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Relationship between Blood Pressure and Nutrition in Adolescents

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Abstract

Aims and Objectives of study: This study was confined to healthy groups. Care was taken to exclude persons suffering from obvious disease and/ or recent history of illness Aims and Objective of present study are:-

- To find out BMI males and females
- To find out systolic and diastolic blood pressure in males and females.

The various parameters which are studies are as follows:-

1. Standing height in cms
2. Weight in kgs.
3. Resting pulse rate
4. Resting systolic blood pressure in mm of Hg.
5. Resting diastolic blood pressure in mm of Hg.
6. Body Mass Index.

Background - The study was conducted in GSMC medical college and Tertiary care Hospital. Total 100students were selected for study, out of 50 were male students and 50 were female students.

Keywords *- Standing Height, Body Mass Index, Body weight, Body weight, Resting pulse rate, Resting systolic and diastolic blood pressure*

Introduction

Studies[1,2] have shown that many of the developing countries including India are struggling against the dual burden of both under nutrition as well as overnutrion. Adolescence begins with pubescence the earliest signs of development of secondary sexual characteristics and continues until morphological and physiological changes approximate adult status usually near the end of second decade of life which considers individuals of about 10-24 years of age. Many of the responses to the transition to adulthood may include behavior that direct implications for health; eg. Dieting, smoking, alcohol consumption, sexual activity, substance abuse, violence.[3]

The emergence of obesity and its related health problems have grown new interest in adult anthropometry. The WHO expert committee recommends that useful data can be derived from measures of height and weight about nutritional and growth status of adolescents.[3] Obesity and overweight due to overnutrion during adolescence are related to obesity related diseases later in life.[3] According to World Health Report in 2002, cardiovascular diseases could be a major cause of death and other major health risks by 2020,in India, hypertension being one of them.

There is evidence that suggests hypertension begins in childhood or adolescence. Several studies in India have reported prevalence of hypertension ranging from 0.46% to 11.7% in children and adolescents.[4,5] Anthropometry is especially important during adolescence because it allows the monitoring and evaluation of the hormone - mediated changes in growth and malnutrition during this period. Moreover, because growth may be indicators of nutritional status and health risk and may be diagnostic of obesity and underweight.[2]

Increased body weight is associated with elevated blood pressure and weight loss in hypertensive individuals is generally accompanied by reduction in blood pressure. With the help of height and weight, Body mass index (BMI) can be calculated which gives an accurate estimation of body size and body compassion and helps in diagnosing presence / absence of obesity/ under nutrition.

Considering malnutrition (which includes both underweight and obesity) in adolescence to be a major problem which

could also lead to cardiovascular diseases, an attempt has been made to correlate anthropometric measurements and hypertension in adolescents.

Limitations of the Study:-
Nutritional status of an individual is assessed from information of 4 types[3]:

1. Diet history
2. Anthropometry
3. Clinical examination
4. Biochemical examination

Here due to time constraint, only anthropometry has used as a tool to assess the nutritional status.

Materials and Methods

Sample size:
A cross sectional study was carried out on 100 1st M.B.B.S. students of GSMC (50 males and 50 females) not suffering from any major illness.

Materials:

Weighing scale for weight measurement
A scale to measure height (stadiometer)
Mercury sphygmomanometer to determine blood pressure.

Methods:

1) **Standing Height:** Body height is measures on a stadiometer. Subject stands erect without shoes and his back close to the calibrated stand. The top piece is pressed firmly on to subjects head. Height recorded in centimeters; correct to ½ cms.

2) **Resting pulse rate:** By palpating the pulse and counting the rate for 1 minute, when the subject is in a relaxed state and lying down position.

3) **Resting systolic and diastolic blood pressure:** Measured with sphygmomanometer by palpatory and auscultatory method when the subject is in a relaxed state and lying down position.

4) **Body weight:** On a weighing machine, subject stands in his normal clothing with shoes off the legs, recorded in kgs; correct to ½ kg.

5) **Body Mass Index:** With the help of height and weight; Body Mass Index (BMI) can be calculated which gives an accurate estimation of body size and body composition and helps in diagnosing presence/ absence of obesity/ under nutrition.

These BMI cut-off values are for adults. Application of adults reference data; to adolescents is inappropriate the distribution of weight for categories of stature are very different for adults than for adolescents, even at the same stature. For example; at a stature of 165-167 cm, median weight of adult men exceeds that of adolescent female by almost 7 kg.[2] Therefore for adolescent different cut-off point for BMI have been established in order to identify the problem of overweight and under nutrition. These cut-off values of BMI for adolescents are as follows:

- >85th percentile BMI for age but <95th percentile BMI for age - person is possibly obese. This value for males corresponds to >26.36 but <30.66 and for females corresponds to >25.85 but <30.72.[8, 9]
- >95th percentile BMI for age: person is obese. This value for males corresponds to >26.36 but >30.66 and for females corresponds to >30.72.[6,7]
- <5th percentile BMI for age: person is under nourished. This value for males corresponds to <17.80 and for females corresponds to <16.87.[8]

Statistical analysis and results
Tables drawn from the available data are descriptive. Qualitative description of sets of clinical values involves measure of central tendency. Common measures of central tendency are mean, median and mode.[27]

Mean: it is arithmetic average of a set of values.

$$X = \frac{Total\ of\ all\ values}{No.of\ population}$$

In the present study, averages are calculated with the help of mean.

The amount of spread or dispersion in a set of a data usually is measured by range of observations of standard deviation which is defined as square root of arithmetic mean of squared deviation of individual values from their arithmetic mean.[9]

Test of Statistical Significance[9]:
Test of statistical significance is needed to evaluate the significance of difference among comparison groups.

Standard error of differences between two means[9].
This test is required to be applied very often in medical practice. Here means of a normally distributed variable in the two like or unlike group are compared such as of height, weight, BP, pulse rate etc.
Taking into consideration, the above mentioned factors, the present study is carried out. Stastical analysis shows the following results.

Table I: profile of physical characters of Males:

Mean age	18 years 6 months
Mean height	168.95 ± 5.335 cm
Mean weight	59.76 ± 9.15 kg

Table I shows the following:

1. Mean height for males is 168.95 which is much below the 50th percentile value of 176.8, as suggested by NCHS.[10]
2. Mean weight for males is 59.76% which is also much below the 50th percentile value of 68.88 kg as suggested by NCHS.[10]

Table II: profile of physical characters of Females:

Mean age	**18 years 6 months**
Mean height	159.3 ± 7.08 cm
Mean weight	52.65± 8.51 kg

Table II shows the following:

1. Mean height for females is 159.3 which is much below the 50th percentile value of 163.7, as suggested by NCHS.[10]
2. Mean weight for females is 52.65% which is also much below the 50th percentile value of 56.62 kg as suggested by NCHS.[10]

Comparison between the physical character of Males and Females shown the following (Refer Table I and Table II):

1. Mean height for males is more than for females.
2. Mean weight for males is more than for females.

Table III: profile of physiological characteristics of Males:

Mean Pulse Rate	78.7 ± 7.27 beast/ min
Mean Systolic blood pressure	123 ± 10.27 mm of Hg
Mean Diastolic blood pressure	76.8 ± 6.27 mm of Hg

Table III shows the average pulse, systolic and diastolic blood pressure of males.

Table IV: profile of physiological characteristics of Females:

Mean Pulse Rate	80.2 ± 6.82 beast/ min
Mean Systolic blood pressure	115.4 ± 9.766 mm of Hg
Mean Diastolic blood pressure	75.96 ± 6.92 mm of Hg

Table IV shows the average pulse, systolic and diastolic blood pressure of females.

Table IX: Profile of BMI of females according to cut-off values for adolescents, as suggested by WHO.[11,12]

Well nourished	72%
Over nourished	8%
Under nourished	20%

Table IX shows 72% of females to be well nourished, 8% to be over nourished and 20% to be undernourished.

Table X: Profile of BMI for females, according to adult BMI values.

Well nourished	60%	
Grade I Obese	10%	12% Over nourished
Grade II Obese	2%	
Grade I CED	10%	
Grade II CED	14%	28% Under nourished
Grade III CED	4%	

Table X shows 60% of females to be Well nourished 12% to be Over nourished and 28% to be Under nourished. Comparison of BMI between adolescent and adult cut-off values (Refer Table IX and X) shows that adult BMI value give high estimate of prevalence of malnutrition.

Table XI: Profile of BMI for males, according to cut-off values for adolescents as suggested by WHO.[11,12]

Well nourished	78%
Over nourished	6%
Under nourished	16%

Table XI shows 78% of females to be well nourished, 6% to be over nourished and 16% to be undernourished.

Table XII: Profile of BMI for females, according to adult BMI values.

Well nourished	76%	
Grade I Obese	8%	8% Over nourished
Grade II Obese	0%	
Grade I CED	10%	
Grade II CED	2%	16% Under nourished
Grade III CED	4%	

Table XII shows 76% of males to be Well nourished 8% to be Over nourished and 16% to be Under nourished. Comparison of BMI between adolescent and adult cut-off values (Refer Table XI and XII) shows that adult BMI value give higher estimate of prevalence of malnutrition.

Discussion

1) **The mean height and weight of males and females is below the 50th percentile value as cited by NCHS. (Refer to Table I and II).**

The findings in present study correlated well with the findings of ***Joshi S.B., Kanade A.N.***[13] It is probable that lower nutritional intakes during adolescents and also widespread childhood malnutrition lead to mean height and weight below the 50th percentile value of NCHS but also certain aspects of adolescents behavior like the extremes of nutritional intakes in from of

dieting can lead to mean height and weight below the standard value.

2) **The mean height and weight of males is more as compared to that of females. (Refer to Table I and II)**

The findings in the present study correlates well with the findings of ***James WPT and Francois PJ*** [14] in addition to be above cited reason probably the other reason for females to be shorter and lighter than males are as follows:-

- *Inequal distribution of food:* Male being the earning member gets the major share of food and females they pay less attention towards their nutritional intakes.
- *Certain belief and customs:* like religious fasting etc can also lead to underweight and growth retardation in females.

3) **Prevalence of under nutrition is 20% in females and 16% in males:**
Prevalence of over nutrition is 8% in females and 6% in males:

(Refer to Table IX and XI)
Various studies have been done on BMI as an Index of undernourishment or over nourishment. Some of the studies with their results are as follows:

- ***Awasthi P.***[15] on their study of Nutritional status assessment using Anthropometric measurement in Adolescents Girls of College of Home Science in Pantnagar, showed that only 4.3% of subjects were severe CED i.e. grade III CED. None of the subjects was found to be obese.

- ***Naidu AM and Rao PM***[16] in their study of BMI as measure of Nutritional Status of Indian Population, showed that nearly one-half of Indian population is suffering from grade of chronic energy deficiency.

  In the present study re have found out that obesity is present is 6% of males and 8% of females whereas undernourishment is found in 16% of males and 20% of females. Thus the major concern is still undernutrition and not overnutrition. Major concern now days is gives on obesity and its related morbidity but little attention is paid towards under nourishment which is still most prevalent even in urban population like the one studies here.

4) **Cut-off value for BMI according to adult value gives a high estimate of prevalence of malnutrition (Refer to Table IX, X, XI and XII)**

BMI cut-off values for adults are as follows:

<16.0	Grade III CED
16.0 – 16.9	Grade II CED
17.0 – 18.4	Grade I CED
18.5 – 24.9	Well nourished
25 +- 29.9	Grade I Obese
>30	Grade II Obese

BMI cut-off value for adolescents, according to WHO are:-

- >85th percentile BMI for age but <95th percentile BMI for age – person is possibly obese. This value for males corresponds to >26.36 but <30.66 and for females corresponds to <30.72.[8,9]

- >95th percentile BMI for age: person is obese. This value for females according to >30.66 and for females corresponds to >30.72.[6,7]

- >5th percentile BMI for age: person is under nourished. This value for females according to >17.80 and for females corresponds to <16.87.[7]

Thus it is seen that adult BMI values give a high estimate of prevalence of malnutrition. Therefore the cut-off value as suggested by WHO for adolescents should be followed because application of adult reference data to adolescents gives distribution of weight for categories of stature to be different for adults than for adolescents even at the same stature. For eg. At a stature of 165-167 cm median weight of adult men exceeds that of adolescent males by 15kg and median weight of adult women exceeds that of adolescent female by almost 7kg.

As per the blood pressure classification hypertension was observed in 27 of boys and 32 of girls. Out of these 17 of boys were obese and 23 girls were obese according to the BMI cutoffs for adolescents. Also hypotension was observed in 17 of boys and 23 of girls. Out of these 9 of boys were underweight and 12 girls were underweight according to the BMI cutoffs for adolescents. These results are in accord to plenty of other studies conducted in adolescents.[17]

Also a relationship was found to exist between nutritional status and blood pressure of both adolescent males and females. Higher the BMI higher was the blood pressure and pulse rate as compared to their non obese counterparts.

Conclusion

From the present study it is seen that higher the BMI higher is the risk of hypertension hence reveals the need for strategies to identify and prevent hypertension and its risk factors (in particular being obese and overweight). Also

information should be distributed to promote better health and diet behavior in adolescents.

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