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ORIGINAL ARTICLE

Lipid profile and anthropometry indices of franchised fast-food consumers in South Western states in Nigeria

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Abstract

Background: Franchised fast foods are known for their unique tastes as it contains a number of spices that makes it delicious. Daily busy schedules have made consumption of franchised fast foods (FFFs) an easy option and control of our food choices even at home.

Objective: This research investigated the lipid profile and anthropometric indices of consumers of franchised fast foods (FFFs) in South-Western States in Nigeria.

Methods: This was a cross-sectional study in South-West Nigeria and comprised three states: Lagos, Oyo, and Ogun. 300 respondents were recruited from ten (10) purposively selected fast-food outlets in Ikeja, Abeokuta and Ibadan cities, Nigeria. Standardized method for assessing plasma lipid profile was used. A well-structured and pretested questionnaire was used for the survey. The statistical analysis was done using 95% confidence interval and an error percentage of 5%.

Results: The major consumers of FFFs are single, younger adults, educated, and relatively high-income earners. Majority of male (39% and 23%) and females (33% and 41%) have excellent and good health status respectively. Significant association was observed between BMI and HDL-C ($p=0.009$) of male, and Significant differences existed among the BMI and all lipid profiles of female respondents ($p<0.050$).

Conclusion: The study conclude that both genders are at risk of age-related NCDs in the future due to inadequate physical activity and dependence on FFFs. The consumption of FFFs is common among young people, high-income earners and educated people.

Keywords: lipid profile, blood pressure, franchised fast-food, nutrition related health status

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Introduction

Fast foods are known for their unique tastes as it contains a number of spices that makes it delicious. Beyond that, many restaurants provide transport services, thereby making the food readily available for consumption. Daily busy schedules have made consumption of franchised fast foods (FFFs) an easy option to make, so much that it controls our food choices even at home. Economic objectives play a prime position in eating fast foods.[1,2] There are several reasons why human beings eat franchised fast foods (FFFs), although they are not oblivious to its dreadful outcomes on their health and family. When people consume junk foods consistently, it predisposes a person to an increased risk of cardiovascular disease, obesity and other chronic non-communicable diseases.

Fast foods have many compromising effects on health, either long term or short.[3] These foods are high in salt, fat and sugar content, and excess cholesterol level, leading to weight problems and a risk factor for many heart conditions.[4,5] Excessive salt intake especially from processed foods can deteriorate one's health including kidney impairment, if taken regularly.[1] Therefore, should be avoided as best as possible so as to enjoy full health and a happy life all through life.

Lipids are heterogeneous group of water insoluble organic molecules providing the body with the major source of energy.[6] More so, serving as carriers of fat-soluble vitamins, providing regulatory or coenzyme functions and synthesis of prostaglandins, bile salts and steroid hormones, which play a major role in maintaining body homeostasis.[7] An imbalance of lipids leads to major clinical problems.[7] A lipid profile measures total cholesterol (TC) which is sum of high-density lipoprotein cholesterol (HDLC), Low density lipoprotein cholesterol (LDLC), very low-density lipoproteins (VLDL) and triglycerides (TG).[6,7,8] Studies show that high Triglycerides (TG) often cause metabolic syndrome. Metabolic syndrome is a condition characterized by increased blood pressure, hyperglycemia, excess weight, low HDL and high TG. Excess TG are stored as fat in fat cells for later use regardless of what kind of calorie source a person eats (carbohydrate or protein).[7,10] Furthermore, cholesterol has been implicated to increase the risk of atherosclerosis, blood clots, heart attack, and stroke if present in high levels.[12] Elevated low-density lipoprotein (LDL) and cholesterol concentration are risk factors for CVD and a decrease in LDL reduces the progression of plaques, atherosclerosis and risk of heart attack and death.[7]

Hyperlipidemia is another adjustable risk factor in the etiology of CVD. Elevated lipid profile is the main contributor to the development of myocardial infarction worldwide.[7] Various authorities like United States National Cholesterol Education Program, Adult Treatment Panel III (NCEP ATP III) and the Joint European Task Force (JETF) have developed standard clinical parameters for CVD risk management.[7,11] Studies on both genders have revealed risk for atherosclerotic disease, an inverse relation to blood levels of HDL-C.[7,12] In general, the higher the HDL-C, the greater its capacity to perform its antioxidant and anti-inflammatory functions.

Problem statement and justification

Researchers suggested that approximately 25 percent (25%) of the adult population from twenty years old have high blood cholesterol levels. Initially, research focus was only on older adults of forty-five years and above because by that age, heart disease may become the leading threat for death.[7,13] Meanwhile, new compelling evidence suggests that heart disease may begin as early as two years of age, thus interventions may be needed at a younger age.[7,14] Besides, it has been reported that most children and adolescents with risk factors for heart disease are more likely to experience heart disease in adulthood. These same risk factors and predictors of heart disease commonly associated with adulthood are now being discovered in youths.

As a consequence, this research investigated the lipid profile and anthropometric indices of consumers of franchised fast foods (FFFs) in South-Western States in Nigeria.

Methods

Study area

Nigeria is made up of six geo-political zones, 36 states and Federal Capital Territory.[15] The South-West zone comprises six states (Lagos, Ekiti, Ondo, Oyo, Ogun and Osun) with an estimated population of 28 million people. The study areas are Ikeja Local Government Area in Lagos State, Abeokuta South Local Government Area in Ogun State and Ibadan the capital of Oyo State.

Study design and population

This cross-sectional study was carried out among consumers of franchised fast food (FFFs) in South-Western States in Nigeria. Respondents were recruited from ten (10) purposely selected fast-food outlets in Ikeja, Abeokuta and Ibadan cities, Nigeria.

Inclusive and exclusive criteria

Inclusive criteria:

- Respondents who were healthy.
- Respondents within the age range of 18 to 70 years old.
- Respondents without chronic illness, food allergies, dietary restriction and others stated in the exclusive criteria.

Exclusive criteria:

- Respondents with chronic illness, food allergies, on dietary restriction.
- Respondents on recreational medication that can affect the weight.
- Respondents who did not consent to partake in the study.

Sample size determination

Minimum sample size was calculated using the formula below:

$$N = \frac{Z^2 \times (p \times q)}{d^2}$$

Where,

N = the minimum sample size
Z^2= the standard normal deviate corresponding to a level of significance of 0.05 is 1.96
p = Prevalence of overweight in Nigeria is 26%.
q = 1-p (i.e. 0.74)
d = the desired precision: 5%

Applying the formula, the minimum sample size is:

$$N = \frac{(1.96)^2 \times (0.26 \times 0.74)}{(0.05)^2}$$

$$N = 295$$

Adjusted sample size was calculated for 15% attrition rate using:

$$\text{Adjusted Sample Size} = \frac{\text{Minimum Sample Size}}{\text{(1-Attrition rate)}}$$

$$\text{Adjusted Sample Size} = \frac{295}{(1-0.15)} = 347.06$$

Therefore, the adjusted sample size, considering a 15% attrition rate is approximately 347 to compensate for non-response rate for the purpose of this study. However, data was only computed for 300 respondents.

Sampling techniques

A multi-stage sampling procedure was used. First stage included random selection of three (3) states (Lagos, Oyo and Ogun) in South-West. In the second stage, the state capital (Ikeja, Ibadan and Abeokuta) were purposely selected. In the third stage, thirty-four (34) registered FFFs outlets in Lagos, twenty-seven (27) in Ibadan and thirteen (13) in Abeokuta and ten (10) FFFs centers were purposely selected. These ten selected FFFs outlets were divided in ratio 5:3:2 respectively.[16] The total number of FFFs outlets in each state capital was divided by Total number of FFFs outlets in the three (3) state capitals and multiplied by sample size. Final stage was a simple random sampling technique to draw the sample for the purpose of the study.

Data collection procedure

Data was collected from 10 food outlets. One hundred respondents were randomly selected from the three selected state capitals. A well-structured and pretested questionnaire was prepared for the survey. Consent was obtained from the consumers of FFFs after the purpose of the study had been explained and thereby, interviewed them directly. The questionnaire was used to collect data on the socio-economic and demographic characteristics of the respondents such as age, marital status, employment status, educational level and average household income. Assessment for lipid profile and anthropometric measurements for weight, height, and 4-site skinfold thickness for body fat percentage was conducted by trained personnels.
Anthropometric measurements were conducted using standard procedures by trained personnels.[17,18] Measurements included: height using a stadiometer, weight using a weighing balance, body mass index (BMI) by dividing weight by square of height, and waist and hip using a non-stretchable measuring tape. All measurements were taken twice using standard procedures by trained personnels.

Body fat measurement (4-site skinfold thickness for body fat percentage)[19,20]

Biceps skinfold (front side middle upper arm), Triceps skinfold (back side middle upper arm), Subscapular skinfold (under the lowest point of the shoulder blade) and suprailiac skinfold (above the upper bone of hip) were estimated for total body fat. The sum of the measurements is inputted in a formula called the DURNIN formula.

- Body Density: 1.1620-0.0630 log (SF)
- The body fat % is calculated from: % Body Fat = 495/BD-450

Biochemical assays – extraction

Collection of blood sample

Venipuncture method was used, a cubital vein using a 20-gauge needle (diameter: 0.9 mm e.g., butterfly system maximum tubing length of 6cm). Tourniquet that was used was removed in less than one minute to avoid error due to hemoconcentration. After venipuncture, plasma is obtained by centrifugation for 10 minutes at 2000 x g at room temperature. The resulting plasma sample was transferred for biochemical assay for lipid profile analysis.

Isolation of high-density lipoproteins (HDL)[21]

HDL was isolated according to the method of Gidez *et al*., after precipitating very low-density lipoprotein (VLDL) and low-density lipoprotein (LDL) with heparin – manganese chloride solution.[22] An aliquot of heparin – manganese chloride solution was vortexed and left to stand at room temperature for 10 minutes, centrifuged at 4000 rpm for 10 minutes. The clear supernatant was removed into clean Eppendorf tubes, the precipitated (VLDL + LDL) returned to the first plasma volume taken with 0.1M phosphate buffer pH 7.4 and stored at – 2^{o}C until analysis.

Isolation of low-density lipoprotein (LDL) and very low-density lipoprotein (VLDL)[23]

The plasma LDL/VLDL fraction was separated using the Ononogbu and Lewis technique, which was precipitated with different concentrations of sodium dodecyl sulfate (SDS). 0.075ml of 100/0 SDS in 0.15 M sodium chloride was added to Iml of plasma in an Eppendorf tube, thoroughly mixed, and the tube was kept at 35^{0}C in bath water for 2 hours. A high-speed bench centrifuge was used to separate precipitated VLDL at 10,000rpm for 10 minutes at room temperature. Using a syringe, the SDS-soluble fraction was extracted, and the sides of the tube were thoroughly flushed with 0.5ml of 0.10/0 SDS in 0.15M sodium chloride to avoid washing off the precipitate.[23] The precipitated VLDL was dissolved in Iml of 1% SDS in 0.15M sodium chloride after centrifugation and stored at 20^{0}C until analysis.

Determination of plasma cholesterol[24]

This was determined spectrophotometrically according to the method of Allain et al. The reagent

was made with three enzymes: cholesterol esterase (Ce), cholesterol oxidase (CO) and peroxidase (POD); and two substrates 4 – amino antipyrine (4 – AA) and phenol.[23] A red dye quinoneimine dye was formed of which the intensity was proportional to the cholesterol concentration.

Determination of HDL cholesterol[21]

This was determined in the HDL-C fraction as described in the Isolation of HDL-C substituting HDL for plasma in the assay according to the method of Gidez *et al*.

Determination of LDL/VLDL cholesterol

0.l ml of VLDL and LDL extract was evaporated to dryness at 60^0C, alongside the standard cholesterol extract and the blank. Dried extracts were dissolved in cholesterol reagents as estimated. Cholesterol was calculated thus:
LDL cholesterol (mg/dl) = TC - HDL-C –TG/5
TC = Total cholesterol
HDL-C = High density lipoprotein cholesterol
TG = Triglycerides

Determination of plasma triglyceride[25]

This was determined spectrophotometrically according to Buccolo & David, using a diagnostic kit based on enzymatic hydrolysis of plasma triglycerides to glycerol and free fatty acids (FFA) by lipoprotein lipase (LPL). The H_2O_2 concentration was determined through the Trinder's reaction which results in a red color dye. The intensity of the color formed was proportional to the triglyceride concentration in the sample.
This questionnaire was structured and adapted from previous questionnaires. Secondary data for this study were collected from different websites, portals, textbooks and published articles.

Data analysis

The data collected from the respondents were analyzed using the statistical software, Microsoft Excel 2016, and IBM SPSS (Statistical Product and Service Solutions) version 25.0. Descriptive statistics (mean, standard deviation, frequency, percentages) and inferential statistics (chi-square and independent t test) were done. The statistical analysis was done using 95% confidence interval and an error percentage of 5%. Statistically the level of significance is set at $p<0.05$.

Results

Socio-demographic and economic characteristics

Table 1 presented the socio-demographic and economic characteristics of the respondents. Of the total 300 selected populations, 56.7% were female and 43.3% were male. The majority (39.3%) belong to the age group 25-37. The mean and standard deviation age of the study population is 33.42±10.66. The ethnicity distribution of the study population shows that the Southwest region represents a mix of diverse cultures of Nigeria. From the total population, the majority (70.5%) were Yoruba, and from Lagos state (36.9%). Most (46.3%) of the respondents had university education, and more than half (54.4%) never married. Half (50%) of the study population have an average household income of ₦500,000 thousand naira and more.

Anthropometric indices for male

Table 2 described the anthropometric indices of the male population which had a mean and standard deviation of 100 ± 16 for mean arterial pressure. Body mass index (BMI) results show that the majority (80%) of the male respondents were beyond normal weight. The male population has a mean and standard deviation of 31.70±06.68 for BMI. More than half of the respondents had a high risk of developing cardiovascular diseases with a significantly high borderline result (63.1%) of waist-hip-ratio, and the majority of the study population (94.8%) had excess body fat percentage. The male population has a mean and standard deviation of 1.01±0.05 and 36±6 for waist-to-hip ratio and body fat percentage respectively.

Table 1. Socio demographic and economic status of the respondents

Socio demographic and economic variables	Frequency	Valid percentage (%)
Sex		
Male	130	43.3
Female	170	56.7
Total	**300**	**100.0**
Age		
18-25	86	28.7
26-39	116	38.7
40-59	72	24.0
60-69	26	8.6
Total	**300**	**100.0**
Level of education		
Primary School	10	3.3
Secondary School	72	24.0
First Degree	138	46.0
Post-Graduate degree	72	24.0
Preferred not to state	8	2.7
Total	**300**	**100.0**
Location		
Ogun State	106	35.4
Oyo State	82	27.3
Lagos State	112	37.3
Total	**300**	**100.0**
Marital status		
Never Married	162	54.0
Married	106	35.2
Separated	14	4.7
Divorced	2	0.7
Widowed	8	2.7
Cohabiting	6	2.0
Preferred not to state	2	0.7
Total	**300**	**100.0**
Work status		
Government Employee	76	25.3
Private Sector	58	19.3
Self Employed	46	15.3
Homemaker	112	37.3
Unemployed	2	0.7
Preferred not to state	6	2.0
Total	**300**	**100.0**
Ethnicity		
Igbo	72	24.0
Hausa	14	4.7
Yoruba	206	68.6
Refuse to state	8	2.7
Total	**300**	**100.0**
Average monthly household income		
₦10,000-150,000	70	23.3
₦151,000-250,000	42	14.0
₦251,000-500,000	36	12.0
More than ₦500,000	150	50.0
Preferred not to state	2	0.7
Total	**300**	**100.0**

NOTE: *All total frequency that is less than 300 is due to non-responses of the respondents.*

Table 2. Anthropometric indices for male

Variable	Frequency	Percentage	$\underline{x}$±S.D
Body mass index			
Normal weight	26	20.0	**31.70 ± 06.68**
Overweight	36	27.7	
Grade i obesity	38	29.2	
Grade ii obesity	18	13.8	
Morbid obesity	12	9.2	
Total	**130**	**100.0**	
Waist-to-hip ratio (male)			
Low risk	16	12.3	**1.01 ± 0.05**
Moderate risk	32	24.6	
High risk	82	63.1	
Total	**130**	**100**	
Body fat percentage			
Below average/athletes	0	0	**36 ± 60**
General fitness	0	0	
Moderate/acceptable	6	4.6	
Obese/excessive fat	110	84.6	
Refuse	14	10.8	
Total	120	100.0	

$\underline{x}$±*sd* (mean±standard deviation)

Plasma lipid profile of male respondents

Table 3 revealed the plasma lipid profile of the study population. Majority (33.8%) of the male respondents were at the borderline of high TC in the blood. Majority (44.6%) had acceptable plasma levels of HDL-C while more than average (53.8%) had desirable plasma levels of LDL-C. Few (13.8%) of the respondents were classified to have high plasma levels of high-density lipoprotein and even less (3.1%) had very high LDL-C making them at risk of cardiovascular disease. Table 4 also shows that more than half of the population (83.1%) had normal TG results. The male population has a mean and standard deviation of 172±38, 57±22, 102±37, and 113±33 for TC, HDL-C, LDL-C and TG.

Anthropometric indices of female respondents

Table 4 showed the BMI of the female respondents. Result shows that the majority (35.3%) of the female respondents were overweight. 91.8% had high risk of developing cardiovascular diseases with a significantly high borderline result of waist-hip-ratio. More than half (61.1%) of the female population had an excess body fat percentage. The female population has a mean and standard deviation of 29.31±06.05, 0.94±0.06 and 30±7 for body mass index, waist-to-hip ratio and body fat percentage respectively.

Plasma lipid profile of female respondents

Table 5 showed the Plasma lipid profile for female respondents including the TC, LDL-C, HDL-C and TG. The percentage of the TC shows that 4.9% has desirable blood cholesterol, 42.0% being the highest blood cholesterol above desirable, 33.3% were at the borderline of having high TC in their blood, 11.1% had high blood cholesterol, and 8.6% blood cholesterol was very high. Majority (46.9%) had acceptable HDL-C. The table also shows that most of the population (91.8%) had normal TG results. The female population has a mean and standard deviation of 167±31, 58±15, 98±37, and 107±55 for TC, HDL-C, LDL-C and TG.

Table 3. Plasma lipid profile of male respondents

Plasma lipid	Frequency	Percentage	$\underline{x} \pm s.d$
Total Cholesterol			
Desirable	4	6.2	***172 ± 38***
Above desirable	21	32.3	
Borderline high	22	33.8	
High	10	15.4	
Very high	8	12.3	
Total	**65**	**100**	
High Density Lipoprotein			
Desirable (high)	27	41.5	***57 ± 22***
Acceptable	29	44.6	
Low	9	13.8	
Total	**65**	**100**	
Low Density Lipoprotein			
Desirable	35	53.8	***102 ± 37***
Above desirable	18	27.7	
Borderline high	5	7.7	
High	5	7.7	
Very high	2	3.1	
Total	**65**	**100**	
Triglyceride			
Normal	54	83.1	***113 ± 33***
Borderline high	11	16.9	
Total	**65**	**100**	

$\underline{x} \pm s.d$ (mean±standard deviation)

Table 4. Anthropometric indices of female respondents

Variable	Frequency	Percentage	$\underline{x} \pm s.d$
Body mass index			
Normal weight	34	20.0	***29.31 ± 06.05***
Overweight	60	35.3	
Grade I obesity	42	24.7	
Grade II obesity	26	15.3	
Morbid obesity	8	4.7	
Total	**170**	**100.0**	
Waist-to-hip ratio (female)			
Low risk	2	1.2	***0.94 ± 0.06***
Moderate risk	12	7.1	
High risk	156	91.8	
Total	**170**	**100**	
Body fat percentage			
Below average/athletes	2	1.4	***30.00 ± 07.00***
General fitness	18	12.5	
Moderate/acceptable	36	25.0	
Obese/excessive fat	88	61.1	
Total	**144**	**100.0**	

$\underline{x} \pm s.d$ (mean±standard deviation)

Table 5. Plasma lipid profile of female respondents

Plasma lipid	Frequency	Percentage	$\underline{x} \pm s.d$
Total Cholesterol			
Desirable	4	4.9	***167 ± 31***
Above desirable	34	42.0	
Borderline high	27	33.3	
High	9	11.1	
Very high	7	8.6	
Total	**81**	**100**	
High Density Lipoprotein			
Desirable (high)	38	46.9	***58 ± 15***
Acceptable	31	38.3	
Low	12	14.8	
Total	**81**	**100**	
Low Density Lipoprotein			
Desirable	49	60.5	***98 ± 37***
Above desirable	20	24.7	
Borderline high	4	4.9	
High	7	8.6	
Very high	1	1.2	
Total	**81**	**100**	
Triglyceride			
Normal	73	91.3	***107 ± 55***
Borderline high	7	8.8	
Total	**80**	**100**	

$\underline{x} \pm s.d$ (mean±standard deviation)

Association between body mass index (BMI), and plasma lipid profile among respondents

Table 6 revealed the association between BMI and plasma lipid profile for male respondents. A significant association was observed between BMI and HDL-C ($p=0.009$), while significant association was not observed between the BMI and TC, LDL-C and TG ($p>0.05$).

Association between BMI with plasma lipid profile among the female respondents

From the study carried out, **Table 7** revealed the significant differences that existed among the BMI and all plasma lipid profile tests that were carried out on female respondents ($p\leq0.05$).

Discussion

There is an increasing burden of non-communicable disease in Africa, including South-Western parts of Nigeria where this recent study was conducted.[26] This study demography mirrors the study population of Uthman-Akinhanmi on nutrient composition of selected snacks in South-West Nigeria. The mean and standard deviation of this study reveal most of the population that patronized franchised fast food are youths (33.42 ± 10.66), unmarried (54.4%) and people with higher income.

The majority of the respondents in this study were obese (52.2%) followed by overweight (27.7%).[27] This ascertained that increase in body weight is directly linked with excessive calorie intake and lack of physical exercise.[28] In contrast to Dsouza & Dsouza, obesity was more predominant in female respondents than male but in the study, it was revealed that the body mass index of both genders were beyond normal weight, in that majority (80%) of the respondents, both male and female are either overweight or obese.

Table 6. Association between BMI and plasma lipid profile among male respondents

Body mass index	TC						
	Desirable	**Above desirable**	**Borderline high**	**High**	**Very high**	**Total**	**p.Value**
Normal weight	2 (3.1)	7 (10.8)	2(3.1)	0(0.0)	2(3.1)	13(20.2).	0.250
Overweight	1(1.5)	7(10.8)	6(9.2)	2(3.1)	2(3.1)	18(27.7)	
Grade 1 obesity	1(1.5)	4(6.2)	10(15.4)	3(4.6)	1(1.5)	19(29.2)	
Grade 2 obesity	0(0.0)	1(1.5)	2(3.1)	4(6.2)	2(3.1)	9(13.8)	
Total	4(6.2)	21(32.3)	22(33.8)	10(15.4)	8(12.3)	65(100.0)	
	LDL-C						
	Desirable	**Above desirable**	**Borderline high**	**High**	**Very high**	**Total**	**p.Value**
Normal weight	9(13.8)	2(3.1)	0(0.0)	1(1.5)	1(1.5)	13(20.0)	0.141
Overweight	12(18.5)	3(4.6)	2(3.1)	1(1.5)	0(0.0)	18(27.7)	
Grade 1 obesity	9(13.8)	8(12.3)	1(1.5)	1(1.5)	0(0.0)	19(29.2)	
Grade 2 obesity	1(1.5)	4(6.2)	2(3.1)	2(3.1)	0(0.0)	9(13.8)	
Morbid obesity	4(6.2)	1(1.5)	0(0.0)	0(0.0)	1(1.5)	6(9.2)	
Total	35(53.8)	18(27.7)	5(7.7)	5(7.7)	2(3.1)	65(100.0)	

	HDL-C					**TG**			
	Desirable (high)	**Acceptable**	**Low**	**Total**	**p-Value**	**Normal**	**Borderline high**	**Total**	**p.Value**
Normal weight	8(12.3)	2(3.1)	3(4.6)	13(20.0)	*0.009	11(16.9)	2(3.1)	13(20)	0.772
Overweight	12(18.5)	6(9.2)	0(0.0)	18(27.7)		16(24.6)	2 (3.1)	18(27.7)	
Grade 1 obesity	4(6.2)	12(18.5)	3(4.6)	19(29.2)		16(24.6)	3(3.1)	19(27.7)	
Grade 2 obesity	0(0.0)	7(10.8)	2(3.1)	9(13.8)		7(10.8)	2(3.1)	9(13.8)	
Morbid obesity	3(4.6)	2(3.1)	1(1.5)	6(9.2)		4(6.2)	2(3.1)	6(6.2)	
Total	27(41.5)	29(44.6)	9(13.8)	65(100.0)		54(83.1)	11(16.9)	65(100)	

Values with asterisk (*) are statistically significant.

Table 7. Association between BMI, with plasma lipid profile among the female respondents

			TC				
Body mass index	**Desirable**	**Above desirable**	**Borderline high**	**High**	**Very high**	**Total**	**p.Value**
Normal weight	1(1.2)	10(12.3)	3(3.7)	0(0.0)	1(1.2)	15(18.5)	0.019
Overweight	1(1.2)	15(18.5)	10(12.3)	1(1.2)	2(2.5)	29(35.8)	
Grade 1 obesity	1(1.2)	6(7.4)	8(9.9)	3(3.7)	2(2.5)	20(24.7)	
Grade 2 obesity	1(1.2)	2(2.5)	5(6.2)	5(6.2)	0(0.0)	13(16.0)	
Morbid obesity	0(0.0)	1(1.2)	1(1.2)	0(0.0)	2(2.5)	4(4.9)	
Total	4(4.9)	34(42.0)	27(33.3)	9(11.1)	7(8.6)	81(100.0)	
			LDL-C				
	Desirable	**Above desirable**	**Borderline high**	**High**	**Very high**	**Total**	**p.Value**
Normal weight	11(13.6)	3(3.7)	0(0.0)	1(1.2)	0(0.0)	15(18.5)	*0.005
Overweight	23(28.4)	3(3.7)	1(1.2)	2(2.5)	0(0.0)	29(35.8)	
Grade 1 obesity	9(11.1)	6(7.4)	1(1.2)	3(3.7)	1(1.2)	20(24.7)	
Grade 2 obesity	5(6.2)	7(8.6)	0(0.0)	1(1.2)	0(0.0)	13(16.0)	
Morbid obesity	1(1.2)	1(1.2)	2(2.5)	0(0.0)	0(0.0)	4(4.9)	
Total	49(60.5)	20(24.7)	4(4.9)	7(8.6)	1(1.2)	81(100.0)	
		HDL-C				**TG**			
	Desirable	**Acceptable**	**Low**	**Total**	**p-Value**	**Normal**	**Borderline high**	**Total**	**p.Value**
Normal weight	10(12.3)	4(4.9)	1(1.2)	15(18.5)	0.025	15(18.8)	0(0.0)	15(18.8)	0.025
Overweight	15(18.5)	12(14.8)	2(2.5)	29(35.8)		26(32.5)	2(2.5)	28(35.0)	
Grade 1 obesity	8(9.9)	9(11.1)	3(3.7)	20(24.7)		19(23.8)	1(1.2)	20(25.0)	
Grade 2 obesity	4(4.9)	6(7.4)	3(3.7)	13(16.0)		11(13.8)	2(2.5)	13(16.2)	
Morbid obesity	1(1.2)	0(0.0)	3(3.7)	4(4.9)		2(2.5)	2(2.5)	4(5.0)	
Total	38(46.9)	31(38.3)	12(14.8)	81(100.0)		73(91.2)	7(8.8)	80(100.0)	

Values with asterisk (*) are statistically significant

According to WHO standard for measurement of waist to hip circumference, it was revealed in this study that 91.8% and 63.1% of the female and male respondents respectively, had high risk of developing cardiovascular diseases with a significantly high borderline result of waist-hip-ratio.[29]

Mohammadbeigi *et al.*, study confirms this in that fast food consumption was associated with abdominal obesity based on WHR, but not related to general obesity based on BMI.[30,31]

FFFs are rich in salt, saturated fats and added sugar which in turn implicates the nutritional health status of people negatively. The health status rating revealed that 41.3% and 29.0% of the female and male respondents were reported to have very good ratings.[32] Since fast food consumption has increased dramatically from the early 1970s its impact on social health status has also increased. From the percentage plasma cholesterol, triglyceride, HDL-C and LDL-C of the respondents from this study, there is a possible risk factor for non-communicable diseases (NCDs) in the near future if nutritional and lifestyle changes are not put in place. This is because the majority of the study participants are younger adults, university graduates and high-income earners (see **Table 1**),[33] and based on previous studies, the major risk factors of NCDs include dyslipidemia, obesity, physical inactivity, and poor to dietary practices among others.[31,33]

The association of a high fat intake with obesity and heart disease is well known and may contribute to the burden of obesity and non-communicable diseases.[34] According to WHO report, more than five (5) out of every ten (10) deaths in developing countries occur due to NCDs, accounting for 80% of the global burden of diseases. Most of these deaths occur in persons less than 70 years old.

It can be deduced from this study that foods that contain saturated fats can cause an increase in plasma cholesterol level. FFFs have been associated with high fat, salt, added sugar and very low dietary fiber that are abundant in fruits and vegetables.[31] Nutritional analysis shows that fast foods are generally high in fat, especially saturated fats, energy dense, high in fructose and glycemic index, but poor in fiber, vitamins A and C, and mineral calcium. About 62% and 54% of the male and female respondents respectively fall in between borderline to very high plasma level for TC.[31] This finding agrees with the previous study that shows that the cholesterol, and LDL-C increases with increased consumption of FFFs in a week, such that within a year the plasma level of total cholesterol LDL-C, TG are increased.

This study validates the effect of FFFs on the plasma lipid level and nutritional status of the consumers as there is significant difference in the association between body mass index (BMI) and HDL-C. Aside that, it revealed a significant association between body mass index and high-density lipoprotein ($p=0.009$) (see **Table 6 and 7**).[3] This finding however is in contrast with the findings of Nascimento *et al.*, which reported obesity as associated with TG and LDL-C with decreased HDL-C.[3]

Dyslipidemia that has been associated with obesity are elevated triglycerides (TGs), LDL-C and decreased HDL-C levels.[35,36] As evidence suggests, high HDL-C and LDL-C levels are associated with longevity in that low HDL-C level is associated with an increased cardiovascular risk, particularly if cholesterol and TGs are also elevated.

From this present study, a significant difference existed among the body mass index and all plasma lipid profile tests that were carried out on female respondents ($p<0.050$). TC, TG, LDL-C and HDL-C were significantly associated with BMI (refer to **Table 6 and 7**).[37] This finding is in line with numerous studies that have concluded that the poor nutritional value, the excessive salt, saturated fats and trans fatty acid are associated with FFFs and are likely to perpetuate the prevalence of hypercholesterolemia, hypertriglyceridemia and with low plasma level in HDL-C.[35] Hypercholesterolemia has been associated with cardiovascular disease (CVD). Similarly, formation of atherosclerotic plaque has been linked with the elevation of non-high density lipoprotein cholesterol.

The mean of plasma lipid for male respondents are [TC-167, HDL-C-58, LDL-C-98 and Tg-107 (mg/d)] while the mean for the female respondents is [TC-172, HDL-C-57, LDL-C-102 and Tg-113

(mg/dl)].[38] Increase in cholesterol levels can be caused by eating fast food on a regular basis. This finding also confirms that foods that contain saturated fat can cause a relative increase in cholesterol. It has been well proven and established in previous studies that FFFs are rich in saturated fat, and they are mostly found in animal-based food products such as cheese, milk, butter and steak.[35,39] It has also been discovered that some plant-based foods, such as palm oil and coconut oil, contain saturated fats. Trans Fats, or trans-fatty acids, have undergone a hydrogenation process. Some trans fats are found in animal and plant products such as peanut butter, margarine, and potato chips.[35,40] Fast foods, although delicious, have been proven to be dangerous to the health of its consumers and may cause arteriosclerosis, hypertension, high blood pressure, diabetes, cholesterol, cancer, gallbladder disease, and liver damage. This cross-sectional study does not assess the factors influencing the consumption of FFFs by participants. This limitation should be noted in understanding the inference of this study.

Conclusion

This study focused on the lipid profile and anthropometric indices of consumers of franchised fast foods (FFFs) in South-Western Nigeria. Our findings revealed that the major consumers of FFFs are single, younger adults, educated, and relatively high-income earners. Significant participants have good health status but a higher percentage from both genders are at risk of age-related NCDs in the future due to inadequate physical activity and dependence on FFFs. To address the public health implications of FFF consumption, it is recommended to implement targeted nutrition and health education programs to promote healthier dietary choices and increase public awareness. Additionally, fostering community-based physical activity initiatives and ensuring the availability of healthier food options in fast food outlets are essential steps to mitigate future risks of age-related NCDs. Further research is needed to explore the factors influencing FFF consumption and to design effective preventive strategies against diet-related non-communicable diseases that might results from consumption of FFF.

Conflict of interest

The authors declare that there is no conflict of interest.

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