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Original Research Paper

Radiology

ULTRASOUND INVESTIGATION OF CAROTID ARTERY THICKNESS AND BODY MASS INDEX IN FEMALE YOUNG ADULTS

Kelvin Kiridi	Department of Radiology, Niger Delta University
Price Joffa	Department of Human Physiology, Niger Delta University
Dibo Pughikumo	Department of Human Physiology, Niger Delta University
Emily Kiridi	Department of Human Physiology, Niger Delta University
Michael Egbejimi	Department of Human Physiology, Niger Delta University
Peter Erigbali*	Department of Human Physiology, Niger Delta University *Corresponding Author

ABSTRACT We investigated 75 healthy, young female adults' left and right carotid artery wall thickness and the association with Body Mass Index (BMI). The weight and height were measured for each individual, and the Body mass index (BMI) calculated using the formula Weight (kg) / [Height (m)] ^{2}. A Scan machine (Philips HD11, with 7.5 MHz linear probe) was used to carry out ultrasound investigation of the carotid arteries, following standard procedure. The mean BMI of the females was 22.1 ± 4.22 kg/m^2, and the mean thickness of the left and right common carotid arteries were (0.05 ± 0.01 and 0.04 ± 0.01) respectively; the difference was not significant at P< 0.05. The result of the correlation analysis showed that for BMI and Left carotid artery, correlation coefficient r = 0.1. Whereas r= 0.2 for BMI vs. right carotid artery. The results suggest that the females studied had normal BMI which is positively correlated with the left and right carotid arteries thickness. The association is however a weak one. Thus, from this study it may be inferred that a BMI increase beyond healthy normal weight, could predispose the left and right carotid arteries to increases in thickness.

KEYWORDS : BMI, Obesity, Carotid artery, Female.

INTRODUCTION

The accumulation of lipids and some other substances on the walls of blood vessels is believed to result in thickening of the walls of blood vessels and subsequently the narrowing of the lumens. This phenomenon appears to be associated with advancement in age (Erigbali *et al*, 2020). Mean while, carotid arteries are reported to be commonly affected when plaques are formed by accumulation of fat or adipose substances in the blood vessels. (O'Leary *et al*, 1992).

In another consideration, obesity which is largely being estimated by a relationship between the weight and height of a person, i.e. (weight (kg) / [height (m)]^2), referred to as Body Mass Index (BMI); has been recorded to be risk factor among others for some cardiovascular diseases such as hypertension, stroke and even diabetes (Lavie *et al,* 2017).

World Health Organization (2020) in a guideline, presented that individuals whose BMI fall within the range BMI < 18.4 kg/m^2 are underweight; BMI 18.5 – 24.9 kg/m^2 are Healthy or normal weight; BMI 25.0 – 29.9 kg/m^2 are overweight; BMI 30 – 34.9 kg/m^2 are Obese; BMI > 40.0 kg/m^2 are extremely Obese. However, the existence of global gender disparity in development of obesity has been reported from a profound review investigation suggesting that generally women are more obese than men (Power & Schulkin, 2008; Kanter & Caballero, 2012).

Among several cardiovascular related diseases, stroke stands out as one leading debilitating risk disease that is reportedly associated with carotid artery disease. Carotid disease is also reported as major risk factor for stroke, particularly ischemic stroke (Ionescu *et al,* 2016; *Aboyans et al,* 2004*).* Carotid disease develop as a result of accumulation of substances such as lipids, minerals (e.g calcium), muscle cells, macrophages, lymphocytes, on the walls of the arteries to form plaques; which result in thickening of the tunica intima and cause narrowing of lumen called carotid stenosis (Ionescu *et al,* 2016*;* Nicolaides *et al,* 2011*).*

In view of these, we carried out this study to investigate BMI, right and left carotid arteries of healthy, young adult females, in whom there are no previous history of plaques and stenosis in the common carotid arteries; specifically to observe whether there is correlation between the BMI and carotid arteries thickness.

MATERIALS AND METHODS

In this research, 75 healthy, young female adults were selected randomly from a University community. Their consent was sought and they were allowed to make informed decision to participate in the study. We measured weight and height of each volunteer with weighing balance and a graduated wall platform in that order. These were measured at different designated points. Each volunteer's weight was recorded while standing upright on the weighing balance with bare feet , and each one's height was measured at the next point, while standing erect, backing a meter rule - graduated wall platform. BMI was calculated using the formula BMI = weight (kg) / [height (m)]^2.

All the participants were briefed on simple ultrasound procedure required for the carotid arteries investigation, after which each one went through the observation process. They were guided to lay flat on an examination couch, with head slightly turned away from the side being examined per time. A Philips HD11, machine with 7.5 MHz linear probe on which a little gel was applied and placed with slight pressure on the

side of the neck was used for the scan. The image of the common carotid arteries as well as the thickness was recorded for both right and left sides (Erigbali et al, 2020).

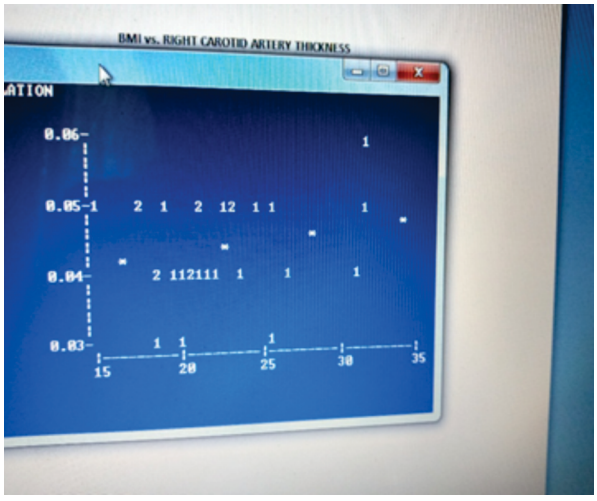
RESULTS

The mean BMI of the females was 22.1 ± 4.22 kg/m^2. Difference in mean thickness of the left and right common carotid arteries (0.05 ± 0.01 and 0.04 ± 0.01) respectively was not significant at P < 0.05 (Table 1). Pearson correlation analysis showed that correlation coefficient r= 0.2, for BMI vs. right carotid artery (Figure 1) but r = 0.1, for BMI and Left carotid artery (Figure 2).

Table 1: Comparison of Mean thickness of the Right and left Carotid arteries

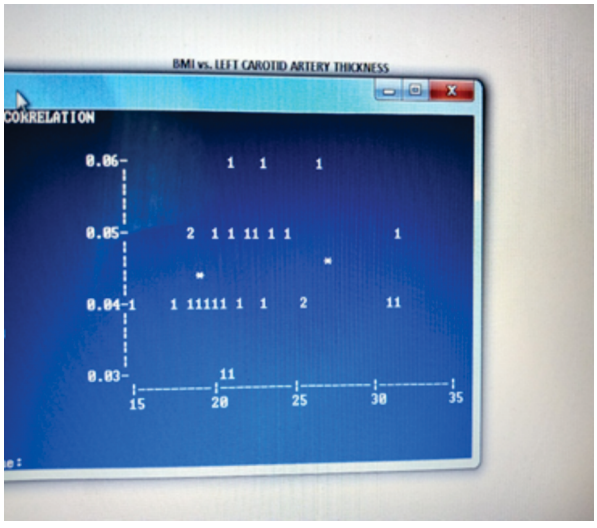
CAROTID ARTERY	SAMPLE SIZE	MEAN BMI	SD
RIGHT	75	0.04	± 0.01
LEFT	75	0.05	± 0.01
P < 0.05			

Figure 1: Correlation between BMI and Right Carotid Artery Thickness



r = 0.199

Figure 2: Correlation between BMI and Left Carotid Artery Thickness



r = 0.129

DISCUSSION AND CONCLUSION

Carotid artery disease has been implicated in some research as a major cause of stroke and it was observed that the left common carotid artery was more vulnerable to disease than the right common carotid artery (Ionescu *et al*, 2016; Munster *et al*, 2016). In another research, obesity which is largely determined by BMI was associated with cardiovascular risk disease including stroke (Kernan *et al*, 2013). But, Power and Schulkin (2008) after a widely covered investigation had observed that there was global gender disparity in the development of obesity.

Following these; we recently did a preliminary investigation and observed that among young adult males, there was a weak positive correlation of BMI with the left and right carotid arteries thickness and neither artery seemed to be more vulnerable (Erigbali *et al*, 2020).

In the present study, we investigated young adult females whether there is association between BMI and the right and left carotid arteries thickness. From the result, the mean BMI of the females was within normal range (22.1 ± 4.22 kg/m^2). And there was difference in mean thickness of the left and right common carotid arteries (0.05 ± 0.01 and 0.04 ± 0.01) respectively, which was not significant at P < 0.05 (Table 1). The Pearson correlation analysis for BMI versus right carotid artery showed that correlation coefficient r= 0.2 (Figure 1). This suggests a positive correlation; and r = 0.1, for BMI and Left carotid artery (Figure 2), also indicating positive correlation.

From the foregoing we may conclude that as BMI in the females increase beyond normal, the left and right carotid artery thickness will also increase, although this association is weak; thus there may be other contributory factors besides BMI that could lead to increased carotid wall thickness. Also, the left carotid artery that appear to have mean thickness which is greater than right carotid artery but not statistically significant may perhaps raise concern about possibility of the left carotid artery being more vulnerable to carotid disease, than right carotid artery, as Ionescu *et al* (2016) observed in a non gender base study.

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