Somatotypic Variations With Age in Institutionalized and Control Adolescents
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Citation

Abstract
In the present study an attempt has been made to assess anthropometric somatotype and study the effect of emotional deprivation on age variations in somatotype of institutionalized and controlled adolescents of Punjab, Haryana and Chandigarh. Cross-sectional data on 504 emotionally deprived and 570 controls (including both sexes) aged 11 to 17 years were collected for various measurements. The institutionalized males followed a trend from being balanced mesomorphs to being balanced ectomorphs during the adolescent years. While the control group ones were mesomorphic ectomorphs during the initial years and became balanced ectomorphs during the later years. The emotionally deprived females followed a trend of being mesomorphic ectomorphs, then balanced ectomorphs and finally endomorphic ectomorphs with the advancing years. On the other hand, the control females initially exhibited equal component ratio, then endomorphic ectomorphy, and finally balanced endomorphy.

INTRODUCTION
An emotion is a short term, transitory, positive or negative evaluative state that involves physical, physiological and cognitive components [[1]]. Emotional means concerned with your emotions and the way you are feeling rather than your physical health or condition. When an individual suffers deprivation, it means that the individual does not have or is prevented from having something that he needs or wants [[2]]. A person may have been criticized, ignored, abused or emotionally rejected by primary caretakers early in life, resulting in that individual’s stunted growth. Loss of parents or abandonment by them leads to intense emotional deprivation in children. This emotional deprivation leads to an overall lag in physical development.

“An orphanage”. Johnson[[3]] wrote, “is a terrible place to raise an infant or young kid”. He attributes lack of stimulation, the absence of a consistent caregiver, inadequate nutrition and physical and sexual abuse as conspirators to delay and sometimes cause failure of the normal development. For institutionalized children, the variable of institutionalization refers to a complete mix of social, perceptual, physical, intellectual and emotional deprivation [[4]]. The parent substitutes can never provide a healthy environment as the parents could, and the individuals providing group care in institutions can never make up the physiological deficit suffered by parental loss.

India has 391,399,591 children in the age range of 0-19 years [[5]], accounting for second largest child population in the world. No data is available on the number of institutionalized children in the Census of India [[5]]. But unofficial reports say that there are 32 million destitutes in our country. UNICEF provides information that in India, the children (0-17 years), orphaned due to all causes by the end of 2005 are estimated to be 25,700,000 [[6]]. India is considered to have the largest population of orphans in the world and in most need of help. It is logical to know what sort of things happen to the child when either a good setting is broken up or when a good setting has never existed, and this involves a study of the whole subject of emotional development of the individual.

Numerous studies have reported that an institutional upbringing is associated with elevated rates of emotional and behavioral disturbances in childhood [[7, 8, 9, 10, 11, 12]]. Emotional deprivation affects physical growth to a large scale [[13, 14, 15, 16, 17, 18, 19, 20, 21]].

A somatotype is convenient short hand descriptor of overall physique in term of body shape and composition independent of body size [[22]]. It combines an appraisal of relative adiposity, musculo- skeletal robustness and linearity into a three number rating. Limited data is, however on the age – differences in somatotype of males and females.
drawn from the same population\cite{[23]}. Few workers \cite{[24, 25, 26]} have focused on the age trends in somatotype of Indian populations. The present study was carried to evaluate the effect of emotional deprivation on age variations in somatotype.

**MATERIAL AND METHODS**

A total of 1074 subjects (504 emotionally deprived and 570 from control group) ranging in age from 11 to 17 years were studied. Efforts were made to study approximately equal no. of subjects for the two sexes in the 7 age groups. The data were collected from the orphanages and similar economic level educational institutions belonging to the areas of Punjab, Haryana and Chandigarh. Body measurements were taken according to Lohman et al. \cite{[27]} and further somatotype components were evaluated using equations given by Carter \cite{[28]}. Heath-Carter \cite{[29]} designed the somatochart. It is a somatotype triangle which has all the three sides of equal length and is arc-shaped. The corners of the triangle represent the extremes in each component i.e. left corner at the base represents endomorphy, right corner represents ectomorphy and the top one represents mesomorphy. The individual and mean somatotypes were plotted for all the studied subjects.

The ratings of three components are then resolved into the values of X and Y using the equation:

\[
X = \text{Ectomorphy} - \text{Endomorphy}
\]

\[
Y = 2 \times \text{Mesomorphy} - (\text{Endomorphy} + \text{Ectomorphy})
\]

The points corresponding to the values of X and Y are plotted on the somatochart, henceforth, get the somatoplot.

**RESULTS**

Variations of the somatotype with age

The emotionally deprived males were balanced mesomorphs at 11 years (Fig.1). Then moved towards the central sector indicating that all components are either equal or differ from each other by no more than 1 unit. They showed a tendency of being mesomorphic-ectomorphs at 13 years and then progressing towards balanced ectomorphy till the age of 17 years. Hence the overall trend was that the institutionalized male adolescents were initially a little mesomorphic and with advancing years, they became balanced ectomorphs.
At the age of 11 and 12 years, the control males were mesomorphic ectomorphs (Figure 1). They exhibited balanced ectomorphy till the age of 17 years. Hence, with the increase in age, the somatotype of male adolescents changed from mesomorphic ectomorphy to balanced ectomorphy.

The emotionally deprived females were mesomorphic ectomorphs at the age of 11 years (Figure 2). They occupied the central sector at 12 years i.e. all components were either equal or differed by not more than 1 unit. Balanced ectomorphy was exhibited at 13 and 14 years. At 15 years, they showed endomorphic ectomorphy and became ectomorphic endomorphs at 16 years of age. Then again exhibited endomorphic ectomorphy at 17 years. These females followed a trend from mesomorphic ectomorphy to balanced ectomorphy and then endomorphic ectomorphy.

The control group females occupied the central sector at 11 and 12 years, denoting almost all equal components (Figure 2). At the age of 13 and 14 years, they were endomorphic ectomorphs. They became ectomorphic endomorphs in the age groups of 15 and 16 years and finally balanced endomorphs at 17 years.

**COMPARISON OF SOMATOTYPES OF EMOTIONALLY DEPRIVED AND CONTROLS**

The comparison of the group physiques on the basis of individual somatoplots were made between the emotionally deprived and control adolescents at the particular age levels. At 11 years, nearly all the emotionally deprived males were endomorphic mesomorphs, while the controls were evenly distributed in the endomorphic mesomorph and mesomorphic ectomorph sectors (Figure 3). At 12 years of age, an even distribution of institutionalized males was there in the endomorphic mesomorph and mesomorphic ectomorph sectors. The control males exhibited greater frequency toward mesomorphic ectomorph and endomorphic ectomorph sectors (Figure 4). The institutionalized males showed more individual towards the mesomorphic ectomorph sectors at the age of 13 years (Figure 5). Whereas in the controls, more number of subjects were in the endomorphic ectomorph sector. At the age level of 14 years, the male adolescents residing in orphanages occupied the mesomorphic ectomorph sector and the controls the endomorphic mesomorph sector (Figure 6). The trend at 15 years was similar to that at 14 years (Figure 7). The 16 years age group exhibited greater frequency of emotionally deprived males and controls in the equal component ratio sector and endomorphic ectomorph sector respectively (Figure 8). The trends shifted by the age of 17 years (Figure 9). Greater number of institutionalized males occupied the endomorphic ectomorph sector. The controls were evenly distributed in the mesomorphic ectomorph and endomorphic ectomorph sectors.

The institutionalized females as well as the controls showed an even distribution of somatoplots in the endomorphic mesomorph, endomorphic ectomorph and mesomorphic ectomorph sectors at 11 years (Figure 10). The age group of 12 years shows greater frequency of emotionally deprived females in the endomorphic mesomorph and endomorphic ectomorph sectors (Figure 11). While the controls showed an equal distribution in all sectors. At the age level of 13 years, more number of females residing in orphanages were in the mesomorphic ectomorph sector (Figure 12). Their control counterparts exhibited more frequency in the endomorphic.
ectomorph sector at the same age level. The institutionalized and control females showed more tendency towards the mesomorphic ectomorph and endomorphic ectomorph sectors, respectively at the age of 14 years (Figure 13). The emotionally deprived females exhibited more number of individuals in the two sectors of mesomorphic ectomorph and endomorphic ectomorph at 15 years (Figure 14). While the controls of the same age group showed more tendency towards endomorphy. The institutionalized and control adolescent females are more concentrated in the ectomorphic endomorph sector at the level of 16 years (Figure 15). The age group of 17 years exhibits greater frequency of emotionally deprived subjects in the endomorphic ectomorph sector and the controls in the mesomorphic endomorph and ectomorphic endomorph sectors (Figure 16).

**Figure 3**
Figure 3: Comparison of somatotypes of emotionally deprived and control males at 11 years

**Figure 4**
Figure 4: Comparison of somatotypes of emotionally deprived and control males at 12 years

**Figure 5**
Figure 5: Comparison of somatotypes of emotionally deprived and control males at 13 years
Figure 6
Figure 6: Comparison of somatotypes of emotionally deprived and control males at 14 years

Figure 7
Figure 7: Comparison of somatotypes of emotionally deprived and control males at 15 years

Figure 8
Figure 8: Comparison of somatotypes of emotionally deprived and control males at 17 years

Figure 9
Figure 9: Comparison of somatotypes of emotionally deprived and control females at 11 years
Figure 10
Figure 11 : Comparison of somatotypes of emotionally deprived and control females at 12 years

Figure 12
Figure 13: Comparison of somatotypes of emotionally deprived and control females at 14 years

Figure 11
Figure 12: Comparison of somatotypes of emotionally deprived and control females at 13 years

Figure 13
Figure 14: Comparison of somatotypes of emotionally deprived and control females at 15 years
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**DISCUSSION**

The institutionalized males followed a trend from being balanced mesomorphs to being balanced ectomorphs during the adolescent years. While the control group ones were mesomorphic ectomorphs during the initial years and became balanced ectomorphs during the later years. The emotionally deprived females followed a trend of being mesomorphic ectomorphs, then balanced ectomorphs and finally endomorphic ectomorphs with the advancing years. On the other hand, the control females initially exhibited equal component ratio, then endomorphic ectomorph, and finally balanced endomorphy.

The age-wise variations of the somatotype of the individuals of the present study have been compared with the findings reported earlier. Singh and Sidhu [[24]] studied 4 to 20 years old Gaddi Rajput boys of Himachal Pradesh, and reported that mean somatotypes were meso-ectomorphic from 10 to 20 years. While Eiben [[30]] concluded that the mean somatotype of the Hungarian boys, aged 6 to 18 years, changed from ectomorphic mesomorph to mesomorphic ectomorph. While girls exhibited a trend of ectomorphic mesomorph to equal component distribution followed by mesomorphic endomorph. Talwar et al.[[31]] reported that the somatoplots shifted from mesomorphic ectomorph sector to balanced ectomorph and then to endomorphic ectomorph sectors of the somatocharts in the upper socio-economic girls. Whereas the lower socio-economic girls exhibited fluctuations between mesomorphic ectomorph and balanced mesomorph. Tamazo-Ravnik [[32]] found a shift from ectomorphic mesomorph to balanced mesomorph, followed by endomorphic mesomorph in the Slovenian boys. While the Slovenian girls exhibited mesomorphic endomorphy with the largest number of girls being in this sector.

It can be elucidated that both emotionally deprived as well as control male adolescents exhibited tendency towards mesomorphy during the initial years and finally became balanced ectomorphs. While there was a shift from mesomorphic ectomorph to endomorphic ectomorph during the adolescent years in institutionalized females. The control females showed a shift from an equal component ratio to balanced endomorphy. The tendency towards mesomorphy in male adolescents residing in orphanages could well be explained that they have greater muscle mass than the controls, exhibiting greater muscular development. The emotionally deprived females exhibited ectomorphy initially with a tendency towards mesomorphy and finally a tendency towards endomorphy. Whereas the control group females shifted from equal component distribution to balanced endomorphy. It could be pointed out that emotionally deprived females were lighter, had lesser fat mass and endomorphy rating than the controls at all ages. Thereby, accounting for tendency towards ectomorphic sector with the advancing years.

The present study elaborates that the somatotypes of individual children are subject to significant changes during childhood and adolescence. The present findings receive support from the earlier studies which indicate instability of somatotypes during adolescence [[33, 34, 35, 36, 37, 24, 38,
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