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RELATIVE BODY SIZE
OF NON-INSTITUTIONALIZED MENTALLY
RETARDED MALES AND FEMALES

ABSTRACT — *A sample of 165 mentally retarded subjects, 6 to 18 years of age and diagnosed as "retardates of unknown aetiology" was examined anthropometrically. The subjects were retarded for all the thirty measurements when compared to the standards of controle. Most noticeably depressed of all anthropometric variables was head length. Approximately 19 to 40 percent of subjects were two or more standard deviations below normal mean for stature, sitting height vertex, trunk height, biacromial diameter, extremities, hands and feet. The remaining measurements were much less depressed. In comparison to the other defined populations of retardates, the subjects of the present series appear to be less retarded.*

Growth studies in India are invariably confined to the normal children. No attempt has apparently been made so far to conduct a systematic study of physical conditions of mentally retarded children. The purpose of the present paper is to present essentially an anthropometric evaluation of body size of mentally retarded children in comparison to their normal peers.

The first attempt to study the physical growth of mentally retarded children was made by Tarbell (1883). He found mental retardates to be shorter in stature and lighter in weight than the normal children of the same age and sex. The subsequent studies supported in substance these findings of Tarbell that mental defect correlates with impaired physical growth and also that growth in mental defectives proceeds at a slower rate than in normals and continues for a longer period of time. Growth studies on retardates have been reviewed by the present authors (Jaswal, 1978).

Tarbell's study and almost all the succeeding ones suffered from several methodological problems which resulted in limiting the validity of their results. The foremost among them is the difficulty of classifying the retarded individuals into meaningful and homogeneous diagnostic categories. However, in the past some recognition of heterogeneity of mentally retarded children was shown particularly by Flory (1936), Van Gelderen (1962) and Bailit and Whelan (1967). Another major problem recognized in growth studies in general and growth studies of mentally retarded children in particular, is the lack of suitable populations for comparison. This is mainly because the studies of normal growth selected for comparison with the growth of mentally retarded children have been found to be highly selective with regard to racial background and more important with regard to socio-economic class. With due consideration to these difficulties, the present study describes a diagnostically homogeneous group of mentally retarded individuals belonging to the middle socio-economic section, for their body size in comparison to the similar racial and socio-economic control group.

MATERIAL AND METHODS

The mentally retarded subjects were selected from among the individuals attending various schools/institutions of special education which are specially meant for mental retardates. Clinical and medical notes on all potential subjects were re-examined to screen out individuals who had been diagnosed as mentally retarded without established organic reasons for their low IQ. In the selection of mentally retarded subjects, full care was taken to exclude cases in which seizures, trauma, infection, tumour, other diseases like cerebral palsy might have caused mental retardation. The individuals with developmental anomalies of the face (hypertelorism), lateralized neurological deficit (hemiparesis) and with metabolic abnormalities were also excluded. X-chromatin test was done to ensure the exclusion of individuals with sex-chromosomal anomalies. Using this criteria, 165 mentally retarded individuals were selected. On the basis that the individuals included in this sample had no overt cause for their low IQ or any other physical, neurological, metabolic or sex-chromosomal abnormality,

the present group may be identified as a group of retardates of "unknown aetiology".

108 of the 165 retardate subjects were males and 57 were females. The male subjects ranged in age from 6 to 18 years, the female subjects from 8 to 18 years. They were predominantly from the middle and lower middle socio-economic class and many had defective parents, sibs and blood relatives. None of them suffered from any physical disability which otherwise could have rendered them incapable of co-operating with the standards of anthropometric techniques. The date of birth of mentally retarded subjects was noted from their medical record and subsequently cross-checked from the parents. The ages of the retardates were calculated from their birthdays to the date of their anthropometric examination.

The control group was selected from the school attending children of comparable age range. There were 153 males and 140 females in the control group. The subjects of both the groups i.e. the mental retardates and the controled subjects are of Indian

origin. Both the groups represent a cross-section of the north Indian population and can be classified ethnically belonging to the Mediterranean stock of the "Caucasoids".

In all, thirty physical measurements were taken on each subject. The measurements were selected for their adequacy in forming a clear, complete and comprehensive picture of body size and form. The definitions of the anthropometric measurements were followed as per the conference on standardization of anthropometric techniques and terminology (Hertzberg, 1968). All physical measurements were changed to standard scores so that subjects of different ages and sex might be compared. A standard score is given by the formula, $Z = x - m/o$, where x is the value for a given subject, m is the mean value for the normal population of subjects of the same age and sex and o is the standard deviation for the normal population. The standard score indicates standard deviation units (Z), a value (x) is above or below the normal population mean (m).

TABLE 1. *Means ($+$ S. E., S. D.) of standard scores of anthropometric variables*

Sl. No.	Anthropometric variable	Males				Females				Sexes Combined			
		N	Mean	$+$S.E.	S.D.	N	Mean	$+$S.E.	S.D.	N	Mean	$+$S.E.	S.D.
1.	Stature	107	—0.80	0.15	1.50	57	—1.31	0.24	1.82	164	—0.98	0.13	1.70
2.	Weight	107	—0.48	0.14	1.51	57	—0.59	0.24	1.81	164	—0.49	0.12	1.60
3.	Total length of the upper limb	107	—0.31	0.15	1.50	57	—0.78	0.22	1.70	164	—0.47	0.12	1.59
4.	Total length of the lower limb	102	—0.75	0.17	1.72	56	—1.07	0.20	1.51	158	—0.86	0.13	1.66
5.	Sitting height (Vertex)	106	—0.80	0.16	1.68	57	—1.51	0.22	1.68	163	—1.04	0.13	1.71
6.	Sitting height (Sternale)	106	—0.72	0.15	1.51	57	—1.42	0.27	2.03	163	—0.97	0.13	1.74
7.	Biacromial diameter	107	—0.91	0.13	1.32	57	—1.57	0.42	1.50	164	—1.14	0.13	1.76
8.	Chest breadth	108	—0.19	0.17	1.79	56	—0.30	0.20	1.51	164	—0.22	0.13	1.70
9.	Chest depth	108	—0.33	0.18	1.91	56	—0.05	0.15	1.16	164	—0.22	0.13	1.69
10.	Chest girth	108	—0.01	0.15	1.51	56	—0.38	0.19	1.38	164	—0.14	0.11	1.47
11.	Head height	105	—0.59	0.16	1.63	57	—0.79	0.20	1.49	162	—0.66	0.12	1.59
12.	Head breadth	107	—0.23	0.20	2.04	57	—0.22	0.19	1.30	164	—0.23	0.14	1.82
13.	Head length	107	—1.66	0.17	1.75	57	—1.60	0.22	1.66	164	—1.64	0.13	1.72
14.	Horizontal circumference of head	107	—1.16	0.15	1.59	57	—1.89	0.34	2.53	164	—1.42	0.15	2.00
15.	Bizygomatic breadth	108	—1.31	0.18	1.85	57	—1.27	0.20	1.54	165	—1.89	0.30	3.94
16.	Bigonial diameter	108	—0.39	0.13	1.32	57	—0.48	0.15	1.14	165	—0.42	0.09	1.27
17.	Physiognomic facial height	108	—0.65	0.14	1.50	57	—1.04	0.17	1.29	165	—0.79	0.11	1.45
18.	Morphological facial height	108	—0.43	0.15	1.57	57	0.15	0.20	1.48	165	—0.33	0.12	1.54
19.	Physiognomic superior facial height	108	—0.71	0.17	1.78	57	0.39	0.18	1.37	165	0.60	0.12	1.66
20.	Morphological superior facial height	107	—0.43	0.14	1.41	57	0.18	0.20	1.54	164	0.34	0.11	1.46
21.	External orbital breadth	108	—0.65	0.12	1.21	57	—0.75	0.18	1.30	165	—0.68	0.09	1.24
22.	Nasal height	108	—0.74	0.14	1.48	57	0.36	0.25	1.88	165	0.61	0.12	1.64
23.	Nasal breadth	108	—0.35	0.14	1.45	57	—0.15	0.24	1.80	165	0.28	0.12	1.58
24.	Nasal depth	107	—0.37	0.15	1.51	57	—0.09	0.16	1.17	164	—0.28	0.11	1.41
25.	Ear length	107	—0.04	0.14	1.42	57	—0.08	0.16	1.18	164	—0.05	0.11	1.37
26.	Ear breadth	108	—0.22	0.17	1.81	57	0.22	0.15	1.13	165	0.22	0.12	1.61
27.	Hand breadth	108	—1.17	0.15	1.56	57	—1.79	0.18	1.38	165	—1.38	0.11	1.53
28.	Hand length	108	—0.94	0.18	1.86	57	—1.74	0.24	1.82	165	—1.21	0.14	1.89
29.	Foot breadth	108	—0.78	0.12	1.29	57	—0.84	0.18	1.36	164	—0.86	0.11	1.43
30.	Foot length	108	—0.65	0.14	1.42	56	—1.28	0.18	1.35	165	—0.63	0.15	2.03

RESULTS AND DISCUSSION

Table 1 presents the mean, standard deviation and standard error of mean for all variables for the sexes separately and in combination. *Table 2* shows the percentage of individuals of the retardates' sample, two or more standard deviation units below the mean of the control population.

The present study revealed that with respect to linear measurements viz., stature, sitting height vertex and trunk height (sitting height sternale), both sexes of retardates were shorter than those of controled. Female retardates were more affected than the male retardates with respect to these measurements. It is evident from the comparison of magnitude of standard scores for sitting height vertex and trunk height with that of stature that the former two showed depression more or less to the same extent as that observed as the latter. Further, a similar view is presented by the comparison of percentage of retardates (of both sexes) two or more standard deviations below the control mean for sitting height vertex and trunk height with that of stature. From this, it might be concluded that the degree of retardation observed for sitting height vertex and trunk height in retardates was in proportion to their short stature.

Biacromial diameter, which is a measure of body width, was slightly more depressed than the linear measurements. Females were more retarded than

males. The comparison of mean standard score for biacromial diameter is comparable to that for stature, therefore it might be deduced that the reduction in the former is proportional to the short stature of retardates.

The total length of upper and lower limbs was depressed in both sexes of retardates. Female retardates recorded more depression than males with respect to the lengths of both the limbs. The degree of departure from normals in case of upper limbs as measured in terms of mean standard scores were appreciably less than what had been observed for stature and trunk height. The lower limbs, stature and trunk height recorded comparable degree of deviations from the normal situation.

These findings suggest that the lenght of upper limbs was proportionally greater than stature and trunk height while the length of the lower limbs was proportionate to the short stature of the retardates. The hand and foot in both sexes of retardates lag in both dimensions of lenght and breadth. Length was more depressed than breadth in both hand and foot. Thus retardates appear to have shorter and less broader hands and feet. The deviations were pronounced more in females than males.

The size of the head in both sexes of retardates was relatively smaller than normals. Head length was the most depressed of all anthropometric variables included in this study. Head breadth was the least affected of all head measurements. The reduction in length and breadth is accompanied by relatively slight lowering of head height. Head height was more depressed in both sexes of retardates than head breadth but was comparatively less affected than head length. As a result, the horizontal circumference of the head was remarkably below normal.

The total length of the face (physiognomic facial length) showed depression in both sexes of retardates. The other measures of facial height namely morphological facial and superior facial heights were slightly above the normal. For morphological facial length, physiognomic and morphological superior facial length, only 3 to 6 % of retardates were two or more than two standard deviations below the respective normal mean. These results, particularly the shortening of total physiognomic facial length and slight increase in other facial dimensions implied relatively shorter height of foreheads in retardates. The bizygomatic breadth, which is a measure of facial width was the most depressed of all other facial measures considered here. Bigonial diameter was less affected than bizygomatic breadth. External orbital breadth was below normal in both sexes of retardates. Only 12 % of retardates were two or more than two standard deviations below the normal mean for external orbital breadth. This slight departure might be due to the shortening of facial width (bizygomatic breadth). The nasal height and breadth were slightly higher than normals as had been evidenced by mean standard scores. Nasal depth, on the other hand was below norms. Nevertheless, deviation for all the three measures of nose seemed to be of small magnitude. Departure from norms in the dimensions of the nose were more pronounced in small retardates. These results suggested a tendency

TABLE 2. *Percentage of retardates, two or more standard deviations below the control population*

Sl. No.	Anthropometric variable	Males (%)	Females (%)	Total (%)
1.	Stature	19	36	24
2.	Weight	11	28	19
3.	Total length of the upper limb	12	25	16
4.	Total length of the lower limb	21	30	24
5.	Sitting height (Vertex)	20	25	21
6.	Sitting (Sternale) height	18	23	19
7.	Biacromial diameter	17	35	23
8.	Chest breadth	8	11	9
9.	Chest depth	17	2	11
10.	Chest girth	8	12	8
11.	Head height	19	17	18
12.	Head breadth	19	5	14
13.	Head length	38	44	40
14.	Horizontal circumference of the head	30	39	33
15.	Bizygomatic breadth	20	30	30
16.	Bigonial diameter	11	12	11
17.	Physiognomic facial height	10	25	15
18.	Morphogical facial height	5	7	6
19.	Physiognomic superior facial height	4	2	3
20.	Morphological superior facial height	5	7	5
21.	External orbital breadth	13	10	12
22.	Nasal height	5	9	6
23.	Nasal breadth	5	10	7
24.	Nasal depth	17	2	12
25.	Ear length	6	10	8
26.	Ear breadth	5	0	3
27.	Hand breadth	25	39	31
28.	Hand length	24	46	28
29.	Foot breadth	15	28	21
30.	Foot length	17	28	19

of the nose form in retardates to be slightly longer, broader and flatter as compared to controled subjects.

The mean standard scores for ear length and breadth of retardates suggested only slight deviations from the controled subjects. In both sexes of retardates ear length was below normals by only 0.04 to 0.08 standard deviation units while ear breadth was above normals by 0.22 standard deviations. Of male retardates only about 5 % were two or more than two standard deviations below the control mean. Ten percent of female retardates were two or more than two standard deviations below the control mean for ear length while for ear breadth, there was none. Thus the deviations were slightly pronounced in females. Considering the magnitude of deviations for dimensions for the ear, it could be concluded that ears of retardates present practically no difference from the controled subjects.

Of the three measurements of chest considered here (chest depth, chest breadth and chest girth), the chest girth was least depressed and chest depth registered maximum reduction for male retardates. In female retardates, the chest depth was least retarded and chest girth was the most affected dimension. However, these deviations were of low magnitude.

Recognizing the limitations of earlier studies of grouping mentally retarded children without much concern for the aetiological factor(s) involved, the results of the present study are comparable only in a limited way. This is mainly because none of the samples of retardates delineated in earlier studies is strictly comparable with the retardates of the present study. However, the present results do suggest in conformity to those of the earlier reports that there is a considerable difference in physique between normal and retardate subjects. There are only few studies, generally comparable to the present one.

The retardates of the present sample had been found to be less retarded for height in comparison to those reported by Rundle and Sylvester and Bailit and Whelan. Rundle and Sylvester found 36 % of their male retardates' sample (without organic damage) was below the third percentile in height. The present findings approximate this figure by showing 24 % retardates (sexes combined) more then two standard deviations (approximately below the 2.5 percentile) below the control mean for height. Another anthropometric study of cultural-familial retardates by Bailit and Whelan observed that 47 % male and 41 % female retardates were two or more than two standard deviations below the normal mean for height. This disparity in the results may be accounted for to some degree by the fact that Rundle and Sylvester, Bailit and Whelan studied institutionalized mentally retarded individuals. The studies by Centerwall and Centerwall, Kugel and Raque, Stedman and Eichorn indicate that institutionalization does have a retarding effect on physical size. Bailit and Whelan also pointed out that "a critical age" factor is involved which determines the magnitude of the effect of institutionalization and, certainly the quality of care and attention may vary from institution to institution.

With regard to other linear measurements i.e., sitting height vertex and trunk height (sitting height

sternale), the present study concluded that the reduction observed in these measurement was in proportion to their relatively short stature. On the other hand, Bailit and Whelan reported that in their sample of familial cultural retardates stature was proportionately shorter than sitting height and further it was concluded that the reduction in overall stature resulted from the failure of legs to attain normal length. Similarly, the reduction of biacromial diameter in the present sample of retardates was found to be proportional to their short stature. The results of Rundle and Sylvester's investigation had shown that there was more depression in biacromial diameter of retardates than that for their stature. Contrarily Bailit and Whelan observed less depression in biacromial diameter in comparison to stature.

Head was found to be the most affected segment of the body in retardates. The present findings are in conformity with those reported by Bailit and Whelan (1967) that head length and breadth showed reduction and that head breadth was much less affected as compared to head length. Martin and Saller (1958) observed that in normal adults, the maximal head length is positively correlated with body length. The short stature of retardates thus may partly be attributed to the shortening of head length.

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