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Anthropometric and Physiological Traits: Age Changes among the Oraon Agricultural Labourers of the Jalpaiguri District, Northern West Bengal, India

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With 3 figures and 7 tables

Summary: Data on anthropometric and physiological parameters were collected as a part of an ongoing biomedical research project on 197 adult Oraon agricultural labourers of the Jalpaiguri District, West Bengal, India. The analysis of the present data focuses attention towards the nature and extent of changes in adulthood in respect of anthropometric and physiological traits. The results reveal that the height increases up to 35 years of age, then declines, weight decreases after 40 years of age, although males and females do not show similar results. Physiological parameters on the other hand reveal that the blood pressure increases with age and strength parameters i.e. grip strength and back strength declines after the age of 25 years or so. However, no generalization can be made out of this, because of the cross-sectional nature of the present study.

Key words: Anthropometric and physiological traits, age changes, agricultural labourers, Oraons, West Bengal, India.

Zusammenfassung: Anthropometrische und physiologische Parameter wurden an erwachsenen Landarbeiterinnen und -arbeitern der Oraon (Jalpaiguri Distrikt, West Bengal, Indien) im Rahmen eines fortlaufenden biomedizinischen Forschungsprojektes bestimmt. Die Analyse der gewonnenen Daten wird unter dem Aspekt von Ursachen und Ausmaß von Veränderungen anthropometrischer und physiologischer Merkmale im Erwachsenenalter durchgeführt. Die Daten zeigen, daß die Körperhöhe bis zum 35. Lebensjahr zunimmt, danach nimmt sie ab. Das Körpergewicht nimmt nach dem 40. Lebensjahr ab, wobei Männer und Frauen kein gleiches Bild zeigen. Unter den physiologischen Merkmalen nimmt z.B. der Blutdruck mit steigendem Alter zu, während die Greifkraft und die Druckkraft etwa nach dem 25. Lebensjahr abnehmen. Diese Ergebnisse können infolge des Querschnittscharakters dieser Untersuchung allerdings nicht verallgemeinert werden.

Schlüsselwörter: Anthropometrische und physiologische Merkmale, Altersveränderungen, Landarbeiterinnen und -arbeiter, Oraons, West Bengal, Indien.

Introduction

It would seem logical to expect that once the human body reached its adult size, all its measurements would remain stable for many years to come. There is actually no clear static point in actual age or particular time of human being, when the morphological body features do not change (Åstrand et al. 1973). It is quite certain that

the processes of formation and destruction are present in all stages of life, beginning from conception to death, the ratio between the processes being, however, different (Susanne 1979). Developmental processes or changes in morphology continue to occur after puberty. It is very likely that changes in individuals during adulthood occur within limits defined by genetic factors, although environmental factors play a significant role in the whole process of change (Sacher 1975). The definition of a period of complete maturation as well as the starting point of ageing process is difficult to assign. Adulthood is not a stable physiological and biochemical period; changes are numerous and constantly observed at anthropometric and physiological levels.

The variation in the anthropometric measurements in adulthood are primarily related to the osteological changes, changes in the fat and muscles tissues, although nutritional status has a great role in making all the changes. Most of the anthropometric studies on adults are often cross-sectional, and it is difficult to separate the changes due to secular changes or resulting from continuing growth or due to aging (Susanne 1979). It is obvious that the length measurements remain relatively stable after reaching final body height. Circumferences tend to grow due to developing muscles and subcutaneous fat, chest and abdominal circumferences grow due to stiffness of the rib cartilages and due to increasing amounts of internal fat. In later years, width tend to increase and stature tends to diminish. Individual measurements attain their peak at different ages. Generally, body height reaches the peak early in life (i.e. around 20 years of age); weight attains its peak after thirty; girths and some functional characteristics reaches at and around the same time; width measurements increase slowly but steadily arriving the peak at the later ages of life (Prokopec 1987).

An increase of blood pressure, especially of systolic blood pressure, has been observed during the entire lifespan (Roberts & Maurer 1978). Prokopec (1987) revealed that systolic blood pressure reached its peak at 60 years and showed differences between sexes, handgrip strength reached its peak between 25–30 years of age and then declines throughout individuals' life span. Very little work has been done in the Indian context, Basu et al. (1984) found that the blood pressure tended to rise with increasing age in the eastern Himalayan populations.

In view of the above, the Oraon agricultural labourers of Shishubari Anchal of Jalpaiguri district, West Bengal were selected in accordance with a biomedical research project and the present data is a part of that study. The objectives of the present study is to investigate into the nature and extent of possible age changes in selected anthropometric and physiological traits in different age groups in a specific ethnic group exposed to a specific physical and socioeconomic niches.

Materials and methods

A total of 197 Oraon agricultural labourers/workers were investigated out of which 113 were males and 84 were females, and all of them were selected from Rangali Bazna Anchal of Madarihat Police Station, Jalpaiguri district, West Bengal.

The Oraons are a Dravidian-speaking tribal population with its major concentration in the Chotanagpur plateau in Bihar. They are believed to have migrated to northern West Bengal from Bihar about the end of the last century (Choudhury 1978). The Oraon population is

inhabiting this area for a long time and practising their traditional occupation agriculture, although a sizable proportion of the Oraons are working as tea garden labourers. The subjects for the present study were all adults, aged between 20 and 60 years. Only one ethnic group was chosen in order to avoid the possible ethnic/genetic effects in respect of the variables under study.

Harvesting of paddy in the Jalpaiguri area of West Bengal and most of the agricultural sectors in India are done manually and individuals of both sexes participate in the job. The productive output data (termed in the present study as "stocks") is primarily the harvesting data. The data have been collected through counting the number of stocks of paddy each individual is harvesting per hour. In the absence of a better method of measuring the productive output of the agricultural labourers, the above method of measuring the rate of harvesting or clearing the land, was adopted.

Anthropometric measurements were done using standard methodology and standard instruments (Weiner & Lourie 1981). Anthropometric Somatotype scoring has been done following Carter & Heath's (1990) multiple regression equation. Endomorphy was determined by using the following formula:

$$-0.7182 + 0.1451(X) - 0.00068(X^2) + 0.0000014(X^3) \quad \ldots\ldots (1)$$

where X is the sum of the triceps, subscapular and suprailiac skinfold thickness, adjusted for stature [i.e. X = Sum of skinfold thickness × (170.18 (cm.)/stature)].
Mesomorphy was determined using the following formula:

$$[(0.858 \times \text{biepicondylar}) + (0.601 \times \text{bicondylar}) + \{0.188 \times (\text{upper arm circumference} - \text{triceps skinfold})\} + \{10.161 \times (\text{calf circumference} - \text{calf skinfold})\}] - (\text{stature} \times 0.131) + 4.50 \quad \ldots\ldots (2).$$

Ectomorphy was obtained by using the reciprocals of Poderal Index, and the formula is

$$\text{HWR (Height Weight Ratio)} \times 0.732 - 28.58 \quad \ldots\ldots (3)$$

where HWR = Stature/Weight$^{0.333}$. If HWR is less than 40.75 but greater than 38.25, a rating of 0.1 is assigned to the ectomorphic rating (Carter & Heath 1990). A single investigator (SKR) took the anthropometric measurements.

Strength data in terms of handgrip strength and back strength have been collected through battery operated automatic hand grip dynamometer and back dynamometer, using standard instruments made by Tekai Scientific Instruments Co. Ltd, Japan and standard test protocols (Mathews 1973).

Systolic (SBP) and diastolic (DBP) blood pressure measurements were measured after 15 minutes rest period, in a sitting position, on the upper arm by the auscultatory method using an inflatable calf and mercury sphygmomanometer. SBP was determined at the point when the Korotkoff sound completely ceased (Rose et al. 1980), pulse rate was also measured.

No statistical sampling was attempted because of obvious difficulties in the field but the subjects were included in the sample without any conscious bias. The subjects who volunteered themselves and could be persuaded to participate in the study were only taken in the sample. In the absence of systematic written records for age in most of the individuals, the ages were estimated by reference to local important events and cross checked with elderly individuals and compared with the ages of individuals for whom age records existed. All the participants in the present study belong to the similar socioeconomic condition. The samples were classified into 10-yearly age groups because of the small number of samples in 5-yearly age cohorts. The sample size of the oldest age group (i.e. 55+) was less than 5 in number, therefore, the group was also merged with the previous age group (i.e. 44+). In order to summarize the data of the present study, firstly, we have calculated the descriptive statistics of all the variables under study. Then One way Analysis of Variance (ANOVA) was used in order to find out the difference in means of each variable between/among age groups separately for males and females under study. Let us consider that there are k-groups with n_i observations in the i - th group and denote the j - th observation in the i - th group by y_{ij}. We will assume that

the following model holds: $Y_{ij} = \mu + \alpha_i + e$, where μ is the constant, representing the underlying means of all the age groups taken together. The α_i is also a constant that is different for each group and represents the difference between the mean of the i - th group and the overall mean. e - represents random error about the mean $\mu + \alpha_i$ for an individual observation from the i - th group, which is normally distributed with mean 0 and variance σ^2. The α_i's are typically constrained in this model so that the sum of α_i's over all groups are 0.

Here we assume the null hypothesis (H_0) that the mean values of all the groups (4 age groups) are same, i.e. $\alpha_i = 0$, and the alternate hypothesis (H_1) that at least mean values of two of the four groups are not same i.e. $\alpha_i \neq 0$. Here we compute the test statistic λ, which follows an F distribution with k-1 and n-k df under H_0. If $\lambda > F_{k-1, n-k, 1-\alpha}$ then we reject H_0, but if $\lambda \leq F_{k-1, n-k, 1-\alpha}$ then we accept H_0.

Results

Table 1 shows the descriptive statistics in anthropometric variables of the four age groups (< 25 yrs., 25–34 yrs., 35–44 yrs., and 45+ yrs.) of male agricultural labourers. In most of the anthropometric traits the second age group (i.e. 25–34 yrs.) shows the highest mean values except in cases of facial measurements and skin fold thickness values. On the other hand the eldest age group (i.e. 44+ yrs.) shows more or less similar lower mean values compared to other younger age groups in most of the anthropometric measurements except that facial measurements and skin fold thickness values.

Table 1. Descriptive statistics of anthropometric variables for males.

AGE GROUP	< 25 YEARS			25–34 YEARS			35–44 YEARS			44 + YEARS		
VARIABLES	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
Height	34	163.52	6.65	34	164.84	5.91	20	163.50	3.67	25	157.98	6.14
Weight	34	48.5	5.48	34	49.90	4.28	20	48.93	5.55	25	44.48	5.45
Sitting Height	34	84.06	3.63	34	84.50	3.12	20	84.00	2.33	25	81.15	3.90
Biacromial Diameter	34	36.18	1.57	34	37.08	1.72	20	36.76	1.83	25	35.67	1.64
Biceps Girth	34	22.27	1.63	34	22.89	1.58	20	22.54	1.42	25	21.30	1.64
Calf Girth	34	29.21	2.1	34	29.26	1.75	20	29.52	2.88	25	27.14	1.51
Chest Girth (Exh.)	34	78.40	3.56	34	79.78	2.66	20	80.01	4.31	25	79.30	4.25
Chest Girth (Inh.)	34	80.37	4.14	34	82.29	3.02	20	82.16	4.33	25	81.38	4.35
Bi. diam. Humerous	34	6.54	.27	34	6.61	.33	20	6.49	.37	25	6.45	.24
Bi. Diam. Femur	34	8.87	.44	34	8.96	.39	20	8.96	.36	25	8.75	.32
Biiliac Diameter	34	25.56	1.28	34	26.17	1.34	30	26.15	3.42	25	25.58	1.27
Bizygo. Breadth	34	13.36	.48	34	13.41	.42	20	13.39	.56	25	13.14	.46
Head Breadth	34	14.10	.75	34	14.11	.51	20	14.12	.62	25	13.73	.36
Head Length	34	18.56	.78	34	18.83	.66	20	18.79	.51	25	18.55	.57
Mor. Face Height	34	10.95	.57	34	10.92	.64	20	11.20	.45	25	10.93	.68
Nose Breadth	34	3.78	.25	34	3.75	.24	20	3.76	.23	25	3.78	.29
Nose Height	34	4.56	.36	34	4.66	.36	20	4.77	.36	25	4.76	.39
Skinfold Biceps	34	3.39	.52	34	3.16	.51	20	3.16	.70	25	2.96	.45
Skinfold Triceps	34	5.21	1.03	34	4.94	1.06	20	5.61	2.03	25	4.80	1.20
Skinfold Subscapular	34	8.56	1.19	34	8.69	1.43	20	9.39	2.04	25	8.71	2.09
Skinfold Suprailiac	34	5.81	1.20	34	5.68	1.53	20	6.00	1.98	25	6.00	1.60
Skinfold Calf	34	5.76	1.36	34	4.57	.90	20	4.37	1.48	25	4.25	.97

Units of measurement: Weight in "kg.", Skinfold measurements in "mm." and rest all other measurements in "cm."

Table 2. Descriptive statistics of anthropometric variables for females.

AGE GROUP	< 25 YEARS			25–34 YEARS			35–44 YEARS			44 + YEARS		
VARIABLES	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
Height	25	151.70	3.71	27	152.08	5.67	21	149.98	7.05	11	146.67	6.01
Weight	25	41.26	3.04	27	41.26	3.64	21	39.52	5.09	11	36.27	3.45
Sitting Height	25	77.55	2.50	27	77.57	2.42	21	77.57	3.82	11	75.92	2.21
Biacromial Diameter	25	32.96	1.30	27	32.73	1.07	21	32.26	1.76	11	31.71	1.37
Biceps Girth	25	21.03	1.35	27	20.48	1.31	21	20.76	1.82	11	19.90	1.85
Calf Girth	25	27.16	1.21	27	27.20	1.73	21	26.62	1.89	11	24.98	1.48
Chest Girth (Exh.)	25	73.28	3.19	27	71.82	3.20	21	69.98	8.08	11	63.76	13.82
Chest Girth (Inh.)	25	75.54	3.27	27	73.76	3.42	21	73.22	3.65	11	71.00	4.05
Bi. diam. Humerous	25	5.57	.20	27	5.70	.24	21	5.76	.43	11	5.64	.25
Bi. Diam. Femur	25	7.94	.30	27	7.91	.35	21	7.86	.43	11	7.95	.21
Biiliac Diameter	25	25.17	1.05	27	25.63	1.10	21	25.78	1.38	11	25.26	.67
Bizygo. Breadth	25	12.55	.36	27	12.81	.36	21	12.57	.47	11	12.54	.25
Head Breadth	25	13.56	.44	27	13.61	.50	21	13.41	.48	11	13.33	.53
Head Length	25	17.80	.81	27	18.36	.65	21	17.05	.56	11	18.78	.41
Mor. Face Height	25	10.31	.56	27	10.68	.63	21	10.50	.72	11	10.48	.80
Nose Breadth	25	3.36	.21	27	3.55	.21	21	3.45	.16	11	3.56	.16
Nose Height	25	4.51	.32	27	4.53	.30	21	4.60	.37	11	4.47	.35
Skinfold Biceps	25	4.75	1.36	27	3.76	1.03	21	3.79	1.56	11	3.64	1.19
Skinfold Triceps	25	9.40	3.17	27	7.52	1.65	21	8.09	2.74	11	6.87	2.76
Skinfold Subscapular	25	10.65	3.31	27	8.56	1.96	21	8.83	1.87	11	7.62	2.77
Skinfold Suprailiac	25	8.59	3.22	27	6.22	2.14	21	5.49	1.46	11	5.29	1.83
Skinfold Calf	25	8.26	2.40	27	6.94	1.73	21	6.90	1.94	11	5.24	1.77

Units of measurement: Weight in "kg.", Skinfold measurements in "mm." and rest all other measurements in "cm."

Table 3. Descriptive statistics of somatotype components of both males and females.

	< 25 YEARS			25–34 YEARS			35–44 YEARS			44 + YEARS		
VARIABLES	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
Male												
Endomorphy	34	1.85	.36	34	1.82	.42	20	1.97	.68	25	1.80	.52
Mesomorphy	34	2.68	1.04	34	2.76	.91	20	2.85	.90	25	2.56	1.36
Ectomorphy	34	4.32	.78	34	4.18	1.01	20	4.25	.90	25	4.14	1.03
Female												
Endomorphy	25	2.94	.94	27	2.17	.63	21	2.14	.61	11	1.77	.82
Mesomorphy	25	2.26	.72	27	1.94	1.24	21	2.45	1.00	11	2.50	.98
Ectomorphy	25	3.60	.78	27	3.67	1.00	21	3.71	.98	11	3.86	1.18

Table 2 shows the descriptive statistics in anthropometric variables of the four age groups of female agricultural labourers. The results are not analogous to that of males because both 1st and 2nd age group share the highest mean values in most of the anthropometric traits and all the skin fold thickness measurements are higher in the 1st (i.e. <25 yrs.) age group. The eldest age group shows the lowest mean values

Table 4. Descriptive statistics of blood pressure, physical fitness and productivity variables for males and females.

AGE GROUP	< 25 YEARS			25–34 YEARS			35–44 YEARS			44 + YEARS		
VARIABLES	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
Male												
Diastolic BP	34	79.35	9.01	34	85.71	7.10	20	89.70	12.85	25	93.20	13.95
Systolic BP	34	122.82	9.13	34	126.21	9.88	20	131.30	21.76	25	151.04	26.85
Pulse Rate	34	73.88	8.75	34	75.00	10.46	20	70.10	7.58	25	77.44	11.66
Back Strength	34	128.02	25.80	34	130.26	20.59	20	115.60	23.12	25	94.38	28.15
Grip Strength (R)	34	35.48	6.35	34	34.11	5.36	20	30.51	6.16	25	25.62	5.29
Grip Strength (L)	34	35.39	6.48	34	34.77	5.35	20	30.84	4.30	25	25.73	5.82
Wrist diam. (R)	34	5.34	.65	34	5.43	.69	20	5.38	.53	25	5.03	.53
Wrist diam. (L)	34	5.23	.77	34	5.39	.69	20	5.29	.58	25	4.89	.53
Stocks	34	4297.76	1436.91	34	4596.41	1522.95	20	4087.80	1295.89	25	2787.40	1151.33
Females												
Diastolic BP	25	80.00	9.67	27	83.70	13.76	21	92.19	17.06	11	96.55	18.11
Systolic BP	25	117.20	12.22	27	124.59	22.07	21	131.71	18.45	11	140.00	24.25
Pulse Rate	25	76.32	9.86	27	73.85	8.43	21	76.19	10.77	11	79.82	5.69
Back Strength	25	69.43	13.12	27	62.07	12.20	21	59.55	11.95	11	61.23	12.14
Grip Strength (R)	25	24.18	3.16	27	23.29	3.62	21	21.16	3.97	11	19.93	3.76
Grip Strength (L)	25	22.54	3.53	27	22.64	3.10	21	20.84	3.77	11	18.83	3.20
Wrist diam. (R)	25	3.91	.41	27	3.93	.50	21	3.84	.72	11	3.73	.37
Wrist diam. (L)	25	3.73	.49	27	3.67	.50	21	3.73	.74	11	3.72	.46
Stocks	25	3088.40	987.43	27	3380.00	1364.67	21	2922.10	818.48	11	1872.00	539.95

Units of measurement: Blood pressure(s) in "mm HG", Pulse Rate in "beat/min.", Strength(s) in "kgf", Wrist diam.(s) in "cm." And Stocks in "number/hour".

in most of the traits. The change in different ages in respect of anthropometric traits can be depicted from Figs. 1 and 2 for both males and females.

Table 3 shows the descriptive statistics of somatotyping variables of the four age groups of both sexes. Among males, mean values of both endomorphic and mesomorphic component is highest in the 3rd (35–44 yrs.) age group and lowest in the eldest age group but ectomorphic component is relatively high in the 1st age group and relatively low in the eldest age group. Females on the other hand, do not show analogous results, as that of males, the mean values of endomorphic component is relatively high in the 1st age group and low in the eldest age group. The mesomorphic component is relatively high in the eldest age group and low in the 2nd age group. The ectomorphic component shows higher mean values in the eldest age group and lower in the 1st age group. Fig. 3 shows the change in somatotyping values in different ages for both males and females.

Table 4 shows the descriptive statistics of blood pressure variables, physical fitness and productive variable (stocks) of the four age groups and of both the sexes. The mean values of blood pressure variables (both systolic and diastolic) show an increasing trend due to age, the increment is gradual in both the sexes and the eldest age group show the highest values and the 1st age group show the lowest value. The mean value of pulse rate is relatively high in the eldest age group in both the sexes but the lowest values are not consistent in either sex. Among males, the mean value of back strength is high in the 2nd age group and lowest in the eldest age group,

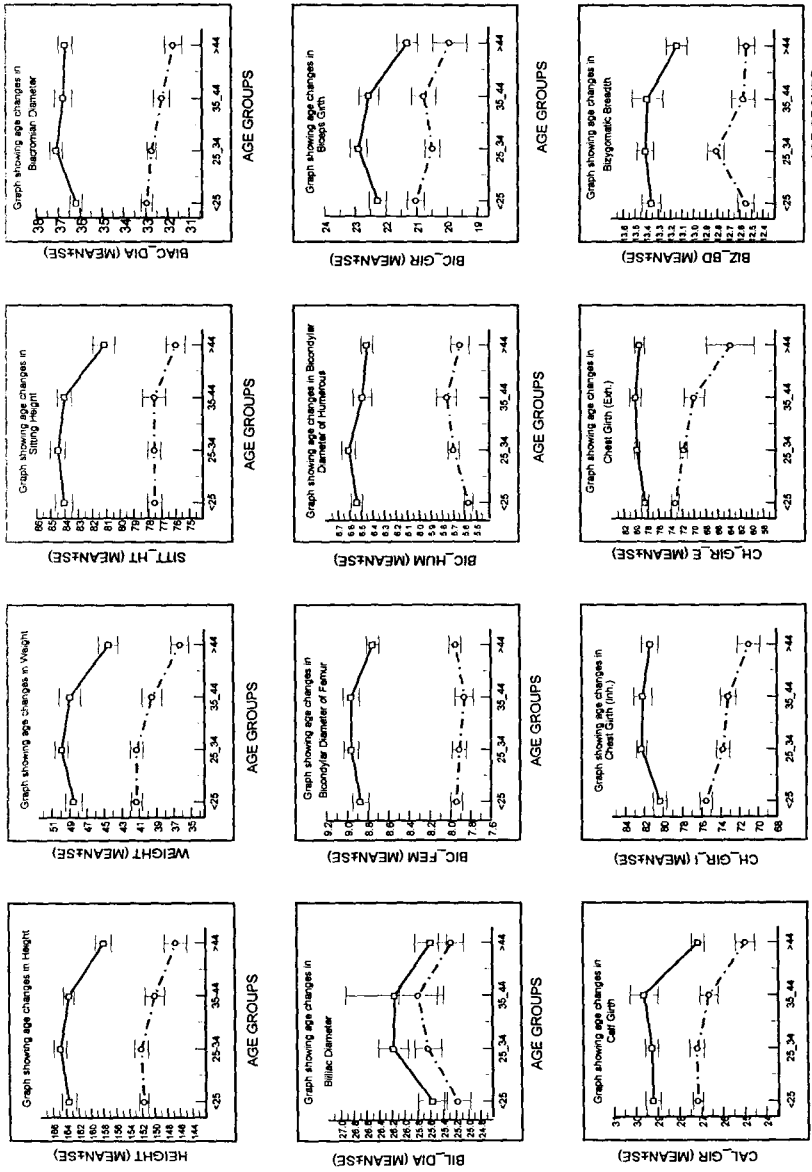

Fig. 1. Age changes of various anthropometric variables in different age groups.

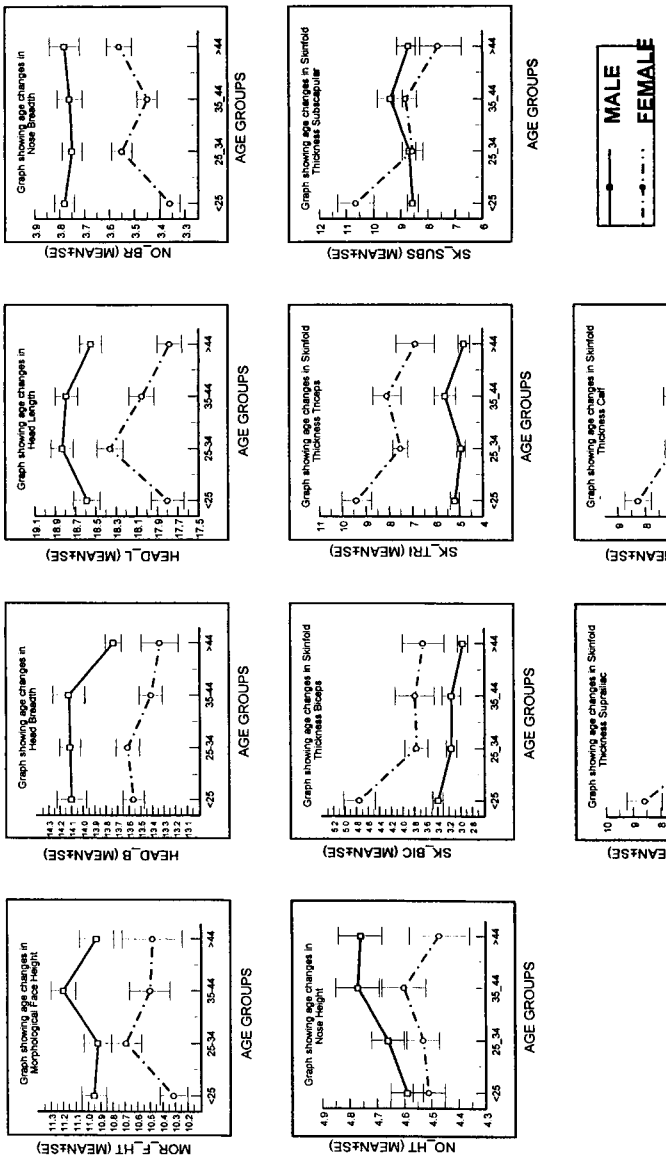

Fig. 2. Age changes of various anthropometric variables in different age groups.

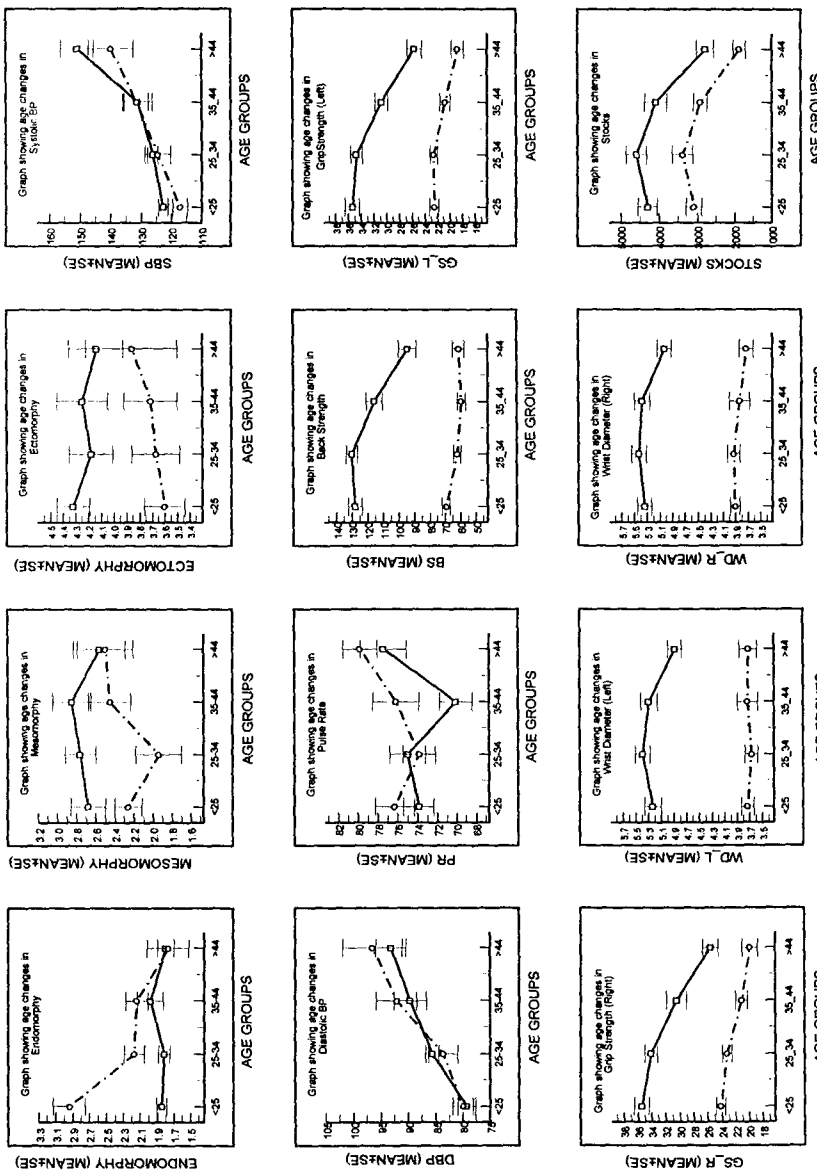

Fig. 3. Age changes of various anthropometric and physiological variables in different age groups.

females on the other show higher values in the 1st age group and lower in the eldest age group. Males show higher mean values of grip strength in the 1st age group and lowest in the eldest age group, whereas females show approximately analogous results as that of males. In regard to wrist diameter, the 2nd age group shows highest mean values and lowest in the eldest age group, females also show more or less similar results. 'Stock' is a measure of harvesting output here used as productive output, the highest productivity is in the 2nd age group and lowest in the eldest age group of males, females show analogous results as that of males. Fig. 3 shows the clear picture of age changes in different parameters for both males and females.

Tables 5 and 6 show the ANOVA results for females and males respectively. The variables, which reveal significant values in comparison within the age groups include weight, height, bizygomatic breadth, calf girth, chest girth, skin fold thickness measurements, blood pressures, strength parameters, productive output (stocks) etc. The table does not require description because the F-statistic is self explanatory. The variables, which show significant values in the table, are obviously rejecting the null hypothesis (H_0) and accepting alternative hypothesis (H_1).

Table 7 shows the t-statistic between/among groups of the variables listed in Tables 5 and 6, the significant differences have been noted in the table, in order to find out the point (age group) of change. In females, there are 20 variables, out of which 13 variables for anthropometry, 1 for somatotyping, 2 for blood pressure, 3 for strength and 1 for productivity. The highest significant difference is observed between 1st and the eldest (4th) group (17 variables out of 20), then comes the difference between 2nd and eldest (4th) group. There is apparently no difference at all between 2nd and 3rd age group. It is apparent from the table that the 1st and 2nd group are close to each other and the 3rd and 4th group form another separate entity in terms of the variables under study. In males, there are 17 variables out of which 9 variables for anthropometry, 2 for blood pressure, 3 for strength and 1 for productivity. The highest significant difference is observed between the 2nd and the 4th group (15 variables out of 17), then comes the difference between the 1st and the eldest (4th) group as well as the 3rd and the 4th group. Strength variables are significantly different between/among all the groups. Productivity variable shows a significant difference between all other 3 age groups versus the eldest (4th) age group.

Discussion

The individuals studied in the present study were similar in terms of ethnicity, occupation, physical environment and socioeconomic condition. The test protocols for collection of data from the individuals were similar and the anthropometric measurements and other data were collected by the same investigator; differences have been reflected in most of the variables (shown in Table 1 – Table 7) under study due to age, although it is not possible to determine the exact age when the incremental value of all the variables are ceasing and when the values are declining, because the sample sizes in each of the age group are small and the nature of data are cross-sectional. Beside these, it is quite impossible to separate true changes from the present study during the lifetime of an individual from morphological characteristics in which older generations differ from younger ones.

Table 5. Some of the variables in females which show significant ANOVA values.

Variables	**Female**	Sum of Squares	df	Mean Square	F	Sig.
Bizygomatic Breadth	Between Groups	1.18	3	0.39	2.72	0.05
	Within Groups	11.59	80	0.14		
	Total	12.77	83			
Back Strength	Between Groups	1319.44	3	439.81	2.85	0.04
	Within Groups	12335.56	80	154.19		
	Total	13655.00	83			
Calf Girth	Between Groups	44.51	3	14.84	5.75	0.00
	Within Groups	206.34	80	2.58		
	Total	250.85	83			
Chest Girth (exhal.)	Between Groups	741.77	3	247.26	5.31	0.00
	Within Groups	3724.67	80	46.56		
	Total	4466.44	83			
Chest Girth (inhal.)	Between Groups	169.29	3	56.43	4.55	0.01
	Within Groups	991.46	80	12.39		
	Total	1160.76	83			
Diastolic Blood Pressure	Between Groups	3056.64	3	1018.88	5.01	0.00
	Within Groups	16269.59	80	203.37		
	Total	19326.24	83			
Endomorphy	Between Groups	14.17	3	4.72	8.23	0.00
	Within Groups	45.91	80	0.57		
	Total	60.08	83			
Grip Strength (left)	Between Groups	147.64	3	49.21	4.20	0.01
	Within Groups	936.38	80	11.70		
	Total	1084.02	83			
Grip Strength (right)	Between Groups	197.67	3	65.89	5.08	0.00
	Within Groups	1037.62	80	12.97		
	Total	1235.29	83			
Head Length	Between Groups	4.91	3	1.64	3.75	0.01
	Within Groups	34.97	80	0.44		
	Total	39.88	83			
Height	Between Groups	265.23	3	88.41	2.81	0.04
	Within Groups	2520.49	80	31.51		
	Total	2785.72	83			
Nose Breadth	Between Groups	0.59	3	0.20	5.12	0.00
	Within Groups	3.09	80	0.04		
	Total	3.68	83			
Systolic Blood Pressure	Between Groups	4828.15	3	1609.38	4.45	0.01
	Within Groups	28936.80	80	361.71		
	Total	33764.95	83			
Skinfold Thickness Biceps	Between Groups	17.96	3	5.99	3.54	0.02
	Within Groups	135.35	80	1.69		
	Total	153.31	83			
Skinfold Thickness Calf	Between Groups	73.18	3	24.39	6.04	0.00
	Within Groups	323.34	80	4.04		
	Total	396.52	83			
Skinfold Thickness Subscapular	Between Groups	93.34	3	31.11	4.88	0.00
	Within Groups	509.76	80	6.37		
	Total	603.10	83			
Skinfold Thickness Suprailiac	Between Groups	147.94	3	49.31	8.89	0.00
	Within Groups	443.74	80	5.55		
	Total	591.68	83			
Skinfold Thickness Triceps	Between Groups	67.84	3	22.61	3.36	0.02
	Within Groups	538.57	80	6.73		
	Total	606.41	83			
Stocks	Between Groups	18188346.43	3	6062782.14	5.50	0.00
	Within Groups	88134293.81	80	1101678.67		
	Total	106322640.24	83			
Weight	Between Groups	237.58	3	79.19	5.29	0.00
	Within Groups	1198.67	80	14.98		
	Total	1436.25	83			

Table 6. Some of the variables in males which show significant ANOVA values.

Variables	Male	Sum of Squares	df	Mean Square	F	Sig.
Biacromial Diameter	Between Groups	33.47	3	11.16	3.97	0.01
	Within Groups	306.55	109	2.81		
	Total	340.01	112			
Biceps Girth	Between Groups	37.86	3	12.62	5.04	0.00
	Within Groups	272.78	109	2.50		
	Total	310.64	112			
Back Strength	Between Groups	22463.67	3	7487.89	12.53	0.00
	Within Groups	65130.61	109	597.53		
	Total	87594.28	112			
Calf Girth	Between Groups	92.40	3	30.80	7.31	0.00
	Within Groups	459.51	109	4.22		
	Total	551.91	112			
Diastolic Blood Pressure	Between Groups	3072.11	3	1024.04	9.18	0.00
	Within Groups	12153.02	109	111.50		
	Total	15225.13	112			
Grip Strength (left)	Between Groups	1653.74	3	551.25	17.19	0.00
	Within Groups	3496.25	109	32.08		
	Total	5149.99	112			
Grip Strength (right)	Between Groups	1627.34	3	542.45	16.10	0.00
	Within Groups	3672.87	109	33.70		
	Total	5300.21	112			
Head Breadth	Between Groups	2.83	3	0.94	2.75	0.05
	Within Groups	37.36	109	0.34		
	Total	40.19	112			
Height	Between Groups	748.86	3	249.62	7.21	0.00
	Within Groups	3771.64	109	34.60		
	Total	4520.50	112			
Systolic Blood Pressure	Between Groups	13057.79	3	4352.60	14.70	0.00
	Within Groups	32275.66	109	296.11		
	Total	45333.45	112			
Sitting Height	Between Groups	187.47	3	62.49	5.56	0.00
	Within Groups	1224.51	109	11.23		
	Total	1411.98	112			
Skinfold Thickness Biceps	Between Groups	2.66	3	0.89	3.05	0.03
	Within Groups	31.68	109	0.29		
	Total	34.34	112			
Skinfold Thickness Calf	Between Groups	38.76	3	12.92	9.28	0.00
	Within Groups	151.77	109	1.39		
	Total	190.53	112			
Stocks	Between Groups	51874567.72	3	17291522.57	9.04	0.00
	Within Groups	208395309.55	109	1911883.57		
	Total	260269877.27	112			
Wrist Diameter (left)	Between Groups	3.75	3	1.25	2.81	0.04
	Within Groups	48.54	109	0.45		
	Total	52.29	112			
Wrist Diameter (right)	Between Groups	2.60	3	0.87	2.26	0.09
	Within Groups	41.92	109	0.38		
	Total	44.52	112			
Weight	Between Groups	456.46	3	152.15	5.73	0.00
	Within Groups	2893.27	109	26.54		
	Total	3349.73	112			

Table 7. t-statistic between/among groups of some selected variables, which shows significant ANOVA values.

Variables (**Female**)	1^{st} vs 2^{nd} df = 50	1^{st} vs 3^{rd} df = 44	1^{st} vs 4^{th} df = 34	2^{nd} vs 3^{rd} df = 46	2^{nd} vs 4^{th} df = 36	3^{rd} vs 4^{th} df = 30
Height			3.08		2.62	
Weight			4.39		3.88	
Calf Girth			4.65		3.73	2.50
Chest Girth (Inh.)		2.27	3.57		2.14	
Chest Girth (Exh.)			3.31		2.90	
Bizygomatic Breadth	2.58				2.28	
Head Length	2.74				2.69	
Nose Breadth	3.24		2.86			
Biceps	2.98	2.23	2.35			
Triceps	2.71		2.28			
Subscapular	2.79	2.23	3.17			
Suprailiac	3.15	4.08	3.17			
Calf	2.28	2.09	3.73		2.73	2.37
Endomorphy	3.50	3.33	3.57			
Systolic BP		3.19	3.78			
Diastolic BP		3.04	3.59		2.38	
Back Strength	2.10	2.65				
Grip Strength (l)			2.98		3.41	
Grip Strength (r)		2.88	3.51		2.56	
Stocks			3.82		3.53	3.83

Variables (**Male**)	1^{st} vs 2^{nd} df = 66	1^{st} vs 3^{rd} df = 52	1^{st} vs 4^{th} df = 57	2^{nd} vs 3^{rd} df = 52	2^{nd} vs 4^{th} df = 57	3^{rd} vs 4^{th} df = 43
Height			3.27		4.34	3.54
Weight			2.79		4.28	2.70
Shitting Height			2.95		3.66	2.88
Biacromial Diameter	2.28				3.19	2.11
Biceps Girth			2.26		3.75	2.68
Calf Girth			4.20		4.87	3.57
Head Breadth			2.31		3.21	2.65
Biceps			3.28			
Calf	3.94	3.29	4.46			
Systolic BP		2.00	5.71		4.97	2.66
Diastolic BP	3.23	3.47	4.63		2.70	
Back Strength			4.76	2.42	5.66	2.72
Grip Strength (l)		2.79	5.90	2.79	6.18	
Grip Strength (r)		2.81		2.25	6.05	2.87
Wrist Diameter (l)					2.99	2.41
Wrist Diameter (r)					2.43	2.23
Stocks			4.33		4.97	3.56

Significant at 5% level

The present study corroborates with the study by Roche et al. (1981), who showed small increase in stature after 16 years followed by decrease after about 36 years. Floris et al. (1977) also showed the increase in stature after the age of 25 years and the biacromial size can continue to grow until the age of 30. The present study also shows decrease in stature at the last age group (i.e. 44+ yrs.), this finding corroborates with the study by Damon (1972), Milne & Lauder (1974) and Sidhu et al. (1975). Milne & Lauder (1974) observed, that the decrease in stature is due to ageing, presumably due to shrinkage or compression of the intervertebral disks, increasing curvature of the spine and inability to stand erect.

Mean weights increase during the first decades of adulthood, but after 60 years a clear and very significant decrease is observed (Norris et al. 1963); the present study also shows significant decrease after 40 years of age. The present study can also be compared with the study of Prokopec (1987), who observed increase in weight up to 40 years and then decline.

In the diameter measurements, significant changes have been observed in the biacromial diameter, increment has been observed up to 25–34 yrs. age group then it declines; this finding is in corroboration with the study of Wessel et al. (1963), who found a large decrease after 55 years of age. Now, girth measurements, biceps girth and calf girth in both sexes show an increase up to 44 years then they decline; this is also in close agreement with the study of Wessel et al. (1963). Skinfold thickness measurement values in the present study show continuous decrease with the age and after the age of 35 the changes are very minimal; this is observed in poorly nourished populations and in agreement with the study of Slome et al. (1960).

Generally, head length and head breadth increase with age (Susanne 1979); in the present study no such trend is observed, although a small declining trend is noticed after the age of 44 years. The present study is partly corroborative with the studies of Marquer & Chamla (1961), who observed such declining trend after the age of 60 years. In the somatotyping measures, the reflection of different anthropometric measurements have been observed, especially in the endomorphic component. However, the present data cannot be compared with any of the studies because of the absence of study on age changes in somatotyping.

A few physiological characteristics have been included in the present study, considering mean values in either sex, blood pressures (e.g. both systolic and diastolic) increases with age, slight increment is also observed in case of pulse rate. This is in agreement with the studies of Boyce et al. (1978), Prokopec (1987), Bhattacharya et al. (1988). The strength parameters, e.g. back strength, grip strength (left hand and right hand) also show a declining trend with the age in the present study. Both sexes reach their maximum in all the parameters before the age of 25, which is also in close agreement with the studies of Prokopec (1987).

In view of the above, there seems to be very specific changes and trends in both the sexes and in most of the variables, both anthropometric and physiological, under study with age. But as a note of caution, it may be pointed out that the results of the present study are absolutely cross-sectional and any kind of generalization cannot be made out of these results.

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