EFFECT OF SOCIO ECONOMIC STATUS (SES) ON FOOT LENGTH, PALM LENGTH, AND MID-FINGER LENGTH OF SCHOOL GOING CHILDREN (8-10 YEARS OLD) IN MUMBAI.

ABSTRACT:

Aims: To Study the effect of Socioeconomic status (SES) of foot length, palm length and mid finger length on School going Children (Age:-8-10 years) in Mumbai city.

Study Design: A survey research design was adopted for measurement and data collection. Foot length was analysed by Standardized measuring tape, Palm length and mid-finger length was analyzed by Calliper, Height (cm) was analysed by stadiometer. The unit of measurement used was centimetre (cm). SES was coded according to Kuppuswamy scale [1].

Place and Duration of Study: The time span required to carry out study was from November to March 2018-2019 in Mumbai city.

Methodology: Total 319 subjects (male & female) participated ranging from public to private schools in Mumbai city, (Maharashtra, India). Kuppuswamy scale (2018) was used to analyse the SES of the subjects. SPSS software version 20 was used for data analysis.

Results: A positive striking correlation was observed between height and different socio economic status at $p < 0.05$ (.001). Maximum height was found among upper class (129.58±6.88), further the lowest mean value of height (124.00 ± 6.34) was noted among the upper lower class. However, foot length and mid-finger length showed highly significant difference statistically at $p < 0.05$ (.000). Although the maximum foot length was found among upper lower class (3.0287± 0.33), further the lowest mean value of foot length (1.0599 ± 0.40), was noted among the lower class and also, higher treatment value (6.195± 0.60) for mid-finger length was found amongst the upper middle class and lower treatment value amongst lower class (5.700 ± 0.34). Moreover, a significant correlation was observed between palm length and Socio-economic status at $p < 0.05$ (.019). Also, the highest statistical association of the palm length to the Socio-economic status of the samples (9.412±3.72) was observed among Upper lower class subjects, Whereas lowest level of palm length was depicted in lower class (7.757 ± 0.82) category.

Keywords: SES, Palm length, Foot length, Mid-finger length, Kuppuswamy scale, Stadiometer.

1. INTRODUCTION

Growth – the vital process is measured by measuring the height of a person, which itself is a sum of the length of certain bones and appendages of the body represent certain relationship with form of proportions to the total stature ([14]; [15]; [16]). There is always particular interest amongst anthropologists to assess the height of an individual from measurement of different parts of the body and bones.

As areas of the developing world continue to go through the transition to modernize economies, they commonly experience a growing divide within their societies. This divide is often measured by the inequality in income, material wealth, and health ([2]; [3]).

Childhood wasting is a global problem and is significantly more pronounced in low and middle income class people among the countries. Socio Economic Status (SES) may be significantly associated with wasting (Mohammad et al 2017) ([11]; [13]; [36]). It has been linked as both a mediator and fundamental cause of variation in human health outcomes in a variety of settings ([4]; [5]; [6]). The three indices of malnutrition weight-for-height (WHZ), height-for-age (HAZ) and weight-for-age (WAZ), depend on birth order, preceding birth interval, parent's educational status, working status of the mother, mother's age at delivery of the children, source of drinking water, toilet facilities and standard of living of the household ([32]; [33]; [40]). Maternal height is independently associated with infant length-for-age z scores and stunting [8]. Short stature in adulthood seemed to be a reflection of a number of adverse conditions in childhood, and socio economic status related ([20]; [30]). In the study conducted by Paeratakul et al. when it was compared between men and women of higher income it was found that women were more overweight individuals with higher body mass index, higher income, and higher education ([23]; [27]; [31]). The associations of obesity with gender, age, ethnicity, and socioeconomic status is complex and dynamic ([43]; [44]).

Malnutrition, especially under-nutrition, is a major health problem affecting the development of children in many low- and middle-income countries [7]. In study conducted short children had unimpaired self-esteem and normal patterns of behaviour, but a tendency towards hyper activity and poor concentration, also attainment especially in reading, was low. The under achievement observed in the short children was largely due to the low socio-economic status of that group ([21]; [35]; [42]). In one of the study conducted it was observed that increase of 1.09 cm per decade in the mean height of men but only 0.36 cm per decade in the mean height of women among different social class [19]. Menarche in the lower class was related to lower rates of growth in stature and weight, and of skeletal and sexual maturation ([24]; [34]). Infection like HIV may also be reason for the malnourished condition [17].

In 1992 Salive et al. determined the relationship of haemoglobin levels and anemia with age and health status in older adults. Hematologic tests were obtained from 3,946 adults aged more than 71 years in three communities (East Boston, MA; Iowa and Washington counties, IA; and New Haven, CT). The results showed that Hemoglobin level was inversely associated with age, although this was more pronounced in men than in women. The proportion of anaemic was equal for men and women aged 71-74 years (8.6%) and proportion was found to be increased differentially with age, reaching 41% and 21% for men and women aged more than 90 years, respectively. Hemoglobin and anaemia were independently associated with age, race, body-mass index, smoking, cancer, hospitalization, renal insufficiency, and hypoalbuminemia. Further author concluded that age was significantly associated with both hemoglobin levels and anemia, with a stronger effect in men as compared to women, even after simultaneously adjusting for demographic characteristics and health status. The decline of hemoglobin and concomitant increase anemia with age was not necessarily a result of "normal aging" so the detection of anemia in an older person might promptly appropriate clinical attention. Nutritional status plays a key role in determining the health of

individual. The children in rural areas had a poorer nutritional status than the children in urban areas had. The causes of malnutrition are many and complex, and they are determined by different factors at various levels of the society ([37]; [45]). Sanli et al, 2005 carried out study to estimate the relationship between hand length, foot length and stature using multiple linear regression analyses based on a sample of male and female adult Turks residing in Adana. Measurements of hand length, foot length and stature were taken from 155 adult Turks (80 male, 75 female) aged 17–23 years. The participants were students of the Medical Faculty of Cukurova University. A multiple linear regression model was fitted to the observed data. Stature was taken as the response or dependent variable, hand length and foot length were taken as explanatory variables or regressors. All possible (simple and multiple) linear regression models for each of males, females and both genders together were tested for the best model. The multiple linear regression model for both genders together was found to be the best model with the highest values for the coefficients of determination R2 ¼ 0.861 and R2 adjusted ¼ 0.859, and multiple correlation coefficient R ¼ 0.928 [38]. Also a significant correlation was found between the stature (height) of an individual and hand length, hand breadth and foot length ([9]; [18]; [25]; [26]; [28]; [29]; [39]). Also significant correlation was found between socioeconomic status and height of individual [41].

In 2000, Hallund et al. conducted study, purpose of study was to analyse the associations between the food variety score (FVS), dietary diversity score (DDS) and nutritional status of children, and to assess the associations between FVS, DDS and socioeconomic status (SES) on a household level. The study also assessed urban and rural differences in FVS and DDS. Three hundred and twenty-nine urban and 488 rural households with 526 urban and 1789 rural children aged 6-59 months in Koutiala County, Sikasso Region, Mali participated. It included a simplified food frequency questionnaire on food items used in the household the previous day. A socioeconomic score was generated, based on possessions in the households. Weight and height were measured for all children aged 6-59 months in the households, and anthropometric indices were generated. Children from urban households with a low FVS or DDS had a doubled risk for being stunted and underweight. Those relations were not found in the rural area. There was an association between SES and both FVS and DDS on the household level in both areas. The FVS and DDS in urban households with the lowest SES were higher than the FVS and DDS among the rural households with the highest SES. It was concluded that food variety and dietary diversity was found to be associated with nutritional status (weight/age and height/age) of children in heterogeneous communities. In rural areas, however, this association could not be shown. Socioeconomic factors seemed to be important determinants for FVS and DDS both in urban and rural areas. Final Body height was achieved as a result of the combination of genetic and environmental factors. Children living in poverty environments face barriers to optimal growth and development. Socioeconomic circumstances that often correlated with poverty resulted in children at risk along were number of pathways. For example, low income may limit access to quality housing, diet, and healthcare, increasing risk of poor health and nutrition, which in turn affect growth and development. Employment status and other socioeconomic measures which were often glossed as socioeconomic status (SES), e.g., educational attainment and occupation, might further impose economic and social hardship and also increase risk for children ([10]; [12]).

In 1935, McCAY et al, had conducted experiment on rats by retarding their growth and not allowing to attain maturity until after periods of 766 and 911

days. The rat body seemed to have the power to grow at these extreme ages. After such periods of retardation the rats were unable to attain a body size equal to that of an animal that grows to maturity at its younger age. Although the males of the retarded groups grow no larger than the normal females of this species [22].

The foot length, palm length and mid finger length are major indicators for measuring height and even actually growth of an individual.
SES of an individual subjects were assessed by questionnaire, although data was individually extracted by the researcher so, chances of wrong data are less. The five classes of SES mentioned in study were upper class, upper middle class, lower middle class, upper lower class, lower class. Ethical committee approved this study and also consent of individual subject was taken in consideration.

2. METHODOLOGY

Mumbai city was selected due to its diverse economic and cultural background, it provided ideal setting to study Total 319 subjects (male & female) participated from 5 different schools ranging from public to private category from different socio economic class in Mumbai city, (Maharashtra, India). Children from selected schools, falling under the age 8-10 years (male & female) from grade 3 were selected by purposive sampling.

Anthropometric measurements of the children were taken with the help of standard stadiometer which helped to measure the height of the children, calibrated measuring tape to measure the foot length of the children, standardized caliper was used to measure the length of mid-finger of the subject and Socio economic status was recorded from the parents/guardian of the students by means of questionnaire. Kuppuswamy scale was used for scoring socio economic status. Criteria for the scoring the question mentioned in questionnaire were Parents/Guardians Education, Profession and Family Income. The information was précised, as the social background data was also discussed with the respective parent teacher of the school.

Stadiometer is the standardized rod used for measuring height of the subject. Stadiometer are used in routine medical examination and also for the clinical tests and experiments. Children were guided accordingly to avoid possible error. Palm length and finger length was measured by Vernier Caliper, student were instructed to hold hand straight in comfortable position then, for palm length jaw of caliper was tighten on lower point of middle finger of hand and starting point of wrist and measurements were noted. Similarly, for mid-finger length measurements were calculated through adjusting jaw between lower and higher point of middle finger. However, Foot length was measured manually for each child. The children were guided to stand on a blank sheet of paper and measurements were noted down by marking highest and the lowest point near toe and the fingers of the foot respectively. Then both points were joined using ruler, and measured using standardized tape. An inclusion criterion for study was the subjects between age group of 8-10 years and also both the genders have participated in study. The data collected was statically analysed by the software Spss version 20. Exclusion criteria for study was subjects less than 8 years and more than 10 years, also subjects with some kind of physical disability. Out of 392 individuals 319 agreed with questionnaire and shared the data so other subjects were excluded from the study.

3. RESULTS AND DISCUSSION

As demonstrated in table 3.1 and fig:-3.1, the samples were analysed with socio economic status, it was observed that the highest number of subjects were found in lower middle class. Whereas the maximum height was found among upper class (129.58±6.88) cm, followed by upper lower class (126.56 ± 8.69) cm and lower middle class (126.35 ± 3.69) cm respectively. Further the lowest mean value of height (124.00 ± 6.34) cm was noted among the upper lower class. Overall it showed positive striking correlation amongst, different socio economic status in correlation to height at p <0.05 (.001). Thus, socio economic status, in long run might affect the height of an individual. Socio economic status may have net effect on the height of an individual.

Table 3.1 Height (cm) BY SES Code Score

Socio Economic Status	Number of subjects	X ± σ (cm) Height	Significance P ≤ 0.05
Upper Class = 1	31	129.58 ± 6.88	.001
Upper Middle Class= 2	83	128.24 ± 6.48	
Lower Middle Class= 3	113	126.56 ± 8.69	
Upper Lower class = 4	84	124.00 ± 6.34	
Lower Class = 5	8	126.35 ± 3.69	
Total	319	126.61 ± 7.48	

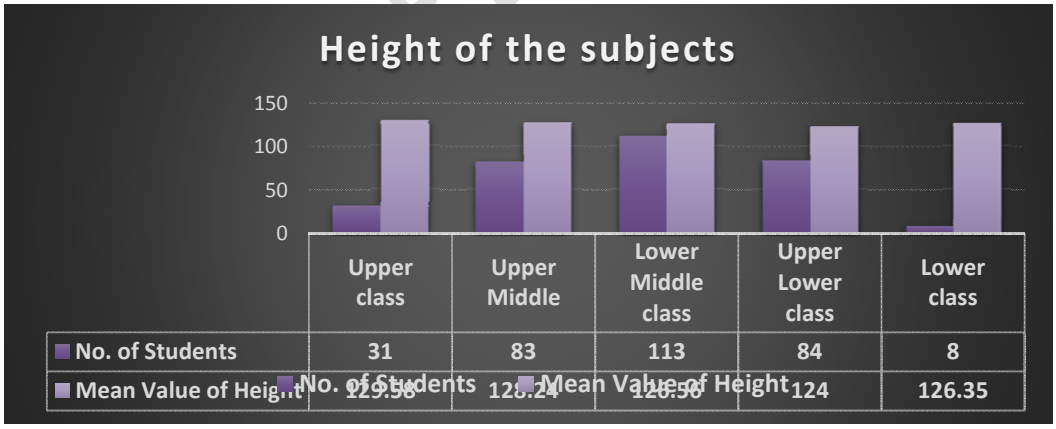

Figure 3.1:- Comparison of Height of Subject with SES.

As illustrated in table 3.2 & fig: 3.2, when foot length was compared with the Socio-economic status, it was observed that maximum subjects were found in lower middle class. Although the maximum foot length was found among upper lower class (3.0287± 0.33), followed by lower middle class (2.6602 ± 0.25), upper middle class (1.8426 ± 0.20) and upper class (1.3504 ± 0.24) respectively. Further the lowest mean value of foot length (1.0599 ± 0.40), was noted among the lower class. Alternatively when measurements of foot length was considered, it was observed that

upper middle class and upper lower class had similar number of subjects however it was noted that upper lower class had higher mean value for foot length compared to upper middle class subjects. Further, a highly significant difference was observed statistically between foot length and socio economic status at p <0.05 (.000). Further it was interpreted that in long run socio economic condition of an individual may affect the foot length and even actually the overall stature of an individual.

Table 3.2 - Foot Length (cm) BY SES Code Score

Socio Economic Status	Number of subjects	X ± σ (cm) Foot length	Significance P ≤ 0.05
Upper Class = 1	31	1.3504 ± .24	
Upper Middle Class= 2	83	1.8426 ± .20	
Lower Middle Class= 3	113	2.6602 ± .25	.000
Upper Lower class = 4	83	3.0287 ± .33	
Lower Class = 5	9	1.0599 ± .40	
Total	319	2.5302 ± .14	

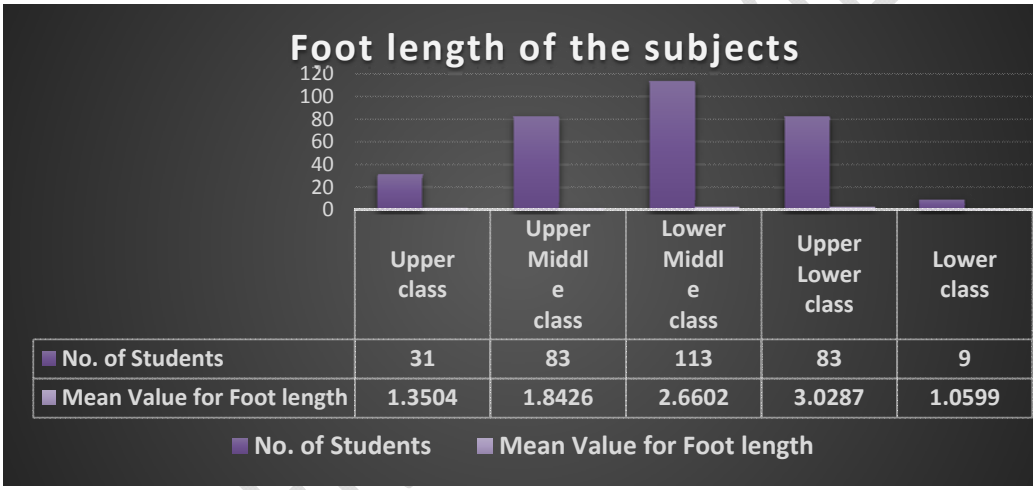

Figure 3.2:- Comparison of Foot length of Subject with SES.

As indicated in table 3.3 and fig 3.3, utmost result for number of subjects was observed in upper lower class, when palm length and socio economic status was compared. Also, the highest level of the palm length to the Socio-economic status of the samples (9.412±3.72) was observed among Upper lower class subjects. Whereas lowest level of palm length was depicted in lower class (7.757 ± 0.82) category. Therefore, a significant correlation was observed between palm length and Socio-economic status at p <0.05 (.019). Further it was interpreted that in long run socio economic condition of an individual may affect the palm length and even actually the overall stature of an individual.

Table 3.3 - Palm Length (cm) BY SES Code Score

Socio Economic Status	Number of subjects	X ± σ (cm)	Significance P ≤ 0.05

		Palm length	
Upper Class = 1	31	8.206 ± .44	
Upper Middle Class= 2	83	8.307 ± 1.34	
Lower Middle Class= 3	113	8.660 ± 2.12	.019
Upper Lower class = 4	83	9.412 ± 3.72	
Lower Class = 5	9	7.757 ± .82	
Total	319	8.701 ± 2.43	

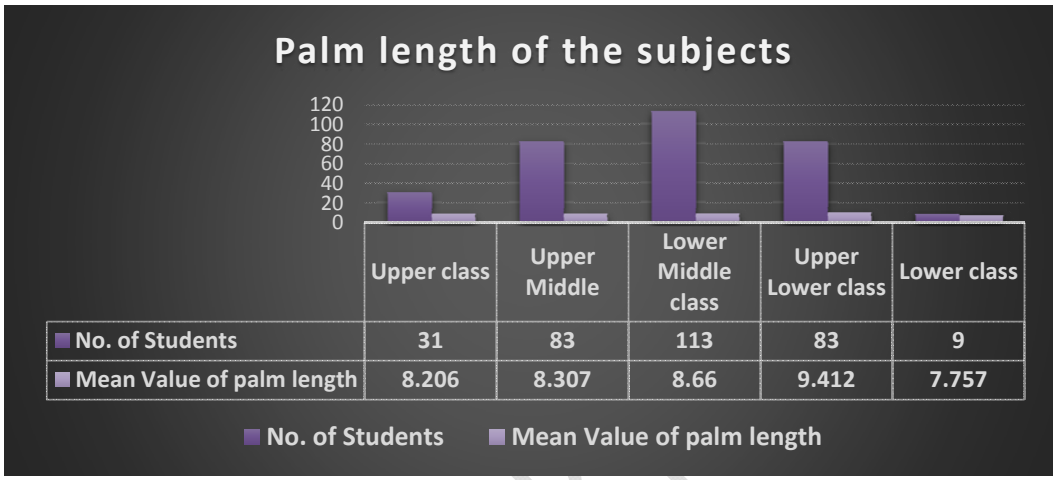

Figure 3.3:- Comparison of Left Palm length of Subject with SES.

As indicated in table 3.4 & fig 3.4, impact of SES on mid-finger length was observed to be maximum in lower middle class subjects. Although, higher treatment value (6.195± 0.60) of mid-finger length was found amongst the upper middle class. Alternatively, SES showed linear trend in mid-finger length of upper class (6.065 ± 0.47) and upper middle class (6.195± 0.60) and also lower class (5.700 ± 0.34) and upper lower class (5.873 ±0.39). Hence a significant difference was noted between mid-length and SES at p <0.05 (.000).

Table 3.4 – Mid-finger length (cm) BY SES Code Score

Socio Economic Status	Number of students	X ± σ (cm) Mid-finger length	Significance P ≤ 0.05
Upper Class = 1	31	6.065 ± .47	
Upper Middle Class= 2	83	6.195 ± .60	
Lower Middle Class= 3	113	5.975 ± .47	.000
Upper Lower class = 4	83	5.873 ± .39	
Lower Class = 5	9	5.700 ± .34	
Total	319	6.009 ± .50	

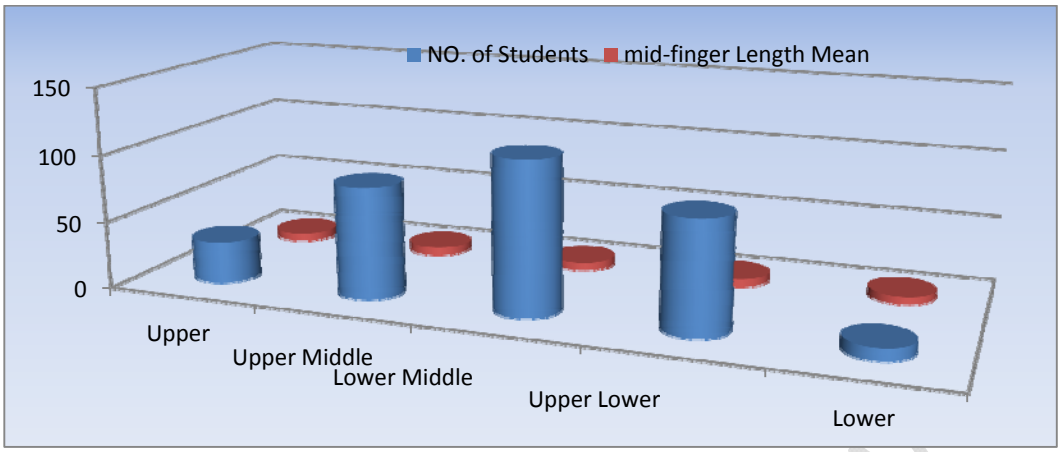

Figure 3.4. Comparison of mid-finger length of Subject with SES.

4. CONCLUSION

When measurements were compared with SES of the subjects, it was found that height, and palm length, showed statistically significant co-relation. Also, mid-finger length and foot length showed highly significant difference statistically when compared with SES. However, a positive correlation was observed among, different socio economic status in correlation to height at $p < 0.05$ (.001). Further highly significant correlation was observed between foot length and socio economic status at $p < 0.05$ (.000) and also, between mid-finger length and SES. Moreover, a significant correlation was observed between palm length and Socio-economic status at $p < 0.05$ (0.019). Thus, it was concluded that, SES had significant impact on the parameters of stature (Height) of an individual.

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