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Abdominal Height: A Safe and Convenient Measurement Using a Novel Locally Fabricated Instrument to Predict the Cardio-Thoracic Ratio (CTR)

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ABSTRACT
This paper reports that significant correlations exist between the abdominal height(AH) measured by a locally fabricated novel instrument, Abdominometer and the Cardio-Thoracic Ratio (CTR) computed using cardiac diameter and thoracic diameter measured on Chest Radiographs by a ruler ($r = 0.387$, $p < 0.01$). In this study, randomly selected 145 consenting young adult Nigerians (both males and females) who are undergoing medical examinations between the ages 16-42 years whose blood pressure was less than 140/90 mmHg were enrolled. CTR was also found to significantly correlate with other study parameters considered in this study such as age, weight, Body Mass Index (BMI) and abdominal height. From regression analysis, a linear relationship between the abdominal height and CTR was found to be CTR = 0.005 (AH) + 0.355, which could be used to predict the CTR.
Keywords: Abdominal height, Abdominometer, Cardio-Thoracic Ratio (CTR), Cardiovascular Diseases.

INTRODUCTION

The cardiothoracic ratio (CTR) is simply the ratio of the transverse cardiac diameter (CD) to the transverse thoracic diameter (TD). Postero-anterior (PA) views of chest X-ray images used in the detection of cardiomegaly (enlargement of the heart) and evaluation of CTR is regarded as an important method of cardiac size assessment [1]. The evaluation of heart size with the use of chest radiographic images has been widely reported [1,4,5,6,8,9]. With the current cost of production of X-ray films and radiation risks to the patients it is important to find some criteria for safer and accurate assessment of the cardiac status especially in rural areas where X-ray facilities are not readily available and affordable. This study was therefore undertaken to determine a relationship between abdominal height and CTR. Abdominal height is a measurement taken between the level of iliac crest which corresponds to the space between 4^{th} and 5^{th} lumbar vertebrate and anterior abdominal wall at the level of the umbilicus. This is also known as the sagittal abdominal diameter and has shown better correlation with cardio vascular disease risk factors than body mass index (BMI) which is widely used by many researchers [3]. A locally fabricated portable instrument [7] made of wood was used to measure the abdominal height.

METHODOLOGY

A total of 145 randomly selected consenting young adult Nigerians (57 males and 88 females) between the ages 16-42 years who were undergoing medical examination in a medical centre of a higher educational institution participated in this study. The study protocol has been approved by the medical

centre. The mean age of male and female groups were 21.49 ± 3.69 and 22.17 ± 5.75 years respectively. The abdominal height was measured using the method earlier described in the pilot study by Okehialam et al [7]. Weight and height of each participant were measured with a bathroom weighing scale and a stadiometer respectively. Those who had blood pressure above 140/90 mmHg were excluded from this study. BMI was computed by dividing body mass (Kg) by square of height (m^2). CD and TD were measured on the chest radiographs (CXR) using a transparent plastic ruler in centimeters and CTR was computed. IBM SPSS STATISTICS Version 21 was used for evaluation of descriptive statistics, Pearson correlations and regression analysis of the study parameters.

RESULTS AND DISCUSSION

From the two groups (male and female) mean values of Abdominal height (AH), CD, TD, CTR and BMI were compared. Abdominal height of female group was found to be greater than the male group but the CD and TD were greater in males than the females. However, the BMI and CTR were greater in female group than the male group. Table 1 shows the mean values with standard deviations (S.D.) of the study parameters in male, female groups and total study population.

Table 1. Mean and S.D values of study parameters

STUDY PARAMETER	MALES (N = 57)	FEMALES (N = 88)	TOTAL (N = 145)
AH (cm)	17.99±1.63	19.46±4.18	18.88±3.48
BMI (Kg/m^2)	21.69±2.42	24.84±4.75	23.60±4.27
CD (cm)	12.82±1.54	12.14±1.24	12.41±1.40
TD (cm)	29.03±2.30	26.61±1.66	27.56±2.27
CTR	0.443±0.049	0.457±0.043	0.451±0.046

From the correlations, it was found that CTR was correlating with only age and abdominal height in the male group. age ($r = 0,287$, $p < 0.05$) and abdominal height ($r = 0.272$, $p < 0.05$). In the female group, CTR was correlating with age ($r = 0.253$, $p < 0.05$), weight ($r = 0.33$, $p < 0.01$), abdominal height ($r = 0.444$, $p < 0.01$) and BMI ($r = 0.400$, $p < 0.01$). This shows that abdominal height has a stronger correlation in the female group than the male group and abdominal height is a better cardiac anthropometric index than the BMI. In the total study population, CTR was correlating with age ($r = 0.261$, $p < 0.01$), weight ($r = 0.274$, $p < 0.01$), abdominal height ($r = 0.387$, $p < 0.01$) and BMI ($r = 0.352$, $p < 0.01$).

The overall mean value of CTR in this study was 0.45 and this is similar and comparable to other published data [1, 4, 6, 8].

From the regression, a linear relationship between the CTR and abdominal height was computed. The Figure 1 and Table 2 show the regression line of best fit and the regression coefficients respectively.

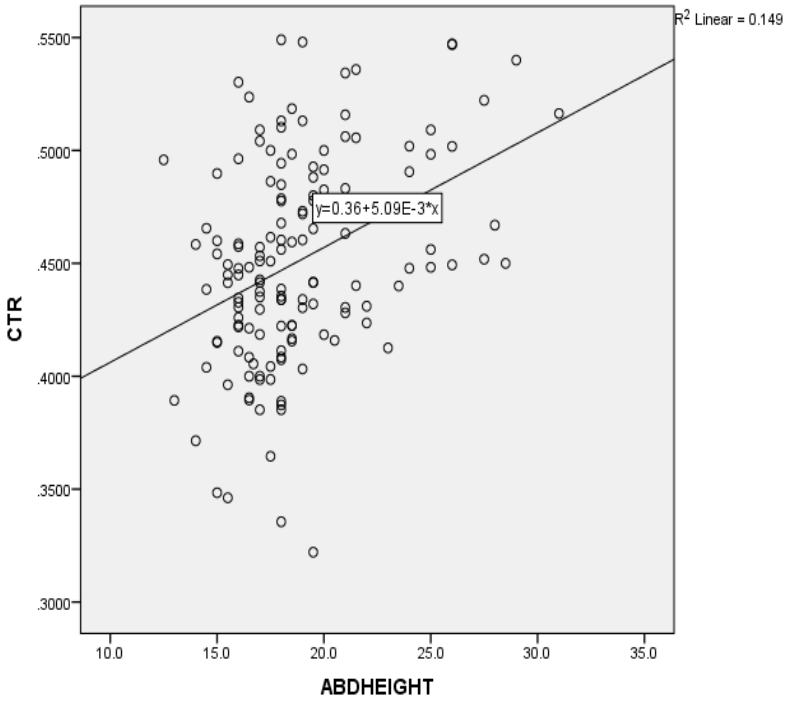

Figure 1. Regression line of CTR and Abdominal height

Table 2. Regression coefficients for the line of best fit.

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
AH	.005	.001	.387	5.011	.000
(Constant)	.355	.019		18.240	.000

This gives the linear relationship between the CTR and abdominal height as:
CTR = 0.005 (AH) + 0.355.

CONCLUSION

From this study, a safe and convenient measurement using a novel, portable, locally fabricated instrument (Abdominometer) to predict the cardio thoracic ratio (CTR) has been established. From this study, we found that the abdominal height (AH) has a stronger and significant positive correlation than body mass index (BMI) with CTR and hence a better predictor of cardiac enlargement than BMI. This will be a new contribution to the clinical practice in assessing the cardiac size accurately and at ease.

REFERENCES

[1]. .Anyawu G.E., Akpuaka F.C., Anibeze C.I.P.(2006) Normal Heart Sizes of Nigerians within The Southeast using Cardiothoracic Ratio. J.Expt & Clin Anat, Vol 5(2) :21-25
[2]. Danzer C.S. (1919) The Cardiothoracic Ratio: An Index of Cardiac Enlargement. AMJ. Med Sc. 157: 513-521

[3]. de Zouza N.C. and Oliveira E.P.(2013) Sagittal Abdominal Diameter Shows Better Correlation with Cardiovascular Risk Factors than Waist Circumference and BMI. Journal of Diabetes and Metabolic Disorders. 12: 41

[4]. Ekedigwe J.E., Pam S.D., Binitie P.O., Sirisena U..A. Hameed M. and Adegbe E.O.(2014) Cardiothoracic ratio and body mass index in normal young adult Nigerians. Journal of Medicine in the Tropics. 16(2): 47-51.

[5]. Gameraddin M., Al-Raddadi M., Yousef M., Nashashqi W., Ali A.M., Salih S. and Ahmed B. (2014) Evaluation of Cardiothoracic Ratio of Nomal Subjects in Al madinah Al Munawwara Using Chest Radiographs. Pensee Journal. Vol.76(4) : 374-385

[6]. Obikili E.N., Okoye I.J., Anyawu G.E. (2010) Cardiothoracic Ratio in Normal Nigerian Subject. Biomedical Research. 21 (2): 195-198

[7]. Okeahialam B.N., Diala U.M., Uwakwe J., Ejeh I. And Ozilo U.(2015). Utility of the Abdominometer: A Novel Contribution to Cardiovascular Anthropometry. Food and Nutrition Science, 6: 1202-1207

[8]. Oladipo G.S., Okoh P.D., Kelly E.I., Arimie C.O.D. and Leko B.J.(2012) Normal Heart Size of Nigerians within Rivers State using Chest Radiographs. Scientia Africa. Vol. 11(2):20-21

.[9] .Yousef M., Gameraddin M, Ali M., and Ahmed M. (2014). Aortic and Heart Dimensions of Adults in Sudanese Population using Chest X-ray. Wulfenia J. Vol 21(4): 122-123