



Anthropometric indices, a predictive marker for stroke and other metabolic disorders

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Abstract. Although a lot of studies have been conducted on stroke and its prevention, stroke is yet a common occurrence in Nigeria. Hence, it becomes imperative to identify reliable and easily accessible predictive markers for stroke and other metabolic disorders. This research therefore aimed to investigate the prediction of stroke and other metabolic disorders using anthropometric indices. The study population included 211 subjects with 86 males and 125 females at an age range of 26 to 95 years, and the selection process employed a simple random sampling method. Anthropometric indices like body mass index, waist-hip ratio, waist circumference, hip circumference and abdominal circumference were measured. The body mass index and waist-hip ratio in females compared to their male counterparts were 32.32 and 28.90 respectively for body mass index and 0.95 and 0.94 respectively for the waist-hip ratio. The male subjects had an abnormal body mass index, with peak values at ages greater than 36. The most number of stroke and metabolic disease patients were documented at the ages of 56 to 65 years for both male and female subjects. All females diagnosed with stroke and other metabolic diseases had an abnormal waist-hip ratio (>0.80) while most of the males had a high normal waist-hip ratio. There was also a statistically significant sex variation ($p \leq 0.05$) in the body mass index and hip circumference for patients diagnosed with stroke and other metabolic diseases. No correlation exists between age and the occurrence of stroke and other metabolic diseases. The findings show that the anthropometric indices: body mass index, waist-hip ratio and hip circumference were better predictive markers than the age of the subjects. Again, the study showed that high normal waist-hip ratio was a good predictive marker for stroke and other metabolic disorders in males. The findings of this study will be relevant for medical experts, nutritionists, and stroke prevention associations

Keywords: anthropometry; body mass index; cardiovascular disease; hip circumference; waist-hip ratio

Introduction

Stroke is a cerebrovascular disease resulting from a haemorrhage of a blood vessel in the brain and arising from several traumatic and metabolic conditions. R. Lalo *et al.* [1] in his study documented that over 65% of stroke

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patients had diabetes and over 47% had hypertension. Most studies conducted have linked stroke to cardiac origin, with cardioembolism being the major precipitating condition and resulting in an ischaemic stroke [2, 3]. Therefore, considering the unreported cases and as well those not accounted for at all, makes stroke an enormous socio-medical burden. Several risk factors have however been documented for stroke and among all, obesity being highly implicated [4] but with no much precision to which anthropometric parameter is of a greater risk. Despite advancements in stroke research and prevention, there is a need to identify reliable and easily accessible predictive markers for stroke and other metabolic diseases. It is being documented from current research that hypertension, sinus arteriosclerosis and as well venous thrombosis in the young are the primary contributors to stroke [5], and these conditions themselves are primarily influenced by anthropometric factors.

Waist circumference (WC) serves as a valuable metric for measuring abdominal fat accumulation. A recent study conducted on adults of Shanghai in China on the association between Body mass index (BMI) and Stroke documented a U-Shaped relationship with attenuations in both stroke and mortality in much advanced age groups [6]. D.H. Kim *et al.* [7] discovered positive associations between WC variations and stroke occurrence and ultimately ending in death.

In a population-based study conducted in southwestern Nigeria, E. Taiwo & L.O.O. Thanni [8] stated that WC emerged as a reliable predictor of cardiovascular risk factors like hypertension and diabetes. It was documented that the association between hip circumference (HC) and stroke risk differs slightly in individuals based on age and height. It was also demonstrated by Y. Li *et al.* [9], that both the HC and the WC have independent and opposite effects on stroke risk, with waist-hip ratio (WHR) having a more significant impact. Therefore, although HC be related to stroke risk, this relationship is often strongly described in terms of the WHR [10]. In the assessment of central obesity, WC and WHR have become profoundly common parameters, and these indices have been related to an increase in cardiovascular diseases [11]. It is evident following the findings from previous studies that anthropometric indices, especially abnormal BMI and WHR, are implicated in cardiovascular diseases. Obesity and high waist circumferences have been tagged as high-risk factors in the occurrence of diabetes and hypertension. These as well are high risk factors in stroke occurrence. This research therefore aimed to investigate the prediction of stroke occurrence as well as other metabolic diseases using the measurement of some anthropometric parameters.

Materials and Methods

This is both a retrospective and prospective cross-sectional study. To align with the research objectives, the selection of the study population encompasses individuals who have received a diagnosis of stroke at the neurologic clinic of the Rivers State University Teaching Hospital (RSUTH) and other patients who have been diagnosed with hypertension,

diabetes and other heart and metabolic related disease. Diagnosis of these health conditions was confirmed from patient's questionnaire and hospital folders collected over a period of three years from 2020 to 2023. Stroke cases due to viral illnesses and trauma were excluded from this study. A sample size of 211 participants with 86 males and 125 females at an age range of 26 to 95 years were recruited, and the selection process employed a simple random sampling method.

Data were collected from participants using a questionnaire with information covering demographic characteristics like gender, age, medical conditions such as stroke and stroke risk factors such as hypertension, diabetes, and other heart related diseases. Participants were interviewed once, at a single time point, providing a snapshot of the relationship between exposures and outcomes at that moment. Patients were recruited to fill the study questions after an informed consent. Patients who had cognitive disabilities were used after relatives had signed the questionnaire. Individuals who excluded details were removed.

Anthropometric indices measurement and calculation. Weight was measured with subjects minimally clothed without shoes, using digital scales and recorded to the nearest 0.01 kg. Height was measured in a standing position without shoes, using a tape meter with shoulders in a normal alignment. BMI was calculated as weight (*kg*) divided by square of height (*m*²).

$$BMI = \frac{Weight (kg)}{Height (m^2)}, \quad (1)$$

where BMI – body mass index.

WC was measured at umbilical level, using an unstretched tape meter to wrap around the body level between the jugular notch superiorly and pubic symphysis inferiorly, without any pressure to body surface and HC at around the widest part of one's hips, typically just below the greater trochanter and above the pubic symphysis. The measuring tape was made to run parallel to the ground and fits comfortably without being excessively tight in both measurements.

WC was measured using an unstretched tape meter, with the measuring tape placed horizontally around the widest part of the person's hips and buttocks. WHR was calculated as WC (*cm*) divided by HC (*cm*).

$$WHR = \frac{WC}{HC}, \quad (2)$$

where WHR – waist-hip-ratio, WC – waist circumference, HC – hip circumference.

Data was analysed using SPSS version 23 and Microsoft Excel. Statistical tools such as mean and standard deviation as well as the student t test, ANOVA and Pearson's correlation were utilised for data analysis. A p-value of ≤0.05 was considered statistically significant.

All subjects who participated in the study were given an informed consent as to the relevance of the study and that the measurements portend no potential hazards to

their body and health. They were assured of confidentiality of their data and informed of private access to outcome of research on request. Ethical principles were observed in the work in accordance to the Helsinki Declaration [12]. Ethical approval was granted by the Rivers State University Teaching Hospital Research Ethics Committee (RSUTH/REC/2023350).

Results

The results of the study presented in Tables 1 to 10 provide important information about the population of

patients diagnosed with stroke and other metabolic diseases. The tables provide detailed statistics on age, sex and anthropometric characteristics of the groups studied. The research shows the relationship between the occurrence of stroke and other metabolic diseases with anthropometry. This could inform researchers and clinicians interventional measures to adopt when managing patients and as well preventive care. Table 1 shows greater BMI and WHR in females compared to their male counterparts at values of 32.32 and 28.90 respectively for BMI and 0.95 and 0.94 respectively for the WHR.

Table 1. Descriptive statistics of subjects diagnosed with stroke and other metabolic diseases

	Sex	N	Mean	Std. Deviation	Std. Error
Age (years.)	Male	86	60.03	11.23	1.21
	Female	125	57.48	13.09	1.17
BMI (kg/m ²)	Male	86	28.90	5.26	0.57
	Female	125	32.32	8.08	0.72
WHR	Male	86	0.94	0.06	0.01
	Female	125	0.95	0.21	0.02
WC (cm)	Male	86	94.72	13.69	1.48
	Female	125	97.56	12.45	1.11
HC (cm)	Male	86	100.71	12.52	1.35
	Female	125	105.08	14.06	1.26
AC (cm)	Male	86	94.72	13.69	1.48
	Female	125	97.56	12.45	1.11

Notes: BMI – body mass index; WHR – waist-hip ratio; WC – waist circumference; HC – hip circumference; AC – abdominal circumference; N – number of participants

Source: compiled by the authors

Both male and female subjects showed slight variations in their anthropometric indices, with females having higher number of abnormal WHR and BMI. This could also explain the reason of having more female than male

patients. Table 2 shows that most male subjects had an abnormal BMI, with peak values at ages greater than 36. The greatest number of patients were documented at the ages of 56 to 65 years.

Table 2. BMI of subjects diagnosed with stroke and other metabolic diseases

Age groups (years)	N		Mean height(m ²)		Mean weight (kg)		BMI (kg/m ²)	
	M	F	M	F	M	F	M	F
16-25	0	1	0	2.62	0	78.00	0	29.70
26-35	2	5	3.12	2.78	75.00	76.10	23.93	27.90
36-45	6	18	2.78	2.36	81.30	70.80	30.40	30.40
46-55	18	24	2.51	2.42	76.00	77.90	30.43	32.60
56-65	38	44	2.57	2.29	70.60	73.60	27.70	33.00
66-75	14	24	2.41	2.18	71.70	71.30	30.20	33.60
76-85	7	6	2.59	2.28	74.40	62.90	30.50	28.70
86-95	1	2	2.34	1.94	58.00	59.50	24.80	31.10

Notes: N – number of subjects; BMI – body mass index; N – number of subjects; M – male; F– female

Source: compiled by the authors

Normal BMI values in the range of 18.5 to 24.9 are considered normal by World Health Organization (WHO) standards at the time of update in 2024 [13]. Most male patients fell into the middle age class, and this appears to be the period with much weight gain and fat accumulation. The table also shows that all female subjects had abnormal BMI (BMI > 24.9 is abnormal

according to WHO) with a greater number of patients within the age range of 56 and 65 years. Stroke cases appear commoner in females of the middle age class. Table 3 shows most male subjects with high normal WHR. A greater number of patients fell into the age range of 46 and 75, with the highest numbers at the ages of 56 to 65 years.

Table 3. WHR of subjects diagnosed with stroke and other metabolic diseases

Age groups (years)	N		Mean WC (CM)		Mean HC (CM)		WHR	
	M	F	M	F	M	F	M	F
16-25	0	1	0	90	0	108	0	0.83
26-35	2	5	83.5	91.5	98	106.3	0.85	0.87
36-45	6	18	93.8	91.9	100.7	102.2	0.93	0.90
46-55	18	24	97.4	97.4	103.1	102.9	0.94	1.01
56-65	38	44	95.1	98.9	101.3	105.9	0.94	0.94
66-75	14	24	88.9	101.2	93.7	106.9	0.94	0.96
76-85	7	6	99.1	100.8	106.3	103.7	0.93	0.98
86-95	1	2	107	102.5	101	102	1.10	1.01

Notes: WHR – waist-hip ratio; WC – waist circumference; HC – hip circumference; N – number of subjects; M – male; F –female

Source: compiled by the authors

Normal values for WHR, males = <0.95 and females = <0.80 are considered normal by WHO standards at the time of update in 2024. [13]. The table also shows that all females diagnosed of stroke and other metabolic diseases had an abnormal WHR (WHR > 0.80 in females are considered abnormal according to WHO). Most

patients fell into the category with very high WHR. Abnormal WHR appears commoner among female subjects as compared to their male counterparts. Table 4 shows statistically significant sex variation ($p \leq 0.05$) in the BMI and HC for patients diagnosed with stroke and other metabolic diseases.

Table 4. T-test to determine sex variation among subjects diagnosed with stroke and other metabolic diseases

Anthropometric indices		T value	t-critical	Df	Sig. (2-tailed)	Mean difference	Std. error difference
Age (years)	Equal variances assumed	1.48	0.68	209.00	0.14	2.56	1.73
	Equal variances not assumed	1.52	0.68	198.98	0.13	2.56	1.68
BMI (kg/m ²)	Equal variances assumed	-3.45	0.68	209.00	0.00	-3.42	0.99
	Equal variances not assumed	-3.72	0.68	208.42	0.00*	-3.42	0.92
WHR	Equal variances assumed	-0.21	0.68	209.00	0.84	-0.00	0.02
	Equal variances not assumed	-0.25	0.68	153.73	0.81	-0.00	0.02
WC	Equal variances assumed	-1.56	0.68	209.00	0.12	-2.84	1.82
	Equal variances not assumed	-1.54	0.68	171.22	0.13	-2.84	1.85
HC	Equal variances assumed	-2.32	0.68	209.00	0.02*	-4.37	1.89
	Equal variances not assumed	-2.37	0.68	195.59	0.02	-4.37	1.85
AC	Equal variances assumed	-1.56	0.68	209.00	0.12	-2.84	1.82
	Equal variances not assumed	-1.54	0.68	171.22	0.13	-2.84	1.85

Notes: BMI – body mass index; WHR – waist-hip ratio; WC – waist circumference; HC – hip circumference; AC – abdominal circumference; * – significance ($p \leq 0.05$)

Source: compiled by the authors

The study shows that sex differences occur with the BMI and HC, and this could suggest the reason for having more female cases of stroke, as shown in earlier

tables. Table 5 shows no statistically significant difference in the various anthropometric indices studied across the male age groups.

Table 5. Variation among different age groups of male subjects diagnosed with stroke and other metabolic diseases using ANOVA

Anthropometric indices	Sum of squares	df	Mean square	F value	F-critical	P value
BMI (kg/m ²)	Between groups	115.63	3	38.54	1.414	2.72
	Within groups	2,235.22	82	27.26		
	Total	2,350.84	85			
WHR	Between groups	0.02	3	0.01	1.61	2.72
	Within groups	0.31	82	0.00		
	Total	0.33	85			
WC (cm)	Between groups	646.23	3	215.41	1.16	2.72
	Within groups	15,286.04	82	186.42		
	Total	15,932.27	85			

Continued Table 5

Anthropometric indices	Sum of squares	df	Mean square	F value	F-critical	P value
HC (cm)	Between groups	398.63	3	132.88	0.84	2.72
	Within groups	12,915.11	82	157.50		
	Total	13,313.73	85			
AC (cm)	Between groups	646.23	3	215.41	1.16	2.72
	Within groups	15,286.04	82	186.42		
	Total	15,932.27	85			

Notes: BMI – body mass index; WHR – waist-hip ratio; WC – waist circumference; HC – hip circumference; AC – abdominal circumference; df – degree of freedom

Source: compiled by the authors

All male subjects diagnosed with stroke and other metabolic diseases had similar anthropometric measurements, irrespective of their age differences. Table 6 shows no statistically significant difference in the various anthropometric indices studied across the female age groups.

All female subjects diagnosed with stroke and other metabolic diseases had similar anthropometric measurements, irrespective of their age differences. Table 7 shows a very weak positive correlation between age and the anthropometric indices studied for both male and female subjects.

Table 6. Variation among different age groups of female subjects diagnosed with stroke and other metabolic diseases using ANOVA

Anthropometric indices	Sum of squares	df	Mean square	F value	F-critical	P value
BMI (kg/m ²)	Between groups	308.92	3	102.97	1.59	2.68
	Within groups	7,794.98	121	64.42		
	Total	8,103.89	124			
WHR	Between groups	0.07	3	0.02	0.49	2.68
	Within groups	5.45	121	0.05		
	Total	5.52	124			
WC (cm)	Between groups	764.55	3	254.85	1.67	2.68
	Within groups	18,451.06	121	152.49		
	Total	19,215.61	124			
HC (cm)	Between groups	472.91	3	157.64	0.79	2.68
	Within groups	24,034.29	121	198.63		
	Total	24,507.20	124			
AC (cm)	Between groups	764.55	3	254.85	1.67	2.68
	Within groups	18,451.06	121	152.49		
	Total	19,215.61	124			

Notes: BMI – body mass index; WHR – waist-hip ratio; WC – waist circumference; HC – hip circumference; AC – abdominal circumference; df – degree of freedom

Source: compiled by the authors

Table 7. Relationship between anthropometric indices and age

Anthropometric indices	Correlation (r)	
	Male (N = 86)	Female (N = 125)
BMI	0.07	0.12
WHR	0.20	0.07
WC	0.11	0.23
HC	0.03	0.07

Notes: N – number of subjects; BMI – body mass index; WHR – waist-hip ratio; WC – waist circumference; HC – hip circumference

Source: compiled by the authors

The independent anthropometric indices studied were not influenced by age, as seen in this table. This could explain the reason for having lots of stroke cases even among

the younger age group. Table 8 shows no correlation between age and the occurrence of stroke and other metabolic diseases for both male and female subjects.

Table 8. Relationship between age and occurrence of stroke and other metabolic diseases

Sex	Correlation (r)
Male	-0.03
Female	0.10

Source: compiled by the authors

The study therefore showed a very weak association with age, and rather holds the fact that the anthropometric indices are a stronger predictor of age. The anthropometric indices studied in the present work have shown a strong relationship with the occurrence of stroke in both male and female subjects. The study shows that these anthropometric indices are stronger stroke indicators than even age, which is a major non-modifiable risk factor in previous studies.

Discussion

A total of 211 participants were involved in the study, comprising 41% males and 59% females. The average age was 60.3 years for males and 57.5 years for females. Male subjects had an average BMI of 28.90 kg/m², while females had an average of 32.32 kg/m². The WHR was 0.94 for males and 0.95 for females, with male and female abdominal circumferences averaging 94.72 cm and 97.56 cm, respectively (Table 1). The study presents the mean height, weight, and BMI for different age groups of male subjects, which are shown in Table 2, ranging from 26 to 94 years. The mean BMI varied from 23.9 to 30.4, with four out of seven age groups classified as obese (>30) by the WHO BMI chart [13]. The remaining age groups were overweight (>24.9) or normal (18-24.9). Over 97% of male subjects had an overweight BMI, aligning with studies by M. Shiozawa *et al.* [14], indicating a link between abnormal BMI in males and the risk of stroke and other cardiovascular and metabolic diseases. There was an increase in the number of patients with an increase in abnormal BMI, such as over 18 subjects had a BMI of 30.43, 38 subjects had a BMI of 27 and 14 subjects had a BMI of 30.2. Further proving previous research such as that of M.A. Bashir *et al.* [15] who stated that obesity is a well-established stroke risk factor among Nigerian subjects and thus maintaining a healthy weight is crucial for stroke prevention. The present study thus observed very few numbers of patients with normal BMI values, such that only one patient had a BMI of 24.8 and two had a mean BMI value of 23.93. This proves BMI as a predictive marker for stroke and other metabolic diseases in the male subjects. Again, as seen in Table 2, the number of stroke cases increased with age up to 65 years. However, the decline in number of cases after 65 years cannot be explained by this study. The age group 66-75 has a relatively higher mean BMI, which, when combined with age, may indicate a higher risk of stroke. The greatest number of patients were documented at the ages of 56 to 65 years. This follows studies by F. Ramati *et al.* [16], who stated that stroke is a disease associated with ageing. This systematic review discovered that the prevalence of stroke increased with increasing mean age of the elderly and

decreased with increasing year of publication. This non-modifiable risk factor increases the incidence of cerebrovascular events, doubling it for each decade after the age of 55 years, which is consistent with the findings for age groups 46-55 and 56-65 (Table 2). In further analysis, the present study obtained that no female subjects had a normal BMI. This suggests that 100% of female subjects had an overweight or obese BMI, consistent with prior research indicating a risk of stroke and other diseases associated with abnormal BMI in females [4, 6]. In the same vein, the greatest number of female patients were documented at the ages of 56 to 65 years (Table 2).

The data displays the mean WC, hip circumference, and WHR for different age groups of male subjects, as shown in Table 3. WHR ranged from 0.85 to 1.10, with six out of seven age groups having a low health risk WHR (<0.95) and one group having a high health risk WHR (>1.0). Approximately 99% of male subjects had a low health risk WHR (<0.95); however, the WHR value for the 99% of the subjects was high normal (within the range of 0.93 to 1.10). The higher the WHR value, the greater the number of subjects diagnosed with stroke and other metabolic disorders in male subjects. The present however shows that high normal WHR is a predictive marker for stroke and other metabolic diseases in male Nigerian subjects. These findings support previous research which suggest a link between abnormal WHR and increased health risks [9]. According to E. Taiwo & L.O.O. Thanni [8], WHR appears to be a more effective anthropometric parameter for predicting cardiovascular outcomes than BMI. Also, the mean WC tends to increase with age, with the highest value observed in the oldest age group (86-95). Increased WC is associated with abdominal obesity, which is a risk factor for stroke and cardiovascular diseases, supporting some previous studies [7, 8]. However, WC alone may not be suitable for comparing individuals with different body sizes and masses [8].

The mean HC also generally increases with age but begins a downward slope at ages greater than 55 in male subjects (Table 3). The present study shows that a larger number of male subjects diagnosed with stroke and other metabolic disorders had a greater HC, whereas only a few subjects with smaller HC were diagnosed with stroke and other metabolic diseases. Hence, HC is shown to be a good predictor of stroke and other metabolic disorders. However, in some isolated metabolic disorders like Type 2 diabetes mellitus, an inverse association exists between HC and the risk of developing diabetes in studies by A. Jayedi *et al.* [17]. Although these studies were cross-sectional, they consistently found inverse associations of HC with diabetes prevalence. It is worthy of note that more than 60% of subjects

in this present study had hypertension with less than 30% diagnosed with diabetes and stroke. It is thus imperative to say that most of the subjects with high HC fell into the category diagnosed with hypertension. Hence, it is correct to admit that the subjects in the present study had no inverse relationship between HC and other metabolic disorders because only a few of the subjects were diagnosed with diabetes. Therefore, finding an inverse relationship between HC and diabetes is justifiable. HC is thus a more complex predictive marker. Hence, making the WHR a more reliable metric according to Y. Li *et al.* [9]. The data shows variability in WC, HC, and WHR across age groups, emphasizing the importance of considering these factors collectively.

The data displays the mean waist and HC and WHR for different age groups of female subjects, as shown in Table 3. The mean WHR ranged from 0.83 to 1.01, with all age groups classified as high health risk (>0.80). This suggests that 100% of female subjects in this study had a high health risk WHR, in line with earlier studies showing a link between abnormal WHR in females and a risk of stroke and other metabolic illnesses [11]. The WHR values in the female subjects are generally lower than those of the male subjects, which is consistent with general findings for sex. Similar to the previous male data, WC tends to increase with age, with the highest values observed in the oldest age groups (76-85 and 86-95) (Table 3). Increased WC is associated with abdominal obesity, a known risk factor for stroke. These findings complement an additional report by A. Jayedi *et al.* [17].

Also, there is a statistically significant difference ($p = 0.00$) (Table 4) in the BMI between male and female subjects, indicating potential gender-related variations in body composition. The negative t-values suggest that, on average, males may have a lower BMI than females, as seen in the current study (Table 2). The significant differences in BMI between genders may contribute to variations in obesity-related risks for stroke and metabolic disorders. Central obesity is a known risk factor for these conditions. This is shown in the findings, females having greater BMI and more cases of stroke (Table 2). Again, ANOVA to test variation among age groups of male and female subjects (Tables 5 and 6) diagnosed with stroke and other metabolic disorders show that the anthropometric indices: BMI, WHR, WC, HC, and AC suggest no statistically significant differences ($p > 0.05$) between sexes. This infers that stroke and other metabolic diseases investigated in this study affects all age groups independently irrespective of their ages as long as their anthropometric indices are abnormal, especially the most predictive factors. Thus, all male and female subjects diagnosed with stroke and other metabolic diseases had similar anthropometric measurements, irrespective of their age differences. The present study also considered the relationship between anthropometric indices and age and discovered no correlation (r) between the two variables (Table 7). Therefore, age in this study had no much influence on the outcome of the anthropometric measures. This could also suggest the reason younger individuals with

abnormal anthropometric indices had greater number of patients in the study. Although N. Ali *et al.* [18], in a study, stated that age is an independent non-modifiable risk factor for metabolic disorders, there was no correlation between age and the occurrence of stroke and other metabolic diseases in the present study (Table 8). Also, L. Li *et al.* [19] in a study documented a 67% increase in stroke incidence in participants younger than 55 years and a 15% decrease in participants 55 years and older. However, this seems to be in agreement with J. Kalita *et al.* [20] who reported higher stroke incidence in persons with greater economic challenges like unemployment and obtained more stroke occurrences in the males. It is imperative, as those younger than 55 years would fall into the class of people faced with joblessness and other economic issues. In a current study, however, S.L. Liew *et al.* [21] stated that brain age and not just the chronological age is a stronger risk factor and determines the outcome of post-stroke in stroke patients. The findings were taken from anthropological measurements of regions of the brain. This also is in consent with the present study which discovered that anthropometric indices: BMI, WHR and HC were better predictive markers than the age of the subjects.

Conclusions

The study provides valuable insights into the health profiles of male and female participants, revealing a high prevalence of abnormal BMI and WHR, with observation of gender-specific differences which should be noted during health interventions. Again, this study showed that males with high normal WHR were diagnosed with stroke and other metabolic disorders. Although WHR may not be an independent factor as it was not studied alone and more so, most of the participants in the present study had both an abnormal WHR ($F = 0.83-1.01$) and as well an abnormal BMI ($M = 27.7-30.5$, $F = 27.9-33.6$), a high normal WHR in males ($0.93-1.10$) could be a good predictor especially, as seen in this study. It is therefore imperative to note that individuals with normal but high-normal WHR should be high-risk indicators for stroke and other metabolic disorders. It is therefore noted that anthropometric indices like the BMI, WHR, WC and HC have great influence on the occurrence of stroke and other metabolic diseases. Again, though age is an important factor in previous studies, the current study shows that once the anthropometric indices are abnormal, age is not a major factor any longer. Hence, whether in young or old age, stroke, and other metabolic disorders could occur once there are abnormal anthropometric indices. This is important, therefore, because age and abnormal anthropometric indices are independently associated with stroke risk. It is important therefore for medical experts and caregivers to measure and document these anthropometric indices when managing patients with stroke and other metabolic diseases, as this could impact on the prognosis and more so predict future outcomes. It is also important that future studies should consider whether high normal WHR and/or even BMI are very strong indicators

for stroke. Studies looking at these anthropometric indices as independent risk factors for stroke and other metabolic diseases should be widely undertaken.

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Conflict of Interest

The authors declare no conflict of interest.

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Антропометричні показники як предиктори інсульту та інших метаболічних захворювань

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Анотація. Незважаючи на достатню кількість проведених досліджень щодо інсульту та його запобігання, він все ще залишається поширеною проблемою в Нігерії. Тому важливо виявити надійні та легкодоступні маркери для прогнозування інсульту та інших метаболічних захворювань. Відтак, дане дослідження було спрямоване на вивчення можливості прогнозування інсультів та інших метаболічних порушень за допомогою антропометричних показників. Досліджувана популяція включала 211 осіб, з них 86 чоловіків і 125 жінок у віковому діапазоні від 26 до 95 років. Вибір учасників здійснювався методом випадкової вибірки. Вимірювались такі антропометричні показники: індекс маси тіла, співвідношення обхвату талії до обхвату стегон, обхват талії, обхват стегон і обхват живота. Індекс маси тіла та співвідношення обхвату талії до обхвату стегон у жінок порівняно з чоловіками склали відповідно 32,32 і 0,95 для індексу маси тіла та 28,90 і 0,94 для співвідношення обхвату талії до обхвату стегон. У чоловіків спостерігали аномальний індекс маси тіла з піковими значеннями у віці старше 36 років. Найбільша кількість пацієнтів із інсультом та метаболічними захворюваннями була зафіксована у віці від 56 до 65 років як серед чоловіків, так і серед жінок. Усі жінки з діагнозом інсульту та інших метаболічних захворювань мали аномальне співвідношення обхвату талії до обхвату стегон ($>0,80$), тоді як більшість чоловіків мали високе, але нормальне співвідношення. Також спостерігалася статистично значуща різниця за статевою ознакою ($p \leq 0,05$) щодо індексу маси тіла та обхвату стегон у пацієнтів, із діагнозом інсульту та інших метаболічних захворювань. Між віком, частотою інсульту та іншими метаболічними захворюваннями кореляції не виявлено. Результати дослідження свідчать про те, що антропометричні показники, такі як індекс маси тіла, співвідношення обхвату талії до обхвату стегон та обхват стегон є кращими прогностичними маркерами, ніж вік досліджуваних осіб. Також дослідження показало, що високе, але нормальне співвідношення обхвату талії до обхвату стегон є гарним маркером для прогнозування інсультів та інших метаболічних розладів у чоловіків. Отримані дані будуть корисними для медичних фахівців, дієтологів та асоціацій з профілактики інсульту.

Ключові слова: антропометрія; індекс маси тіла; серцево-судинні захворювання; обхват стегон; співвідношення обхвату талії до обхвату стегон