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Full length research paper

Comparison between mid-arm circumference and height of school children 3-5 years in Jos University Primary School

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The use of anthropometric data for assessing nutritional status has been internationally accepted as a standard practice. Mid arm circumference and height are examples of such parameters used. The aim of this study is to compare and possibly establish a relationship between mid-arm circumference and height of children (3 to 5 years old) and evaluate them as a simple and reliable alternative for determining the nutritional status of children. Mid arm circumference and height of 195 randomly selected pupils consisting of 97 males and 98 females were measured and statistically compared with their means and standard deviations. There was a slight difference in the means of male and female subjects, though not statistically significant. The difference in mean heights of males and females compared across age groups showed marked significance. With a correlation coefficient of r=0.001 (P>0.01), there exists a positive correlation between the mid arm circumference and height of children 3 to 5 years. This can be used to determine the rate of growth as well as the nutritional status of children.

Keywords: mid-arm circumference, height, children, 3 – 5 years, Jos University Primary School

INTRODUCTION

Anthropometric measurements are well established and widely used as indicators of health and nutritional status in both children and adults. Despite challenges and limitations, anthropometry provides the most prominent tool for the assessment of nutritional status among members of the communities in most developing countries of the world, W.H.O (1995).Mid arm circumference is the circumference of the left upper arm, measured at the mid – point between the tip of the shoulder and the tip of the elbow (olecranon process and the acromium) www.unsystem.org/scn/.../ch06.htm. Mid arm circumference is useful for the assessment of the nutritional status of children, De Onis and Habicht (1996). It is an appropriate indicator for the assessment of acute and chronic muscle wasting in children which is used in predicting mortality and death in children than any other anthropometric indicator when the period of follow-up is short, Beaton *et al*., (1990).Mid arm circumference (MAC) was used as a public health index of protein calorie malnutrition in Haiti. These measurements were employed because thin limbs were clinically obvious in malnutrition which probably reflected stores of protein (muscle) and fat. Bennett (1969) showed mid arm circumference as a public health index of malnutrition in early childhood by putting together data collected from widely separated regions of east and west Africa, Tunisia, Malaysia, Lebanon, and the Caribbean. Height (H) is the distance from the vertex of the head to the sole of the foot. It differs from one community to another as is

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Fig. 1: Showing the measurement of MAC and Height.

revealed by anthropometric studies, W.H.O (1995).A number of factors may affect the height of an individual. These include nutrition, environmental factors, exercise, genetic factors and adequate sleep. Height is therefore very important in physical and personal development.

This study will be useful in identifying low birth weight babies and monitoring their progress at subsequent follow-up visits, assessment of acute and chronic muscle wasting which is used for predicting protein and calorie intake and malnutrition in children, useful in screening admissions into feeding centres in children emergencies and is significant in determining growth and nutritional status in children.

MATERIALS AND METHODS

A calibrated meter rule and a non – stretchable measuring tape (tailors tape) were used for the measurements. A total of 195 pupils consisting of 97 males and 98 females, all aged 3 to 5 years were randomly selected. Ethical clearance and informed consent were duly obtained. Mid arm circumference measurements were taken with the subject standing with their non-dominant arm straightened, resting proximal to the corresponding thigh. The tape is then wrapped firmly round the arm, mid-way between the acromium and olecranon processes and measurements taken to the nearest 1.0cm. Also, the height (from the vertex to the sole of the feet) of each subject was taken while standing against the wall, with their shoes off on a flat surface. The data collected was entered into statistical software (SPSS version 17), a computer based software program which organized and analyzed the data statistically using descriptive statistical method after their means, standard deviations and normality (by plotting a histogram and line graph which showed the characteristic dumbbell shape) were determined by it. Being a normally distributed data, t- test and ANOVA were used for the determination of the difference in means for both sexes and across age groups while the Pearson correlation was used to determine the level of significance of the relationship between the two variables: mid arm circumference and height.

RESULTS

The results of this study are shown in the tables 1-6 below:

DISCUSSION

The W.H.O child growth standard provides a technically robust set of tools that represent the best description of

Table 1: showing sample size.

AGE	NO. OF MALES	NO. OF FEMALES
3	27 (27.87%)	34 (34.69%)
4	19 (19.59%)	24 (24.49%)
5	51 (51.58%)	40 (40.82%)
TOTAL	**97 (40.74%)**	**98 (50.26%)**

The table shows that 40.74% of the sample size was males and 50.26 per cent females

Table 2: showing the mean, standard deviation and standard error of mean of MAC and Height for males and females.

	SEX	N	MEAN	STD. DEVIATIAN	STD. ERROR OF MEAN
MAC	MALE	97	16.08	1.29	0.13
	FEMALE	98	16.52	1.25	0.13
HEIGHT	MALE	97	109.63	7.45	0.76
	FEMALE	98	108.99	7.67	0.77

The table shows that the mean MAC was 16.08 (SD: 1.29) cm for males, 16.53 (SD: 1.25) cm for females & the mean height was 109.63 (SD: 7.45) cm for males &108.99 (SD: 7.67) cm for females.

Table 3: showing test of equity of means for means of MAC and height

		Leven's test for equality of variances		t-test for equality of means					
		F	Sig.	t	Df	Sig. (2-tailed)	Mean diff.	Std. error dif.	95%confidence interval of Lower	Upper
MAC	Equal variances assumed	0.35	0.55	-2.44	193.0	0.02	-0.44	0.18	-0.80	-0.1
	Equal variances not assumed			-2.44	192.7	0.02	-0.44	0.18	-0.80	-0.1
Height	Equal variances assumed	0.28	0.28	0.59	193.0	0.55	0.64	1.08	-1.49	2.78
	Equal variances not assume			0.59	192.9	0.55	0.64	1.08	-1.49	2.78

The table shows test of equality of variance with a mean difference of -0.44 cm for MAC and 0.64cm for height with a significance of 0.55cm for Mac and 0.59cm for height.

physiological growth for infants and children of five years and below. This is found to be very relevant in the measurements of children. The standards depict normal early childhood growth under optimal environmental conditions and can be used to assess children anywhere regardless of ethnicity, socio-economic status and type of feeding, W.H.O (2003).The mid arm circumference requires little equipment and is easily performed even on

Table 4: showing the mean, standard deviation, maximum and minimum values for all ages for both MAC and height.

		N	Mean	Std. Dev.	Std. Error	95% confidence interval for mean		Min.	Max.
						Lower bound	Upper bound		
	3yrs	53	15.65	1.11	0.15	15.35	15.95	13.0	18.0
	4yrs	51	16.31	1.05	0.15	16.02	16.61	13.3	19.1
MAC	5yrs	91	16.68	1.36	0.14	16.39	16.96	13.0	19.6
	Total	195	16.30	1.29	0.09	16.12	16.49	13.0	19.6
	3yrs	53	102.47	5.03	0.69	101.08	103.86	93.5	115.0
	4yrs	51	107.96	6.25	0.88	106.21	109.72	96.0	120.0
Height	5yrs	91	114.04	5.94	0.62	112.81	115.27	102.5	129.0
	total	195	109.31	7.55	0.54	108.24	110.37	93.5	129.0

The table shows that mean, standard deviation, minimum and maximum values for age 3yrs as 16.65cm, 1.11cm, 13.0cm and 18.0cm respectively for MAC, 16.32cm, 1.05cm, 13.3cm and 19.1cm for age 4, 16.68cm, 1.36cm, 13.0cm and 19.6cm for age 5. For height, the means, standard deviation, maximum and minimum values were 102.47cm, 5.03cm, 93.5cm and 115.ocm for age 3, 107.69cm, 6.25cm, 96.0cm and120.0cm for age 4, and 109.31cm, 7.55cm, 93.5cm and 129.0cm for age 5 respectively.

Table 5: showing multiple comparisons of mean difference between ages at 95% confidence level.

Department variable	(i) Age, yrs	(j) Age, yrs	Mean difference (i-j)	Std. error	Sig.	95% confidence interval	
						Lower bound	Upper bound
	3	4	-0.66(*)	0.24	0.01	-1.13	-0.19
		5	-1.03(*)	0.21	0.00	-1.44	-0.61
MAC	4	3	0.66(*)	0.24	0.01	0.19	1.13
		5	-0.36	0.21	0.09	-0.78	0.05
	5	3	1.03(*)	0.21	0.00	0.61	1.44
		4	0.36	0.21	0.09	-0.06	0.78
	3	4	-5.49(*)	1.13	0.00	-7.73	-3.26
		5	-11.57(*)	1.00	0.00	-13.58	-9.60
Height	4	3	5.49(*)	1.14	0.00	3.26	7.73
		5	-6.08(*)	1.01	0.00	-8.08	-4.08
	5	3	11.57(*)	1.00	0.00	9.60	13.55
		4	6.07(*)	1.01	0.00	4.08	8.08

*The mean is significant at the 0.05 level. The mean is significant at 0.05 levels and comparing the p values (indicated by 'sig') with 0.05, there is a relationship between ages except 4 years for MAC while in height there is a relationship between all ages.

the most debilitated individuals. It is potentially suited for screening admissions to feeding centres during emergencies including preschool assessment. Mid arm circumference is less affected than BMI by localized accumulation of excess fluid (pedal oedema, periorbital oedema and ascitis) common in famine, it is likely to prove to be a more sensitive index of tissue atrophy than low body weight and it is also relatively independent of height (www.unsystem.org/scn/.../ch06.htm). It is a new frontier in the assessment of Protein Energy Malnutrition (PEM) and this we hope will be replicated in many countries and groups in order to have a national standard for the usage of Mid Arm Circumference.

The present study demonstrates positive correlation between mid-arm circumference and height, since it was observed from the tabulated results that, as the age of a

Table 6: showing Pearson's Correlation for MAC versus Height

		MAC	Height
MAC	Pearson correlation	1.00	0.55(**)
	Sig.(2-tailed)		0.00
	N	195.00	195.00
Height	Pearson correlation	0.55(**)	1.00
	Sig.(2-tailed	0.00	
	N	195.00	195.00

From the table above, comparing the p value (0.001) with level of significance (0.01), there is a positive correlation between MAC and Height. (**correlation is significant at 0.01 level (2-tailed))

child increases, the mean mid arm circumference also increases. It was also observed that as a child increased in age, the mean height also increased. The mean MAC was 15.7 cm at age 3 and 16.3 cm at age 4 and 16.6 cm at age 5 showing a progressive increase in MAC as the age of the children increased from 3 to 5 yrs. Similarly, at age 3, the mean height was 102.5 cm and at age 4, there was an increase of about 5.4 cm that the mean height increased from 102.5 cm at age 3 to 107.9 cm at the age of 4. So also, as they advanced from 4 to 5 years, there was an increase from 107.9 cm to 114.0 cm, indicating an increment of 6.1 cm. A slight difference in mean value of the MAC and height was observed, the females have 16.5 cm as mean value for MAC, and the males had 16.08 cm, showing a difference of about 0.4 cm. This difference is however not significant, also a slight difference was observed in the mean height, (0.1 cm) and was also not significant because the mean height is more or less the same. Similar study by Bob – Manuel and Udouka (2009) observed a mean MAC of 17.5 cm for males and 16.5 cm for females, and the mean height of 101.4 cm for males and 97.9 cm for females in a semi – urban community in Nigeria. Comparing the results of MAC obtained with the W.H.O recommended standard of 17.0 cm for males and 16.6 cm for females, it was found that the value for males which is 16.1 cm fell below W.H.O standard while that of the females 16.5 cm corresponded with W.H.O standard. Also, a mean height of 109.6 cm for males and 108.9 cm for females was observed as against the recommended W.H.O values of 101.4 cm for males and 97.9 cm for females. Lower MAC values could be attributed to nutritional and environmental factors, while higher mean height values as against the recommended mean height value by WHO could be as a result of nutritional balance, good exercise and influence of growth hormone. A strong positive correlation between mid - arm circumference and height was observed using the Pearson's product moment coefficient of correlation with r = 0.001 and a p value of 0.01 (P< 0.01). Thus in both sexes, as the height increases, mid - arm circumference also increases.

CONCLUSION

It can be said from this study that the mid - arm circumference and height measurements are reliable and feasible methods of assessing nutritional status of an individual. However, it should be kept in mind that mid - arm circumference and height change with age and so cut - off points differ for different ages. There is a positive correlation between mid - arm circumference and height of children aged 3 – 5 years with a correlation coefficient of r = 0.001 for both males and females. It is recommended moreover that more studies be geared towards identifying more simple methods of assessing nutritional status in children, adolescents and adults and in the assessment of nutritional status in larger population with regards to age, sex ethnic groups and races so that standards can be documented for same.

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