**	0.1277
20	807	65.89	3.1281	0.5524**	1.3435**
21	763	65.74	2.9071	0.4315**	0.3700*
22	754	65.75	3.2398	0.2927**	0.1688
23	800	65.87	3.5333	0.4015**	0.3682*
24-25	807	65.43	3.6650	0.4159**	0.6662**
26-30	805	65.20	3.4066	0.3466**	0.3264
31-35	715	65.55	3.4544	0.2911**	0.3703*
total	7615	65.60	3.4101	0.2580**	0.5487**
		Uttar Pradesh Hindu			
17	596	65.84	3.8847	-0.1085	-0.0067
18	856	65.91	3.4002	-0.0549	0.5133**
19	823	66.28	3.1350	-0.1956*	0.5866**
20	908	66.23	4.3308	-0.1298	0.5424**
21	797	66.08	3.9067	-0.1235	0.4662**
22	792	66.14	4.1902	-0.0625	0.0226
23	739	65.97	4.2685	0.0100	0.1365
24-25	857	65.83	4.3947	-0.0501	0.0158
26-30	868	65.25	3.8901	-0.0332	-0.1593
31-35	656	65.33	4.5163	-0.0520	0.1035
total	7892	65.90	4.0931	-0.0906**	0.2076**

Appendix 3A

TEST FOR DIFFERENCES AMONG MEANS OF SAMPLES FROM TRUNCATED NORMAL POPULATIONS

Suppose we have k samples of sizes n_1, n_2 - - - - n_k from k normal populations of which the means are unknown and the standard deviations are known to be equal. If these samples are selected after omitting all values below a given value $m + \sigma\xi$ where m and σ are the mean and standard deviation of the population, Fisher (1951) has shown that the maximum likelihood estimates of m and for any population, say the first will be given by

$$\bar{x}_1 = \sigma \frac{I_1}{I_o} \qquad \text{- - - - - (1)}$$

$$\frac{n_1 S(x^2)}{S^2(x)} = 2 \frac{I_o \; I_2}{I_1^2} \qquad \text{- - - - (2)}$$

where $\bar{x}_1$ is the arithmetic mean of the n_1 observations, and $S(x^2)$ and $S^2(x)$ are computed about the point of truncation. The values of I_o, I_1, I_2 and $\frac{I_o \; I_2}{I_1^2}$ are available from the British Association tables. From equations (1) and (2) we estimate the value of ξ and σ. The mean is calculated by subtracting $\sigma\xi$ from the value representing the point of truncation.

To test whether the k means thus arrived at are significantly different the null hypothesis is

$$H_o : \xi_1 = \xi_2 = \text{ - - } = \xi_k$$ and the

alternative hypothesis is

$$H : \xi_1 \neq \xi_2 \neq \text{ } \neq \text{ - } \neq \xi_k$$

The likelihood ratio criterion will be given by

$\chi^2 = L(\xi^*, \sigma^*) - \sum_1^k L_i(\hat{\xi}_i, \hat{\sigma})$ with k-1 degrees of freedom

where, $L(\xi, \sigma) = n \log \sigma + n \log I_0(\xi) + \frac{1}{2}\left(n\xi^2 + \frac{\Sigma x'^2}{\sigma^2} + 2\xi \frac{\Sigma x^1}{\sigma}\right)$

and x^1 is the deviation from the point of truncation.

ξ^* and σ^* will be obtained by using the equations (1) and (2) on the total sample of N values where $N = n_1 + n_2 + \; - \; - \; + nk$.

$\hat{\sigma}$ will be taken as $= \dfrac{\hat{\sigma}_1 + \hat{\sigma}_2 + \quad \hat{\sigma}_k}{k}$ as a first approximation.

Appendix 4A

Table 4.1 Distribution of stature of accepted and rejected candidates

stature (in)	number		percentage		difference
	accepted	rejected	accepted	rejected	4-5
1	2	3	4	5	6
			Bihar		
57.0-	-	1	-	0.0	-0.0
59.0-	-	1	-	0.0	-0.0
60.0-	42	27	0.9	0.6	0.3
61.0-	107	76	2.4	1.8	0.6
62.0	312	212	7.0	5.0	2.0
63.0-	508	439	11.4	10.4	1.0
64.0-	791	713	17.7	17.0	0.7
65.0-	772	796	17.3	19.0	-1.7
66.0-	791	727	17.7	17.3	0.4
67.0-	539	542	12.1	12.9	-0.8
68.0-	352	356	7.9	8.5	-0.6
69.0-	148	174	3.3	4.1	-0.8
70.0-	77	75	1.7	1.8	-0.1
71.0-	20	45	0.4	1.1	-0.7
72.0-	7	14	0.2	0.4	-0.2
73.0-	2	4	0.0	0.1	-0.1
74.0-	1	1	0.0	0.0	-0.0
total	4469	4203	100.0	100.0	
			Bombay		
57.0-	-	2	-	0.0	-0.0
58.0-	-	7	-	0.1	-0.1
59.0-	1	18	0.0	0.2	-0.2
60.0-	33	118	0.8	1.5	-0.7
61.0-	123	248	2.8	3.1	-0.3
62.0-	245	596	5.6	7.4	-1.8
63.0-	616	1133	14.1	14.2	-0.1
64.0-	1026	1971	23.5	24.6	-1.1
65.0-	885	1434	20.2	17.9	2.3
66.0-	703	1244	16.1	15.6	0.5
67.0-	381	670	8.7	8.4	0.3
68.0-	211	333	4.8	4.2	0.6
69.0-	102	143	2.3	1.8	0.5
70.0-	25	52	0.6	0.7	-0.1
71.0-	18	23	0.4	0.3	0.1
72.0-	3	2	0.1	0.0	0.1
73.0-	-	2	-	0.0	-0.0
total	4372	7996	100.0	100.0	

stature (in)	number accepted	number rejected	percentage accepted	percentage rejected	difference 4-5
1	2	3	4	5	6
		Jammu and Kashmir			
56.0-	-	1	-	0.1	-0.1
59.0-	-	2	-	0.1	-0.1
60.0-	10	7	0.3	0.5	-0.2
61.0-	57	22	1.8	1.6	0.2
62.0-	88	63	2.7	4.5	-1.8
63.0-	282	146	8.7	10.4	-1.7
64.0-	511	283	15.9	20.2	-4.3
65.0-	639	228	19.8	16.3	3.5
66.0-	671	300	20.8	21.4	-0.6
67.0-	439	197	13.6	14.1	-0.5
68.0-	283	86	8.8	6.2	2.6
69.0-	149	44	4.6	3.2	1.4
70.0-	60	14	1.9	1.0	0.9
71.0-	28	3	0.9	0.2	0.7
72.0-	6	1	0.2	0.1	0.1
73.0-	1	-	0.0	0.0	0.0
74.0-	-	2	-	0.1	-0.1
total	3224	1399	100.00	100.0	
		Kerala State			
58.0-	1	2	0.0	0.1	-0.1
59.0-	1	5	0.0	0.2	-0.2
60.0-	38	24	0.5	1.0	-0.5
61.0-	117	50	1.6	2.1	-0.5
62.0-	293	106	3.9	4.4	-0.5
63.0-	635	223	8.4	9.3	-0.9
64.0-	1619	515	21.6	21.5	0.1
65.0-	1673	502	22.3	21.0	1.3
66.0-	1393	432	18.6	18.1	0.5
67.0-	908	279	12.1	11.7	0.4
68.0-	470	154	6.3	6.4	-0.1
69.0-	227	67	3.0	2.8	0.2
70.0-	91	22	1.2	0.9	0.3
71.0-	28	9	0.4	0.4	-0.0
72.0-	9	2	0.1	0.1	0.0
73.0-	1	1	0.0	0.0	-0.0
total	7504	2393	100.0	100.0	

stature	number		percentage		difference
	accepted	rejected	accepted	rejected	4-5
1	2	3	4	5	6
		Madras			
58.0-	1	3	0.0	0.1	-0.1
59.0-	3	5	0.0	0.2	-0.2
60.0-	22	23	0.3	0.7	-0.4
61.0-	78	71	1.1	2.1	-1.0
62.0-	225	142	3.2	4.2	-1.0
63.0-	637	313	9.0	9.2	-0.2
64.0-	1649	712	23.2	21.0	2.2
65.0-	1521	670	21.4	19.7	1.7
66.0-	1300	656	18.3	19.4	-1.1
67.0-	872	421	12.3	12.4	-0.1
68.0-	474	211	6.7	6.2	0.5
69.0-	201	107	2.8	3.2	-0.4
70.0-	87	34	1.2	1.0	0.2
71.0-	32	9	0.4	0.3	0.1
72.0-	7	5	0.1	0.2	-0.1
73.0-	1	4	0.0	0.1	-0.1
total	7110	3386	100.0	100.0	
		Punjab			
56.0-	1	-	0.0	-	0.0
57.0-	1	1	0.0	0.0	-0.0
58.0-	3	-	0.0	-	0.0
59.0-	7	4	0.0	0.0	0.0
60.0-	73	53	0.4	0.5	-0.1
61.0-	147	95	0.8	0.8	-0.0
62.0-	407	281	2.2	2.4	-0.2
63.0-	960	541	5.1	4.6	0.5
64.0-	2121	1399	11.3	12.0	-0.7
65.0-	2710	1695	14.4	14.5	-0.1
66.0-	4299	2721	22.8	23.3	-0.5
67.0-	3317	1998	17.6	17.1	0.5
68.0-	2264	1422	12.0	12.2	-0.2
69.0-	1394	796	7.4	6.8	0.6
70.0-	662	407	3.6	3.5	0.1
71.0-	323	185	1.7	1.6	0.1
72.0-	101	50	0.5	0.4	0.1
73.0-	34	20	0.2	0.2	0.0
74.0-	7	5	0.0	0.0	-0.0
75.0-	1	6	0.0	0.1	-0.1
76.0-	-	1	-	0.0	-0.0
77.0-	1	1	0.0	0.0	-0.0
78.0-	1	2	0.0	0.0	-0.0
total	18834	11683	100.0	100.0	

stature (in)	number		percentage		difference
	accepted	rejected	accepted	rejected	4-5
1	2	3	4	5	6
		Rajasthan			
60.0-	6	5	0.2	0.2	-0.0
61.0-	7	15	0.2	0.6	-0.4
62.0-	33	34	1.0	1.5	-0.5
63.0-	103	96	3.2	4.1	-0.9
64.0-	215	164	6.7	7.0	-0.3
65.0-	341	272	10.7	11.6	-0.9
66.0-	815	615	25.5	26.3	-0.8
67.0-	681	456	21.3	19.5	1.8
68.0-	475	318	14.8	13.6	1.2
69.0-	278	219	8.7	9.4	-0.7
70.0-	161	93	5.0	4.0	1.0
71.0-	58	34	1.8	1.5	0.3
72.0-	19	13	0.6	0.6	0.0
73.0-	6	3	0.2	0.1	0.1
74.0-	3	1	0.1	0.0	0.1
79.0-	1	-	0.0	-	0.0
total	3202	2338	100.0	100.0	
		Uttar Pradesh			
55.0-	1	-	0.0	-	0.0
56.0-	-	1	-	0.0	-0.0
57.0-	2	-	0.0	-	0.0
58.0-	-	2	-	0.0	-0.0
59.0-	4	7	0.0	0.1	-0.1
60.0-	82	102	0.6	0.9	-0.3
61.0-	377	300	2.7	2.6	0.1
62.0-	700	629	5.0	5.4	-0.4
63.0-	1557	1200	11.2	10.3	0.9
64.0-	2016	1656	14.5	14.3	0.2
65.0-	2490	1964	17.9	16.9	1.0
66.0-	2745	2392	19.8	20.6	-0.8
67.0-	1971	1586	14.2	13.7	0.5
68.0-	1094	956	7.9	8.2	-0.3
69.0-	494	512	3.6	4.4	-0.8
70.0-	234	206	1.7	1.8	-0.1
71.0-	94	78	0.7	0.7	0.0
72.0-	19	11	0.2	0.1	0.1
73.0-	4	3	0.0	0.0	0.0
74.0-	2	-	0.0	-	0.0
75.0-	2	-	0.0	-	0.0
total	13888	11605	100.00	100.00	

stature (in)	number		percentage		difference
	accepted	rejected	accepted	rejected	4-5
1	2	3	4	5	6
		West Bengal			
59.0-	-	2	0.0	0.2	-0.2
60.0-	19	4	0.6	0.3	0.3
61.0-	61	11	1.8	0.8	1.0
62.0-	180	48	5.3	3.6	1.7
63.0-	326	91	9.5	6.7	2.8
64.0-	618	223	18.1	16.5	1.6
65.0-	685	264	20.1	19.6	0.5
66.0-	541	238	15.9	17.7	-1.8
67.0-	438	218	12.8	16.2	-3.4
68.0-	289	132	8.5	9.8	-1.3
69.0-	163	72	4.8	5.3	-0.5
70.0-	56	31	1.6	2.3	-0.7
71.0-	21	10	0.6	0.7	-0.1
72.0-	9	4	0.3	0.3	-0.0
73.0-	2	-	0.1	0.0	0.1
74.0-	1	-	0.0	0.0	0.0
total	3409	1348	100.00	100.00	
		Other States			
56.0-	-	4	-	0.0	-0.0
57.0-	1	2	0.0	0.0	-0.0
58.0-	3	11	0.0	0.2	-0.2
59.0-	23	37	0.3	0.6	-0.3
60.0-	299	158	3.4	2.7	0.7
61.0-	731	381	8.2	6.5	1.7
62.0-	1131	630	12.7	10.8	1.9
63.0-	1399	853	15.7	14.6	1.1
64.0-	1638	1061	18.4	18.2	0.2
65.0-	1398	937	15.7	16.0	-0.3
66.0-	1012	772	11.3	13.2	-1.9
67.0-	635	505	7.1	8.6	-1.5
68.0-	377	293	4.2	5.0	-0.8
69.0-	152	129	1.7	2.2	-0.5
70.0-	73	53	0.8	0.9	-0.1
71.0-	39	16	0.4	0.3	0.1
72.0-	8	11	0.1	0.2	-0.1
74.0-	1	-	0.0	-	0.0
total	8920	5853	100.0	100.0	

Appendix 5A

Table 5.2 Analysis of variance of stature between and within age groups

community	df			ss			ms		F
	B	W	T	B	W	T	B	W	
1	2	3	4	5	6	7	8	9	10
				Bihar					
Rajput	9	183	192	67.77	619.11	686.88	7.53	3.38	2.23*
Ahir	9	485	494	439.84	1613.70	2053.54	48.87	3.33	14.68***
Bihari Hindu	9	7090	7099	1623.58	30654.50	32278.08	180.40	4.32	41.76***
Adibasi	9	1898	1907	163.39	6279.66	6443.05	18.15	3.31	5.48***
total	9	9789	9798	1931.29	42252.87	44184.16	214.59	4.32	49.67***
				Bombay					
Marahatta	9	6595	6604	434.66	24117.67	24552.33	48.30	3.66	13.20***
Mahar	9	5371	5380	480.55	18605.49	19086.04	53.40	3.46	15.43***
total	9	13145	13154	1014.23	47545.30	48559.53	112.69	3.62	31.13***
				Jammu and Kashmir					
J & K Hindu	9	5040	5049	260.80	19437.97	19698.77	28.98	3.86	7.51***
Dogra	8	357	365	41.91	1363.72	1405.63	5.24	3.82	1.37
Sikh (Other)	9	226	235	46.01	992.60	1038.61	5.11	4.39	1.16
total	9	5674	5683	264.67	2207928	22343.95	29.41	3.89	7.56***
				Kerala					
Malayali	9	7711	7720	1049.61	25613.55	26663.16	116.62	3.32	35.13***
S.I. Christian	9	3287	3296	474.37	11197.63	11672.00	52.71	3.41	15.46***
total	9	11124	11133	1482.89	37137.02	38619.91	164.77	3.34	49.33***
				Madras					
Tamil Hindu	9	7533	7542	732.91	25342.87	26075.78	81.43	3.36	24.24***
S.I. Christian	9	3512	3521	406.50	11833.15	12239.65	45.17	3.37	13.40***
total	9	11164	11173	1097.73	37674.03	38771.76	121.97	3.37	36.19***
				Punjab					
Dogra	9	7072	7081	433.12	25981.43	26414.55	48.12	3.67	13.11***
Punjabi Hindu	9	7827	7836	536.80	31797.49	32334.29	59.64	4.06	14.68***
Sikh (M & R)	9	5517	5526	288.09	20126.49	20414.58	32.01	3.65	8.77***
Sikh (Other)	9	10019	10028	511.37	40014.37	40525.74	56.81	3.99	14.23***

1	2	3	4	5	6	7	8	9	10
				Punjab (contd)					
Jat	9	4092	4101	180.96	14216.61	14397.57	20.10	3.47	5.79***
Rajput	9	813	822	141.66	3282.17	3423.83	15.74	4.04	3.90***
Ahir	9	2633	2642	54.40	9116.24	9170.64	6.04	3.46	1.75
Gujar	9	205	214	35.01	580.14	615.15	3.89	2.89	1.37
total	9	38461	38470	1428.42	16822.37	169657.79	158.71	4.37	36.32***
				Rajasthan					
Jat	9	1242	1251	96.09	4197.40	4293.49	10.68	3.38	3.16**
Rajput	9	3997	4006	192.31	15075.08	15267.39	21.37	3.77	5.67***
Ahir	9	730	739	92.99	2693.16	2786.15	10.33	3.69	2.80**
total	9	6780	6789	328.97	25288.34	25617.31	36.55	3.73	9.80***
				Uttar Pradesh					
Jat	9	2390	2399	134.58	7517.54	7652.12	14.95	3.14	4.76***
Rajput	9	2378	2387	174.95	7939.99	8114.94	19.44	3.34	5.82***
Garhwali	9	6953	6962	751.86	27100.71	27852.57	83.54	3.90	21.42***
Kumaoni	9	5950	5959	319.19	20848.84	21168.03	35.46	3.50	10.13***
Ahir	9	2201	2210	294.48	7009.13	7303.61	32.72	3.18	10.29***
U.P. Hindu	9	7487	7496	1065.05	30724.63	31789.68	118.34	4.10	28.86***
total	9	28298	28307	2148.67	122672.95	124821.62	238.74	4.34	55.01***
				West Bengal					
Gorkha	9	248	257	50.57	840.59	891.16	5.62	3.39	1.66
Bengali Hindu	9	5058	5067	380.34	19717.69	20098.03	42.26	3.90	10.84***
total	9	5341	5350	354.66	21784.30	22138.96	39.41	4.08	9.66***
				Other states					
total	9	17190	17199	3764.86	82425.69	86190.55	418.32	4.79	87.24***
				All states					
total	9	147056	147065	7531.14	679164.65	686695.79	836.79	4.62	181.20***

Appendix 6A

Table 6.4 Analysis of variance of stature between and within communities

age	df			ss			ms		F
	B	W	T	B	W	T	B	W	
1	2	3	4	5	6	7	8	9	10
				Bihar					
17	5	607	612	29.83	2333.86	2363.69	5.97	3.84	1.55
18	6	1094	1100	447.28	3780.83	4228.11	74.55	3.46	21.55***
19	4	1025	1029	378.72	4033.86	4412.58	94.68	3.94	24.03***
20	7	1149	1156	624.64	4556.23	5180.87	89.23	3.97	22.48***
21	5	1018	1023	257.20	4177.97	4435.17	51.44	4.10	12.55***
22	7	1114	1121	272.58	4384.86	4657.44	38.94	3.94	9.88***
23	7	992	999	291.07	4552.37	4843.44	41.58	4.59	9.06***
24-25	7	1019	1026	282.11	4491.52	4773.63	40.30	4.41	9.14***
26-30	11	1021	1032	182.79	4313.63	4496.42	16.62	4.22	3.94***
31-35	5	686	691	70.02	2791.50	2861.52	14.00	4.07	3.44**
total	13	9785	9798	2270.36	41913.80	44184.16	174.64	4.28	40.80***
				Bombay					
17	8	963	971	55.23	3666.55	3721.78	6.90	3.81	1.81
18	7	1456	1463	46.92	4464.64	4511.56	6.70	3.07	2.18*
19	12	1501	1513	139.90	4836.40	4976.30	11.66	3.22	3.62***
20	14	1553	1567	114.28	5128.72	5243.00	8.16	3.30	2.47**
21	13	1541	1354	60.73	4566.26	4626.99	4.67	3.41	1.37
22	10	1351	1361	114.62	5140.20	5254.82	11.46	3.80	3.02***
23	10	1228	1238	84.73	4484.36	4569.09	8.47	3.65	2.32*
24-25	13	1254	1267	144.90	4558.83	4703.73	11.15	3.64	3.06***
26-30	11	1323	1334	251.85	5705.92	5957.77	22.90	4.31	5.31***
31-35	10	1067	1077	137.57	3842.70	3980.27	13.76	3.60	3.82***
total	24	13130	13154	811.07	47748.46	48559.53	33.79	3.64	9.28***

age	df			ss			ms		F
	B	W	T	B	W	T	B	W	
1	2	3	4	5	6	7	8	9	10
				Jammu and Kashmir					
17	1	462	463	12.35	1555.93	1568.28	12.35	3.37	3.66
18	3	809	812	16.46	2750.67	2767.13	5.49	3.40	1.61
19	3	738	741	21.33	2668.68	2690.01	7.11	3.62	1.96
20	4	740	744	5.40	3076.38	3081.78	1.35	4.16	0.32
21	3	479	482	12.94	1513.88	1526.82	4.31	3.16	1.36
22	5	520	525	86.29	2304.68	2390.97	17.26	4.43	3.90**
23	4	416	420	21.24	1861.39	1882.63	5.31	4.47	1.19
24-25	5	594	599	34.13	2355.55	2389.68	6.83	3.97	1.72
26-30	6	608	614	19.92	2437.16	2457.08	3.32	4.01	0.83
31-35	4	270	274	5.28	1379.74	1385.02	1.32	5.11	0.26
total	8	5675	5683	52.10	22291.85	22343.95	6.51	3.93	1.66
				Kerala					
17	3	786	789	2.52	3500.58	3503.10	0.84	4.45	0.19
18	4	1110	1114	31.75	3643.43	3675.18	7.94	3.28	2.42*
19	5	1176	1181	9.51	3767.92	3777.43	1.90	3.20	0.59
20	7	1275	1282	9.35	3796.40	3805.75	1.34	2.98	0.45
21	5	1274	1279	9.54	4295.01	4304.55	1.91	3.37	0.57
22	3	1225	1228	1.08	3846.39	3847.47	0.36	3.14	0.11
23	4	1132	1136	16.06	3642.70	3658.76	4.02	3.22	1.25
24-25	3	1203	1206	4.48	3985.89	3990.37	1.49	3.31	0.45
26-30	3	1021	1024	1.99	3788.83	3790.82	0.66	3.71	0.18
31-35	2	883	885	4.59	2779.00	2783.59	2.30	3.15	0.73
total	10	11123	11133	12.07	38607.84	38619.91	1.21	3.47	0.35

age	df			ss			ms		F
	B	W	T	B	W	T	B	W	
1	2	3	4	5	6	7	8	9	10
				Madras					
17	2	1009	1011	7.43	4706.72	4714.15	3.72	4.66	0.80
18	4	1130	1134	20.08	3174.50	3194.58	5.02	2.81	1.79
19	3	1086	1089	11.34	3143.20	3154.54	3.78	2.89	1.31
20	4	1133	1137	24.67	3621.87	3646.54	6.17	3.20	1.93
21	5	1074	1079	14.01	3083.49	3097.50	2.80	2.87	0.98
22	3	1057	1060	8.21	3520.77	3528.98	2.74	3.33	0.82
23	3	1155	1158	47.57	3958.79	4006.36	15.86	3.43	4.62**
24-25	4	1165	1169	14.30	4085.66	4099.96	3.58	3.51	1.02
26-30	3	1204	1207	13.15	4225.46	4238.61	4.38	3.51	1.25
31-35	3	1117	1120	93.84	3898.96	3992.80	31.28	3.49	8.96***
total	7	11166	11173	128.54	38643.22	38771.76	18.36	3.46	5.31***
				Punjab					
17	9	3234	3243	2240.43	10860.60	13101.03	248.93	3.35	74.30***
18	10	5440	5450	2915.15	17050.67	19965.82	291.51	3.13	93.13***
19	9	4499	4508	1985.38	15362.02	17347.40	220.60	3.41	64.69***
20	12	4492	4504	2879.89	16698.92	19578.81	239.99	3.71	64.68***
21	12	3770	3782	1670.62	13532.27	15202.89	139.21	3.58	38.88***
22	11	3587	3598	2145.44	14584.17	16729.61	195.04	4.06	48.03***
23	10	3062	3072	2276.13	12407.92	14684.05	227.61	4.05	56.20***
24-25	11	3600	3611	1889.56	15658.22	17547.78	171.78	4.35	39.49***
26-30	10	4039	4049	2752.91	17774.87	20527.78	275.29	4.40	62.57***
31-35	11	2633	2644	1632.64	11911.56	13544.20	148.42	4.52	32.83***
total	11	38459	38470	21542.79	148115.00	169657.79	195843	3.85	508.68***

age	df			ss			ms		F
	B	W	T	B	W	T	B	W	
1	2	3	4	5	6	7	8	9	10
				Rajasthan					
17	6	468	474	70.41	1397.15	1467.56	11.74	2.98	3.94***
18	5	869	874	128.27	2804.46	2932.73	25.65	3.23	7.94***
19	6	657	663	65.69	1973.40	2039.09	10.95	3.00	3.65***
20	9	740	749	126.46	2551.81	2678.27	14.05	3.45	4.07***
21	6	713	719	94.07	2685.08	2779.15	15.68	3.76	4.17***
22	8	657	665	160.14	2674.48	2834.62	20.02	4.07	4.92***
23	9	697	706	30.39	2278.21	2308.60	3.38	3.27	1.03
24-25	11	725	736	123.44	3083.19	3206.63	11.22	4.25	2.64**
26-30	9	649	658	72.84	2791.43	2864.27	8.09	4.30	1.88
31-35	6	530	536	50.19	2127.23	2177.42	8.36	4.01	2.08
total	17	6772	6789	667.07	24950.24	25617.31	39.24	3.68	10.66***
				Uttar Pradesh					
17	11	2401	2412	2307.96	8108.93	10416.89	209.81	3.38	62.07***
18	15	3271	3286	2985.39	9915.47	12900.86	199.03	3.03	65.69***
19	13	3026	3039	2353.14	9970.36	12323.50	181.01	3.29	55.02***
20	14	3241	3255	2231.36	10619.55	12850.91	159.38	3.28	48.59***
21	12	2986	2998	1837.11	10725.37	12562.48	153.09	3.59	42.64***
22	15	2882	2897	2356.70	10618.20	12974.90	157.11	3.68	42.69***
23	13	2504	2517	1522.03	9929.03	11451.06	117.08	3.96	29.57***
24-25	16	2771	2787	1772.43	11944.53	13716.96	110.78	4.31	25.70***
26-30	12	2850	2862	1224.12	11218.20	12442.32	102.01	3.94	25.89***
31-35	11	2234	2245	1201.18	9831.89	11033.07	109.20	4.40	24.82***
total	21	28286	28307	18748.48	106073.14	124821.62	892.78	3.75	238.07***

age	df			ss			ms		F
	B	W	T	B	W	T	B	W	
1	2	3	4	5	6	7	8	9	10
				West Bengal					
17	2	439	441	7.28	1621.93	1629.21	3.64	3.69	1.00
18	2	574	576	2.14	2063.28	2065.42	1.07	3.59	0.30
19	2	630	632	54.83	2021.41	2076.24	27.42	3.21	8.54***
20	3	642	645	230.18	2250.93	2481.11	76.73	3.51	21.86***
21	3	643	646	382.30	2457.98	2840.28	127.43	3.82	33.36***
22	2	567	569	130.96	2277.86	2408.82	65.48	4.02	16.29***
23	2	501	503	78.59	2216.71	2295.30	39.30	4.42	8.89***
24-25	6	524	530	84.36	2131.52	2215.88	14.06	4.07	3.45**
26-30	3	477	480	116.30	2143.64	2259.94	38.77	4.49	8.63***
31-35	5	314	319	119.27	1392.83	1512.10	23.85	4.44	5.37***
total	9	5341	5350	1047.60	21091.36	22138.96	116.40	3.95	29.47***

Appendix 7A

Table 7.4 Mean stature in districts

state and district	n	mean stature (in)	state and district	n	mean stature (in)
1	2	3	4	5	6
Andhra Pradesh			Assam Unspecified	206	64.10
Nellore	34	64.75	Goalpara	543	64.26
Hyd Unspecified	4	64.88	Kamrup	381	64.42
Kurnool	17	65.36	United Khasi Jainta	55	64.49
West Godavari	206	65.59	Cachar	519	64.52
Hyderabad	14	65.69	Lakhimpur	324	64.65
Cuddapah	8	65.70	Nowgong	199	64.83
Krishna	100	65.74	Sibsagar	577	64.84
Vishakhapatnam	436	65.77	Siang	1	65.00
Guntur	139	65.78	Darrang	172	65.15
East Godavari	146	65.86	Lohit	13	65.20
Anantapur	12	65.87	Tirap	1	65.50
Srikakulam	115	65.99	total	4858	64.31
Chittoor	83	66.12			
Mahbubnagar	1	67.00	Bihar		
Nizamabad	1	71.00	Singhbhum	670	64.20
total	1316	65.76	Hazaribagh	88	64.31
			Santal Parganas	226	64.72
Assam			Ranchi	1496	64.77
Khasi & Jaintia Hills	622	63.83	Purnea	46	65.22
Mizo Hills	390	63.92	Champaran	415	65.59
Garo Hills	114	63.93	Patna	1270	65.63
Kohima	741	63.94	Shahabad	1981	65.73

state and district	n	mean stature (in)	state and district	n	mean stature (in)
1	2	3	4	5	6
Bihar (contd)			Akola	372	64.86
Gaya	397	65.74	North Satara	2488	64.87
Monghyr	329	65.76	Nagpur	508	64.94
Saran	951	65.81	Buldana	434	64.95
Palamau	131	65.84	Yeotmal	124	64.95
Muzaffarpur	1077	65.88	Ahmadabad	5	64.96
Bhagalpur	172	66.06	Poona	416	64.97
Darbhanga	480	66.16	Wardha	148	64.97
Dhanbad	21	66.16	Bombay Subarban	552	64.99
Bihar Unspecified	39	66.19	Sabar Kantha	1	65.00
Saharsa	10	67.08	Kolaba	638	65.01
total	9799	65.48	East Khandesh	205	65.09
Bombay			Nasik	303	65.09
Amreli	6	63.45	Sholapur	312	65.09
Mehsana	5	63.56	Amraoti	310	65.14
Bombay Unspecified	18	64.37	Chanda	67	65.14
West Khandesh	101	64.48	Thana	31	65.28
Halar	1	64.50	Surat	12	65.44
South Satara	1969	64.68	Ahmadnagar	313	65.47
Kolhapur	754	64.71	Panch Mahals	42	65.47
Bhandara	29	64.72	Kutch	92	65.51
Nander	24	64.75	Aurangabad	682	65.52
Ratnagiri	2020	64.79	Parbhani	45	65.52
Biro	5	64.84	Kaira	12	65.61

state and district	n	mean stature (in)	state and district	n	mean stature (in)
1	2	3	4	5	6
Bombay (contd)			Raisi	102	65.79
Baroda	10	65.73	Jammu	4050	65.92
Osmanabad	99	65.73	J&K Unspecified	78	66.10
Broach	1	66.00	Muzaffarabad	1	66.50
Madhya Sourashtra	1	66.50	Chenani	1	67.00
total	13155	64.93	Kashmir	2	67.85
Delhi			total	5684	65.79
Delhi	743	66.42	Kerala		
Himachal Pradesh			Ernakulum	2	64.00
Mahasu	198	64.52	Trivandrum	1734	65.26
Chamba	50	64.70	Kottayam	1117	65.37
Bilaspur	60	64.88	T & C Unspecified	431	65.38
Mandi	409	65.20	Cannanore (Kasargod)	2960	65.49
Sirmur	37	65.21	Trichur	2064	65.55
H.P. Unspecified	11	65.74	Quilon	17151	65.56
total	765	64.97	Calicut	1075	65.79
Jammu and Kashmir			total	11134	65.49
Baramula	94	65.07	Madhya Pradesh		
Anantnagar	210	65.10	Datia	1	62.00
Udhampur	406	65.32	Raigarh	4	63.68
Srinagar	414	65.39	Bhilsa	1	64.00
Mirpur	15	65.43	Shajapur	3	64.03
Punch	76	65.72	Mandla	8	64.10
Kathua	235	65.77	Balaghat	10	64.33
			Sehore	1	64.50

state and district	n	mean stature (in)	state and district	n	mean stature (in)
1	2	3	4	5	6
Madhya Pradesh (contd)			Mandasor	14	66.71
Bilaspur	51	64.53	Morena	122	66.93
Surguja	6	64.65	Bhind	237	66.94
Rajgarh	6	64.88	Satna	25	67.46
Chhindwara	33	64.99	Chhatarpur	2	67.90
Dewas	5	65.02	Jhabus	1	69.70
Raipur	191	65.07	total	1814	65.83
Dhar	9	65.08			
Betul	53	65.15	Madras		
M.P. Unspecified	87	65.24	Nilgiri	43	64.71
East Nimar	45	65.38	Madras	755	65.32
Indore	147	65.39	Chingleput	724	65.37
Jubbulpore	236	65.47	Coimbatore	492	65.38
Panna	10	65.48	South Arcot	1177	65.38
Drug	11	65.56	Tiruchchirappalli	1137	65.45
Hoshangabad	183	65.65	Salem	462	65.47
Guna	27	65.71	Tanjore	663	65.50
Sidhi	5	65.74	North Arcot	2287	65.61
Ratlam	4	65.88	Tinnevelly	1061	65.62
Raisen	1	66.00	Madras Unspecified	120	65.66
Ujjain	9	66.00	Madurai	1326	65.72
Saugor	46	66.11	Rampad	907	65.74
Rewa	112	66.27	total	11174	65.53
Gwalior	108	66.70	Manipur . . .		

state and district	n	mean stature (in)	state and district	n	mean stature (in)
1	2	3	4	5	6
Manipur			Baudh Khondmals	11	64.00
Manipur	50	64.53	Sundargarh	36	64.51
Mysore			Puri	25	64.65
Mandya	2	64.15	Sambalpur	63	64.71
Belgaum	983	64.79	Ganjam	743	64.90
Bijapur	166	64.79	Cuttack	62	64.97
Dharwar	160	64.85	Dhenkanal	57	65.25
Gulbarga	6	65.00	total	1057	64.82
Bellary	5	65.20	Punjab		
North Kanara	132	65.20	Kangra	723	65.10
Bidar	61	65.60	Simla	235	65.19
Kolar	6	65.68	Hoshiarpur	3665	66.36
Bangalore	292	65.82	Bhatinda	198	66.38
South Kanara	68	66.35	Ambala	2196	66.39
Mysore	13	66.45	Karnal	940	66.48
total	1894	65.08	Gurdaspur	2112	66.51
Orissa			Jullundur	2854	66.52
Keonjhargarh	2	62.75	Ferozepur	3110	66.57
Mayurbhang	43	63.77	Kapurthala	364	66.62
Balasore	11	63.95	Ludhiana	3549	66.67
Balngir	1	64.00	Amritsar	3516	66.68
Kalahandi	1	64.00	Patiala	979	66.69
Koraput	2	64.00	Sangrur	372	67.03

state and district	n	mean stature (in)	state and district	n	mean stature (in)
1	2	3	4	5	6
Punjab (contd)			Nagpur	330	66.98
Rohtak	4310	67.06	Sawai Madhopur	330	66.98
Gurgaon	1783	67.08	Pali	45	67.00
Hissar	1362	67.11	Jaipur	1216	67.05
Punjab Unspecified	125	67.30	Bikaner	446	67.10
Mahendrgarh (Narnaul)	1078	67.55	Sikar	145	67.16
total	38471	66.46	Ganganagar	12	67.18
			Alwar	924	67.21
Rajasthan			Jhunjhunu	250	67.31
Jalor	1	65.00	Banswara	1	67.50
Barmer	18	65.54	total	6790	66.89
Sirohi	8	65.60			
Kotah	407	65.95	Uttar Pradesh		
Tonk	66	65.95	Garhwal	6731	64.48
Jhalwar	14	66.21	Tehrigarhwal	47	65.03
Bhilwara	136	66.26	Almora	5714	65.38
Bundi	99	66.35	Gorkhpur	274	65.52
Ajmer	300	66.46	Jaunpur	80	65.58
Chittorgarh	2	66.50	Raibarailly	144	65.60
Rajasthan Unspecified	4	66.63	Dehra Dun	171	65.63
Jaisalmer	78	66.76	Bareilly	501	65.65
Bharatpur	175	66.86	Saharanpur	192	65.68
Jodhpur	1363	66.88	Badaun	939	65.71
Churu	217	66.89	Gonda	114	65.72
Udaipur	203	66.94	Naini Tal	63	65.74

state and district	n	mean stature (in)	state and district	n	mean stature (in)
1	2	3	4	5	6
Uttar Pradesh (contd)			Aligarh	505	66.35
Rampur	35	65.76	Unnao	91	66.35
Allahabad	222	65.77	Etawah	326	66.44
Faizabad	194	65.87	Pilibhit	58	66.46
Basti	145	65.90	Sitapur	50	66.46
Jhansi	95	65.94	Agra	566	66.47
Lucknow	928	65.94	Meerut	2603	66.53
Bahraich	22	65.95	Mirzapur	38	66.53
Shahjahanpur	229	65.96	Mainpuri	544	66.56
Bijnor	63	66.02	Bara Banki	66	66.60
Pratapgarh	201	66.07	Kanpur	170	66.63
Sultanpur	286	66.09	Bulandshar	1217	66.67
Deoria	114	66.09	Muzaffarnagar	366	66.70
Azamgarh	201	66.13	Mathura	460	66.71
Ballia	443	66.14	Jalaun	127	66.73
Hardoi	166	66.15	Kheri	29	66.74
Moradabad	221	66.18	Hamirpur	35	66.89
Banda	99	66.19	total	28308	65.65
Etah	305	66.23			
Ghazipur	643	66.23	West Bengal		
Fatehpur	134	66.24	Darjeeling	286	63.89
Varanassi	746	66.25	Malda	10	65.08
Farrukhabad	450	66.26	Purulia	4	65.13
UP Unspecified	45	66.30	West Dinazpur	5	65.36

state and district	n	mean stature (in)	state and district	n	mean stature (in)
1	2	3	4	5	6
West Bengal (contd)			Bhirkot	203	62.79
Nadia (Krishnannagar)	184	65.48	Golkot	32	62.80
Burdwan	885	65.73	Sallyan	92	62.85
Calcutta	2301	65.83	Satung	66	62.93
Bankura	75	65.90	Tanhu	181	62.93
Parganas	833	65.90	4000 RBT	330	62.94
Murshidabad	43	65.91	Payjung	210	62.94
Howrah	259	65.99	Gorkha	243	62.95
Cooch Behar	7	66.07	Nawakot	80	63.06
Midnapore	203	66.08	Surkhet	12	63.08
Hooghly	218	66.15	Dailakh	147	63.11
Jalpaiguri	10	66.22	Guluzi	633	63.11
Birbhum	27	66.73	Piuthan	283	63.17
W. B. Unspecified	1	67.50	Kaski	172	63.23
total	5351	65.74	Nepal Unspecified	846	63.35
			Khatmandu	5	63.60
Tripura			Jamjung	528	63.61
Tripura	13	65.73	Itam	29	64.07
			Dhunkuta	136	64.10
Nepal			total	4671	63.15
Kalimpong	2	62.00			
Ghiring	48	62.44			
Khanchi	9	62.50	Sikkim		
Palpa	206	62.56	Sikkim	19	63.51
Garhung	173	62.78	grand total	147066	65.69

Appendix 7B

Table 7.6 Analysis of variance of stature between and within districts separately for age groups.

age	df			ss			ms		F
	B	W	T	B	W	T	B	W	
1	2	3	4	5	6	7	8	9	10
				Bihar					
17	17	595	612	137.44	2226.25	2363.69	8.08	3.74	2.16**
18	18	1082	1100	277.20	3950.91	4228.11	15.40	3.65	4.22***
19	16	1013	1029	571.59	3840.99	4412.58	35.72	3.79	9.42***
20	17	1139	1156	688.26	4492.61	5180.87	40.49	3.94	10.28***
21	17	1006	1023	370.54	4064.63	4435.17	21.80	4.04	5.40***
22	18	1103	1121	357.03	4300.41	4657.44	19.83	3.90	5.08***
23	17	982	999	436.78	4406.66	4843.44	25.69	4.49	5.72***
24-25	17	1009	1026	404.87	4368.76	4773.63	23.82	4.33	5.50***
26-30	18	1014	1032	232.88	4263.54	4496.42	12.94	4.20	3.08***
31-35	16	675	691	106.47	2755.05	2861.52	6.65	4.08	1.63
total	18	9780	9798	297.21	41236.95	44184.16	163.73	4.22	38.80***
				Bombay					
17	27	944	971	139.03	3582.75	3721.78	5.15	3.80	1.36
18	29	1434	1463	166.38	4345.18	4511.56	5.74	3.03	1.89**
19	31	1482	1513	118.75	4857.55	4976.30	3.83	3.28	1.17
20	34	1533	1567	253.86	4989.14	5243.00	7.47	3.25	2.30***
21	29	1325	1354	88.37	4538.62	4626.99	3.47	3.42	1.01
22	31	1330	1361	252.22	5002.60	5254.82	8.14	3.76	2.16***
23	30	1208	1238	144.53	4424.56	4569.09	4.82	3.66	1.32
24-25	30	1237	1267	255.58	4448.15	4703.73	8.52	3.59	2.37***
26-30	32	1302	1334	341.91	5615.86	5957.77	10.68	4.31	2.48***
31-35	27	1050	1077	123.56	3856.71	3980.27	4.58	3.67	1.25
total	38	13116	13154	777.87	47781.66	48559.53	20.53	3.54	5.80***

age	df			ss			ms		F
	B	W	T	B	W	T	B	W	
1	2	3	4	5	6	7	8	9	10
				J & K					
17	10	453	463	66.33	1501.95	1568.28	6.63	3.32	2.00*
18	9	803	812	118.55	2648.58	2767.13	13.17	3.30	3.99***
19	9	732	741	75.34	2614.67	2690.01	8.37	3.57	2.34*
20	9	735	744	215.60	2866.18	3081.78	23.96	3.90	6.14***
21	8	474	482	25.42	1501.40	1526.82	3.18	3.17	1.00
22	10	515	525	36.05	2354.92	2390.97	3.61	4.57	0.79
23	7	413	420	74.28	1808.35	1882.63	10.61	4.35	2.44*
24-25	9	590	599	56.21	2333.47	2389.68	6.25	3.96	1.58
26-30	9	605	614	79.33	2377.75	2457.08	8.81	3.93	2.24*
31-35	8	266	274	23.14	1361.88	1385.02	2.89	5.12	0.56
total	12	5671	5683	386.39	21957.56	22343.95	32.20	3.87	8.32***
				Kerala					
17	5	784	789	68.80	3434.30	3503.10	13.76	4.38	3.14**
18	6	1108	1114	71.91	3603.27	3675.18	11.98	3.25	3.69**
19	7	1174	1181	36.40	3741.03	3777.43	5.02	3.18	1.58
20	6	1276	1282	21.71	3784.04	3805.75	3.62	2.96	1.22
21	6	1273	1279	81.17	4223.38	4304.55	13.53	3.32	4.08***
22	6	1222	1228	76.88	3770.59	3847.47	12.81	3.08	4.16***
23	6	1130	1136	85.07	3573.69	3658.76	14.18	3.16	4.49***
24-25	6	1200	1206	31.52	3958.85	3990.37	5.25	3.30	1.59
26-30	7	1017	1024	34.13	3756.69	3790.82	4.88	3.69	1.32
31-35	6	879	885	55.34	2728.25	2783.59	9.22	3.10	2.97**
total	7	11126	11133	237.59	38382.32	38619.91	33.94	3.45	9.84***

age	df			ss			ms		F
	B	W	T	B	W	T	B	W	
1	2	3	4	5	6	7	8	9	10
				Madras					
17	12	999	1011	117.32	4596.83	4714.15	9.78	4.60	2.13*
18	12	1122	1134	38.06	3156.52	3194.58	3.17	2.81	1.13
19	12	1077	1089	36.67	3117.87	3154.54	3.06	2.89	1.06
20	12	1125	1137	26.76	3619.78	3646.54	2.23	3.22	0.69
21	12	1067	1079	58.89	3038.61	3097.50	4.91	2.85	1.72
22	11	1049	1060	56.36	3472.63	3528.99	5.12	3.31	1.55
23	12	1146	1158	147.43	3858.93	4006.36	12.28	3.37	3.64***
24-25	12	1157	1169	91.48	4008.48	4099.96	7.62	3.46	2.20**
26-30	12	1195	1207	73.26	4165.35	4238.61	6.10	3.48	1.75*
31-35	12	1108	1120	53.67	3939.13	3992.80	4.47	3.56	1.26
total	12	11161	11173	279.85	38491.91	38771.76	23.32	3.45	6.76***
				Punjab					
17	20	3223	3243	1528.04	11572.98	13101.02	76.40	3.59	21.28***
18	22	5428	5450	2299.68	17666.14	19965.82	104.53	3.25	32.16***
19	22	4486	4508	1507.78	15839.62	17347.40	68.53	3.53	19.41***
20	23	4481	4504	2298.73	17280.08	19578.81	99.94	3.85	25.95***
21	22	3760	3782	1082.97	14119.92	15202.89	49.23	3.75	13.13***
22	23	3575	3598	1588.98	15140.64	16729.62	69.08	4.23	16.33***
23	22	3050	3072	1627.85	13056.20	14684.05	73.99	4.28	17.28***
24-25	23	3588	3611	1467.56	16080.22	17547.78	63.80	4.48	14.24***
26-30	23	4026	4049	2379.74	18148.03	20527.77	103.46	4.50	22.99***
31-35	22	2622	2644	1227.39	12316.80	13544.19	55.79	4.69	11.89***
total	23	38447	38470	15745.49	153912.30	169657.79	684.59	4.00	171.15***

age	df			ss			ms		F
	B	W	T	B	W	T	B	W	
1	2	3	4	5	6	7	8	9	10
				Rajasthan					
17	17	457	474	142.37	1325.19	1467.56	8.37	2.90	2.89***
18	22	852	874	161.08	2771.65	2932.73	7.32	3.25	2.25***
19	20	643	663	118.53	1920.56	2039.09	5.93	2.99	1.98**
20	22	727	749	143.90	2534.37	2678.27	6.54	3.49	1.87*
21	22	697	719	165.29	2613.86	2779.15	7.51	3.75	2.00**
22	20	645	665	131.36	2703.26	2834.62	6.57	4.19	1.57
23	19	687	706	190.54	2118.06	2308.60	10.03	3.08	3.26***
24-25	22	714	736	210.76	2995.87	3206.63	9.58	4.20	2.28***
26-30	20	638	658	211.54	2652.73	2864.27	10.58	4.16	2.54***
31-35	21	515	536	158.68	2018.74	2177.42	7.56	3.92	1.92**
total	25	6764	6789	816.08	24801.23	25617.31	32.64	3.67	8.89***
				U. P.					
17	51	2361	2412	2521.68	7895.21	10416.89	49.44	3.34	14.80***
18	51	3235	3286	3077.88	9822.98	12900.86	60.35	3.04	19.85***
19	49	2990	3039	2426.97	9896.53	12323.50	49.53	3.31	14.96***
20	51	3204	3255	2001.28	10849.63	12850.91	39.24	3.39	11.58***
21	49	2949	2998	1810.65	10751.83	12562.48	36.95	3.64	10.15***
22	50	2847	2897	2050.57	10924.33	12974.90	41.01	3.84	10.68***
23	51	2466	2517	1500.25	9950.81	11451.06	29.42	4.04	7.28***
24-25	50	2737	2787	1748.88	11968.08	13716.96	34.98	4.37	8.00***
26-30	50	2812	2862	1191.20	11251.12	12442.32	23.82	4.00	5.96***
31-35	47	2198	2245	1268.78	9764.29	11033.07	27.00	4.44	6.08***
total	51	28256	28307	17156.16	107665.46	124821.62	336.40	3.81	88.29***

age	df			ss			ms		F
	B	W	T	B	W	T	B	W	
1	2	3	4	5	6	7	8	9	10
				West Bengal					
17	13	428	441	53.27	1575.94	1629.21	4.10	3.68	1.11
18	15	561	576	58.45	2006.97	2065.42	3.90	3.58	1.09
19	13	619	632	128.75	1947.49	2076.24	9.90	3.15	3.14***
20	13	632	645	317.90	2163.21	2481.11	24.45	3.42	7.15***
21	13	633	646	441.14	2399.14	2840.28	33.93	3.79	8.95***
22	12	557	569	137.01	2271.81	2408.82	11.42	4.08	2.80***
23	11	492	503	130.60	2164.70	2295.30	11.87	4.40	2.70**
24-25	11	519	530	149.70	2066.18	2215.88	13.61	3.98	3.42***
26-30	10	470	480	125.00	2134.94	2259.94	12.50	4.54	2.75**
31-35	9	310	319	100.13	1411.97	1512.10	11.12	4.55	2.44*
total	16	5334	5350	1158.77	20980.19	22138.96	72.42	3.93	18.43***

Appendix 8A

Table 8.1 Analysis of variance of stature between and within years of recruitment separately for age groups.

age	df			ss			ms		F
	B	W	T	B	W	T	B	W	
1	2	3	4	5	6	7	8	9	10
				Bihar					
17	6	606	612	38.22	2325.47	2363.69	6.37	3.84	1.66
18	7	1093	1100	72.26	4155.85	4228.11	10.32	3.80	2.71**
19	7	1022	1029	124.56	4288.02	4412.58	17.79	4.20	4.24***
20	7	1149	1156	118.75	5062.12	5180.87	16.96	4.40	3.85***
21	7	1016	1023	145.92	4289.25	4435.17	20.85	4.22	4.94***
22	7	1114	1121	177.29	4480.15	4657.44	25.33	4.02	6.30***
23	7	992	999	218.58	4624.86	4843.44	31.23	4.66	6.70***
24-25	7	1019	1026	411.93	4361.70	4773.63	58.85	4.28	13.75***
26-30	7	1025	1032	173.68	4322.74	4496.42	24.81	4.22	5.88***
31-35	7	684	691	92.45	2769.07	2861.52	13.21	4.05	3.26**
total	7	9791	9798	1003.45	43180.71	44184.16	143.34	4.41	32.50***
				Bombay					
17	7	964	971	146.01	3575.77	3721.78	20.86	3.71	5.62***
18	7	1456	1463	246.86	4264.70	4511.56	35.26	2.93	12.03***
19	7	1506	1513	214.01	4762.29	4976.30	30.57	3.16	9.67***
20	7	1560	1567	192.11	5050.89	5243.00	27.44	3.24	8.47***
21	7	1347	1354	210.51	4416.48	4626.99	30.07	3.28	9.17***
22	7	1354	1361	174.59	5080.23	5254.82	24.94	3.75	6.65***
23	7	1231	1238	112.33	4456.76	4569.09	16.05	3.62	4.43***
24-25	7	1260	1267	157.02	4546.71	4703.73	22.43	3.61	6.21***
26-30	7	1327	1334	71.29	5886.48	5957.77	10.18	4.44	2.29*
31-35	7	1070	1077	37.36	3942.91	3980.27	5.34	3.68	1.45
total	7	13147	13154	1095.73	47463.80	48559.53	156.53	3.61	43.36***

age	df			ss			ms		F
	B	W	T	B	W	T	B	W	
1	2	3	4	5	6	7	8	9	10
				Jammu and Kashmir					
17	6	457	463	31.03	1537.25	1568.28	5.17	3.36	1.54
18	7	805	812	70.47	2696.66	2767.13	10.07	3.35	3.01**
19	7	734	741	58.94	2631.07	2690.01	8.42	3.58	2.35*
20	7	737	744	91.88	2989.90	3081.78	13.13	4.06	3.23**
21	7	475	482	27.57	1499.25	1526.82	3.94	3.16	1.25
22	7	518	525	34.22	2356.75	2390.97	4.90	4.55	1.08
23	7	413	420	66.14	1816.49	1882.63	9.45	4.40	2.15*
24-25	7	592	599	50.21	2339.47	2389.68	7.17	3.95	1.82
26-30	7	607	614	13.71	2443.37	2457.08	1.96	4.03	0.49
31-35	7	267	274	12.29	1372.73	1385.02	1.76	5.14	0.34
total	7	5676	5683	60.86	22283.09	22343.95	8.69	3.93	2.21*
				Kerala					
17	7	782	789	179.07	3324.03	3503.10	25.58	4.25	6.02***
18	7	1107	1114	140.97	3534.21	3675.18	20.14	3.19	6.31***
19	7	1174	1181	140.11	3637.32	3777.43	20.02	3.10	6.46***
20	7	1275	1282	121.10	3684.65	3805.75	17.30	2.89	5.99***
21	7	1272	1279	213.26	4091.29	4304.55	30.46	3.22	9.46***
22	7	1221	1228	127.83	3719.64	3847.47	18.26	3.05	5.99***
23	7	1129	1136	135.42	3523.34	3658.76	19.35	3.12	6.20***
24-25	7	1199	1206	152.26	3838.11	3990.37	21.75	3.20	6.80***
26-30	7	1017	1024	57.80	3733.22	3790.82	8.23	3.67	2.24*
31-35	7	878	885	90.64	2692.95	2783.59	12.95	3.07	4.22***
total	7	11126	11133	838.96	37780.95	38619.91	119.85	3.40	35.25***

age	df			ss			ms		F
	B	W	T	B	W	T	B	W	
1	2	3	4	5	6	7	8	9	10
				Madras					
17	7	1004	1011	32.05	4682.10	4714.15	4.58	4.66	0.98
18	7	1127	1134	89.87	3104.71	3194.58	12.84	2.75	4.67***
19	7	1082	1089	74.10	3060.44	3154.54	10.59	2.85	3.72***
20	7	1130	1137	65.01	3581.53	3646.54	9.29	3.17	2.93**
21	7	1072	1079	57.62	3039.88	3097.50	8.23	2.84	2.90**
22	7	1053	1060	87.34	3441.65	3528.99	12.48	3.27	3.82***
23	7	1151	1158	76.64	3929.72	4006.36	10.95	3.41	3.21**
24-25	7	1162	1169	84.49	4015.47	4099.96	12.07	3.46	3.49***
26-30	7	1200	1207	195.82	4042.79	4238.61	27.97	3.37	8.30***
31-35	7	1113	1120	76.58	3916.22	3992.80	10.94	3.52	3.11**
total	7	11166	11173	505.84	38265.92	38771.76	72.26	3.43	21.07***
				Punjab					
17	7	3236	3243	134.77	12966.26	13101.03	19.25	4.00	4.81***
18	7	5443	5450	189.63	19776.19	19965.85	27.09	3.63	7.46***
19	7	4501	4508	99.85	17247.55	17347.40	14.26	3.83	3.72***
20	7	4497	4504	174.57	19404.24	19578.81	24.93	4.31	5.78***
21	7	3775	3782	193.48	15009.41	15202.89	27.64	3.97	6.96***
22	7	3591	3598	172.69	16556.92	16729.61	24.67	4.61	5.35***
23	7	3065	3072	219.37	14464.68	14684.05	31.33	4.71	6.65***
24-25	7	3604	3611	181.72	17366.06	17547.78	25.96	4.81	5.39***
26-30	7	4042	4049	176.82	20350.96	20527.78	25.26	5.03	5.02***
31-35	7	2637	2644	101.60	13442.60	13544.20	14.51	5.09	2.85**
total	7	38463	38470	1091.51	168566.28	169657.79	155.93	4.38	35.60***

age	df			ss			ms		F
	B	W	T	B	W	T	B	W	
1	2	3	4	5	6	7	8	9	10
				Rajasthan					
17	7	467	474	89.99	1377.57	1467.56	12.86	2.95	4.36***
18	7	867	874	68.31	2864.42	2932.73	9.76	3.30	2.96**
19	7	656	663	120.20	1918.89	2039.09	17.17	2.92	5.88***
20	7	742	749	86.56	2591.71	2678.27	12.37	3.49	3.54***
21	7	712	719	133.98	2645.17	2779.15	19.14	3.72	5.14***
22	7	658	665	147.87	2686.75	2834.62	21.12	4.08	5.18***
23	7	699	706	77.70	2230.90	2308.60	11.10	3.19	3.48**
24-25	7	729	736	78.94	3127.69	3206.63	11.28	4.29	2.63**
26-30	7	651	658	71.89	2792.38	2864.27	10.27	4.29	2.39*
31-35	7	529	536	28.32	2149.10	2177.42	4.04	4.06	1.00
total	7	6782	6789	637.60	24979.71	25617.31	91.09	3.68	24.75***
				Uttar Pradesh					
17	7	2405	2412	248.82	10168.07	10416.89	35.54	4.23	8.40***
18	7	3279	3286	173.94	12726.92	12900.86	24.85	3.88	6.41***
19	7	3032	3039	150.50	12173.00	12323.50	21.50	4.02	5.35***
20	7	3248	3255	109.94	12740.97	12850.91	15.71	3.92	4.01***
21	7	2991	2998	118.59	12443.89	12562.48	16.94	4.16	4.07***
22	7	2890	2897	216.69	12758.21	12974.90	30.95	4.41	7.02***
23	7	2510	2517	244.42	11206.64	11451.06	34.92	4.46	7.83***
24-25	7	2780	2787	327.55	13389.41	13716.96	46.79	4.82	9.71***
26-30	7	2855	2862	86.23	12356.09	12442.32	12.32	4.33	2.84***
31-35	7	2238	2245	157.07	10876.00	11033.07	22.44	4.86	4.62***
total	7	28300	28307	818.51	124003.11	124821.62	116.93	4.38	26.70***

age	df			ss			ms		F
	B	W	T	B	W	T	B	W	
				West Bengal					
17	6	435	441	46.78	1582.43	1629.21	7.80	3.64	2.14*
18	5	571	576	88.75	1976.67	2065.42	17.75	3.46	5.13***
19	6	626	632	49.53	2026.71	2076.24	8.26	3.24	2.55*
20	6	639	645	69.30	2411.81	2481.11	11.55	3.77	3.06**
21	7	639	646	331.16	2509.12	2840.28	47.31	3.93	12.04***
22	7	562	569	160.56	2248.26	2408.82	22.94	4.00	5.73***
23	7	496	503	117.13	2178.17	2295.30	16.73	4.39	3.81***
24-25	6	524	530	84.20	2131.68	2215.88	14.03	4.07	3.45**
26-30	5	475	480	77.64	2182.30	2259.94	15.53	4.59	3.38**
31-35	5	314	319	25.56	1486.54	1512.10	5.11	4.73	1.08
total	7	5343	5350	630.88	21508.08	22138.96	90.12	4.02	22.42

Appendix 8B

Table 8.2 Analysis of variance between and within years of recruitment separately for communities.

community	df			ss			ms		F
	B	W	T	B	W	T	B	W	
1	2	3	4	5	6	7	8	9	10
Bihar									
Rajput	5	187	192	42.63	644.25	686.88	8.53	3.44	2.48*
Ahir	7	487	494	175.89	1877.65	2053.54	25.13	3.86	6.51***
Bihari	7	7092	7099	1181.64	31096.43	32278.07	168.81	4.38	38.54***
Adibasi	3	1904	1907	136.20	6306.85	6443.05	45.40	3.31	13.72***
total	7	9791	9798	1003.45	43180.71	44184.16	143.34	4.41	32.50***
Bombay									
Maratha	7	6597	6604	477.21	24075.12	24552.33	68.17	3.65	18.68***
Mahar	7	5373	5380	384.20	18701.84	19086.04	54.89	3.48	15.77***
total	7	13147	13154	1095.73	47463.80	48559.53	156.53	3.61	43.36***
Jammu and Kashmir									
Hindu J&K	7	5042	5049	64.74	19634.03	19698.77	9.25	3.89	2.38*
Dogra	1	364	365	2.04	1403.59	1405.63	2.04	3.86	0.53
Sikh (Other)	4	231	235	31.60	1007.01	1038.61	7.90	4.36	1.81
total	7	5676	5683	60.86	22283.09	22343.95	8.69	3.93	2.21*
Kerala									
Malayali	7	7713	7720	493.34	26169.82	26663.16	70.48	3.39	20.79***
Madras Christian	7	3289	3296	377.71	11294.29	11672.00	53.96	3.43	15.73***
total	7	11126	11133	838.96	37780.95	38619.91	119.85	3.40	35.25
Madras									
Tamil Hindu	7	7535	7542	313.43	25762.35	26075.78	44.78	3.42	13.09***
Tamil Christian	7	3514	3521	222.73	12016.92	12239.65	31.82	3.42	9.30***
total	7	11166	11173	505.84	38265.94	38771.78	72.26	3.43	21.07***

community	df			ss			ms		F
	B	W	T	B	W	T	B	W	
1	2	3	4	5	6	7	8	9	10
				Punjab					
Dogra	7	7074	7081	630.70	25783.81	26414.51	90.10	3.64	24.75***
Punjabi	7	7829	7836	195.82	32138.46	32334.28	27.97	4.11	6.81***
Sikh (M & R)	6	5520	5526	421.22	19993.36	20414.58	70.20	3.62	19.39***
Sikh (Other)	7	10021	10028	651.70	39874.04	40525.74	93.10	3.98	23.39***
Jat	7	4094	4101	109.05	14288.53	14397.58	15.58	3.49	4.46***
Rajput	7	815	822	118.09	3305.74	3423.83	16.87	4.06	4.16***
Ahir	7	2635	2642	99.37	9071.27	9170.64	14.20	3.44	4.13***
total	7	38463	38470	1091.51	168566.28	169657.79	155.93	4.38	35.60***
				Rajasthan					
Jat	7	1244	1251	65.09	4228.40	4293.49	9.30	3.40	2.74**
Rajput	7	3999	4006	602.95	14664.44	15267.39	86.14	3.67	23.47***
Ahir	7	732	739	59.00	2727.15	2786.15	8.43	3.72	2.27*
total	7	6782	6789	637.60	24979.71	25617.31	91.08	3.68	24.75***
				Uttar Pradesh					
Jat	7	2392	2399	126.20	7525.92	7652.12	18.03	3.15	5.72***
Rajput	7	2380	2387	122.92	7992.02	8114.94	17.56	3.36	5.23***
Garhwali	7	6955	6962	268.39	27684.18	27952.57	38.34	3.97	9.66***
Kumaoni	7	5952	5959	195.47	20972.56	21168.03	27.92	3.53	7.91***
Ahir	7	2203	2210	247.55	7056.06	7303.61	35.37	3.20	11.05***
UP Hindu	7	7489	7496	280.43	31509.25	31789.68	40.06	4.21	9.51***
total	7	28300	28307	818.51	124003.11	124821.62	116.93	4.38	26.70***
				West Bengal					
Gorkha	4	253	257	30.24	860.92	891.16	7.56	3.40	2.22
Bengali	5	5062	5067	323.56	19774.47	20098.03	64.71	3.91	16.55***
total	7	5343	5350	630.88	21508.08	22138.96	90.12	4.02	22.42***

Appendix 8C

Table 8.3 Linear regression of stature on years of recruitment

age	regression coefficient	variance due to regression	error mean square	ratio of variances
1	2	3	4	5
		Bihar		
17	-0.0832	19.93	3.84	5.19*
18	-0.0755	40.42	3.80	10.64**
19	-0.0349	7.65	4.20	1.82
20	-0.0621	27.93	4.40	6.35*
21	0.0940	54.08	4.22	12.82***
22	0.1120	83.12	4.02	20.68***
23	0.0933	49.23	4.66	10.56**
24-25	0.1662	160.60	4.28	37.52***
26-30	0.1094	77.60	4.22	18.39***
31-35	0.0504	12.63	4.05	3.12
total	0.0631	235.35	4.41	53.37
		Bombay		
17	0.1294	75.01	3.71	20.22***
18	0.1479	174.78	2.93	59.65***
19	0.1186	126.98	3.16	40.18***
20	0.1054	100.81	3.24	31.11***
21	0.1328	139.55	3.28	42.55***
22	0.1043	84.28	3.75	22.47***
23	0.0969	63.48	3.62	17.54***
24-25	0.1107	83.58	3.61	23.15***
26-30	0.0262	4.89	4.44	1.10
31-35	0.0013	0.01	3.68	0.00
total	0.0993	720.89	3.61	199.69***

age	regression coefficient	variance due to regression	error mean square	ratio of variances
1	2	3	4	5
		Jammu and Kashmir		
17	0.0120	0.17	3.36	0.05
18	0.0087	0.32	3.35	0.10
19	-0.0338	3.84	3.58	1.07
20	0.0210	1.48	4.06	0.36
21	-0.1099	18.84	3.16	5.96**
22	-0.0106	0.26	4.55	0.06
23	0.0219	0.80	4.40	0.18
24-25	-0.0003	0.00	3.95	0.00
26-30	0.0141	0.72	4.03	0.18
31-35	0.0268	0.92	5.14	0.18
total	0.0002	0.00	3.93	0.00

age	regression coefficient	variance due to regression	error mean square	ratio of variances
1	2	3	4	5
		Kerala		
17	0.0195	1.59	4.25	0.37
18	0.1264	98.55	3.19	30.89***
19	0.1349	112.08	3.10	36.15***
20	0.1127	87.01	2.89	30.11***
21	0.1608	175.77	3.22	54.59***
22	0.1202	92.82	3.05	30.43***
23	0.1422	122.85	3.12	39.38***
24-25	0.1341	117.52	3.20	36.72***
26-30	0.0501	14.98	3.67	4.08*
31-35	0.0856	38.35	3.07	12.49***
total	0.1017	624.08	3.40	183.54***
		Madras		
17	-0.0162	1.28	4.66	00.27
18	0.1041	63.29	2.75	23.01***
19	0.0713	29.94	2.85	10.51**
20	0.0961	56.54	3.17	17.84***
21	0.0709	28.85	2.84	10.16**
22	0.1025	59.18	3.27	18.10***
23	0.0646	25.53	3.41	7.49**
24-25	0.0899	48.79	3.46	14.10***
26-30	-0.0247	3.52	3.37	1.04
31-35	0.0317	5.50	3.52	1.56
total	0.0634	231.28	3.43	67.43***

age	regression coefficient	variance due to regression	error mean squares	ratio of variances
1	2	3	4	5
		Punjab		
17	0.0314	16.72	4.00	4.18*
18	0.0475	64.34	3.63	17.72***
19	0.0387	34.45	3.83	8.99**
20	0.0506	59.93	4.31	13.90***
21	0.0218	9.11	3.97	2.29
22	0.0647	74.44	4.61	16.15***
23	0.0446	29.74	4.71	6.31*
24-25	0.0192	6.74	4.81	1.40
26-30	0.0269	14.71	5.03	2.92
31-35	0.0258	9.15	5.09	1.80
total	0.0406	323.82	4.38	73.93***
		Rajasthan		
17	0.0328	1.92	2.95	0.65
18	0.0498	11.80	3.30	3.58
19	0.0949	33.20	2.92	11.37***
20	0.0713	20.94	3.49	6.00*
21	0.1361	63.34	3.72	17.03***
22	0.1239	48.95	4.08	12.00***
23	0.0276	2.46	3.19	0.77
24-25	0.1112	39.99	4.29	9.32**
26-30	0.0265	2.58	4.29	0.60
31-35	0.0673	9.60	4.06	2.36
total	0.0723	168.74	3.68	45.85***

age	regression coefficient	variance due to regression	error mean square	ratio of variances
1	2	3	4	5
		Uttar Pradesh		
17	0.0962	100.19	4.23	23.69***
18	0.0771	108.19	3.88	27.88***
19	0.0809	101.15	4.02	25.16***
20	0.0159	4.08	3.92	1.04
21	0.0701	73.23	4.16	17.60***
22	0.1003	141.82	4.41	32.16***
23	0.1245	186.49	4.46	41.81***
24-25	0.1222	204.70	4.82	42.47***
26-30	-0.0157	3.50	4.33	0.81
31-35	0.0047	0.25	4.86	0.05
total	0.0656	606.64	4.38	138.50***
		West Bengal		
17	0.0373	2.60	3.64	0.71
18	-0.2261	132.36	3.46	38.25***
19	-0.0809	19.85	3.24	6.13*
20	0.0002	0.00	3.77	0.00
21	-0.1407	61.16	3.93	15.56***
22	-0.0946	22.08	4.00	5.52*
23	-0.1055	27.76	4.39	6.32*
24-25	-0.0163	0.64	4.07	0.16
26-30	0.0155	0.54	4.59	0.12
31-35	-0.0820	8.84	4.73	1.87
total	-0.0568	79.57	4.02	19.79***

Appendix 8D

Table 8.4 Mean stature in each age group for different years of recruitment.

age	year of recruitment								total
	1948	1949	1950	1951	1952	1953	1954	1955	
				Bihar					
				number in sample					
17	2	-	60	102	98	100	101	150	613
18	230	79	190	105	97	100	99	201	1101
19	169	69	189	104	100	100	100	199	1030
20	214	124	211	106	100	100	102	200	1157
21	161	92	185	100	102	100	100	184	1024
22	165	134	226	104	100	100	101	192	1122
23	158	161	190	101	61	99	133	97	1000
24-25	164	171	225	101	62	80	122	102	1027
26-30	181	311	173	102	29	30	118	89	1033
31-35	167	171	36	100	11	14	107	86	692
total	1611	1312	1685	1025	760	823	1083	1500	9799
				mean value of stature					
17	67.00	-	65.96	65.70	65.83	65.51	65.34	65.30	65.56
18	65.96	66.37	65.85	65.83	66.11	65.81	65.39	65.52	65.82
19	66.30	65.62	65.78	65.70	66.56	66.35	65.43	65.82	65.95
20	66.02	66.19	65.60	66.14	66.41	66.07	65.45	65.50	65.87
21	65.21	65.34	66.04	65.61	66.35	66.24	65.76	65.97	65.82
22	64.79	65.55	65.68	65.57	66.05	66.21	65.69	65.81	65.63
23	64.60	64.86	65.81	64.94	65.70	65.92	65.24	65.37	65.26
24-25	64.00	64.78	65.80	65.14	65.54	65.79	65.64	65.43	65.20
26-30	64.02	64.69	64.90	65.28	65.49	65.05	65.05	65.14	64.78
31-35	64.18	64.44	65.00	64.77	66.77	64.75	64.50	64.65	64.53
total	65.07	65.12	65.68	65.47	66.10	65.94	65.34	65.54	65.48

age	year of recruitment								total
	1948	1949	1950	1951	1952	1953	1954	1955	
				Bombay					
				number in sample					
17	112	15	173	106	175	148	126	117	972
18	183	184	195	180	129	201	196	196	1464
19	186	132	198	182	118	199	194	305	1514
20	185	194	193	198	127	197	194	280	1568
21	186	100	186	175	117	171	169	251	1355
22	179	93	183	134	134	167	177	245	1362
23	193	79	176	155	160	153	145	178	1239
24-25	186	93	188	176	140	150	163	172	1268
26-30	199	138	193	196	142	140	169	158	1335
31-35	151	46	148	170	143	70	133	217	1078
total	1760	1074	1833	1722	1385	1596	1666	2119	13155
				mean value of stature					
17	64.00	62.75	63.77	63.95	63.96	64.31	64.14	64.96	64.11
18	64.03	64.40	64.66	64.90	64.61	65.33	64.80	65.27	64.76
19	64.31	65.18	64.68	65.08	65.04	65.34	64.93	65.51	65.04
20	64.66	64.89	64.86	64.90	64.45	65.18	64.96	65.65	65.01
21	64.73	65.37	64.65	64.93	65.10	65.11	65.64	65.70	65.16
22	64.73	65.56	64.74	64.81	65.30	65.26	65.16	65.68	65.15
23	64.83	65.30	64.95	64.78	65.26	65.62	65.25	65.53	65.18
24-25	64.47	65.09	65.15	64.79	64.80	65.26	65.02	65.67	65.02
26-30	64.69	65.31	64.57	64.84	64.71	65.01	64.77	65.14	64.86
31-35	64.60	64.95	64.86	64.60	64.78	64.66	64.32	64.88	64.70
total	64.52	65.02	64.69	64.80	64.78	65.15	64.93	65.44	64.93

age	year of recruitment								total
	1948	1949	1950	1951	1952	1953	1954	1955	
				Jammu and Kashmir					
				number in sample					
17	9	-	61	91	100	100	93	10	464
18	69	166	100	68	100	100	110	100	813
19	36	89	99	100	100	100	135	83	742
20	46	97	100	100	100	100	128	74	745
21	27	54	87	100	100	50	44	21	483
22	42	96	99	85	60	50	57	37	526
23	40	76	65	99	60	22	44	15	421
24-25	58	179	71	100	63	35	63	31	600
26-30	102	260	48	100	13	23	47	22	615
31-35	36	72	18	100	11	4	19	15	275
total	465	1089	748	943	707	584	740	408	5684
				mean value of stature					
17	65.80	-	65.34	65.27	64.95	65.04	65.44	66.32	65.23
18	65.98	65.79	65.15	66.24	65.64	65.44	65.83	65.94	65.73
19	65.65	66.20	66.38	65.73	65.89	65.53	65.77	66.21	65.92
20	66.36	65.89	65.27	66.05	66.51	66.17	65.96	65.82	65.98
21	66.20	66.44	66.00	65.91	65.78	65.96	65.73	65.35	65.94
22	65.71	65.97	66.18	65.88	65.69	65.69	65.55	66.48	65.91
23	66.07	65.80	65.66	65.97	65.35	67.13	65.67	66.52	65.86
24-25	65.67	65.84	66.18	65.90	65.32	65.62	66.59	65.58	65.82
26-30	65.54	65.51	65.41	65.33	64.81	65.64	65.74	65.87	65.50
31-35	65.59	65.79	66.33	65.96	65.93	65.58	65.53	66.23	65.87
total	65.82	65.82	65.76	65.81	65.66	65.66	65.72	66.08	65.78

age	year of recruitment								total
	1948	1949	1950	1951	1952	1953	1954	1955	
				Kerala					
				number in sample					
17	90	2	123	100	126	77	127	145	790
18	163	126	146	113	122	155	150	140	1115
19	155	193	166	129	129	161	133	116	1182
20	155	267	174	118	137	169	129	134	1283
21	166	228	179	138	144	154	134	137	1280
22	139	172	170	134	140	171	150	153	1229
23	140	130	159	132	130	145	148	153	1137
24-25	155	207	165	129	116	157	141	137	1207
26-30	178	135	141	127	121	65	125	133	1025
31-35	146	63	124	134	100	49	118	152	886
total	1487	1523	1547	1254	1265	1303	1355	1400	11134
				mean value of stature					
17	64.10	65.90	64.24	64.31	64.32	65.05	65.10	63.72	64.37
18	65.16	65.65	65.48	65.71	65.36	66.04	65.85	66.30	65.69
19	65.14	65.37	65.73	65.85	65.51	65.82	66.12	66.27	65.69
20	65.20	65.53	65.74	66.02	65.91	66.20	66.06	65.96	65.79
21	64.91	65.22	65.57	65.70	65.98	66.10	65.84	66.10	65.63
22	64.99	65.56	65.56	65.56	65.94	65.84	66.16	65.88	65.69
23	65.17	65.30	65.55	65.41	65.85	65.97	66.14	66.05	65.69
24-25	64.83	65.12	65.36	65.21	65.52	65.78	66.01	65.58	65.41
26-30	64.91	65.27	65.32	64.93	65.23	65.72	65.08	65.49	65.20
31-35	64.80	64.91	65.58	64.87	65.32	65.47	65.21	65.61	65.22
total	64.96	65.36	65.44	65.37	65.52	65.88	65.98	65.68	65.49

age	year of recruitment								total
	1948	1949	1950	1951	1952	1953	1954	1955	
				Madras					
				number in sample					
17	111	1	128	137	162	183	139	151	1012
18	136	115	154	137	156	145	144	148	1135
19	145	65	133	139	148	139	151	170	1090
20	144	115	128	152	145	129	166	159	1138
21	134	77	123	134	145	146	165	156	1080
22	163	62	129	141	151	130	149	136	1061
23	160	130	144	133	153	155	147	137	1159
24-25	145	120	138	157	168	143	144	155	1170
26-30	122	126	160	171	168	155	173	133	1208
31-35	153	15	145	164	175	158	179	132	1121
total	1413	826	1382	1465	1571	1463	1557	1477	11174
				mean value of stature					
17	65.04	64.50	65.00	64.61	64.76	64.83	65.15	64.70	64.86
18	65.25	65.20	65.54	65.50	65.40	66.01	65.94	65.81	65.59
19	65.53	66.19	65.84	65.59	65.86	66.26	65.88	66.21	65.91
20	65.48	65.65	65.73	65.72	65.81	66.16	65.98	66.21	65.85
21	65.36	65.69	65.82	65.44	65.62	66.06	65.81	65.96	65.73
22	65.30	65.51	65.55	65.72	65.54	66.23	65.94	65.94	65.72
23	65.42	65.60	65.89	65.58	65.68	66.30	65.79	65.84	65.76
24-25	65.08	65.50	65.15	65.03	65.35	65.68	65.63	65.75	65.39
26-30	64.94	65.77	65.00	64.67	64.73	65.71	65.23	65.55	65.17
31-35	65.12	66.23	65.59	64.91	65.24	65.64	65.30	65.47	65.33
total	65.26	65.62	65.50	65.26	65.38	65.85	65.66	65.75	65.53

age	year of recruitment								total
	1948	1949	1950	1951	1952	1953	1954	1955	
				Punjab					
				number in sample					
17	429	24	461	378	472	512	460	508	3244
18	429	1819	533	534	553	569	550	464	5451
19	433	1012	528	516	523	564	462	471	4509
20	400	1193	490	474	489	543	456	460	4505
21	417	605	527	446	459	493	431	405	3783
22	387	694	506	452	429	425	380	326	3599
23	389	544	516	405	321	371	306	221	3073
24-25	401	980	507	461	377	303	319	264	3612
26-30	376	1378	571	464	415	278	327	241	4050
31-35	364	520	427	502	168	148	285	231	2645
total	4025	8769	5066	4632	4206	4206	3976	3591	38471
				mean value of stature					
17	66.12	65.94	66.09	66.18	66.22	66.42	65.86	66.50	66.20
18	66.57	66.29	66.55	66.43	66.65	66.84	66.70	66.45	66.50
19	66.59	66.55	66.79	66.47	66.83	66.89	66.65	66.84	66.69
20	66.53	66.56	66.66	66.31	66.82	66.99	66.61	66.89	66.66
21	66.60	66.40	66.92	66.31	66.84	66.93	66.50	66.66	66.65
22	66.36	66.31	66.76	66.26	66.55	66.71	66.61	66.93	66.53
23	66.43	66.28	66.64	65.87	66.66	66.65	66.53	66.75	66.45
24-25	66.27	66.03	66.55	65.82	66.24	66.08	66.32	66.43	66.18
26-30	66.24	66.19	66.21	65.83	66.26	66.30	66.06	66.85	66.20
31-35	66.47	66.28	66.16	65.99	66.35	66.27	66.46	66.65	66.29
total	66.42	66.32	66.55	66.16	66.57	66.69	66.45	66.69	66.46

age	year of recruitment								total
	1948	1949	1950	1951	1952	1953	1954	1955	
				Rajasthan					
				number in sample					
17	20	9	58	95	73	83	93	44	475
18	93	263	29	179	65	57	99	90	875
19	67	132	34	130	38	64	110	89	664
20	84	196	26	149	58	49	109	79	750
21	65	109	33	161	56	102	132	62	720
22	78	139	26	178	36	85	76	48	666
23	98	110	53	189	51	89	78	39	707
24-25	48	212	36	173	55	93	83	37	737
26-30	49	208	27	174	75	60	35	31	659
31-35	55	124	60	183	39	28	28	20	537
total	657	1502	382	1611	546	710	843	539	6790
				mean value of stature					
17	66.76	65.00	66.67	65.73	66.32	66.80	66.07	66.67	66.30
18	66.84	66.64	67.03	66.51	66.16	67.19	67.07	67.04	66.74
19	67.23	66.37	67.76	66.76	66.59	67.14	67.14	67.56	66.98
20	67.27	66.68	67.34	66.64	66.56	67.15	67.30	67.48	66.96
21	67.29	66.61	67.45	66.71	66.93	67.52	67.64	67.70	67.17
22	66.65	66.87	68.15	66.78	66.15	67.52	67.60	67.61	67.05
23	67.35	66.94	67.78	66.77	66.84	67.40	67.50	67.30	67.15
24-25	66.57	66.54	67.21	66.50	66.69	67.24	67.30	67.01	66.77
26-30	66.86	66.77	67.60	66.52	66.45	67.49	66.78	67.11	66.79
31-35	66.55	66.75	66.98	66.80	66.76	67.53	67.37	66.82	66.85
total	66.99	66.67	67.33	66.61	66.53	67.30	67.20	67.30	66.89

age	year of recruitment								total
	1948	1949	1950	1951	1952	1953	1954	1955	
				Uttar Pradesh					
				number in sample					
17	215	18	340	332	433	380	373	322	2413
18	385	527	466	331	395	353	334	496	3287
19	398	432	435	367	407	342	357	302	3040
20	398	480	470	397	443	369	387	312	3256
21	403	301	433	349	441	382	398	292	2999
22	372	383	339	357	403	447	356	241	2898
23	411	222	355	294	404	370	310	152	2518
24-25	449	385	412	382	388	297	301	174	2788
26-30	468	420	437	422	346	261	356	153	2863
31-35	420	215	268	373	309	209	325	127	2246
total	3919	3383	3955	3604	3969	3410	3497	2571	28308
				mean value of stature					
17	64.95	63.47	64.78	65.42	65.41	65.03	65.46	65.61	65.24
18	65.08	65.13	65.52	65.44	65.36	65.50	65.34	65.81	65.40
19	65.49	65.72	65.66	65.57	65.65	65.87	65.92	66.29	65.75
20	65.56	66.17	65.98	65.98	65.82	65.86	65.82	66.16	65.92
21	65.64	65.92	65.80	65.67	65.76	66.12	66.12	66.17	65.89
22	65.49	65.88	65.95	65.70	66.04	66.00	66.06	66.11	65.94
23	65.46	65.82	65.86	65.53	66.14	66.14	66.24	66.44	65.92
24-25	65.16	65.68	65.63	65.43	65.81	66.34	65.94	66.07	65.70
26-30	65.31	65.54	65.18	65.10	65.36	64.94	65.30	65.49	65.27
31-35	65.28	65.06	65.29	65.17	65.90	65.33	65.24	64.88	65.30
total	65.36	65.65	65.58	65.50	65.72	65.75	65.75	65.99	65.65

age	year of recruitment								total
	1948	1949	1950	1951	1952	1953	1954	1955	
				West Bengal					
				number in sample					
17	1	1	-	100	62	99	100	79	442
18	-	76	-	100	102	100	100	99	577
19	-	118	1	100	100	100	100	114	633
20	-	112	12	101	100	100	100	121	646
21	8	72	3	100	100	100	162	102	647
22	7	66	3	100	100	100	115	79	570
23	7	67	1	100	59	75	102	93	504
24-25	-	68	2	100	100	60	110	91	531
26-30	-	61	-	100	100	19	112	89	481
31-35	-	12	-	99	40	18	114	37	320
total	23	653	22	1000	863	771	1115	904	5351
				mean value of stature					
17	63.00	65.00	-	64.94	65.96	65.44	65.46	65.35	65.38
18	-	66.68	-	65.75	66.09	65.89	65.32	65.06	65.93
19	-	66.23	63.50	66.37	66.18	66.33	65.89	65.64	66.10
20	-	66.21	63.73	65.85	65.91	66.06	66.01	65.96	65.96
21	63.44	66.56	66.00	66.15	66.48	66.06	64.74	65.81	65.79
22	63.86	66.33	65.33	65.82	66.29	65.78	64.91	65.85	65.75
23	64.11	66.64	64.00	65.67	66.40	65.87	65.43	65.48	65.80
24-25	-	65.76	63.00	65.62	66.10	66.06	65.10	65.94	65.71
26-30	-	64.80	-	65.43	65.61	65.83	64.70	65.57	65.26
31-35	-	64.23	-	65.30	65.29	65.06	65.42	65.82	65.35
total	63.75	66.15	64.20	65.69	66.07	65.91	65.26	65.75	65.74

Table 9.1 Number of soldiers in different communities by years of enlistment : 1844-1947

year	Other Hindu	Maratha	Jat	Ahir	Rajput	Gujar	Sikh	Muslim	Christian	Jews	total
1	2	3	4	5	6	7	8	9	10	11	12
1844	1	-	-	-	-	-	-	-	-	-	1
1846	4	-	-	-	-	-	-	-	-	-	4
1849	1	-	-	-	-	-	-	-	-	-	1
1851	1	-	-	-	-	-	-	-	-	-	1
1852	1	-	-	-	-	-	-	-	-	-	1
1853	3	4	-	-	-	-	-	1	-	-	8
1854	2	2	-	-	-	-	-	2	-	-	6
1855	4	2	-	-	-	-	-	1	-	-	7
1856	6	3	-	-	-	-	-	-	-	-	9
1857	24	18	-	1	-	-	-	-	-	1	44
1858	3	-	-	1	-	-	-	-	-	-	4
1860	2	1	-	-	-	-	-	-	-	-	3
1862	-	1	-	-	-	-	-	-	-	-	1
1863	4	-	-	-	-	-	-	-	-	-	4
1864	6	4	-	-	-	-	-	-	-	-	10
1865	4	4	-	-	-	-	-	1	-	-	9
1866	10	1	-	-	-	-	-	1	-	-	12
1867	9	2	1	-	1	-	1	9	-	-	23
1868	18	10	3	1	1	-	4	3	-	-	40
1869	-	1	-	-	-	-	-	3	-	-	4
1870	15	28	-	-	-	-	-	10	-	-	53
1871	12	17	-	-	-	-	-	2	1	-	32
1872	30	47	-	-	-	-	-	1	-	-	78
1873	13	11	-	-	-	-	-	4	-	-	28
1874	12	26	-	-	-	-	1	5	-	-	44
1875	16	46	-	-	2	-	-	19	-	1	84

year	Other Hindu	Maratha	Jat	Ahir	Rajput	Gujar	Sikh	Muslim	Christian	Jews	total
1	2	3	4	5	6	7	8	9	10	11	12
1876	22	26	-	-	5	-	-	10	-	-	63
1877	13	37	-	-	-	-	-	6	-	-	56
1878	3	-	-	-	-	-	-	2	-	1	6
1879	16	4	-	-	-	-	-	1	-	-	21
1880	50	37	-	-	1	-	-	7	-	2	97
1881	29	9	-	-	-	-	-	3	1	1	43
1882	40	6	1	-	3	5	-	5	-	-	60
1883	29	11	4	-	3	5	-	4	-	1	57
1884	32	11	2	-	-	-	-	10	-	-	55
1885	27	13	1	-	-	3	-	7	2	-	53
1886	22	5	1	-	3	3	-	6	2	-	42
1887	54	26	14	-	-	2	-	7	-	-	103
1888	10	9	-	-	2	-	-	4	-	-	25
1889	8	22	3	-	2	9	-	22	-	-	66
1892	-	-	-	-	2	-	-	1	-	-	3
1893	-	-	-	-	3	-	-	-	-	-	3
1894	-	-	-	-	-	-	-	1	-	-	1
1896	-	-	-	-	1	-	-	1	-	-	2
1897	-	-	3	-	1	-	-	3	-	-	7
1898	1	-	72	-	25	-	-	11	-	-	109
1899	1	-	40	-	22	-	-	29	-	-	92
1900	-	-	67	-	48	-	-	28	-	-	143
1901	-	-	73	-	25	-	-	15	-	-	113
1902	-	-	43	-	11	-	-	10	-	-	64
1903	-	-	32	-	13	-	-	36	-	-	81
1904	-	-	-	-	-	-	-	1	-	-	1
1905	-	-	-	-	-	-	-	1	-	-	1
1907	-	-	-	-	-	-	-	7	-	-	7
1909	-	-	-	-	-	-	-	3	-	-	3
1910	-	-	-	-	1	-	-	1	-	-	2
1911	1	-	-	-	2	-	-	2	-	-	5
1912	-	-	2	-	-	-	-	1	-	-	3
1913	-	-	1	-	1	-	-	2	-	-	4
1914	-	-	3	-	7	-	-	14	-	-	24

year	Other Hindu	Maratha	Jat	Ahir	Rajput	Gujar	Sikh	Muslim	Christian	Jews	total
1	2	3	4	5	6	7	8	9	10	11	12
1915	2	-	11	-	8	7	-	28	-	-	56
1916	14	-	3	1	7	10	-	40	-	-	75
1917	13	-	37	-	26	8	-	111	-	-	195
1918	159	2	353	1	427	195	-	585	2	-	1724
1919	66	-	4	1	40	56	-	132	1	1	309
1920	47	-	33	1	26	11	-	57	5	-	180
1921	4	-	13	-	16	-	1	10	-	-	44
1922	128	-	33	128	259	1	-	75	-	-	624
1923	89	-	15	32	91	-	-	34	-	-	261
1924	29	-	7	33	79	-	1	16	-	-	165
1925	36	-	4	30	83	-	-	32	-	-	185
1926	15	-	7	17	39	1	-	8	-	-	87
1927	54	-	10	59	70	-	-	7	-	-	200
1928	71	-	37	58	66	1	-	16	-	-	249
1929	47	-	34	29	54	-	-	49	-	-	213
1930	28	-	26	44	49	-	-	37	-	-	184
1931	17	-	35	54	101	-	-	39	-	-	246
1932	69	-	26	16	288	2	8	233	-	-	642
1933	77	-	2	4	341	-	1	110	1	-	536
1934	33	-	27	-	360	-	5	183	1	-	609
1935	45	-	26	-	270	-	7	102	-	-	450
1936	9	-	179	-	131	-	-	77	1	-	397
1937	4	-	194	-	97	-	2	124	1	-	422
1938	5	-	235	-	129	-	-	206	-	-	575
1939	5	-	460	-	239	-	5	188	-	-	897
1940	20	1	1333	-	633	-	2	690	-	-	2679
1941	19	-	1228	1	586	-	1	679	-	-	2514
1942	10	-	862	8	407	-	3	339	-	-	1629
1943	274	3	512	75	619	-	4	295	1	-	1783
1944	21	-	685	36	545	10	1	361	1	-	1660
1945	70	-	548	13	404	1	-	456	-	-	1492
1946	15	-	68	-	65	1	-	111	-	-	260
1947	8	-	345	-	231	-	-	82	-	-	666
total	2062	450	7758	644	6979	331	47	5835	20	8	24134

Table 9.2 Average stature of soldiers in different communities by years of enlistment: 1844-1947

year	Other Hindu	Maratha	Jat	Ahir	Rajput	Gujar	Sikh	Muslim	Christian	Jew	total
1	2	3	4	5	6	7	8	9	10	11	12
1844	66.5	-	-	-	-	-	-	-	-	-	66.5
1846	65.9	-	-	-	-	-	-	-	-	-	65.9
1849	62.2	-	-	-	-	-	-	-	-	-	62.2
1851	66.2	-	-	-	-	-	-	-	-	-	66.2
1852	65.5	-	-	-	-	-	-	-	-	-	65.5
1853	66.7	67.7	-	-	-	-	-	69.0	-	-	67.5
1854	66.4	67.7	-	-	-	-	-	66.5	-	-	66.9
1855	66.8	66.9	-	-	-	-	-	66.0	-	-	66.7
1856	67.6	68.6	-	-	-	-	-	-	-	-	67.9
1857	66.9	62.9	-	67.0	-	-	-	-	-	66.0	66.6
1858	67.4	-	-	67.0	-	-	-	-	-	-	67.3
1860	66.6	68.0	-	-	-	-	-	-	-	-	67.1
1862	-	66.0	-	-	-	-	-	-	-	-	66.0
1863	65.5	-	-	-	-	-	-	-	-	-	65.5
1864	68.4	67.1	-	-	-	-	-	-	-	-	67.9
1865	67.2	67.2	-	-	-	-	-	68.0	-	-	67.3
1866	66.6	68.0	-	-	-	-	-	66.5	-	-	66.7
1867	67.4	65.6	67.3	-	68.2	-	67.3	68.2	-	-	67.6
1868	67.6	66.1	67.8	68.2	65.7	-	67.3	68.2	-	-	67.2
1869	-	63.0	-	-	-	-	-	65.2	-	-	64.7
1870	66.4	66.7	-	-	-	-	-	66.3	-	-	66.5
1871	66.3	66.9	-	-	-	-	-	65.9	71.5	-	66.8
1872	67.2	67.2	-	-	-	-	-	66.8	-	-	67.2
1973	67.1	67.1	-	-	-	-	-	66.5	-	-	67.0
1874	66.4	66.8	-	-	-	-	66.2	67.5	-	-	66.8
1875	67.5	67.0	-	-	69.1	-	-	67.2	-	67.0	67.2

year	Other Hindu	Maratha	Jat	Ahir	Rajput	Gujar	Sikh	Muslim	Christian	Jew	total
1	2	3	4	5	6	7	8	9	10	11	12
1876	67.3	67.1	-	-	67.8	-	-	67.4	-	-	67.3
1877	66.6	67.4	-	-	-	-	-	66.9	-	-	67.1
1878	66.7	-	-	-	-	-	-	66.7	-	68.0	66.9
1879	67.2	67.4	-	-	-	-	-	69.5	-	-	67.4
1880	67.1	66.2	-	-	67.3	-	-	66.2	-	66.7	66.7
1881	67.1	65.0	-	-	-	-	-	68.6	66.2	69.3	67.3
1882	67.9	67.5	67.0	-	67.8	68.5	-	68.7	-	-	67.9
1883	67.5	67.4	67.3	-	67.8	69.3	-	66.7	-	65.5	67.5
1884	67.6	67.8	70.5	-	-	-	-	67.1	-	-	67.7
1885	67.8	67.4	67.5	-	-	67.8	-	68.1	66.3	-	67.7
1886	68.2	67.5	70.0	-	67.7	67.7	-	67.9	65.8	-	67.9
1887	67.9	67.2	68.4	-	-	70.5	-	66.6	-	-	67.7
1888	67.2	66.8	-	-	69.3	-	-	66.9	-	-	67.2
1889	67.6	67.2	66.5	-	67.5	67.9	-	67.5	-	-	67.4
1892	-	-	-	-	68.7	-	-	67.0	-	-	68.2
1893	-	-	-	-	68.2	-	-	-	-	-	68.2
1894	-	-	-	-	-	-	-	70.0	-	-	70.0
1896	-	-	-	-	71.0	-	-	68.5	-	-	69.7
1897	-	-	66.5	-	60.0	-	-	67.0	-	-	65.8
1898	61.5	-	67.2	-	66.7	-	-	67.9	-	-	67.1
1899	64.5	-	67.9	-	68.1	-	-	68.7	-	-	68.1
1900	-	-	67.9	-	69.5	-	-	67.7	-	-	68.0
1901	-	-	67.8	-	67.4	-	-	68.2	-	-	67.8
1902	-	-	67.9	-	67.5	-	-	68.2	-	-	67.9
1903	-	-	67.8	-	67.5	-	-	68.6	-	-	68.1
1904	-	-	-	-	-	-	-	67.5	-	-	67.5
1905	-	-	-	-	-	-	-	62.0	-	-	62.0
1907	-	-	-	-	-	-	-	68.1	-	-	68.1
1909	-	-	-	-	-	-	-	67.2	-	-	67.2
1910	-	-	-	-	67.5	-	-	64.5	-	-	66.0
1911	66.0	-	-	-	65.9	-	-	66.7	-	-	66.2
1912	-	-	67.6	-	-	-	-	68.5	-	-	67.9
1913	-	-	67.5	-	68.0	-	-	64.5	-	-	66.1
1914	-	-	65.8	-	66.7	-	-	66.0	-	-	66.2

[illegible]	Other Hindu	[illegible]	Jat	Ahir	Rajput	Gujar	Sikh	Muslim	Christian	Jew	total
1	2	3	4	5	6	7	8	9	10	11	12
1915	65.9	-	66.2	-	67.1	67.0	-	66.5	-	-	66.6
1916	65.1	-	65.2	64.0	66.1	65.9	-	66.2	-	-	65.9
1917	65.8	-	65.5	-	67.3	66.9	-	65.5	-	-	65.8
1918	64.9	62.5	65.9	64.5	66.2	66.3	-	65.7	63.5	-	65.9
1919	65.8	-	63.8	64.0	65.8	66.8	-	66.4	63.0	63.0	66.2
1920	66.0	-	66.7	66.0	66.2	65.5	-	66.5	65.6	-	66.3
1921	67.3	-	66.7	-	67.3	-	66.0	66.6	-	-	66.9
1922	66.5	-	66.3	66.3	66.6	68.5	-	66.4	-	-	66.5
1923	66.1	-	66.0	65.9	66.4	-	-	67.2	-	-	66.3
1924	65.9	-	65.1	65.9	66.6	-	66.0	66.8	-	-	66.3
1925	67.4	-	66.2	67.1	67.2	-	-	67.1	-	-	67.2
1926	66.8	-	68.6	66.9	66.8	67.0	-	66.8	-	-	67.0
1927	67.0	-	67.0	67.5	66.8	-	-	67.0	-	-	67.1
1928	67.0	-	67.7	67.2	67.4	66.2	-	66.5	-	-	67.3
1929	67.0	-	67.1	67.0	67.0	-	-	66.8	-	-	67.0
1930	66.9	-	67.1	67.1	67.1	-	-	67.1	-	-	67.1
1931	66.7	-	67.5	67.2	67.1	-	-	66.8	-	-	67.1
1932	67.7	-	67.4	67.4	67.3	68.0	68.2	67.1	-	-	67.3
1933	67.2	-	70.0	67.8	67.2	-	64.0	67.6	65.7	-	67.3
1934	67.3	-	67.9	-	67.7	-	67.4	67.8	65.0	-	67.7
1935	66.9	-	67.4	-	67.7	-	66.4	67.9	-	-	67.7
1936	64.6	-	67.5	-	67.4	-	-	67.2	63.5	-	67.3
1937	65.3	-	67.5	-	66.9	-	66.3	67.6	63.0	-	67.3
1938	65.3	-	67.4	-	67.1	-	-	66.9	-	-	67.1
1939	65.0	-	67.8	-	67.5	-	65.3	67.4	-	-	67.6
1940	65.9	66.8	67.4	-	66.9	-	66.7	67.0	-	-	67.0
1941	66.1	-	66.4	66.5	66.3	-	68.2	66.7	-	-	66.5
1942	65.6	-	66.1	65.5	65.9	-	66.2	65.7	-	-	66.0
1943	65.3	65.4	65.8	65.6	65.8	-	64.8	65.5	64.0	-	65.6
1944	64.2	-	65.8	66.0	67.6	67.0	66.0	65.5	64.5	-	65.7
1945	64 8	-	66.4	65.2	66.0	67.5	-	65.6	-	-	66.0
1946	64.4	-	67.4	-	66.8	68.5	-	66.8	-	-	66.8
1947	65.4	-	67.6	-	67.2	-	-	67.4	-	-	67.4
total	66.4	-	67.1	-	67.1	-	-	67.0	-	-	66.9

Appendix 11A

DEFINITION OF PHYSICAL CHARACTERS

8. Weight

Taken with the weighing machine correct to a pound. Subject stands on the machine in the normal erect position. The weight of the under-wear is subtracted.

HEIGHTS

Subject stands in the normal erect position with heels together, arms hanging down, and palms open. Measurements are taken with Anthropometer correct to half centimeter. For landmarks L1, L2, etc see attached diagram.

9. Height

Vertical height of the subject upto the vertex of the head from the ground is measured.
Subject stands against a wall, his shoulders and buttocks just touching it. The anthropometer is placed in his front. Sufficient pressure is applied on the spike to compress the hair on the vertex of the head.

10. Cervicale height

Vertical height of the cervicale (L-1) from the ground is measured. The anthropometer is placed at the back of the subject.

11. Neck base height

Vertical height of the lateral neck point (L-4) from the ground is measured.

12. Shoulder point height

Vertical height of the Shoulder point (L-5) from the ground is measured.

13. Elbow height

Vertical height of the elbow point (L-27) from the ground is measured, care being taken that the arm is hanging down with its principal axis vertical.

14. Wrist level height

Vertical height of the wrist point (L-29) from the ground is measured, care being taken that the arm is hanging down without any flexing at the elbow with its principal axis vertical.

15. Sternale height

Vertical height of the sternale (L-2) from the ground is measured.

16. Armscye level height

Vertical height of the anterior corner at armscye level from the ground is measured.

17. Waist height

Vertical height of the waist point (L-10) from the ground is measured.

18. Hip height

Vertical height of the hip point (L-11) from the ground is measured.

19. Knee height

Vertical height of the knee point (L-23) from the ground is measured on the leg of the subject.

20. Crotch height

Vertical height of the point of the crotch from the ground is measured. Subject stands with feet slightly apart. The anthropometer is placed in front of the subject with the spike between his legs and at right angles to them. The spike is raised till its upper edge just touches the point of the crotch. This is judged by asking the subject if the spike is touching the point or not. His heels are then brought together, at the same time adjusting the spike so that its upper edge still keeps contact with the same point.

GIRTHS

Subject stands in the same position as for heights. Measurements are taken with $\frac{1}{2}$ cm wide flexible steel tape correct to $\frac{1}{2}$ centimeter.

22. Neck Girth

Girth round the base of the neck (L-3) is to be measured. In practice this is obtained by measuring the length of the chain looped about the neck for marking the neck base.

23. Normal Chest girth

Girth round the chest at the chest level (L-8) is measured in the horizontal plane, with both arms of the subject hanging down. The subject is asked to speak, to ensure that he is breathing normally. Reading is made at the mid-point of his breathing excursion.

24. Maximum Chest Girth

Girth round the chest at the chest level (L-8) when the chest is expanded to its maximum is measured in the horizontal plane. The reading is taken when the subject has expanded his chest to his maximum by inhaling. Arms are held down.

25. Waist Girth

Girth round the waist at the waist level (L-10) is measured in the horizontal plane. Reading is taken at the mid-point of the subject's breathing excursion when the breathing is normal.

26. Hip Girth

Girth round the hip at the maximum hip girth level (L-12) is measured in the horizontal plane. It is taken over the drawer.

27. Thigh Girth

Girth round the thigh is measured at the thigh girth position (L-22) in the horizontal plane. Care is taken that there is no constriction of the thigh.

28. Knee Girth

Girth round the knee is measured over the Knee point (L-23) in the horizontal plane.

29. Small Girth

Girth round the leg is measured in the horizontal plane at the small girth position (L-24). Care is taken that there is no constriction of the leg.

30. Calf Girth

Girth round the calf is measured in the horizontal plane at the calf girth position (L-25). Care is taken that there is no constriction of the calf.

31. Minimum Leg Girth

Girth round the leg at the minimum leg girth position (L-26) is measured in the horizontal plane.

32. Ankle Girth

Girth of leg over the inner ankle (L-30) is measured in the horizontal plane. The guiding point is the most protruding point of the inner ankle.

33. Arm Scye Girth

Girth round the arm hole line (L-5) is to be measured. In practice, this is obtained by measuring the length of a chair held about the arm just along the arm hole line.

34. Upper Arm Girth

Girth round the upper arm is measured at the upper arm girth position (L-28) in the horizontal plane, with the arm hanging down so that its principal axis is nearly vertical. Care is taken that there is no constriction of the arm.

35. Elbow Girth

Girth round the elbow is measured over the elbow point (L-27) in the horizontal plane, with the arm hanging down so that its principal axis is vertical.

36. Lower Wrist Girth

Girth round the most distal crease between the arm and the hand is measured on the wrist, in the horizontal plane, with the arm hanging down.

37. Total Crotch

Distance from the waist level (L-10) anteriorly to the waist level posteriorly over the point of the crotch is measured. The subject moves his feet a little apart to allow the tape to the point of the crotch. This is judged by asking the subject if the tape is just touching the point or not and adjusting it. Then the heels are brought together at the same time adjusting the tape so that it still keeps contact with the same point.

SECTIONS

Subject stands in the same position as for heights. Measurements are taken with ⅜ cm wide flexible steel tape, correct to ½ cm.

38. Anterior Chest Arc (Half)

Distance between the under arm mid-point (L-7) and the centre front at arm scye level (L-20) is measured anteriorly across the chest.

39. Anterior Waist Arc (Half)

Distance between the waist point (L-19) and the centre front at waist level (L-21) is measured anteriorly across the waist.

40. Across Back (Half)

Distance between the posterior arm hole line (L-9) and the centre back line (L-13) is measured along the curve of the back, in the horizontal plane at the level of the mid point of the depth of scye (L-17)

41. Front of Scye

Distance between the anterior corner at arm scye level (L-8) and the centre back at arm scye level (L-14) is measured in the arm scye level, over the under arm mid point (L-7). The arms are kept hanging down.

42. Posterior Hip Arc (Half)

Distance between the hip level point (L-12) and the centre back at maximum hip girth level (L-16) is measured posteriorly across the hip.

43. Depth of Scye

Distance between the cervicale (L-1) and the centre back at arm scye level (L-12) is measured along the back. Care is taken that the subject does not bend his head.

44. Posterior Waist Length

Distance between the cervicale (L-1) and the centre back at waist level (L-15) is measured along the back. Care is taken that the subject does not bend his head.

45. Waist to Hip

Distance between the waist point (L-10) and the Hip point (L-11) is measured along the contour of the body.

46. Anterior Waist Length

Distance between the centre front on neck base (L-24) and the centre front at waist level (L-21) is measured. Care is taken that the subject does not lift his chin during the measurement.

47. Shoulder Length

Distance between the lateral neck point (L-4) and the shoulder point (L-5) is measured along the shoulder line of the subject.

48. Over Shoulder

Distance between the centre back at arm scye level (L-14) and the anterior corner at arm scye level (L-8) is measured over the shoulder directly.

49. Front Shoulder

Distance between the cervicale (L-1) and the anterior corner at arm scye level (L-8) is measured over the shoulder directly.

50. Front over Shoulder

Distance between the cervicale (L-1) and centre front at arm scye level (L-20) is measured over the shoulder directly

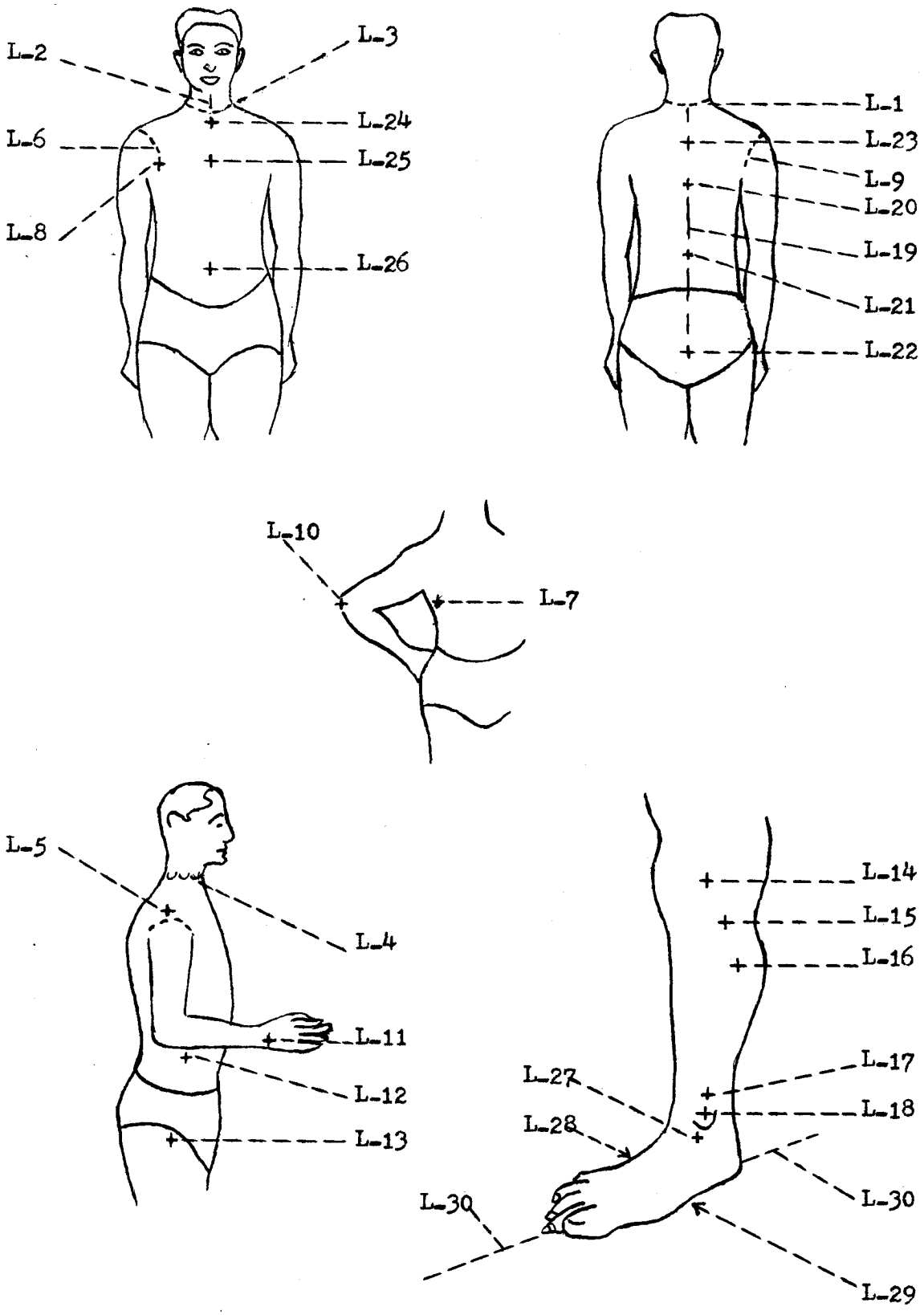
51. Posterior Upper Arm Length

Distance between the shoulder point (L-5) and the elbow point (L-27) is measured posteriorly along the subject's arm, with the arm flexed at the elbow so that the fore-arm is in contact with the body across the stomach and is at right angle to the upper arm which is kept vertical.

52. Sleeve length

Distance between the shoulder point (L-5) and the wrist point (L-29) is measured posteriorly along the subject's arm, with the arm held as for posterior upper arm length measurement.

Diagram showing landmarks on the body



Appendix 11B

Table 11.2 Showing for body characteristics their means, standard deviations and correlations with stature separately for each of twenty communities.

S No	community	weight in lbs			cervicale height			neck base		height
		m	sd	r	m	sd	r	m	sd	r
1	2	3	4	5	6	7	8	9	10	11
1	Ahir	125	11	0.39	149.2	4.7	0.97	148.4	4.6	0.98
2	Assamese	121	10	0.69	139.0	5.0	0.97	138.2	4.9	0.97
3	Christian	122	12	0.57	143.7	5.3	0.97	143.0	5.2	0.98
4	Bengali Hindu	123	11	0.55	143.0	4.6	0.98	142.1	4.6	0.97
5	Bihari & U.P.Hindu	124	12	0.48	144.6	5.2	0.97	144.0	5.1	0.97
6	Dogra	122	12	0.54	144.7	4.8	0.97	143.9	4.8	0.98
7	Garhwali	125	10	0.48	140.4	4.8	0.97	139.8	4.6	0.97
8	Gorkha	126	10	0.62	139.0	4.8	0.97	138.6	4.7	0.98
9	Gujar	131	12	0.60	147.9	4.5	0.96	147.2	4.4	0.96
10	Jat	128	13	0.51	148.8	4.9	0.97	148.1	4.8	0.97
11	Kashmiri Hindu	127	12	0.51	145.1	4.6	0.97	144.5	4.4	0.90
12	Kumaoni	129	12	0.64	143.1	5.1	0.96	142.5	5.1	0.96
13	Mahar	122	10	0.61	142.1	4.2	0.96	141.6	4.2	0.97
14	Maratha	126	12	0.55	144.0	4.3	0.98	143.5	4.1	0.97
15	Malayali Hindu	123	10	0.44	143.7	5.1	0.98	144.6	6.0	0.98
16	Punjabi Hindu	125	14	0.45	145.4	6.0	0.98	143.0	5.0	0.98
17	Rajput	125	13	0.57	147.1	5.1	0.97	146.4	5.0	0.98
18	Sikh (M & R)	130	13	0.45	145.6	5.0	0.97	144.9	4.9	0.97
19	Sikh (Other)	134	14	0.49	148.7	4.8	0.96	147.9	4.8	0.97
20	Tamil Hindu	125	12	0.50	144.6	4.8	0.98	143.8	4.7	0.98
	total	126	12	0.51	144.5	5.7	0.97	143.8	5.6	0.97

S No	community	shoulder point height			elbow height			wrist level height		
		m	sd	r	m	sd	r	m	sd	r
1	2	3	4	5	6	7	8	9	10	11
1	Ahir	143.0	4.6	0.95	109.6	3.7	0.90	83.1	3.1	0.82
2	Assamese	133.4	5.0	0.95	103.1	3.8	0.90	78.5	3.2	0.82
3	Christian	138.2	5.0	0.95	106.0	4.0	0.91	79.9	3.4	0.84
4	Bengali Hindu	137.2	4.6	0.95	105.0	3.7	0.93	79.4	3.2	0.76
5	Bihari & U.P.Hindu	139.1	5.0	0.96	104.8	3.7	0.92	80.8	3.6	0.86
6	Dogra	138.3	4.7	0.95	105.7	3.6	0.90	80.3	3.1	0.80
7	Garhwali	135.0	4.7	0.94	103.4	3.8	0.89	78.5	3.2	0.81
8	Gorkha	133.5	4.6	0.95	102.3	3.6	0.90	77.7	3.1	0.83
9	Gujar	142.5	4.4	0.93	109.1	3.5	0.89	82.4	3.0	0.81
10	Jat	142.9	4.8	0.94	109.1	3.8	0.90	82.9	3.1	0.83
11	Kashmiri Hindu	139.7	4.5	0.94	107.2	3.4	0.90	81.6	2.8	0.80
12	Kumaoni	137.5	5.0	0.95	104.8	4.2	0.89	79.7	3.6	0.83
13	Mahar	136.6	4.2	0.95	104.8	3.4	0.88	78.7	3.0	0.77
14	Maratha	138.6	4.1	0.95	106.1	3.4	0.90	79.6	2.9	0.81
15	Malayali Hindu	138.0	4.8	0.95	105.8	3.9	0.90	79.9	3.2	0.85
16	Punjabi Hindu	139.3	5.8	0.96	106.6	4.7	0.93	81.1	3.8	0.86
17	Rajput	141.1	4.9	0.94	107.6	4.1	0.91	81.8	3.4	0.85
18	Sikh (M & R)	140.0	4.9	0.95	107.0	3.8	0.91	80.8	3.2	0.83
19	Sikh (Other)	142.4	4.8	0.94	108.9	3.8	0.89	82.9	3.1	0.83
20	Tamil Hindu	138.9	4.7	0.95	106.5	3.7	0.90	80.0	3.3	0.83
	total	138.7	5.5	0.96	106.2	4.3	0.91	80.5	3.6	0.85

S No.	community	sternale height			arm scye level height			posterior upper arm length		
		m	sd	r	m	sd	r	m	sd	r
1	2	3	4	5	6	7	8	9	10	11
1	Ahir	142.9	4.3	0.97	131.0	4.3	0.96	39.3	1.6	0.70
2	Assamese	134.0	4.8	0.97	122.3	4.7	0.96	36.3	1.7	0.75
3	Christian	138.2	5.0	0.98	126.2	4.9	0.96	38.0	1.8	0.71
4	Bengali Hindu	137.9	4.6	0.97	126.0	4.4	0.95	37.8	1.5	0.73
5	Behari & U.P.Hindu	139.6	4.9	0.96	125.8	4.3	0.94	38.2	1.5	0.60
6	Dogra	138.9	4.5	0.97	126.7	4.4	0.96	37.9	1.8	0.66
7	Garhwali	135.2	4.5	0.96	123.4	4.4	0.94	37.2	1.6	0.68
8	Gorkha	134.3	4.5	0.97	121.4	4.4	0.95	36.0	1.5	0.69
9	Gujar	142.0	4.2	0.95	130.2	4.2	0.92	39.3	1.5	0.68
10	Jat	142.7	4.6	0.96	130.9	4.5	0.95	39.2	1.9	0.60
11	Kashmiri Hindu	140.0	4.4	0.96	128.2	4.3	0.93	38.0	1.4	0.69
12	Kumaoni	137.7	5.0	0.96	125.5	4.8	0.95	37.0	1.6	0.71
13	Mahar	137.1	4.1	0.97	124.4	3.9	0.98	37.3	1.5	0.69
14	Maratha	138.6	4.1	0.97	126.1	4.0	0.95	38.4	1.5	0.56
15	Malayali Hindu	138.2	4.8	0.97	126.1	4.6	0.96	37.9	1.4	0.66
16	Punjabi Hindu	139.5	5.6	0.98	127.5	5.5	0.96	38.4	1.9	0.74
17	Rajput	141.1	4.7	0.97	129.7	4.7	0.93	38.7	1.9	0.62
18	Sikh (M & R)	140.0	4.6	0.97	127.9	4.6	0.94	38.7	1.5	0.76
19	Sikh (Other)	142.6	4.7	0.96	129.9	4.5	0.95	38.8	1.8	0.63
20	Tamil Hindu	139.1	4.6	0.97	127.0	4.5	0.95	38.4	1.6	0.68
	total	139.0	5.3	0.97	126.9	5.2	0.96	38.0	1.9	0.74

Sl. No.	community	sleeve length			waist height			hip height		
		m	sd	r	m	sd	r	m	sd	r
1	2	3	4	5	6	7	8	9	10	11
1	Ahir	67.6	2.6	0.68	112.6	4.1	0.90	89.9	3.7	0.87
2	Assamese	62.4	2.7	0.72	102.5	4.4	0.92	82.2	3.9	0.87
3	Christian	66.1	2.7	0.73	108.3	4.4	0.92	87.4	3.7	0.87
4	Bengali Hindu	65.3	2.5	0.73	106.4	4.0	0.91	87.4	3.4	0.87
5	Bihari & U.P.HINDU	65.7	2.5	0.69	108.0	4.0	0.91	87.7	3.5	0.84
6	Dogra	65.1	2.6	0.75	108.4	4.1	0.93	86.1	3.6	0.86
7	Garhwali	63.7	2.5	0.76	104.3	3.9	0.92	84.2	3.5	0.87
8	Gorkha	62.6	2.4	0.76	102.7	4.0	0.92	81.3	3.6	0.86
9	Gujar	67.9	2.7	0.59	110.6	3.7	0.88	90.3	3.5	0.80
10	Jat	67.6	2.7	0.73	111.9	4.2	0.89	89.5	3.5	0.86
11	Kashmiri Hindu	65.2	2.3	0.78	108.2	3.9	0.92	87.8	3.4	0.87
12	Kumaoni	64.7	2.5	0.77	106.3	4.5	0.91	84.6	3.7	0.85
13	Mahar	65.2	2.5	0.76	106.4	3.6	0.91	86.0	3.1	0.87
14	Maratha	66.8	2.7	0.67	107.9	3.9	0.92	87.5	3.1	0.86
15	Malayali Hindu	65.7	2.7	0.62	108.0	4.4	0.94	87.3	3.7	0.86
16	Punjabi Hindu	65.7	3.1	0.77	108.7	5.1	0.92	87.6	4.1	0.89
17	Rajput	66.8	2.7	0.69	110.4	4.2	0.92	88.5	3.6	0.82
18	Sikh (M & R)	66.4	2.5	0.80	109.1	4.3	0.93	88.6	3.7	0.85
19	Sikh (Other)	66.8	2.7	0.71	111.7	4.3	0.89	89.0	3.4	0.85
20	Tamil Hindu	66.5	2.5	0.74	108.8	3.9	0.90	88.3	3.5	0.83
	total	65.7	3.0	0.76	108.0	5.0	0.93	87.1	4.3	0.87

S No.	community	knee height			crotch height			death of scye		
		m	sd	r	m	sd	r	m	sd	r
1	2	3	4	5	6	7	8	9	10	11
1	Ahir	48.9	2.0	0.86	81.2	3.6	0.87	18.7	1.6	0.24
2	Assamese	43.9	2.1	0.86	73.4	3.8	0.88	16.5	1.5	0.26
3	Christian	47.1	2.2	0.85	78.8	3.7	0.88	17.8	1.6	0.34
4	Bengali Hindu	45.8	2.0	0.84	78.5	3.5	0.86	17.5	1.3	0.21
5	Bihari & U.P.Hindu	46.6	2.1	0.82	79.1	3.6	0.86	17.6	1.6	0.23
6	Dogra	47.1	2.1	0.86	77.8	3.5	0.88	19.0	1.4	0.36
7	Garhwali	44.9	2.2	0.81	75.8	3.6	0.88	16.2	1.4	0.29
8	Gorkha	42.8	1.9	0.87	72.4	3.5	0.85	18.3	1.6	0.26
9	Gujar	48.3	2.6	0.75	81.3	3.4	0.80	15.8	1.4	0.12
10	Jat	48.7	2.1	0.83	81.4	3.5	0.85	19.1	1.5	0.34
11	Kashmiri Hindu	46.9	2.4	0.90	78.8	3.5	0.86	17.2	1.3	0.38
12	Kumaoni	45.1	2.2	0.88	76.3	3.6	0.87	18.2	1.4	0.34
13	Mahar	45.5	1.8	0.87	76.8	3.2	0.87	18.8	1.3	0.24
14	Maratha	46.4	1.9	0.84	78.3	3.1	0.86	18.1	1.4	0.29
15	Malayali Hindu	47.0	2.2	0.86	78.6	3.7	0.89	17.7	1.8	0.30
16	Punjabi Hindu	46.9	2.5	0.89	79.0	4.3	0.90	18.8	1.5	0.38
17	Rajput	47.8	2.2	0.81	79.9	3.7	0.82	18.8	1.6	0.25
18	Sikh (M & R)	47.8	2.3	0.86	79.2	3.8	0.84	17.7	1.6	0.32
19	Sikh (Other)	48.6	2.1	0.84	80.6	3.3	0.85	19.6	1.2	0.29
20	Tamil Hindu	47.2	2.0	0.81	79.3	3.5	0.85	17.6	1.7	0.12
	total	46.7	2.7	0.87	78.3	4.3	0.88	17.9	1.8	0.32

S No	community	post waist length			waist to hips			shoulder length			height	
		m	sd	r	m	sd	r	m	sd	r	m	sd
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Ahir	38.3	2.1	0.41	23.4	2.0	0.27	12.9	1.1	0.38	172.4	4.8
2	Assamese	38.9	1.7	0.55	20.7	1.4	0.39	11.9	0.9	0.22	160.8	5.3
3	Christian	37.3	2.1	0.51	21.4	1.8	0.44	12.2	1.1	0.34	167.0	5.6
4	Bengali Hindu	38.6	1.7	0.56	19.7	1.2	0.34	12.2	0.9	0.33	167.4	5.1
5	Bihari & U.P Hindu	38.4	1.8	0.49	21.0	2.0	0.50	12.4	0.9	0.38	168.5	5.6
6	Dogra	37.8	2.1	0.45	23.2	2.1	0.38	12.6	1.1	0.41	167.9	5.1
7	Garhwali	38.2	1.8	0.58	20.9	1.4	0.35	12.2	0.9	0.25	163.1	4.8
8	Gorkha	38.2	1.9	0.51	21.7	1.7	0.37	12.2	0.9	0.41	161.9	5.1
9	Gujar	39.2	1.7	0.57	21.0	1.3	0.39	12.2	0.9	0.25	170.7	4.8
10	Jat	38.8	2.3	0.47	23.3	2.3	0.26	12.8	1.0	0.41	171.6	5.0
11	Kashmiri Hindu	38.9	1.7	0.56	20.6	1.4	0.36	12.4	1.0	0.25	168.3	4.7
12	Kumaoni	38.6	1.9	0.52	22.2	2.0	0.44	12.5	1.0	0.28	166.2	5.4
13	Mahar	37.7	1.5	0.52	21.1	1.5	0.36	12.2	0.9	0.34	164.5	4.6
14	Maratha	38.4	1.5	0.42	21.0	1.5	0.47	12.2	0.9	0.19	166.9	4.5
15	Malayali Hindu	37.6	2.2	0.36	21.1	2.0	0.47	12.3	1.7	0.16	166.8	5.4
16	Punjabi Hindu	38.8	2.3	0.48	21.7	2.3	0.40	12.7	1.2	0.27	169.1	6.2
17	Rajput	38.3	2.1	0.53	22.5	1.9	0.40	12.7	1.1	0.28	170.5	5.4
18	Sikh (M & R)	38.2	1.8	0.56	21.0	2.0	0.42	12.7	0.9	0.39	167.9	5.0
19	Sikh (Other)	38.8	2.1	0.46	23.3	2.1	0.40	13.1	1.1	0.36	172.1	5.0
20	Tamil Hindu	38.1	1.9	0.48	20.9	1.7	0.39	12.3	1.3	0.33	167.5	5.3
	total	38.4	2.0	0.44	21.6	2.1	0.42	12.4	1.1	0.35	167.5	6.0

APPENDIX 12A - CORRELATION TABLES

(Appendix 12A (Table 12.1) consists of 32 two-way frequency distributions. These are numbered to indicate states by first letters and characters by the numbers 1, 2, 3 and 4 respectively for stature, weight, maximum chest girth and minimum chest girth.)

List of tables

Table No	characters	state
12.1A.12	stature and weight	Assam
12.1B.12	"	Bihar
12.1Bo12	"	Bombay
12.1JK12	"	Jammu and Kashmir
12.1K.12	"	Kerala
12.1M.12	"	Madras
12.1P.12	"	Punjab
12.1R.12	"	Rajasthan
12.1U.12	"	Uttar Pradesh
12.1WB12	"	West Bengal
12.10.12	"	other states
12.1I.12	"	all states
12.1A.13	stature and maximum chest girth	Assam
12.1B.13	"	Bihar
12.1K.13	"	Kerala
12.1P.13	"	Punjab
12.1A.14	stature and minimum chest girth	Assam
12.1B.14	"	Bihar
12.1K.14	"	Kerala
12.1P.14	"	Punjab
12.1A.23	weight and maximum chest girth	Assam
12.1B.23	"	Bihar
12.1K.23	"	Kerala
12.1P.23	"	Punjab
12.1A.24	weight and minimum chest girth	Assam
12.1B.24	"	Bihar
12.1K.24	"	Kerala
12.1P.24	"	Punjab
12.1A.34	maximum and minimum chest girth	Assam
12.1B.34	"	Bihar
12.1K.34	"	Kerala
12.1P.34	"	Punjab

Table 12.1A.12 Distribution of stature and weight - Assam

stature (in)	weight (lb)											total
	78-	88-	98-	108-	118-	128-	138-	148-	158-	178-	188-	
56-	-	-	2	1	-	-	-	-	-	-	-	3
59-	-	1	1	1	-	-	-	-	-	-	-	3
60-	-	2	29	62	5	2	-	-	-	-	-	100
61-	-	7	48	215	45	3	3	-	-	-	-	321
62-	-	9	79	425	115	10	1	-	-	-	-	639
63-	-	8	99	503	218	28	4	-	1	-	-	861
64-	-	5	89	517	317	66	10	2	1	-	-	1007
65-	1	3	44	345	288	78	23	3	-	1	-	786
66-	-	1	15	172	222	71	19	4	2	-	-	506
67-	-	-	9	92	129	68	17	3	1	-	1	320
68-	-	-	6	41	72	49	19	3	-	-	-	190
69-	-	-	3	14	29	17	5	2	-	-	-	70
70-	-	-	-	7	9	3	10	1	-	-	-	30
71-	-	-	1	2	-	6	4	-	-	-	-	13
72-	-	-	-	-	5	2	1	1	-	-	-	9
total	1	36	425	2397	1454	403	116	19	5	1	1	4858

Table 12.1B.12 Distribution of stature and weight - Bihar

stature (in)	weight (lb)													total
	68-	78-	88-	98-	108-	118-	128-	138-	148-	158-	168-	178-	188-	
57-	-	-	1	-	-	-	-	-	-	-	-	-	-	1
59-	-	-	1	-	-	-	-	-	-	-	-	-	-	1
60-	1	1	5	53	13	8	-	4	-	-	-	-	-	85
61-	-	2	8	148	56	7	3	-	-	-	-	1	-	225
62-	-	1	12	298	273	35	5	-	-	-	-	-	-	624
63-	-	-	14	302	588	174	14	1	-	-	-	-	-	1093
64-	-	-	9	303	812	476	63	12	3	-	1	-	-	1679
65-	-	-	9	174	797	599	119	32	8	1	-	-	-	1739
66-	-	-	2	97	500	844	243	49	7	1	-	-	-	1743
67-	-	-	-	28	259	609	227	61	7	4	-	1	1	1197
68-	-	1	-	9	112	356	216	69	12	5	1	-	-	781
69-	-	-	-	4	45	134	111	47	11	5	1	-	-	358
70-	-	-	-	1	14	50	61	36	7	1	1	-	-	171
71-	-	-	-	-	6	14	20	15	14	3	-	-	-	72
72-	-	-	-	-	3	2	8	5	2	1	-	-	-	21
73-	-	-	-	-	-	2	1	2	2	-	-	-	-	7
74-	-	-	-	-	-	1	1	-	-	-	-	-	-	2
total	1	5	61	1417	3478	3311	1092	333	73	21	4	2	1	9799

Table 12.1Bo.12 Distribution of stature and weight - Bombay

stature (in)	weight (lb) 68-	78-	88-	98-	108-	118-	128-	138-	148-	158-	168-	178-	188-	total
57-	1	1	-	-	-	-	-	-	-	-	-	-	-	2
58-	2	1	3	1	-	-	-	-	-	-	-	-	-	7
59-	1	4	9	5	-	-	1	-	-	-	-	-	-	20
60-	1	13	44	59	27	6	5	2	-	-	-	-	-	157
61-	-	12	87	195	71	15	2	-	-	-	-	-	-	382
62-	-	14	148	437	247	22	8	1	-	1	-	-	1	879
63-	-	8	135	761	775	152	26	5	1	-	-	-	-	1863
64-	-	8	122	829	1612	510	63	13	2	2	-	-	-	3161
65-	-	2	45	529	1269	519	92	27	7	1	1	1	-	2493
66-	-	2	32	287	971	635	121	19	6	-	1	-	-	2074
67-	-	-	7	104	444	413	135	23	8	-	-	-	-	1134
68-	-	1	2	34	194	227	95	26	3	2	-	-	-	584
69-	-	-	1	9	60	98	62	20	4	1	1	1	-	257
70-	-	-	-	3	11	29	31	10	2	1	-	-	-	87
71-	-	-	-	-	3	15	20	4	1	2	-	1	-	46
72-	-	-	-	-	-	2	3	-	-	1	-	-	-	6
73-	-	-	-	1	1	1	-	-	-	-	-	-	-	3
total	5	66	635	3254	5685	2644	664	150	34	11	3	3	1	13155

Table 12.1JK.12 Distribution of stature and weight - Jammu & Kashmir

stature (in)	weight (lb)										total
	78-	88-	98-	108-	118-	128-	138-	148-	158-	168-	
56-	-	-	-	-	-	1	-	-	-	-	1
58-	-	1	-	-	-	-	-	-	-	-	1
59-	1	1	-	1	-	-	-	-	-	-	3
60-	1	2	11	3	2	1	-	-	-	-	20
61-	1	14	49	32	6	-	2	-	-	-	104
62-	1	14	70	76	18	3	1	2	1	-	186
63-	-	8	105	292	92	14	4	-	-	-	515
64-	-	10	131	549	218	51	2	1	-	-	962
65-	-	4	59	531	373	80	19	1	-	-	1067
66-	-	1	68	419	510	150	29	3	-	-	1180
67-	-	1	22	227	363	147	24	4	-	1	789
68-	-	-	2	83	205	131	43	2	-	1	467
69-	-	-	2	37	85	82	33	7	2	1	249
70-	-	-	-	3	29	39	15	-	1	1	88
71-	-	-	-	2	7	18	7	2	2	-	38
72-	-	-	-	-	3	4	3	-	-	-	10
73-	-	-	-	-	-	1	-	-	1	-	2
74-	-	-	-	-	-	-	1	1	-	-	2
total	4	56	519	2255	1911	722	183	23	7	4	5684

Table 12.1K.12 Distribution of stature and weight - Kerala

stature (in)	weight (lb)											total
	68-	78-	88-	98-	108-	118-	128-	138-	148-	158-	168-	
58-	-	-	2	1	-	-	-	-	-	-	-	3
59-	-	3	2	2	-	-	-	-	-	-	-	7
60-	-	6	28	25	9	3	1	-	-	-	-	72
61-	-	2	55	85	38	7	1	1	-	-	-	189
62-	1	3	75	222	126	17	1	1	-	-	-	446
63-	-	2	63	367	411	86	6	1	-	-	-	936
64-	-	1	33	347	1520	475	75	9	1	3	2	2466
65-	-	-	18	237	1356	692	130	20	-	-	2	2455
66-	-	-	3	116	992	729	155	35	4	1	-	2035
67-	-	-	2	39	553	559	142	24	5	1	-	1325
68-	-	-	-	14	211	319	118	31	6	1	-	700
69-	-	-	-	9	60	148	77	22	5	-	-	321
70-	-	-	1	1	19	42	43	13	2	2	-	123
71-	-	-	-	-	4	12	11	11	4	-	-	42
72-	-	-	-	-	1	5	2	2	-	-	2	12
73-	-	-	-	-	1	-	1	-	-	-	-	2
total	1	17	282	1465	5301	3094	763	170	27	8	6	11134

Table 12.1M.12 Distribution of stature and weight - Madras

stature (in)	weight (lb)													total
	68-	78-	88-	98-	108-	118-	128-	138-	148-	158-	168-	178-	188-	
57-	-	-	-	-	1	-	-	-	-	-	-	-	-	1
58-	2	1	2	-	-	-	-	-	-	-	-	-	-	5
59-	-	4	2	2	-	-	-	-	-	-	-	-	-	8
60-	3	1	18	19	5	2	1	1	-	-	-	-	-	50
61-	2	3	63	71	21	-	2	-	-	-	-	-	-	162
62-	-	5	53	202	111	9	2	1	-	-	-	-	-	383
63-	-	4	55	404	445	70	14	-	-	-	-	1	-	993
64-	-	6	52	451	1527	415	50	14	3	-	-	-	-	2518
65-	-	-	23	264	1388	563	77	13	1	1	1	-	-	2331
66-	-	-	13	156	1068	687	115	33	4	-	-	1	-	2077
67-	-	-	5	81	630	538	101	22	2	5	1	-	1	1386
68-	-	-	-	28	247	317	116	21	2	1	1	-	-	733
69-	-	-	-	3	93	139	73	20	2	4	-	-	-	334
70-	-	-	-	-	30	54	33	12	2	1	-	-	-	132
71-	-	-	-	-	5	17	15	2	5	-	-	-	-	44
72-	-	-	-	-	1	4	6	-	1	-	-	-	-	12
73-	-	-	-	-	-	2	3	-	-	-	-	-	-	5
total	7	24	286	1681	5572	2817	608	139	22	12	3	2	1	11174

Table 12.1P.12 Distribution of stature and weight - Punjab

stature (in)	weight (lb) 68-	78-	88-	98-	108-	118-	128-	138-	148-	158-	168-	178-	188-	total
56-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
57-	1	-	-	-	-	1	2	-	-	-	-	-	-	4
58-	-	1	1	1	2	1	-	-	-	-	-	-	-	6
59-	-	1	3	9	3	-	1	-	-	-	-	-	-	17
60-	2	4	26	41	40	37	7	2	-	1	-	-	-	160
61-	-	8	33	182	97	26	6	5	3	1	-	-	1	362
62-	-	4	51	372	397	88	17	7	4	1	1	-	-	942
63-	-	1	48	530	992	330	51	12	5	4	-	1	-	1974
64-	-	1	40	477	2396	1240	213	52	17	3	2	-	-	4441
65-	-	2	25	329	2458	2112	505	103	11	7	1	2	2	5557
66-	2	1	9	198	2224	4514	1405	324	85	15	8	2	-	8790
67-	4	1	2	84	1173	3271	1494	460	66	20	4	3	1	6583
68-	-	-	3	19	502	2049	1368	501	117	32	7	3	1	4602
69-	2	-	-	10	142	1027	956	438	124	29	8	-	2	2738
70-	-	-	-	2	45	365	508	301	130	19	11	2	-	1383
71-	-	-	1	1	18	98	234	180	74	16	7	2	-	631
72-	-	-	-	-	5	37	51	54	22	10	4	1	-	184
73-	-	-	-	-	-	5	20	20	17	3	1	1	-	67
74-	-	-	-	-	1	-	3	5	4	1	-	1	-	15
75-	-	-	-	-	1	-	3	3	-	1	-	-	-	8
76-	-	-	-	-	-	-	-	1	-	-	-	-	-	1
77-	-	-	-	-	-	2	-	-	-	-	-	-	-	2
78-	-	-	-	-	-	2	-	-	1	-	-	-	-	3
total	11	25	242	2255	10496	15205	6844	2471	680	163	54	18	7	38,471

Table 12.1R.12 Distribution of stature and weight - Rajasthan

stature (in)	weight (lb)										total
	78-	88-	98-	108-	118-	128-	138-	148-	158-	178-	
60-	1	2	5	5	1	2	-	-	-	-	16
61-	-	2	17	4	1	1	1	1	1	-	28
62-	-	6	41	35	11	2	1	-	-	-	96
63-	-	3	72	121	38	6	2	-	-	2	244
64-	-	8	76	227	135	21	3	-	-	-	470
65-	-	6	61	296	318	59	4	-	1	-	745
66-	-	5	70	388	992	266	43	3	1	-	1768
67-	-	-	25	245	742	289	62	11	-	-	1374
68-	-	-	10	137	493	262	78	7	2	-	989
69-	-	-	-	49	242	206	79	12	2	-	590
70-	-	-	1	12	119	93	51	14	3	-	293
71-	-	-	-	3	33	46	30	6	5	-	123
72-	-	-	-	-	7	11	10	6	3	-	37
73-	-	-	-	-	1	2	5	3	-	-	11
74-	-	-	-	-	-	2	-	2	-	-	4
75-	-	-	-	-	-	-	-	1	-	-	1
79-	-	-	-	-	-	1	-	-	-	-	1
total	1	32	378	1522	3133	1269	369	66	18	2	6790

Table 12.1U.12 Distribution of stature and weight - Uttar Pradesh

stature (in)	weight (lb)												total
	68-	78-	88-	98-	108-	118-	128-	138-	148-	158-	168-	178-	188-	
55-	-	-	-	-	-	1	-	-	-	-	-	-	-	1
56-	-	-	-	-	-	-	1	-	-	-	-	-	-	1
57-	-	-	-	-	2	-	1	-	-	-	-	-	-	3
58-	-	1	1	-	2	-	1	-	-	-	-	-	-	5
59-	-	2	4	4	3	-	-	-	-	-	-	-	-	13
60-	-	1	20	92	77	19	12	4	2	-	1	-	-	228
61-	-	4	41	309	324	55	12	1	1	-	-	-	-	747
62-	-	6	35	429	829	152	20	3	1	1	-	-	-	1476
63-	-	1	33	533	1850	526	64	6	-	1	2	-	1	3017
64-	-	1	25	503	2234	1097	157	25	4	1	-	1	.	4048
65-	-	3	10	342	2297	1916	314	52	9	1	1	1	-	4946
66-	-	1	-	155	1753	2867	774	138	22	10	2	1	-	5723
67-	1	1	3	77	793	1984	827	205	27	5	3	5	-	3931
68-	-	-	-	15	369	1044	629	194	40	6	4	-	1	2302
69-	-	-	-	9	85	463	366	168	17	6	2	1	2	1119
70-	-	-	-	3	16	168	168	105	30	5	2	-	-	497
71-	-	-	-	-	11	41	74	51	16	2	3	-	-	198
72-	-	-	-	-	3	9	8	11	4	4	-	-	1	40
73-	-	-	-	-	-	2	-	2	3	2	-	-	-	9
74-	-	-	-	-	-	-	-	1	-	1	-	-	-	2
75-	-	-	-	-	-	-	-	-	2	-	-	-	-	2
total	1	21	172	2471	10648	10344	3428	966	178	45	20	9	5	28308

Table 12.1WB.12 Distribution of stature and weight - West Bengal

stature (in)	weight (lb)												total
	78-	88-	98-	108-	118-	128-	138-	148-	158-	168-	178-	188-	
59-	-	1	1	-	-	-	-	-	-	-	-	-	2
60-	-	4	10	8	1	-	1	-	-	-	-	-	24
61-	-	8	26	33	8	3	-	-	-	-	-	-	78
62-	1	9	95	106	29	6	1	1	2	-	-	1	251
63-	2	15	115	228	61	23	6	3	-	-	-	1	454
64-	-	10	120	462	220	48	23	7	1	-	-	-	891
65-	2	2	102	512	309	59	35	12	4	1	-	-	1038
66-	-	3	13	408	382	94	49	13	2	-	1	-	965
67-	-	1	32	257	310	96	43	11	-	2	2	1	755
68-	-	1	9	137	185	74	55	11	4	1	1	1	479
69-	-	-	2	54	122	56	19	6	2	2	-	-	263
70-	-	-	-	21	39	19	17	3	-	1	2	-	102
71-	-	-	1	5	8	5	6	6	1	1	-	-	33
72-	-	-	-	-	5	4	3	1	-	-	-	-	13
73-	-	-	-	-	-	-	2	-	-	-	-	-	2
74-	-	-	-	-	-	-	-	1	-	-	-	-	1
total	5	54	526	2231	1679	487	260	75	16	8	6	4	5351

Table 12.10.12 Distribution of stature and weight - other states

stature (in)	weight (lb) 68-	78-	88-	98-	108-	118-	128-	138-	148-	158-	168-	178-	188-	total
56-	-	1	-	2	1	-	-	-	-	-	-	-	-	4
57-	-	2	1	-	-	-	-	-	-	-	-	-	-	3
58-	-	1	7	6	1	-	-	-	-	-	-	-	-	15
59-	-	4	11	30	18	-	-	-	-	-	-	-	-	63
60-	-	8	43	162	246	34	4	-	1	-	-	-	-	498
61-	2	13	68	350	672	131	10	5	-	-	-	-	1	1252
62-	-	6	61	514	1109	298	32	3	-	-	-	-	-	2023
63-	1	6	60	540	1364	534	77	11	2	1	1	-	-	2597
64-	-	3	42	432	1540	885	175	37	9	3	-	-	-	3126
65-	-	5	30	273	1241	915	231	65	8	1	4	1	-	2774
66-	1	-	10	131	737	807	266	81	14	3	-	1	-	2131
67-	-	-	-	56	394	556	249	84	14	3	-	-	1	1357
68-	-	-	1	26	154	323	186	61	17	3	2	-	-	773
69-	-	-	-	8	47	130	112	41	7	2	-	-	-	347
70-	-	-	-	2	24	45	30	37	8	5	-	-	-	151
71-	-	-	-	1	7	11	21	18	4	1	-	-	-	63
72-	-	-	-	-	-	9	5	3	3	-	-	-	-	20
73-	-	-	-	-	-	-	1	-	-	-	-	-	-	1
74-	-	-	-	-	-	-	-	1	1	-	-	-	-	2
total	4	49	334	2533	7555	4758	1399	447	88	22	7	2	2	17,200

Table 12.1I.12 Distribution of stature and weight - all states

stature (in)	weight (lb)													total
	68-	78-	88-	98-	108-	118-	128-	138-	148-	158-	168-	178-	188-	
55-	-	-	-	-	-	1	-	-	-	-	-	-	-	1
56-	-	2	-	2	1	-	2	-	-	-	-	-	-	7
57-	2	3	2	-	3	1	3	-	-	-	-	-	-	14
58-	4	5	17	9	5	1	1	-	-	-	-	-	-	42
59-	1	19	34	53	25	-	2	-	-	-	-	-	-	134
60-	7	36	192	477	433	113	33	14	3	1	1	-	-	1310
61-	4	45	379	1432	1348	256	40	15	5	2	-	1	2	3529
62-	1	41	464	2680	3309	679	96	19	8	6	1	-	2	7306
63-	1	24	434	3729	7066	2063	295	48	11	6	3	4	2	13686
64-	-	20	351	3669	12879	5671	916	190	47	13	5	1	-	23762
65-	-	14	172	2370	12145	8316	1666	370	57	17	11	5	2	25145
66-	3	4	78	1291	9460	13047	3589	803	161	33	11	6	-	28486
67-	5	2	21	548	4975	9345	3707	1008	155	38	11	11	5	19831
68-	-	2	7	166	2146	5518	3195	1079	217	56	17	4	3	12410
69-	2	-	1	56	672	2588	2101	887	195	52	16	2	4	6576
70-	-	-	1	13	195	940	1025	597	198	38	16	4	-	3027
71-	-	-	1	3	64	256	464	324	132	32	11	3	-	1290
72-	-	-	-	-	13	83	102	91	39	19	6	1	1	355
73-	-	-	-	1	2	13	29	31	25	6	1	1	-	109
74-	-	-	-	-	1	1	6	8	9	2	-	1	-	28
75-	-	-	-	-	1	-	3	3	3	1	-	-	-	11
76-	-	-	-	-	-	-	-	1	-	-	-	-	-	1
77-	-	-	-	-	-	2	-	-	-	-	-	-	-	2
78-	-	-	-	-	-	2	-	-	1	-	-	-	-	3
79-	-	-	-	-	-	-	1	-	-	-	-	-	-	1
total	30	217	2154	16499	54743	48896	17276	5488	1266	322	110	44	21	1,47,066

Table 12.1A.13 Distribution of stature and maximum chest girth - Assam

stature (in)	chest maximum												total
	29-	30-	31-	32-	33-	34-	35-	36-	37-	38-	39-	40-	
56-	-	-	-	-	-	1	2	-	-	-	-	-	3
59-	-	-	1	-	-	2	-	-	-	-	-	-	3
60-	-	1	3	4	42	32	13	4	1	-	-	-	100
61-	-	-	2	9	101	136	50	19	2	1	1	-	321
62-	-	3	5	25	187	275	115	23	4	2	-	-	639
63-	1	1	3	32	246	331	177	53	14	2	1	-	861
64-	-	1	-	27	233	453	207	68	15	2	1	-	1007
65-	-	-	4	18	172	343	159	60	22	5	2	1	786
66-	-	1	-	3	83	213	116	68	8	8	6	-	506
67-	-	-	-	4	45	126	58	27	24	3	1	2	320
68-	-	-	-	2	25	74	46	29	8	5	1	-	190
69-	-	-	-	1	6	31	18	7	4	2	1	-	70
70-	-	-	-	-	3	12	6	6	-	3	-	-	30
71-	-	-	-	-	2	2	3	4	1	1	-	-	13
72-	-	-	-	-	-	1	5	-	1	1	1	-	9
total	1	7	18	125	1145	2032	1005	368	104	35	15	3	4858

Table 12.1B,13 Distribution of stature and maximum chest girth - Bihar

stature (in)	chest maximum (in)															total
	28-	29-	30-	31-	32-	33-	34-	35-	36-	37-	38-	39-	40-	41-	42-	
57-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
59-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1
60-	-	1	-	6	31	27	10	7	3	-	-	-	-	-	-	85
61-	-	-	3	8	58	86	48	18	2	1	1	-	-	-	-	225
62-	-	-	3	15	86	288	154	61	14	1	2	-	-	-	-	624
63-	-	1	4	15	118	396	354	149	45	9	2	-	-	-	-	1093
64-	-	-	3	30	103	568	559	290	98	20	7	-	1	-	-	1679
65-	1	-	3	26	107	547	588	311	111	31	12	1	1	-	-	1739
66-	-	-	4	13	72	381	626	422	156	46	16	4	1	2	-	1743
67-	-	-	-	2	31	215	479	286	129	41	11	1	2	-	-	1197
68-	-	-	-	3	24	116	288	188	110	35	15	1	1	-	-	781
69-	-	-	-	-	11	48	126	88	45	26	10	3	1	-	-	358
70-	-	-	-	2	2	18	49	46	36	12	3	2	-	-	1	171
71-	-	-	-	-	1	3	21	20	12	11	4	-	-	-	-	72
72-	-	-	-	-	-	1	8	4	5	1	1	1	-	-	-	21
73-	-	-	-	-	-	-	3	2	2	-	-	-	-	-	-	7
74-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	2
total	1	2	20	120	646	2695	3313	1893	768	234	84	13	7	2	1	9799

Table 12.1K.13 Distribution of stature and maximum chest girth - Kerala

stature (in)	chest maximum (in)																total
	27-	28-	29-	30-	31-	32-	33-	34-	35-	36-	37-	38-	39-	40-	41-	42-	
58-	-	-	1	-	1	-	1	-	-	-	-	-	-	-	-	-	3
59-	1	3	1	-	-	1	1	-	-	-	-	-	-	-	-	-	7
60-	-	2	2	7	19	10	23	7	2	-	-	-	-	-	-	-	72
61-	-	-	1	14	38	48	58	20	6	3	1	-	-	-	-	-	189
62-	-	-	4	20	60	93	190	57	17	4	1	-	-	-	-	-	446
63-	-	-	4	11	66	158	426	214	45	7	3	1	1	-	-	-	936
64-	-	-	3	3	67	154	1244	727	185	65	10	4	3	-	-	1	2466
65-	-	2	4	6	36	117	1132	846	223	73	10	3	1	2	-	-	2455
66-	-	-	1	1	14	69	895	724	232	78	12	7	1	-	1	-	2035
67-	-	-	-	1	5	30	568	481	165	64	10	1	-	-	-	-	1325
68-	-	-	-	-	8	17	274	242	105	32	15	6	1	-	-	-	700
69-	-	-	-	-	2	9	104	122	54	25	1	4	-	-	-	-	321
70-	-	-	-	-	2	1	35	42	24	9	7	2	1	-	-	-	123
71-	-	-	-	-	-	1	7	19	8	5	2	-	-	-	-	-	42
72-	-	-	-	-	-	-	2	4	3	-	2	1	-	-	-	-	12
73-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	2
total	1	7	21	63	318	709	4960	3505	1070	365	74	29	8	2	1	1	11134

Table 12.1P.13 Distribution of stature and maximum chest girth - Punjab

stature (in)	chest maximum (in)															total
	28-	29-	30-	31-	32-	33-	34-	35-	36-	37-	38-	39-	40-	41-	42-	
56-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
57-	-	1	-	-	-	-	1	2	-	-	-	-	-	-	-	4
58-	-	-	1	-	1	1	1	2	-	-	-	-	-	-	-	6
59-	-	-	-	2	4	2	7	2	-	-	-	-	-	-	-	17
60-	-	1	4	11	17	39	57	24	2	3	2	-	-	-	-	160
61-	-	2	9	18	62	114	99	37	15	3	2	1	-	-	-	362
62-	-	3	12	24	129	319	285	110	36	14	8	2	-	-	-	942
63-	1	1	17	44	167	562	744	292	95	39	7	3	2	-	-	1974
64-	-	1	18	42	178	812	2070	873	317	91	28	8	3	-	-	4441
65-	-	1	7	32	187	856	2428	1296	511	170	45	19	2	2	1	5557
66-	-	-	6	25	139	832	3755	2372	1136	366	119	27	8	4	1	8790
67-	-	1	1	16	81	487	2719	1835	886	400	110	35	7	3	2	6583
68-	-	-	-	6	36	250	1674	1354	799	327	100	46	8	1	1	4602
69-	-	-	-	-	17	100	851	806	536	258	120	33	14	2	1	2738
70-	-	-	-	1	4	57	329	437	301	165	58	21	6	4	-	1383
71-	-	-	-	1	4	14	139	181	144	93	35	16	2	1	1	631
72-	-	-	-	-	-	6	35	59	45	27	7	4	1	-	-	184
73-	-	-	-	-	-	2	14	15	15	14	4	2	1	-	-	67
74-	-	-	-	-	-	-	2	3	2	5	1	-	2	-	-	15
75-	-	-	-	1	-	-	2	2	1	1	1	-	-	-	-	8
76-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1
77-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	2
78-	-	-	-	-	-	-	2	-	-	1	-	-	-	-	-	3
total	1	11	75	224	1026	4453	15217	9702	4841	1977	647	217	56	17	7	38471

Table 12.A.14 Distribution of stature and minimum chest girth - Assam

stature (in)	chest minimum (in)											total
	28-	29-	30-	31-	32-	33-	34-	35-	36-	37-	38-	
56-	-	-	-	-	1	2	-	-	-	-	-	3
59-	-	1	-	-	2	-	-	-	-	-	-	3
60-	1	2	4	44	32	12	5	-	-	-	-	100
61-	-	2	10	106	138	44	17	3	1	-	-	321
62-	-	8	19	200	281	108	18	4	1	-	-	639
63-	1	5	34	255	339	160	56	8	2	1	-	861
64-	1	-	22	243	455	210	66	7	1	2	-	1007
65-	-	5	16	177	361	149	56	16	2	3	1	786
66-	-	-	2	88	214	122	60	10	6	4	-	506
67-	-	-	2	52	121	93	25	23	2	-	2	320
68-	-	-	2	25	74	46	32	7	3	1	-	190
69-	-	-	1	7	31	19	5	6	1	-	-	70
70-	-	-	-	3	13	6	5	1	2	-	-	30
71-	-	-	-	2	2	3	4	1	1	-	-	13
72-	-	-	-	-	1	5	-	3	-	-	-	9
total	3	23	112	1202	2065	979	349	89	22	11	3	4,858

Table 12.1B .14 Distribution of stature and minimum chest girth - Bihar

stature (in)	chest minimum (in)															total
	27-	28-	29-	30-	31-	32-	33-	34-	35-	36-	37-	38-	39-	40-	/	
57-	-	-	-	-	1	-	-	-	-	-	-	-	-	-		1
59-	-	-	-	1	-	-	-	-	-	-	-	-	-	-		1
60-	1	-	6	31	28	9	7	3	-	-	-	-	-	-		95
61-	-	3	9	58	89	45	18	2	-	1	-	-	-	-		225
62-	-	2	19	83	295	155	53	14	1	2	-	-	-	-		624
63-	1	5	16	122	403	345	148	42	9	2	-	-	-	-		1093
64-	-	4	28	110	588	560	275	90	18	5	-	1	-	-		1679
65-	2	2	23	109	568	601	292	100	29	11	1	1	-	-		1739
66-	-	3	15	77	412	622	408	142	40	18	3	2	1	-		1743
67-	-	-	1	36	235	487	267	124	37	7	1	2	-	-		1197
68-	-	-	4	23	127	301	182	95	31	16	1	1	-	-		781
69-	-	-	-	10	56	123	92	43	22	8	3	1	-	-		358
70-	-	-	2	1	22	52	48	31	9	4	1	-	-	1		171
71-	-	-	-	1	8	18	21	11	9	4	-	-	-	-		72
72-	-	-	-	-	4	5	5	4	1	2	-	-	-	-		21
73-	-	-	-	-	-	3	2	2	-	-	-	-	-	-		7
74-	-	-	-	1	-	-	1	-	-	-	-	-	-	-		2
total	4	19	123	663	2836	3326	1819	703	206	80	10	8	1	1		9799

Table 12.1K.14 Distribution of stature and minimum chest girth - Kerala

stature (in)	chest minimum(in)																total
	25-	26-	27-	28-	29-	30-	31-	32-	33-	34-	35-	36-	37-	38-	39-	40-	
58-	-	-	1	-	1	-	1	-	-	-	-	-	-	-	-	-	3
59-	1	2	2	-	-	1	1	-	-	-	-	-	-	-	-	-	7
60-	-	1	2	9	18	10	23	8	1	-	-	-	-	-	-	-	72
61-	-	-	1	14	40	48	57	21	6	1	1	-	-	-	-	-	189
62-	-	-	4	23	58	96	190	57	13	4	1	-	-	-	-	-	446
63-	-	-	4	13	63	166	439	203	37	7	2	1	1	-	-	-	936
64-	-	-	3	4	65	168	1294	698	173	44	9	4	3	-	-	1	2466
65-	-	1	4	10	38	122	1175	839	200	55	6	2	1	2	-	-	2455
66-	-	-	1	1	18	71	942	717	205	63	10	5	1	-	1	-	2035
67-	-	-	-	-	9	34	599	474	150	49	9	1	-	-	-	-	1325
68-	-	-	-	-	6	21	283	250	97	26	12	4	1	-	-	-	700
69-	-	-	-	-	2	9	116	124	48	18	1	3	-	-	-	-	321
70-	-	-	-	-	2	1	39	41	24	9	5	1	1	-	-	-	123
71-	-	-	-	-	-	1	8	19	8	4	2	-	-	-	-	-	42
72-	-	-	-	-	-	-	2	5	2	2	-	1	-	-	-	-	12
73-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	2
total	1	4	22	74	320	749	5169	3457	964	282	58	22	8	2	1	1	11134

Table 12.1P.14 Distribution of stature and minimum chest girth - Punjab

stature (in)	chest minimum (in)															total
	26-	27-	28-	29-	30-	31-	32-	33-	34-	35-	36-	37-	38-	39-	40-	
56-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
57-	-	1	-	-	-	-	1	2	-	-	-	-	-	-	-	4
58-	-	1	-	-	1	1	1	2	-	-	-	-	-	-	-	6
59-	-	-	1	2	3	2	8	1	-	-	-	-	-	-	-	17
60-	-	2	3	12	20	41	58	17	2	2	3	-	-	-	-	160
61-	-	3	8	19	72	113	101	30	11	2	2	1	-	-	-	362
62-	-	4	13	30	134	330	285	97	31	11	6	1	-	-	-	942
63-	-	4	18	53	191	594	749	244	88	23	7	2	1	-	-	1974
64-	-	4	21	46	231	948	2135	691	266	71	20	6	2	-	-	4441
65-	-	1	9	49	236	1106	2459	1102	417	126	39	8	4	-	1	5557
66-	-	-	7	37	206	1245	3917	2054	925	283	90	16	6	3	1	8790
67-	1	-	3	15	116	836	2878	1616	719	285	88	15	6	3	2	6583
68-	-	-	3	5	57	460	1846	1189	685	243	80	27	6	-	1	4602
69-	-	-	-	2	21	233	954	738	477	190	86	28	8	1	-	2738
70-	-	-	-	2	13	98	428	400	258	116	48	13	5	2	-	1383
71-	-	-	-	2	6	23	161	190	147	64	25	9	3	1	-	631
72-	-	-	-	-	1	10	51	54	38	21	6	3	-	-	-	184
73-	-	-	-	-	-	5	12	15	22	9	2	1	1	-	-	67
74-	-	-	-	-	-	-	4	2	2	4	2	-	1	-	-	15
75-	-	-	-	1	-	-	2	2	1	2	-	-	-	-	-	8
76-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1
77-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	2
78-	-	-	-	-	-	-	2	-	-	1	-	-	-	-	-	3
total	1	20	86	276	1308	6046	16054	8446	4089	1453	504	130	43	10	5	38,471

Table 12.1A.23 Distribution of weight and maximum chest girth - Assam

chest max.(in)	weight (lb)											total
	78-	88-	98-	108-	118-	128-	138-	148-	158-	178-	188-	
29-	-	1	-	-	-	-	-	-	-	-	-	1
30-	-	4	2	-	1	-	-	-	-	-	-	7
31-	-	8	10	-	-	-	-	-	-	-	-	18
32-	-	10	57	54	4	-	-	-	-	-	-	125
33-	1	6	203	739	176	14	5	-	1	-	-	1145
34-	-	6	120	1138	656	99	11	1	-	1	-	2032
35-	-	1	23	366	436	142	35	2	-	-	-	1005
36-	-	-	8	86	135	101	35	3	-	-	-	368
37-	-	-	1	11	39	32	18	3	-	-	-	104
38-	-	-	-	2	6	9	10	6	2	-	-	35
39-	-	-	1	1	1	5	2	4	1	-	-	15
40-	-	-	-	-	-	1	-	-	1	-	1	3
total	1	36	425	2397	1454	403	116	19	5	1	1	4858

Table 12.1B .23 Distribution of weight and maximum chest girth - Bihar

chest max.(in)	weight (lb)													total
	68-	78-	88-	98-	108-	118-	128-	138-	148-	158-	168-	178-	188-	
28-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
29-	1	-	1	-	-	-	-	-	-	-	-	-	-	2
30-	-	-	8	11	1	-	-	-	-	-	-	-	-	20
31-	-	2	21	60	29	8	-	-	-	-	-	-	-	120
32-	-	3	23	388	203	26	2	-	-	-	-	-	1	646
33-	-	-	7	663	1436	541	43	2	1	1	-	1	-	2695
34-	-	-	1	241	1277	1492	276	23	3	-	-	-	-	3313
35-	-	-	-	48	441	878	419	98	6	2	1	-	-	1893
36-	-	-	-	4	81	303	252	110	17	1	-	-	-	768
37-	-	-	-	1	6	49	76	74	22	5	1	-	-	234
38-	-	-	-	-	4	14	21	23	13	7	1	1	-	84
39-	-	-	-	-	-	-	2	1	6	3	1	-	-	13
40-	-	-	-	-	-	-	1	2	2	2	-	-	-	7
41-	-	-	-	-	-	-	-	-	2	-	-	-	-	2
42-	-	-	-	-	-	-	-	-	1	-	-	-	-	1
total	1	5	61	1417	3478	3311	1092	333	73	21	4	2	1	9799

Table 12.1K.23 Distribution of weight and maximum chest girth - Kerala

chest max. (in)	chest minimum (in)											total
	68-	78-	88-	98-	108-	118-	128-	138-	148-	158-	168-	
27-	-	1	-	-	-	-	-	-	-	-	-	1
28-	-	3	3	-	1	-	-	-	-	-	-	7
29-	-	2	15	4	-	-	-	-	-	-	-	21
30-	-	4	44	14	1	-	-	-	-	-	-	63
31-	1	7	145	138	20	6	1	-	-	-	-	318
32-	-	-	65	454	170	20	-	-	-	-	-	709
33-	-	-	10	745	3286	860	50	8	-	-	1	4960
34-	-	-	-	96	1520	1544	312	29	2	2	-	3505
35-	-	-	-	12	255	511	236	52	4	-	-	1070
36-	-	-	-	1	43	141	127	46	6	1	-	365
37-	-	-	-	1	5	8	23	25	10	-	2	74
38-	-	-	-	-	-	3	12	8	5	1	-	29
39-	-	-	-	-	-	1	2	1	-	4	-	8
40-	-	-	-	-	-	-	-	-	-	-	2	2
41-	-	-	-	-	-	-	-	1	-	-	-	1
42-	-	-	-	-	-	-	-	-	-	-	1	1
total	1	17	282	1465	5301	3094	763	170	27	8	6	11134

Table 12.1P.23 Distribution of weight and maximum chest girth - Punjab

chest max.(in)	weight (lb)													total
	68-	78-	88-	98-	108-	118-	128-	138-	148-	158-	168-	178-	188-	
28-	-	-	1	-	-	-	-	-	-	-	-	-	-	1
29-	1	3	5	1	1	-	-	-	-	-	-	-	-	11
30-	-	8	32	28	6	-	1	-	-	-	-	-	-	75
31-	1	10	62	98	40	10	2	-	-	1	-	-	-	224
32-	2	2	82	515	371	47	2	1	2	2	-	-	-	1026
33-	-	2	43	951	2611	771	68	5	-	2	-	-	-	4453
34-	3	-	10	548	5585	7507	1408	139	11	2	1	1	2	15217
35-	3	-	2	95	1527	4848	2614	542	66	2	1	1	1	9702
36-	1	-	1	13	297	1658	1853	837	162	13	5	1	-	4841
37-	-	-	1	5	44	321	737	629	206	31	3	-	-	1977
38-	-	-	2	1	10	30	132	256	150	50	12	4	-	647
39-	-	-	1	-	2	12	24	52	72	33	16	5	-	217
40-	-	-	-	-	1	1	3	10	10	22	6	2	1	56
41-	-	-	-	-	1	-	-	-	1	4	8	1	2	17
42-	-	-	-	-	-	-	-	-	-	1	2	3	1	7
total	11	25	242	2255	10496	15205	6844	2471	680	163	54	18	7	38,471

Table 12.1A.24 Distribution of weight and minimum chest girth - Assam

chest min.(in)	weight (lb)											total
	78-	88-	98-	108-	118-	128-	138-	148-	158-	178-	188-	
28-	-	1	2	-	-	-	-	-	-	-	-	3
29-	-	12	8	3	-	-	-	-	-	-	-	23
30-	-	8	58	43	3	-	-	-	-	-	-	112
31-	-	8	208	775	191	14	5	-	1	-	-	1202
32-	1	7	120	1147	670	105	13	1	-	1	-	2065
33-	-	-	21	342	432	147	35	2	-	-	-	979
34-	-	-	7	77	132	96	34	3	-	-	-	349
35-	-	-	1	9	23	31	20	4	1	-	-	89
36-	-	-	-	1	3	5	7	5	1	-	-	22
37-	-	-	-	-	-	4	2	4	1	-	-	11
38-	-	-	-	-	-	1	-	-	1	-	-	3
total	1	36	425	2397	1454	403	116	19	5	1	1	4858

Table 12.1B .24 Distribution of weight and minimum chest girth - Bihar

chest min.(in)	weight (lb)													total
	68-	78-	88-	98-	108-	118-	128-	138-	148-	158-	168-	178-	188-	
27-	1	-	1	1	1	-	-	-	-	-	-	-	-	4
28-	-	-	9	10	-	-	-	-	-	-	-	-	-	19
29-	-	2	20	65	29	7	-	-	-	-	-	-	-	123
30-	-	3	23	390	204	39	3.	-	-	-	-	-	1	663
31-	-	-	6	671	1498	603	51	3	2	1	-	1	-	2836
32-	-	-	2	233	1258	1509	293	29	2	-	-	-	-	3326
33-	-	-	-	43	411	838	414	103	7	2	1	-	-	1819
34-	-	-	-	2	70	258	241	112	18	1	-	1	-	703
35-	-	-	-	2	3	45	66	63	21	5	1	-	-	206
36-	-	-	-	-	4	12	21	20	14	8	1	-	-	80
37-	-	-	-	-	-	-	2	1	4	2	1	-	-	10
38-	-	-	-	-	-	-	1	2	3	2	-	-	-	8
39-	-	-	-	-	-	-	-	-	1	-	-	-	-	1
40-	-	-	-	-	-	-	-	-	1	—	-	-	-	1
total	1	5	61	1417	3478	3311	1092	333	73	21	4	2	1	9797

Table 12.1K.24 Distribution of weight and minimum chest girth - Kerala

chest min. (in)	chest maximum (in)											total
	68-	78-	88-	98-	108-	118-	128-	138-	148-	158-	168-	
25-	-	1	-	-	-	-	-	-	-	-	-	1
26-	-	2	2	-	-	-	-	-	-	-	-	4
27-	-	2	15	4	1	-	-	-	-	-	-	22
28-	-	5	46	21	1	1	-	-	-	-	-	74
29-	1	7	149	142	16	4	1	-	-	-	-	320
30-	-	-	62	470	187	30	-	-	-	-	-	749
31-	-	-	8	726	3416	944	67	7	-	-	1	5169
32-	-	-	-	96	1439	1551	334	33	2	2	-	3457
33-	-	-	-	5	209	455	234	57	4	-	-	964
34-	-	-	-	1	28	98	100	45	7	1	2	282
35-	-	-	-	-	4	8	18	19	9	-	-	58
36-	-	-	-	-	-	2	7	7	5	1	-	22
37-	-	-	-	-	-	1	2	1	-	4	-	8
38-	-	-	-	-	-	-	-	-	-	-	2	2
39-	-	-	-	-	-	-	-	1	-	-	-	1
40-	-	-	-	-	-	-	-	-	-	-	1	1
total	1	17	282	1465	5301	3094	763	170	27	8	6	11134

Table 12.1P.24 Distribution of weight and minimum chest girth - Punjab

chest min.(in)	weight (lb)													total
	68-	78-	88-	98-	108-	118-	128-	138-	148-	158-	168-	178-	188-	
26-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
27-	1	5	12	1	1	-	-	-	-	-	-	-	-	20
28-	-	8	35	33	8	1	1	-	-	-	-	-	-	86
29-	1	7	65	132	59	9	2	-	-	1	-	-	-	276
30-	1	2	78	567	527	110	15	3	3	2	-	-	-	1308
31-	1	2	37	952	3242	1606	188	14	2	2	-	-	-	6046
32-	3	-	8	486	5284	8120	1891	237	18	2	2	1	2	16054
33-	2	-	3	74	1141	3948	2545	643	85	3	-	2	-	8446
34-	2	-	3	9	192	1185	1595	865	203	25	8	1	1	4089
35-	-	-	-	1	32	206	503	486	192	31	2	-	-	1453
36-	-	-	1	-	7	15	93	194	128	47	14	5	-	504
37-	-	-	-	-	1	5	11	21	44	30	12	4	2	130
38-	-	-	-	-	2	-	-	8	5	15	10	2	1	43
39-	-	-	-	-	-	-	-	-	-	4	4	1	1	10
40-	-	-	-	-	-	-	-	-	-	1	2	2	-	5
total	11	25	242	2255	10496	15205	6844	2471	680	163	54	18	7	38,471

Table 12.1A.34 Distribution of maximum and minimum chest girth - Assam

chest max.(in)	chest minimum (in)											total
	28-	29-	30-	31-	32-	33-	34-	35-	36-	37-	38-	
29-	1	-	-	-	-	-	-	-	-	-	-	1
30-	2	4	1	-	-	-	-	-	-	-	-	7
31-	-	16	2	-	-	-	-	-	-	-	-	18
32-	-	3	101	19	2	-	-	-	-	-	-	125
33-	-	-	7	1110	22	6	-	-	-	-	-	1145
34-	-	-	1	61	1953	14	3	-	-	-	-	2032
35-	-	-	-	11	82	907	4	1	-	-	-	1005
36-	-	-	-	-	6	45	316	1	-	-	-	368
37-	-	-	-	1	-	6	25	71	1	-	-	104
38-	-	-	-	-	-	1	1	13	20	-	-	35
39-	-	-	-	-	-	-	-	3	1	11	-	15
40-	-	-	-	-	-	-	-	-	-	-	3	3
total	3	23	112	1202	2065	979	349	89	22	11	3	4858

Table 12.1B .34 Distribution of maximum and minimum chest girth - Bihar

chest max.(in)	chest minimum (in)														total
	27-	28-	29-	30-	31-	32-	33-	34-	35-	36-	37-	38-	39-	40-	
28-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
29-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
30-	-	17	2	1	-	-	-	-	-	-	-	-	-	-	20
31-	1	2	107	10	-	-	-	-	-	-	-	-	-	-	120
32-	-	-	13	598	34	1	-	-	-	-	-	-	-	-	646
33-	-	-	1	46	2617	26	5	-	-	-	-	-	-	-	2695
34-	-	-	-	6	167	3112	22	6	-	-	-	-	-	-	3313
35-	-	-	-	2	15	171	1692	11	2	-	-	-	-	-	1893
36-	-	-	-	-	1	15	98	649	2	3	-	-	-	-	768
37-	-	-	-	-	2	1	2	31	197	1	-	-	-	-	234
38-	-	-	-	-	-	-	-	6	5	73	-	-	-	-	84
39-	-	-	-	-	-	-	-	-	-	3	10	-	-	-	13
40-	-	-	-	-	-	-	-	-	-	-	-	7	-	-	7
41-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	2
42-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
total	4	19	123	663	2836	3326	1819	703	206	80	10	8	1	1	9799

Table 12.1K.34 Distribution of maximum and minimum chest girth - Kerala

chest max.(in)	chest minimum (in)																total
	25-	26-	27-	28-	29-	30-	31-	32-	33-	34-	35-	36-	37-	38-	39-	40-	
27-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
28-	-	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-	7
29-	-	1	18	2	-	-	-	-	-	-	-	-	-	-	-	-	21
30-	-	-	-	61	2	-	-	-	-	-	-	-	-	-	-	-	63
31-	-	-	-	10	297	7	4	-	-	-	-	-	-	-	-	-	318
32-	-	-	-	1	16	685	7	-	-	-	-	-	-	-	-	-	709
33-	-	-	-	-	5	54	4891	7	3	-	-	-	-	-	-	-	4960
34-	-	-	-	-	-	3	254	3242	2	4	-	-	-	-	-	-	3505
35-	-	-	-	-	-	-	12	197	860	-	1	-	-	-	-	-	1070
36-	-	-	-	-	-	-	-	11	95	259	-	-	-	-	-	-	365
37-	-	-	-	-	-	-	1	-	4	16	53	-	-	-	-	-	74
38-	-	-	-	-	-	-	-	-	-	3	4	22	-	-	-	-	29
39-	-	-	-	-	-	-	-	-	-	-	-	-	8	-	-	-	8
40-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	2
41-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
42-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
total	1	4	22	74	320	749	5169	3457	964	282	58	22	8	2	1	1	11134