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# Normal Extracranial Carotid Artery Parameters for A Healthy Nigerian Population.

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***Abstract***
***Background:*** *Duplex carotid vascular scan is a non-invasive imaging tool used to evaluate the extracranial course of the common carotid artery and its branches. Its finding has compared favorably to findings at CT angiogram. Considering the prevalence and rising burden of stroke in the Nigerian population, this study set out to derive the normal variables of duplex carotid ultrasound scan for a Nigerian population.*
***Method:*** *The study assessed the extra-cranial carotid artery variables in individuals, who met the inclusion criteria, randomly selected from residents of Mgbuoba in Obio/Akpor local Government area of Rivers State. Subjects were evaluated using a predefined imaging protocol to involve the vessel diameter, intimal media thickness (IMT), peak systolic velocities (PSV), the end diastolic velocities (EDV), resistivity index (RI) and ratio of peak systolic velocity and end diastolic velocity (S/D) for all 6 extracranial carotid arteries,*
***Results:*** *113 subjects consented to the study and met the inclusion criteria; 52(46.02%) males and 61(53.98%) females with mean age of 42.65±11.90yrs. The normal variables for the common carotid arteries were for* ***mean diameters 0.68±0.08cm and 0.68±0.11cm on the left and right respectively. IMT: 0.07± 0.02cm for both common carotid arteries. PSV: 59.37 ±.20.32 on the left and 58.44 ±.19.20 on the right. EDV: 22.25 ± 17.77 cm/s on the left and 20.77 ± 12.25cm/s on the right. RI was 0.60 ± 0.19 and 0.60 ± 0.19 for the left and right carotids. The S/D: 3.38 ± 1.30 on the left and 3.94 ±.1.72 on the right****.*
***Conclusion:*** *There were significant differences between Left Common Carotid artery (LCC) and Right common carotid artery (RCC)doppler parameters; LCC PSV, EDV, RI and S/D ratio were significantly higher, when compared to the right. However, all other parameters were relatively higher on the left carotid vessels when compared to the right, but for the S/D ratio and resistivity indices which were higher on the right carotid vessels. In addition, the mean values for peak systolic velocities and end diastolic velocities increased across all vessels till age 50 after which there was a decline in the values. There was also an increase in the vessel diameter and IMT with age, but the RI and S/D ratios showed a steady decrease with age. There were no significant differences between the male and female values.*
***Keywords:*** *Carotid, Healthy, Nigerian. Normal, Stroke*

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## I. Introduction

There has been a growing interest in vascular biology and vascular diseases globally. The advent of percutaneous vascular interventional procedures has been very valuable, as early intervention will allow prevention of debilitating consequences of vascular diseases. Duplex vascular ultrasound has improved the use of non-invasive testing in evaluating vascular diseases[1]. Findings at vascular ultrasonography have been corroborated with findings at CT angiography[2]. Duplex carotid vascular ultrasound employs the use of 2D imaging with superimposed colour flow and spectral doppler in evaluating the extra cranial course of the carotid

arteries. Power doppler has also been employed[3]. Most ultrasound labs are encouraged to set out normal values for the population they serve, as ethnicity, sex, and race has presented some differences in these parameters[4], on this background there is a need to derive normal variables that will enable interpretation of results locally.

The left and right carotid arteries follow the same course but differ in their origins. The left common carotid artery is a direct branch of the aortic arch, and the right common carotid originates from the brachiocephalic trunk. The common carotid arteries run cranially, latero-medially to bifurcate to the larger internal carotid and a more superficial, smaller external carotid artery which has branches. The internal carotid supplies the brain while the external carotid supplies the neck and face[5].

Duplex carotid vascular scan is usually performed using a high frequency linear probe that gives high resolution (5 - 12mHz). Scanning employs both 2D real time imaging and still M-mode cuts for structural evaluation and the added value of colour flow and spectral that aids elimination of artefacts and also reveals hypoechoic plaques that maybe masked. Mosaic flow patterns, filling defects, retrograde flow, high peak systolic flow velocities, thickening of the Intimal medial thickness (IMT), vascular plaques and absence of flow through a vessel are indicators to vascular diseases[6,7,8]. Care is needed to interpret the presence of a plaque; usually more than 1 of the points are employed in interrogation of a plaque[9]. Plaques can be defined as hypoechoic (echolucent) or hyperechoic (echogenic) depending on the echogenicity[10]. The echogenicity usually is a measure of its calcium content[11]. It can also be classified as homogeneous or heterogeneous depending on the uniformity of its echogenic pattern. Plaque stability has been judged by its echogenicity. Hypoechoic or echolucent plaques have been shown to be associated with increased stroke[12]. This was a prospective study aimed at deriving normal variables for a Nigerian population and assess sex and age differences of the carotid artery parameters. To guide future research in the use of duplex vascular scans.

## II. Method:

**Study Design**: Prospective, cross sectional, observational survey.

**Sample Size:** the population of Mgbuoba community was obtained using the Taro Yamani Formula

$$n \quad \frac{N}{1+N(e)^2}$$

Where, n= sample size required, N= the finite population, 1= constant, e= level of precision or sampling error (0.05).

The population of the Mgbuoba community from a projected estimate for 2019 was 73030 [13]

from the above formula with finite N= 73030

$73030/\ 1+\ 73030(0.05)^2$,

n = 40. The study recruited 113 subjects.

**Subjects**: Apparently normal subjects were randomly picked from individuals who were residents of Mgbuoba Community in Obio/Akpor LGA of Rivers State. An ad-hoc lab was set up in a private room at the community hall. An SSI 8000 Sonoscape high-definition imaging machine with appropriate vascular probes.

Ethical clearance was received from the Mgbuoba community leaders and the Rivers State Primary Health Care Management Board (RSPHCMB) and consent obtained from each patient, after educating patients on the procedure. Study was carried out over a period of 3weeks in February 2021. Covid protocols were strictly adhered to.

A questionnaire was used to obtain baseline demographic data as well as history of cigarette smoking and alcohol consumption. All subjects had their weights and heights measured from which their body mass indices (BMI) were computed. The BMI was further categorised into group 0-3; group 0 for subjects with mass indices less than 18.5kg/m(underweight), class 1 BMI = 18.5 – 24.9kg/$m^2$(normal weight), class 2 BMI = 25 – 29.9kg/$m^2$(overweight) and Class 3 BMI ≥ 30kg/$m^2$. Blood glucose measured using a glucometer to exclude diabetes and blood pressure measured to exclude hypertension.

**Exclusion Criteria:** Diabetics and hypertensives were carefully excluded. Smokers and those that had stopped smoking for less than 3 years were also excluded.

**Ultrasound Examination:** patients were made to lie supine and asked to face the opposite side of the carotid to be examined. Carotid examination was performed using a predefined protocol. The peak systolic velocities (PSV), end diastolic velocities (EDV). Vessel diameters, Intima media thickness (IMT) the resistivity index (RI) and the ratio of peak systolic velocities to the end diastolic velocities were measured for the six vessels; left common carotid (LCC), the right common carotid (RCC), left internal carotid (LIC), right internal carotid (RIC), left external carotid (LEC), right external carotid (REC). Sonoscape SS1 8000 was used, the machine is equipped with linear probe 712 (5mHz – 12mHz) a duplex ultrasound scanner which provided simultaneous 2 D mode arterial images and a single gate pulsed doppler flow, superimposed on 2D structures to detect velocity changes.

Examination was started proximally in transverse and followed distally to the bifurcation and beyond this to assess the presence of any intimal thickening or plaque[9]. This was repeated in longitudinal plane to follow the course and measure intimal thickeness as well as velocity of flow. Then colour flow was used to aid in assessing patency and direction of flow. The origins of the ICA and ECA arteries were noted and their course followed. The pulse wave doppler and IMT was taken as the mid part of each vessel. Two values for Vessel diameter and IMT was taken and two successive spectral wave was taken for PSV, EDV, RI and S/D and the average calculated.

**Statistical Analysis:** Data was collected on Excel statical software package. The study population was grouped into five groups based on age; 21-30yrs, 31 – 40yrs, 41 – 50years, 51 – 60yrs. And greater than 60yrs. SPSS 23 statistical software package was used to analyze data. The general mean for the population was obtained and the mean for individual age subgroups were obtained and expressed as tables. Paired student t-test was used to compare differences of cardiovascular parameters and carotid artery variables between males and females and to compare the differences between the right and the left vessels, in all six (6) vessels.

## III. Results:

**Baseline Demographics and Social:** the study recruited a total of 113 subjects with age range 22-90yrs, who met the inclusion criteria and consented to be part of the study. 52 males and 61 females at a male to female ratio of 1:1.17 accounting for 46.02% and 55.98% respectively, from different occupation and spheres of life (traders, stylist, drivers, teachers, students, engineers and farmers some were unemployed). 11 admitted to taking occasional alcohol, 5 had stopped smoking for over 3years prior to the study.

**Clinical Characteristics of Subjects:**

The mean age for the 113 subjects was 42.65 ± 11.90 yrs (mean±SD age). Mean BMI of 25.75 ± 4.20kg/$m^2$, mean systolic blood pressure of 124.36 ± 16.52mmHg, diastolic blood pressure 75.40 ± 8.64mmHg and mean pulse of 75.40 ± 8.64beats/min. The mean age for the male subjects was 42.52 ± 11.20yrs (mean±SD age) and 43.19 ±12.87yrs (mean±SD age) for the females. There were no significant differences in age and other cardiovascular parameters between sexes (see table 2&3). The mean for the age groups is as shown in Table 6 and 7. Forty-eight (48) subjects had Class 1 BMI (normal); 44 had Class 2 BMI; 18 had Class 3 BMI (obese) and 3 were in Class 0 BMI (underweight).

**Carotid Artery Variables:** The mean value of carotid arteries for right and left are shown in table 4. Comparison of right and left carotid arteries as in table 5: Table 5 shows significantly higher values for left common carotid artery doppler measurements as PSV, EDV, S/D and RI were significantly higher on the left common carotid than the right common carotid using paired Student T-test (95% CI). However, it is noteworthy to say that the values of all parameters were higher on the left but for the S/D that was higher on the right carotid vessels.

## IV. Discussion:

Whilst the use of duplex carotid ultrasound scan in Nigeria is growing, it has replaced carotid angiogram for screening of cardiovascular diseases and preoperative evaluation of patients in some other countries [[14]].

Most carotid artery studies in Nigeria have employed the use of B-mode (2D) ultrasonography in deriving normal values and others have evaluated the carotid artery findings in some disease conditions [15-17]. A recent study published in August 2021 [18] attempted to derive normal value for the left common carotid and right common carotid arteries diameters.

It is important however to note that, beyond vessel diameter and other 2D parameters, there are other doppler parameters employed in assessing carotid atherosclerotic disease and its severity. These parameters include Intimal Media Thickness (IMT), the Peak Systolic Velocity (PSV), End Diastolic velocity (EDV) the resistance Index (RI) and S/D; the ratio of the systolic velocity and diastolic velocity.

**Intimal Media Thickness:** The intimal media thickness is usually measured on 2d Gray scale and it is the distance between the upper bright border and the lower bight border of the vessel wall. It is measured with the probe parallel to the vessel wall usually in the longitudinal view. Care is taken not to include areas of focal atherosclerotic lesions. It is the most widely researched of all doppler carotid ultrasound parameters.it is said to be an independent risk factor for stroke and MI [15] Another study from eastern Nigeria evaluated intimal media thickness in hypertensives and diabetics against that of a normal population [13].

This study obtained a value of 0.072 ± 0.02cm for the left common carotid and 0.069 ± 0.02cm for the right common carotid. There was a noted increase in IMT with age and the value for IMT was higher in left when

compared to the right and in males than females. Though the differences were not significant on assessment with paired t test.

This was different from a mean for a normal Nigerian population provided by the study of Sonetye et al [16]. Which gave a value 0.067 ± 0.06cm for the left common carotid artery and 0.064 ± 0.06cm for the right common carotid artery The values for this study was slightly higher. Another study published an IMT of 0.07 ± 0.01 cm and 0.08 ± 0.02 cm on the right and left, respectively. [17]. In all cases the right had a smaller value than the left.

These differences can be accounted for by different ethnic variations [19] Another study showed a significant progressive increase in IMT with age [20] this was similar with our findings, as we noted a progressive increase in IMT across all vessels with age.

**Luminal Diameter**: The common carotid luminal diameter is obtained by measuring the distance between the anterior IMT and inferior IMT on a Gray scale longitudinal view [21].

This study got a mean of 0.69 ± 0.08cm on the left and 0.67 ± 0.01cm on the right. The size of the right **ICA** was on the LIC 0.69 ± 0.16cm and the RIC 0.65 ± 0.19cm respectively. The diameter of the external carotid vessels was 0.54 ± 0.14cm and 0.55 ± 0.12cm on the left and right respectively.

This compared favourably with the recent study by Kpuduwei et al [18] which recorded a mean value of 0.61 ± 0.08cm for CCA, 0.61cm ± 0.08cm for ICA and 0.49±0.10 for ECA. Though the values obtained from this study are slightly higher this can be accounted for, by the fact that the mean age of this study population is slightly higher than that of the aforementioned study. The mean age for the Kpuduwei et al study was 28.32 ± 9.09yrs while the man age of our study population is 42.65 ±11.90yrs. A Study by that compared carotid artery diameter with age noted that there was a decrease in vessel compliance with age [22].

In comparing the diameters of the vessels in most foreign studies the diameter of the internal carotid has been shown to be significantly smaller than the common carotid artery. However, our Nigerian studies have noted a very similar diameter between both vessels. This should be a noted ethnic difference; Nigerians have relatively larger internal carotid artery diameters almost similar to the common carotid diameter when compared to Caucasian studies [22].

Comparing sex differences; though this study revealed that carotid diameters were larger in males when compared to the females, but on comparing means only the internal carotid artery showed significant differences between males and females. The sex differences have been noted in studies of a Swedish and an American population. [23-24]

**Peak Systolic Velocity:** The peak systolic velocity is a vascular parameter measured by spectral doppler wave form and it corresponds to the tall part in the spectral window [25,26]. It is measured by employing the single gated pulsed wave doppler. Spectra obtained of the common carotid is derived from the branches of the common carotid internal and external carotid arteries with about 80% going directly to the internal carotid artery. [22] Sample volume is usually taken from the center of the vessel to measure the peak systolic velocity with cognizance to the flow direction. The peak systolic velocities and spectral broadening of the pulse wave doppler are used to assess severity of vessel stenosis [24,25].

The mean LCC PSV on the left was 59.37 ± 20.32 cm/s and on the right 58.44 ± 19.20cm/s. The mean PSV for the LIC was 48.65 ± 22.50cm/s and RIC, 48.05 ± 21.53cm/s. The mean PSV for the LEC was 52.26 ± 22.57cm/s and REC 47.96 ± 23.40 cm/s .

There has been variability in the accepted normal PSV of the carotid vessels but consensus opinion has accepted a peak systolic velocity of <125 cm/sec in the common carotid artery is normal[25]. The same value is also used for the ICA, However, faster than 125cm/s or twice as fast as that of the common carotid artery is thought to indicate possible significant stenosis of the CCA and ICA respectively.[27]

Most Nigerian studies deployed the use of two dimensional (2D) in interrogating the carotid, however the audit carried out from a tertiary hospital in Northern Nigeria: Kano even if it deployed pulsed wave velocity and power doppler, the researchers did not deploy pulsed wave velocity in determining degree of stenosis but rather measured visible plaques and assessed stenosis using the protocol of the European carotid surgery trial. [28] this only limits the detection of possible plaques not visible on 2D Gray scale. Though doppler sonographic samples are primarily used to quantify velocities at sites of stenosis, yet it has an added benefit as subtle guide to diseases are revealed in the shape and contour of the sonography spectral waveform.[29]

An important derivation of this study is, noting that the PSV in the white population was higher than that in our study of black subjects. Lower PSV and EDV has been associated with endothelial dysfunction and vascular dysfunction predispose to cardiovascular disease [30] the mean PSV of this population was LCC PSV: 59.37 ± 20.32 cm/s and RCC 58.44 ± 19.20cm/s; it is an established fact that the black race is a risk factor for cardiovascular events.

**End Diastolic Velocity:** End diastolic velocity is another important parameter measured by carotid pulse wave doppler. It corresponds to the end of the cardiac cycle [31] low resistance vessels usually supply end organs which require perfusion throughout the entire cardiac cycle, such vessels exhibit high diastolic flow in contrast with high resistant vessels that show low or absent EDV [32]. Degree stenosis has been shown to correspond with taller PSV and EDV, however with increased stenosis to near occlusion the PSV and EDV velocities can be high low or even absent. [33] Studies have shown that End diastolic velocity maybe a better surrogate marker or predictor of cardiovascular event. [34-35]
The mean EDV obtained in this study was for LCC: 22.25 ± 17.76cm/s$^2$ and on the RCC 20.77 ± 12.24cm/s$^2$. The LIC EDV was 20.34 ± 21.30 cm/s$^2$, RIC EDV was 19.65 ± 18.74cm/s$^2$. The LEC EDV was 22.35 ± 20.68cm/s$^2$ and the REC was 20.55± 19.77cm/s$^2$.

**The Resistivity Index:** This is also known as the Pourcelet index, is derived from the maximum, minimum and mean doppler frequency shifts during a defined cardiac cycle, it increases as vessels get narrower and it is directly proportional to vascular resistance and compliance. [36] It is calculated as PSV-EDV/PSV[36-37]. Resistivity index is a parameter of pulsatility and used to measure the resistance of the vessel wall [37]. It has been well evaluated as a surrogate marker of atherosclerotic disease in the renal vessels. [38-40] a study that compared the relationship between Carotid IMT and Resistive index showed a positive corelation between the RI and carotid IMT.[41]
The resistivity index derived from this study was for LCC 0.60 ± 0.19 and RCC 0.60 ± 0.19, the LIC RI was 0.75 ± 1.13 and RIC RI was 0.62 ± 0.20 and for LEC 0.60 ± 0.19 and for REC 0.62 ± 0.26. The RI was higher in the internal carotid relative to the common carotid and external carotid vessels.

**The S/D Ratio:** Just like the resistivity index the S/D is a ratio used in describing vessel type and assessing the severity of stenosis. It is the ratio of the Peak systolic velocity to the End diastolic velocity. In mixed resistant vessel like the common carotid, it while low resistant vessels like the ICA that supplies tissues direct you have a higher S/D ratio when compared to high resistant vessels like the ECA [42].

**Conclusion:** There were significant differences between Left Common Carotid artery (LCC) doppler parameters; LCC PSV, EDV,RI and S/D ratio were significantly higher in the left when compared to the right. In addition, all other parameters were relatively higher on the left carotid vessels when compared to the right, but for the S/D ratio and resistivity indices which were higher on the right carotid vessels. Furthermore, the mean values for peak systolic velocities and end diastolic velocities increased across all vessels till age 50 after which there was a decline in the values. There was also an increase in the vessel diameter and IMT with age, but the RI and S/D ratios showed a steady decrease with age. There were no significant differences between the male and female values.

**Table 1: Descriptive Statistics**

**Cardiovascular Parameters**

| | N | Minimum | Maximum | Mean ±Std. Deviation |
|---|---|---|---|---|
| AGE (yrs) | 113 | 22.0 | 90.0 | 42.65 ± 11.90 |
| BMI (kg/m$^2$) | 113 | 17.63 | 37.65 | 25.75 ± 4.20 |
| FBS (mmol/l) | 63 | 4.00 | 6.90 | 5.10 ± 0.67 |
| RBS (mmol/l) | 50 | 4.8 | 8.0 | 6.42 ± 0.71 |
| PULSE (beats/min) | 113 | 55.0 | 111.0 | 75.94 ± 11.46 |
| SYSTOLIC BP(mmHg) | 113 | 90.0 | 139.0 | 124.36 ± 16.52 |
| DIASTOLIC BP(mmHg) | 113 | 58.0 | 93.0 | 75.40 ± 8.64 |

BMI: Body mass index, SBP: systolic blood pressure, DBP: diastolic blood pressure.

**Table 2: Sex Comparison Of Cardiovascular Indices**

| | MALES 61 | FEMALES 52 | Std. Error Mean | t | Sig. (2-tailed) |
|---|---|---|---|---|---|
| AGE (yrs.) | 42.52± 11.20 | 43.19± 12.87 | 1.55 | -.28 | .78 |
| BMI($Kg/m^{2)}$ | 25.26± 3.26 | 26.58± 5.09 | 0.45 | -1.60 | .12 |
| SBP (mmHg) | 125.50± 11.78 | 122.94± 20.95 | 1.67 | .77 | .45 |
| DBP (mmHg) | 75.38±8.41 | 75.26±8.75 | 1.19 | .07 | .94 |
| PULSE(Beats/min) | 73.39± 20.67 | 77.52± 11.91 | 1.48 | -1.66 | .10 |

BMI: Body mass index, SBP: systolic blood pressure, DBP: diastolic blood pressure.

**Table 3: Comparison of Left and Right Carotid (Mid Artery) Variables**

| Carotid Parameters | Left Mean ± SD | Right Mean±SD | STD. Error of Mean | t | Sig( 2 tailed) |
|---|---|---|---|---|---|
| CC/DIAM(cm) | 0.68 ± 0.08 | 0.68± 0.11 | 0.01 | .04 | .97 |
| CC/IMT cm | 0.07± 0.02 | 0.07± 0.02 | 0.00 | 1.40 | .16 |
| CC/PSV (cm/s) | 59.37± 20.32 | 58.44±19.20 | 2.67 | 3.72 | .00 |
| CC/EDV (cm/s) | 22.25 ±17.77 | 20.77 ± 12.25 | 1.69 | 3.84 | .00 |
| CC/RI | 0.75 ±0.40 | 0.70 ± 0.63 | 2.00 | 3.95 | .00 |
| CC/SD | 3.38 ± 1.30 | 3.94± 1.72 | 0.14 | -3.96 | .00 |
| IC/DIAM (cm) | 0.69 ± 0.17 | 0.65 ± 0.14 | 0.02 | 2.22 | .03 |
| IC/IMT | 0.06 ± 0.02 | 0.06 ± 0.02 | 0.00 | -.10 | .92 |
| IC/PSV(cm/s) | 48.65 ± 22.50 | 48.05 ± 21.53 | 2.84 | .21 | .83 |
| IC/EDV (cm/s) | 20.34 ± 21.30 | 19.65 ± 18.74 | 2.34 | .27 | .79 |
| IC/RI | 0.75 ± 1.13 | 0.72 ± 0.20 | 0.12 | 1.02 | .31 |
| IC/SD | 3.44 ± 1.87 | 3.59 ± 2.22 | 0.25 | -.60 | .55 |
| EC/DIAM(cm) | 0.56 ± 0.12 | 0.55 ± 0.13 | 0.01 | .67 | .50 |
| EC/PSV (cm/s) | 52.26 ± 22.57 | 47.96 ± 23.40 | 2.66 | 1.62 | .11 |
| EC/EDV (cm/s) | 22.35 ± 20.68 | 20.55 ± 19.77 | 2.60 | 0.69 | .49 |
| EC/RI | 0.60 ± 0.19 | 0.62 ± 0.26 | 0.03 | -0.65 | .52 |
| EC/SD | 3.01 ± 1.38 | 3.10 ± 1.84 | 0.18 | -0.55 | .62 |

CC/IMT: common carotid intimal media thickness, CC/Diam: common carotid diameter, CC/PSV, common carotid peak systolic velocity, CC/ EDV: common carotid end diastolic velocity, CC/RI: left common carotid resistivity index. CC/S/D: common carotid ratio of Peak systolic to end diastolic velocities. IC/IMT: internal carotid intimal media thickness, IC/Diam: internal carotid diameter, IC/PSV, internal carotid peak systolic velocity, IC/EDV: left internal carotid end diastolic velocity, IC/RI: internal carotid resistivity index. IC/ S/D: internal carotid ratio of Peak systolic to end diastolic velocities.EC/IMT: external carotid intimal media thickness, EC/Diam: external carotid diameter, EC/PSV, carotid peak systolic velocity, EC EDV: external carotid end diastolic velocity, EC/RI: external carotid resistivity index. EC/S/D: external carotid ratio of peak systolic to end diastolic velocities

**Table 4: Age Distribution of Clinical Parameters.**

| Clinical Parameters | Mean + SD (21 - 30yrs) (21) | Mean + SD (31 - 40yrs) (27) | Mean + SD (41 - 50yrs) (37) | Mean + SD (51 - 60yrs) (22) | Mean + SD (>60yrs) (6) |
|---|---|---|---|---|---|
| **AGE** | 27.00 ± 2.35 | 36.93 ± 3.0 | 45.37 ± 3.20 | 53.95 ± 2.77 | 70.40 ± 11.05 |
| **BMI** | 24.01 ± 3.50 | 27.19 ± 5.00 | 25.80 ± 3.31 | 25.71 ± 5.29 | 24.73 ± 4.13 |
| **SYSTOLIC BP** | 114.83 ± 10.79 | 128.07 ± 11.98 | 127.37 ± 11.42 | 129.90 ± 11.10 | 135.80 ± 3.70 |
| **DIASTOLIC BP** | 69.94 ±7.02 | 77.37 ± 9.30 | 77.60 ± 7.96 | 76.74 ± 6.62 | 73.40 ± 5.00 |

**Table 5: Age Comparison**
**Of Right and Left Carotid (Mid Artery) Variables.**

| Carotid Artery Variables. n | Mean + SD ( 21 - 30yrs) (21) | Mean + SD (31 - 40yrs) (27) | Mean + SD (41 - 50yrs) (37) | Mean + SD (51 - 60yrs) (22) | Mean + SD (> 60yrs) (6) |
|---|---|---|---|---|---|
| **LCC/DIAM(cm )** | 0.66 ± 0.07 | 0.67 ± .03 | 0.68 ± 0.08 | 0.69 ± .08 | 0.72 ± 0.1 |
| **LCC/IMT(cm)** | 0.065 ± 0.12 | 0.068 ± .03 | 0.074 ± 0.03 | 0.074 ±0.02 | 0.078 ± 0.02 |
| **LCC/PSV(cm/s)** | 59.55 ± 14.72 | 61.80 ± 17.00 | 62.41± 20.92. | 52.99 ± 22.50 | 59.44 ± 21.17 |
| **LCC/EDV(cm/s )** | 13.40 ± 4.0 | 18.78 ± 12.46 | 25.64 ± 17.89 | 22. 50 ± 8.83 | 18.54 ± 10.22 |
| **LCC/RI** | 0.76 ± .05 | 0.73 ± 0.13 | 0.59 ± 0.20 | 0.61 ± 0.2 | 0.53 ± 0.24 |
| **LCC/SD** | 4.23 ± 0.90 | 3.80 ± 1.00 | 3.31`± 1.01. | 3.01 ± 1.36 | 2.70 ± 1.46 |
| **LIC/DIAM(cm)** | 0.71 ± .09 | 0.73 ± 0.14 | 0.82 ± 0.2 | 0.69 ±.08 | 0.77 ± 0.14 |
| **LIC/IMT(cm)** | 0.061 ± -01 | 0.064 ± 0.02 | 0.066 ± 0.01 | 0.068 ± 0.02 | 0.07 ± 0.01 |
| **LIC/PSV(cm/s)** | 42.55 ± 12.29 | 54.43 ± 18.84 | 51.46 ± 21.96 | 52.99± 22.50 | 47.32 ± 34. 48 |
| **LIC/EDV(cm/s)** | 11.32 ± 4.28 | 14.87 ± 12.93 | 23.95 ± .10.45 | 22.00 ± 15.90 | 31.55 ±16.44 |
| **LIC/RI** | 0.72 ± 0.12 | 0.70 ± 0.1 | 0.60 ± 0.02 | 0.61± .02 | 0.61 ± .01 |
| **LIC/SD** | 4.37 ± 2.10 | 3.69 ± 1.31 | 3.12 ± 1.68 | 3.10 ± 1.36 | 2.01 ± 0.8 |
| **LEC/DIAM(cm)** | 0.54 ± 0.08 | 0.58 ± 0.14 | 0.60 ± 0.14 | 0.78±0.14 | 0.61 ± .07 |
| **LEC/IMT(cm)** | .054 ± 0.02 | 0.054 ± .01 | 0.054 ± 0.02 | 0.055 ±0.02 | 0.07 ± .01 |
| **LEC/PSV(cm/s)** | 46.01 ± 17. 70 | 42. 54 ± 15.94 | 53.98 ± 23,00 | 46.58 ± 25.38 | 51.78 ± 24.29 |
| **LEC/EDV(cm/s)** | 10.39 ± 5.06 | 12. 54 ± 7.57 | 25.21 ± 20.78 | 17.60 ± 12.46 | 25.78 ± 24.90 |
| **LEC/RI** | 0.73 ±0.13 | 0.72 ± 0.11 | 0.55 ± 0.19 | 1.22 ± 0.6 | 0.57 ± 0.21 |
| **LEC/SD** | 3.65 ± 1.45 | 3. 98 ± 1.37 | 2.62 ± 0.94 | 3.16 ± 1.26 | 2.67 ± 1.02 |
| **RCC/DIAM(cm )** | 0.70 ± 0.08 | 0. 68 ± .09 | 0.68 ± 0.08 | 0.78 ± 0.16 | 0.79 ± 0.04 |
| **RCC/IMT(cm)** | 0.065 ± 0.01 | 0. 071 ± 0.02 | 0.071 ± 0.02 | 0.068 ± 0..02 | 0.07 ± .01 |
| **RCC/PSV(cm/s)** | 67.03 ± 15,07 | 52. 30 ± 16.42 | 52.48 ± 20.71 | 46.84 ± 21.06 | 56.34 ± 15.38 |
| **RCC/EDV(cm/s )** | 10.22 ± 4.64 | 12. 19 ± 6.01 | 19.74 ± 15.98 | 17.60 ± 12.46 | 14.41 ± 9.2 |
| **RCC/RI** | 0.76 ± 0.11 | 0. 76 ± 0.08 | 0.66 ± 0.09 | 0.78 ± 0.16 | 0.56 ± 0.17 |
| **RCC/SD** | 5.07 ± 1.80 | 4. 71 ± 1.92 | 3.27 ± 1.22 | 3.16 ± 1.47 | 2.71 ± 1.44 |
| **RIC/DIAM(cm)** | 0.71 ± 0.8 | 0. 75 ± 0.10 | 0.75 ± 0.15 | 0.78 ± 0.16 | 0.78 ± 0.4 |

| | | | | | |
|---|---|---|---|---|---|
| **RIC/IMT(cm)** | 0.059 ± .01 | 0. 065 ± 0.02 | 0.065 ±0.02 | 0.068 ± 0.02 | 0.07 ± 0.01 |
| **RIC/PSV(cm/s)** | 41.69 ± 14.20 | 44. 16 ± 17.52 | 52.03 ± 22.43 | 48.25 ± 27.99 | 40.74 ± 11.99 |
| **RIC/EDV(cm/s)** | 12.30 ± 4.81 | 13. 57 ± 9.06 | 23.05 ± 20.80 | 23.35 ± 12.53 | 16.68 ±10.53 |
| **RIC/RI** | 0.67 ± 0.12 | 0. 68 ± 0.22 | 0.59 ± 0.20 | 0.57 ± 0.2 | 0.62 ± 0.19 |
| RIC/SD | 3.66 ± 1.43 | 4. 56 ± 2.94 | 3.11 ± 1.56 | 3,35 ± 2.25 | 4.27 ±1.43 |
| REC/DIAM(cm) | 0.55 ± 0.12 | 0. 57 ± 0.03 | 0.53 ± 0.12 | 0.50 ± 0.2 | 0.63 ± 0.2 |
| REC IMT(cm) | 0.056 ± 0.12 | 0.057 ± 0.03 | 0.057 ± 0.03 | 0.060 ± 0.01 | 0.067 ±0.01 |
| REC/PSV(cm/s) | 39.87 ± 13.61 | 44. 56 ± 14.03 | 50.42 ± 24.91 | 54.71 ± 29.01 | 40.83 ± 4.64 |
| REC/EDV(cm/s) | 8.92 ± 3.15 | 13. 57 ± 6.93 | 25.82 ± 24.14 | 26.46 ± 14.47 | 12.49 ± 4.14 |
| REC/RI | 0.67 ± 0.09 | 0. 71 ± 10 | 0.53 ± 0.20 | 0.67 ± 0.3 | 0.57 ± 0.3 |
| REC/SD | 3.34 ± 0.83 | 3. 80 ± 1.46 | 2.56 ± 1.20 | 2.83 ± 1.71 | 2.64 ±1.23 |

LCC/IMT: Left common carotid intimal media thickness, RCC/IMT: right common carotid intima media thickness, LCC/Diam: left common carotid diameter, RCC/DIAM: right common carotid diameter, LCC/PSV, left common carotid peak systolic velocity, RCC/PSV: right common carotid peak systolic velocity. LCC/ EDV: left common carotid end diastolic velocity, RCC/EDV: right common carotid end diastolic velocity, LCC/RI: left common carotid resistivity index. RCC/RI: right common carotid resistivity index. LCC/S/D: left common carotid ratio of Peak systolic to end diastolic velocities. RCC/S/D: right common carotid ratio of Peak systolic to end diastolic velocities. LIC/IMT: Left internal carotid intimal media thickness, RIC/IMT: right internal carotid intima media thickness, LIC/Diam: left internal carotid diameter, RIC/DIAM: right internal carotid diameter, LIC/PSV, left internal carotid peak systolic velocity, RIC/PSV: right internal carotid peak systolic velocity. LIC/EDV: left internal carotid end diastolic velocity, RIC/EDV: right internal carotid end diastolic velocity, LIC/RI: left internal carotid resistivity index. RIC/RI: right internal carotid resistivity index. LIC/ S/D: left internal carotid ratio of Peak systolic to end diastolic velocities. RIC S/D: right internal carotid ratio of Peak systolic to end diastolic velocities. LEC/IMT: Left external carotid intimal media thickness, REC/IMT: right external carotid intima media thickness, LEC/Diam: left external carotid diameter, REC/DIAM: right external carotid diameter, LEC/PSV, left external carotid peak systolic velocity, REC/PSV: right external carotid peak systolic velocity. LEC EDV: left external carotid end diastolic velocity, REC/EDV: right external carotid end diastolic velocity, LEC/RI: left external carotid resistivity index. REC/RI: right external carotid resistivity index. LEC/S/D: left external carotid ratio of peak systolic to end diastolic velocities. REC S/D: right external carotid ratio of peak systolic to end diastolic velocities.

**Table 6: Mean Values of Left Carotid (Mid Artery) Variables For Sexes.**

| Left Carotid Variables | Mean ± Std. Deviation | Std. Error Mean |
|---|---|---|
| LCC/DIAMM(cm) | 0.69 ± 0.09 | 0.01 |
| LCC/DIAMF(cm) | 0.67±0.08 | 0.01 |
| LCC/IMTM(cm) | 0.076±0.03 | .004 |
| LCC/IMTF(cm) | 0.069 ± 0.02 | .004 |
| LCC/PSVM(cm/s) | 55.42±20.32 | 3.03 |
| LCC/PSVF(cm/s) | 59.98±20.63 | 3.08 |
| LCC/EDVM(cm/s) | 21.24±16.23 | 2.42 |
| LCC/EDVF(cm/s) | 24.71± 20.28 | 3.02 |
| LCC/RIM | 0.66 ± 0.19 | .03 |
| LCC/RIF | 0.63 ± 0.19 | .03 |
| LCC/SDM | 3.33± 1.33 | .20 |
| LCC/SDF | 3.25±1.22 | .179 |
| LIC/DIAMM(cm) | 0.84± 0.18 | .03 |
| LIC/DIAMF(cm) | 0.73± 0.14 | .02 |

| | | |
|---|---|---|
| LIC/IMTM(cm) | 0.065±0.01 | .002 |
| LIC/IMTF(cm) | 0.062± 0.03 | .004 |
| LIC/PSVM(cm/s) | 50.50±19.64 | 3.11 |
| LIC/PSVF(cm/s) | 50.32±26.45 | 4.18 |
| LIC/EDVM(cm/s) | 17.07±14.88 | 2.35 |
| LIC/EDVF(cm/s) | 24.00±25.43 | 4.02 |
| LIC/RIM | 0.99±1.69 | .28 |
| LIC/RIF | 0.54±0.22 | .04 |
| LIC/SDM | 3.97±1.93 | .32 |
| LIC/SDF | 2.69±1.36 | .23 |
| LEC/DIAMM(cm) | 0.57±0.11 | .02 |
| LEC/DIAMF(cm) | 0.55±0.14 | .02 |
| LEC/IMTM(cm) | 0.059±0.02 | .00 |
| LEC/IMTF(cm) | 0.058±0.02 | .00 |
| LEC/PSVM(cm/s) | 53.09 ±23.62 | 4.05 |
| LEC/PSVF(cm/s) | 51.09 ±23.80 | 4.08 |
| LEC/EDVM(cm/s) | 21.56±21.59 | 3.76 |
| LEC/EDVF(cm/s) | 24.39±21.24 | 3.70 |
| LEC/RIM | 0.62±0.86228 | .03 |
| LEC/RIF | 0.54±0.20 | 0.03 |
| LEC/SDM | 3.12±1.40 | 0.24 |
| LEC/SDF | 2.63±1.14 | 0.20 |

LCC/IMTM: left common carotid intimal media thickness in males, LCC/IMTF: left common carotid intima media thickness in females, LCC/DiamM: left common carotid diameter, LCC/DIAMF: left common carotid diameter, LCC/PSVM, left common carotid peak systolic velocity, in males. LCC/PSVF: left common carotid peak systolic velocity in females. LCC/ EDVM: left common carotid end diastolic velocity, LCC/EDVF: left common carotid end diastolic velocity in females, LCC/RIM: left common carotid resistivity index in males. LCC/RIF: left common carotid resistivity index in females. LCC/S/DM: left common carotid ratio of Peak systolic to end diastolic velocities in males. LCC/S/DF: left common carotid ratio of Peak systolic to end diastolic velocities in females. LIC/IMTM: left internal carotid intimal media thickness in males, LIC/IMTF: left internal carotid intima media thickness in females, LIC/DiamM: left internal carotid diameter, LIC/DIAMF: left internal carotid diameter, LIC/PSVM, left internal carotid peak systolic velocity, in males. LIC/PSVF: left internal carotid peak systolic velocity in females. LIC/ EDVM: left internal carotid end diastolic velocity, LIC/EDVF: left internal carotid end diastolic velocity in females, LIC/RIM: left internal carotid resistivity index in males. LIC/RIF: left internal carotid resistivity index in females. LIC/S/DM: left internal carotid ratio of Peak systolic to end diastolic velocities in males. LIC/S/DF: left internal carotid ratio of Peak systolic to end diastolic velocities in females. LEC/DiamM: left external carotid diameter, LEC/DIAMF: left external carotid diameter, LEC/PSVM, left external carotid peak systolic velocity, in males. LEC/PSVF: left external carotid peak systolic velocity in females. LEC/ EDVM: left external carotid end diastolic velocity, LEC/EDVF: left external carotid end diastolic velocity in females, LEC/RIM: left external carotid resistivity index in males. LEC/RIF: left external carotid resistivity index in females. LEC/S/DM: left external carotid ratio of Peak systolic to end diastolic velocities in males. LEC/S/DF: left external carotid ratio of Peak systolic to end diastolic velocities in females.

**Table 7: Sex Comparison Of Left Carotid (Mid Artery) Variables**

| Left Carotid Variables | Mean | Std. Deviation | Std. Error Mean | T | Sig. (2-tailed) |
|---|---|---|---|---|---|
| LCC/DIAMM - LCC/DIAM(cm) | .02 | .11 | .02 | 1.47 | .15 |
| LCC/IMTM - LCC/IMT(cm) | .01 | .04 | .01 | 1.35 | .19 |
| LCC/PSVM - LCC/PSV(cm/s) | -4.56 | 33.20 | 4.95 | -.92 | .36 |
| LCC/EDVM - LCC/EDV(cm/s) | -3.47 | 24.73 | 3.69 | -.94 | .35 |
| LCC/RIM - LCC/RI | .03 | .23 | .03 | 1.03 | .31 |
| LCC/SDM - LCC/SD | .08 | 1.40 | .21 | .38 | .70 |
| LIC/DIAMM - LIC/DIAM(cm) | .10 | .2140 | .03 | 3.27 | .00 |
| LIC/IMTM - LIC/IMT(cm) | .00 | .03 | .01 | .57 | .57 |
| LIC/PSVM - LIC/PSV(cm/s) | .18 | 33.88 | 5.36 | .03 | .97 |
| LIC/EDVM - LIC/EDV(cm/s) | -6.93 | 27.79 | 4.39 | -1.58 | .12 |
| LIC/RIM - LIC/RI | .43 | 1.67 | .28 | 1.56 | .13 |
| LIC/SDM - LIC/SD | 1.28 | 2.23 | .37 | 3.43 | .00 |
| LEC/DIAMM - LEC/DIAM(cm) | .02 | .18 | .03 | .60 | .55 |
| LEC/IMTM - LEC/IMT(cm) | .00 | .03 | .01 | .24 | .81 |
| LEC/PSVM - LEC/PSV(cm/s) | 1.21 | 33.50 | 5.75 | .35 | .73 |
| LEC/EDVM - LEC/EDV(cm/s) | -2.83 | 28.36 | 4.94 | -.57 | .57 |
| LEC/RIM - LEC/RI | .09 | .23 | .04 | 2.17 | .04 |
| LEC/SDM - LEC/SD | .49 | 1.48 | .26 | 1.90 | .07 |

LCC/IMTM: left common carotid intimal media thickness in males, LCC/IMTF: left common carotid intima media thickness in females, LCC/DiamM: left common carotid diameter, LCC/DIAMF: left common carotid diameter, LCC/PSVM, left common carotid peak systolic velocity, in males. LCC/PSVF: left common carotid peak systolic velocity in females. LCC/ EDVM: left common carotid end diastolic velocity, LCC/EDVF: left common carotid end diastolic velocity in females, LCC/RIM: left common carotid resistivity index in males. LCC/RIF: left common carotid resistivity index in females. LCC/S/DM: left common carotid ratio of Peak systolic to end diastolic velocities in males. LCC/S/DF: left common carotid ratio of Peak systolic to end diastolic velocities in females. LIC/IMTM: left internal carotid intimal media thickness in males, LIC/IMTF: left internal carotid intima media thickness in females, LIC/DiamM: left internal carotid diameter, LIC/DIAMF: left internal carotid diameter, LIC/PSVM, left internal carotid peak systolic velocity, in males. LIC/PSVF: left internal carotid peak systolic velocity in females. LIC/ EDVM: left internal carotid end diastolic velocity, LIC/EDVF: left internal carotid end diastolic velocity in females, LIC/RIM: left internal carotid resistivity index in males. LIC/RIF: left internal carotid resistivity index in females. LIC/S/DM: left internal carotid ratio of Peak systolic to end diastolic velocities in males. LIC/S/DF: left internal carotid ratio of Peak systolic to end diastolic velocities in females. LEC/DiamM: left external carotid diameter, LEC/DIAMF: left external carotid diameter, LEC/PSVM, left external carotid peak systolic velocity, in males. LEC/PSVF: left external carotid peak systolic velocity in females. LEC/ EDVM: left external carotid end diastolic velocity, LEC/EDVF: left external carotid end diastolic velocity in females, LEC/RIM: left external carotid resistivity index in males. LEC/RIF: left external carotid resistivity index in females. LEC/S/DM: left external carotid ratio of Peak systolic to end diastolic velocities in males. LEC/S/DF: left external carotid ratio of Peak systolic to end diastolic velocities in females.

**Table 8: Mean Values of Right Carotid (Mid Artery) Variables. For Sexes.**

| Right Carotid Variables | Mean± Std. Deviation | Std. Error Mean |
|---|---|---|
| RCC/DIAMM(cm) | 0.67± 0.13 | .02 |
| RCC/DIAMF(cm) | 0.68±0.08 | .01 |
| RCC/IMTM(cm) | 0.069±0.02 | .00 |
| RCC/IMTF(cm) | 0.066±0.02 | .00 |
| RCC/PSVM(cm/s) | 52.98±18.95 | 3.00 |
| RCC/PSVF(cm/s) | 48.31±20.92 | 3.31 |
| RCC/EDVM(cm/s) | 17.01±11.20 | 1.77 |
| RCC/EDVF(cm/s) | 16.91± 14.83 | 2.35 |
| RCC/RIM | 0.65 ± 0.15 | 0.24 |
| RCC/RIM | 0.62 ± 0.19 | 0.22 |
| RCC/SDM | 3.99±1.88 | 030 |
| RCC/SDF | 3.63±1.57 | 0.25 |
| RIC/DIAMM(cm) | 0.69±0.16 | 0.03 |
| RIC/DIAMF(cm) | 0.70±0.11 | 0.02 |
| RIC/IMTM(cm) | 0.066±0.02 | 0.00 |
| RIC/IMTF(cm) | 0.060±.02 | 0.00 |
| RIC/PSVM(cm/s) | 54.72± 24.45 | 4.26 |
| RIC/PSVF(cm/s) | 57.28± 20.40 | 3.55 |
| RIC/EDVM(cm/s) | 23.83± 21.77 | 3.79 |
| RIC/EDVF(cm/s) | 20.02± 18.62 | 3.24 |
| RIC/RIM | 0.62± 0.21 | 0.04 |
| RIC/RIF | 0.61± 0.16 | 0.03 |
| RIC/SDM | 3.53± 40 | 0.42 |
| RIC/SDF | 3.25±0.85 | 0.32 |
| REC/DIAM(cm) | 0.55 ± 0.14 | 0.03 |
| REC/DIAM(cm) | 0.51± 0.11 | 0.02 |
| REC/PSV(cm/s) | 56.11±0.87 | 4.72 |
| REC/PSV(cm/s) | 45.07± 22.02 | 4.02 |
| REC/EDV(cm/s) | 27.68± 24.73 | 4.51 |
| REC/EDV(cm/s) | 20.86± 9.08 | 3.48 |
| REC/RI | 0.61± 0.35 | 0.06 |
| REC/RI | 0.57 ± 0.18 | 0.03 |
| REC/SD | 2.71 ± 1.47 | 0.27 |
| REC/SD | 2.72 ± 1.18 | 0.21 |

RCC/IMTM: right common carotid intimal media thickness in males, RCC/IMTF: right common carotid intima media thickness in females, RCC/DiamM: right common carotid diameter, RCC/DIAMF: right common carotid diameter, RCC/PSVM, right common carotid peak systolic velocity, in males. RCC/PSVF: right common carotid peak systolic velocity in females. RCC/ EDVM: right common carotid end diastolic velocity, RCC/EDVF: right common carotid end diastolic velocity in females, RCC/RIM: right common carotid resistivity index in males. RCC/RIF: right common carotid resistivity index in females. RCC/S/DM: right common carotid ratio of Peak systolic to end diastolic velocities in males. RCC/S/DF: right common carotid ratio of Peak systolic to end diastolic velocities in females. RIC/IMTM: right internal carotid intimal media thickness in males, RIC/IMTF: right internal carotid intima media thickness in females, RIC/DiamM: right internal carotid diameter, RIC/DIAMF: right internal carotid diameter, RIC/PSVM, right internal carotid peak systolic velocity, in males. RIC/PSVF: right internal carotid peak systolic velocity in females. RIC/ EDVM: right internal carotid end diastolic velocity, RIC/EDVF: right internal carotid end diastolic velocity in females, RIC/RIM: right internal carotid resistivity index in males. RIC/RIF: right internal carotid resistivity index in females. RIC/S/DM: right internal carotid ratio

of Peak systolic to end diastolic velocities in males. RIC/S/DF: right internal carotid ratio of Peak systolic to end diastolic velocities in females. REC/DiamM: right external carotid diameter, REC/DIAMF: right external carotid diameter, REC/PSVM, right external carotid peak systolic velocity, in males. REC/PSVF: right external carotid peak systolic velocity in females. REC/ EDVM: right external carotid end diastolic velocity, REC/EDVF: right external carotid end diastolic velocity in females, REC/RIM: right external carotid resistivity index in males. REC/RIF: right external carotid resistivity index in females. REC/S/DM: right external carotid ratio of Peak systolic to end diastolic velocities in males. REC/S/DF: right external carotid ratio of Peak systolic to end diastolic velocities in females.

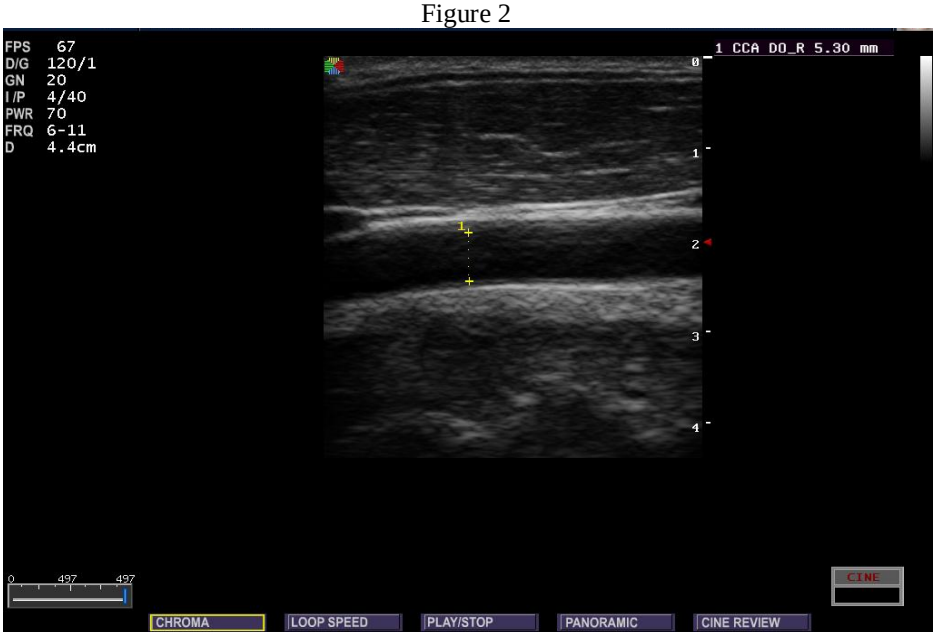
**Table 9: Sex Comparison Of Right Carotid (Mid Artery) Variables**

| CAROTID PARAMETRS | Mean | Std. Deviation | Std. Error Mean | t | Sig. (2-tailed) |
|---|---|---|---|---|---|
| RCC/DIAMM - RCC/DIAMF(cm) | -0.00 | .14 | .02 | -.29 | .77 |
| RCC/IMTM - RCC/IMTF(cm) | 0.00 | .02 | .00 | .70 | .49 |
| RCC/PSVM - RCC/PSVF(cm/s) | 4.67 | 29.83 | 4.72 | .99 | .33 |
| RCC/EDVM - RCC/EDVF(cm/s) | 0.10 | 18.32 | 2.90 | .03 | .97 |
| RCC/SDM - RCC/SDF | 0.35 | 2.17 | .34 | 1.02 | .31 |
| RIC/DIAMM - RIC/DIAMF(cm) | 0.10 | 0.18 | .04 | 3.29 | .00 |
| RIC/IMTM - RIC/IMTF(cm) | 0.01 | .02 | .00 | 1.45 | .17 |
| RIC/PSVM - RIC/PSVF(cm/s) | 7.44 | 34.18 | 5.95 | 1.25 | .22 |
| RIC/EDVM - RIC/EDVF(cm/s) | 3.81 | 26.75 | 4.66 | .82 | .42 |
| RIC/RIM - RIC/RIF | 0.01 | .26 | .05 | .27 | .79 |
| RIC/SDM - RIC/SDF | 0.28 | 2.78 | .48 | .58 | .57 |
| REC/DIAMM - REC/DIAMF(cm) | 0.04 | .18 | .03 | 1.32 | .20 |
| REC/PSVM - REC/PSVF(cm/s) | 11.04 | 35.80 | 6.54 | 1.69 | .102 |
| REC/EDVM - REC/EDVF(cm/s) | 6.82 | 30.08 | 5.49 | 1.24 | .24 |
| REC/RIM - REC/RIF | 0.04 | .36 | .07 | .65 | .52 |
| REC/SDM - REC/SDF | -0.01 | 1.36 | .25 | -.03 | .98 |

RCC/IMTM: right common carotid intimal media thickness in males, RCC/IMTF: right common carotid intima media thickness in females, RCC/DiamM: right common carotid diameter, RCC/DIAMF: right common carotid diameter, RCC/PSVM, right common carotid peak systolic velocity, in males. RCC/PSVF: right common carotid peak systolic velocity in females. RCC/ EDVM: right common carotid end diastolic velocity, RCC/EDVF: right common carotid end diastolic velocity in females, RCC/RIM: right common carotid resistivity index in males. RCC/RIF: right common carotid resistivity index in females. RCC/S/DM: right common carotid ratio of Peak systolic to end diastolic velocities in males. RCC/S/DF: right common carotid ratio of Peak systolic to end diastolic velocities in females. RIC/IMTM: right internal carotid intimal media thickness in males, RIC/IMTF: right internal carotid intima media thickness in females, RIC/DiamM: right internal carotid diameter, RIC/DIAMF: right internal carotid diameter, RIC/PSVM, right internal carotid peak systolic velocity, in males. RIC/PSVF: right internal carotid peak systolic velocity in females. RIC/ EDVM: right internal carotid end diastolic velocity, RIC/EDVF: right internal carotid end diastolic velocity in females, RIC/RIM: right internal carotid resistivity index in males. RIC/RIF: right internal carotid resistivity index in females. RIC/S/DM: right internal carotid ratio of Peak systolic to end diastolic velocities in males. RIC/S/DF: right internal carotid ratio of Peak systolic to end diastolic velocities in females. REC/DiamM: right external carotid diameter, REC/DIAMF: right external carotid diameter, REC/PSVM, right external carotid peak systolic velocity, in males. REC/PSVF: right external carotid peak systolic velocity in females. REC/ EDVM: right external carotid end diastolic velocity, REC/EDVF: right external carotid end diastolic velocity in females, REC/RIM: right external carotid resistivity index in males. REC/RIF: right external carotid resistivity index in females. REC/S/DM: right external carotid ratio of Peak systolic to end diastolic velocities in males. REC/S/DF: right external carotid ratio of Peak systolic to end diastolic velocities in females.

Figure 1


Figure 2

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