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Comparative Studies on Lipid Profile in Both Obese and Lean Subjects in Imo State

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Abstract

This study was carried out to compare the levels of lipid profiles in both obese and lean subjects in patients attending Federal Medical Center, Owerri. Eighty (80) subjects including male and female who were within the age range of 25-50 years attending the outpatient department at Federal Medical Center, Owerri were recruited for the study and they were divided into two groups of forty (40) obese and forty (40) lean subjects. Data obtained was analyzed using Statistical Package for Social Sciences (SPSS) version 21. Values was expressed as mean±standard deviation. The student t-test was used to compare the parameters (at level of significance 0.05). P< 0.05 was considered as statistically significant and P>0.05 was considered not statistically significant. The mean values of serum total cholesterol (216.48±28.42mg/dl), triglyceride (165.5±18.79 mg/dl) and LDL (155.15±10.67mg/dl) was significantly decreased in obese subjects while the mean values of serum HDL (45.68±7.47mg/dl) was significantly decreased in obese subjects. The mean values of serum total cholesterol, triglyceride and LDL was significantly increased in obese male (162.95±20.29mg/dl, 156.95±18.34mg/dl and 84±7.36mg/dl) and female(200.15±16.69mg/dl, 165.25±10.36mg/dl and 125±13.86mg/dl) subjects while serum HDL was significantly decreased in obese male(47.7±5.14mg/dl) and female(42.0±6.89mg/dl) subjects when compared with the control subjects at p<0.05 respectively. The mean value of serum total cholesterol, triglycerides and LDL was significantly increased while HDL was significantly decreased in those within the age range of 25-35 years when compared with the mean value of total cholesterol, triglycerides, LDL and HDL in those between 36-50 years at P<0.05. In conclusion, Lipid profile may serve as a biomarker in obesity and it makes the obese individuals prone to several cardiovascular diseases.

Key words: lipid profile; obese, lean; Imo State

Introduction:

The prevalence of obesity is rising quickly in many developed countries, making it a serious public health concern both domestically and abroad. According to a National Center for Health Statistics analysis, the prevalence of obesity among US adults aged 20 and over increased substantially from 19.4% in 1997 to 31.4% between January and September 2017 [1]. Furthermore, almost one-third of people are overweight, which is characterized as having a BMI of 25 to 30 kg/m. Furthermore, because obesity incidence has significantly increased globally, the obesity epidemic is not limited to the United States. Additionally, there is a significant rise in the number of people who are morbidly obese (BMI > 40) [2].

It is important to remember that extremely athletic people may have a high BMI without having extra body fat because their weight is primarily from muscle mass, and as a result, they may not have metabolic problems. The fact that childhood obesity rates have also significantly grown is also concerning. Insulin resistance, changes in lipid metabolism, and the metabolic syndrome are all linked to obesity, especially when the excess adipose tissue is found in the upper chest or intra-abdominal region. Although obesity is a risk factor for cardiovascular disease, it seems that a large portion of this effect is explained by the procoagulant state, inflammation, diabetes, hypertension, and dyslipidemia that obesity causes. Heart disease accounts for most of the deaths associated with high BMI [3]

Obesity simply means excess of body-fat. It is defined as having a body mass index (BMI) of greater than 30 kg/m^2. Healthy weight is defined as a BMI between 19 and 25 kg/m^2. Overweight is defined as a BMI between 25 and 30 kg/m^2. It is due to greater energy intake compared with energy expenditure [4]. It is difficult to study obesity because the abnormality is not a single disease and because the result of long-term follow up in large scale is not available in the existing literature. The knowledge that is available today is only a cross-sectional survey in the population. Obesity currently threatens the health, well-being and economic welfare of virtually every country in the world [5]. Over 300 million people are estimated to be obese. Obesity is considered a chronic (long-term) disease, like high blood pressure or diabetes. It has many serious long-term consequences for health, and it is the second leading cause of preventable deaths in many countries [6]

Although several classifications and definitions for degrees of obesity are accepted, the most widely accepted classifications are those from the World Health Organization (WHO), based on body mass index (BMI).

Adipose tissue is a key endocrine organ that communicates with brain, muscle, liver, and pancreas, thereby maintaining energy homeostasis. Adipose tissue stores excess energy in the form of lipids and are thus able to dramatically change in size in accordance with changing metabolic needs [7]. Moreover, studies have shown that fat tissue exerts important endocrine functions which are mediated by a complex network of various soluble factors derived from adipocytes called adipocytokines [8]. At the cellular level, obesity is not solely pathology of adipocytes as there are other cell types within adipose tissue that participate as well. In fact, the presence of infiltrating macrophages in adipose tissue makes obesity comparable to a low-grade chronic inflammation with links between adipose cells and the immune system. At present comprehension of these concepts is essential for a better understanding of the pathophysiological mechanisms of insulin resistance and type 2 diabetes [9]

Although the exact biochemical mechanisms responsible for the association between obesity and the above diseases have not been completely elucidated, it is known that increase in triglyceride stores is associated with a linear increase in the production of cholesterol which in turn is associated with increased cholesterol secretion in bile and an increased risk of gallstone formation and the development of gall bladder diseases [10]. Similarly, increased levels of circulating triacylglycerol in obesity are associated with decreased concentrations of high-density lipoprotein, which may account for the increased risks for cardiovascular disease and heart attack in obese patients [11]

Cholesterol levels should be measured at least once every five years in everyone over the age of 20. Experts recommend that men aged 35 and older and women aged 45 and older be more frequently screened for lipid disorders [12]. The lipoprotein profile includes: LDL (low-density lipoprotein cholesterol, also called "bad" cholesterol), HDL (high-density lipoprotein cholesterol, also called "good" cholesterol), Triglycerides and Total cholesterol. LDL cholesterol can build up on the walls of your arteries and increase your chances of getting heart disease. That is why LDL cholesterol is referred to as "bad" cholesterol. The lower your LDL cholesterol number, the lower your risk. Optimum level of LDL cholesterol is less than 100, borderline high is between 130 and 159, high level is between 160 and 189 and very high level is above 190 [13]. When it comes to HDL cholesterol "good" cholesterol the higher the number, the lower your risk. This is because HDL cholesterol protects against heart disease by taking the "bad" cholesterol out of your blood and keeping it from building up in your arteries. HDL cholesterol level is less than 40 in men, 50 in women. Triglycerides are the chemical form in which most body fat and food exist. A high triglyceride level has been linked to higher risk of coronary artery disease. Triglycerides less than 150 are considered as normal, mildly high between 150-199, high between 200 and 499 and very high above 500. Total blood cholesterol is a measure of LDL cholesterol, HDL cholesterol, and other lipid components [14].

The mean levels of total cholesterol, triglycerides and LDL cholesterol were significantly de-creased meanwhile those of HDL cholesterol were significantly increased in weight loss as compared to obese group [15].

Obesity is increasingly becoming an important public health concern among all age groups in most of the developed and underdeveloped world. Greater than 30% of the United States population is obese and in Nigeria, about 8.1%-22.2% are obese and at risk to develop insulin resistance and associated metabolic disorders, including hypertension, hyperlipidemia, fatty liver disease, atherosclerosis, and Type 2 diabetes mellitus [16]

There is paucity of information in evaluating the relationship in lipid profiles in both obese and lean subjects so therefore this

work is aimed at evaluating and comparing the levels of lipid profile in both obese and lean subject and also provide knowledge on the disparity in both the obese and lean subjects in Owerri.

Materials and Methods:

Study area

The study was carried out in the medical out-patient department Federal Medical Center, Owerri, Imo State.
Ethical approval. The ethical approval was obtained from Federal Medical Center, Owerri

Study population

A total of 80 subjects including male and female subjects attending the outpatient department at Federal Medical Center, Owerri was recruited for the study. The 80 subjects was within the age range of 25-50 years. The 80 subjects was divided into two groups:
Group 1(Test) consists of 40 obese patients
Group 2(Control) consists of 40 lean subjects
Anthropometric measurements, including height, weight, waist circumference (WC) and hip circumference (HC) wa sperformed on the subjects. Body Mass Index (BMI) was calculated as weight in (kg) divided by height in meters squared (m^2). Waist-to-hip ratio (WHR) was also calculated as waist circumference (WC) divided by hip circumference (HC). BMI was used to reflect the total body fat while waist circumference (WC) and Waist-to-hip ratio (WHR) was indirect measurements of body fat centralization
Selection criteria

Inclusion

The participants were those that met the enrollment criteria. The criteria are as follows:

- Subjects with low levels of physical activity
- Lean subjects with a body mass index between 19 and 25 $\frac{kg}{m^2}$
- Obese subjects with a BMI of over 30 $\frac{kg}{m^2}$
- Subjects between the age range of 25-50 years

Exclusion

The following was excluded from the study they are:

- Insulin dependent type 1 diabetes, concomitant disturbances of liver and thyroid, renal insufficiency and chronic inflammatory diseases.
- Those with mental disorder or any intellectual disability
- A current eating disorder or any psychiatric disorder (psychotic disorder, bipolar disorder, substance dependence or anxiety and depressive disorders)
- Pregnant women or those currently breast feeding
- Elderly patients who are above the age of 50 years

Sample collection:

About 10ml of venous blood was collected from each subject using the standard clean veni-puncture technique and dispensed into a labeled plain container. The blood samples was spun at 3000rpm for 5minutes and serum was separated into a new labeled plain container. The serum samples was then be taken to the Laboratory Complex, Federal Medical Center, Owerri where the following parameters was estimated: lipid profiles

Laboratory Procedures

All reagents used were commercially procured and the manufacturer's standard operating procedures was strictly followed.

Serum Lipid profile estimation

A) Serum total cholesterol estimation
This was determined using the Randox cholesterol kit (Cat.No.HN 1530), based on the enzymatic end point method

Triglyceride estimation

This was determined using the Randox triglyceride kit (Cat.No. 1530), based on the enzymatic end point method

HDL estimation:

This was determined using the Randox HDL kit (Cat.No. HN 1530),based on the enzymatic end point method

LDL estimation by formular method

The concentration of LDL to T_c will be calculated using Friedwald equation (2000).
LDL-cholesterol (mg/dl) => T_c – HDL- $\left(\frac{t_g}{5}\right)$

Statistical Analysis

Data obtained was analysed using Statistical Package for Social Sciences (SPSS) version 21. Values was expressed as mean±standard deviation. The student t-test was used to compare the parameters (at level of significance 0.05). P< 0.05 was considered as statistically significant and P>0.05 was considered not statistically significant.

Results:

Parameters	Obese n=40	Lean n=40	T-Value	P-Value
Total Cholesterol (mg/dl)	216.48±28	42164.18±11.94	9.317	0.003
HDL-Cholesterol (mg/dl)	45.68±7.47	58.88±8.97	-7.259	0.0001
LDL-Cholesterol (mg/dl)	155.15±10.67	82±4.49	13.645	0.0001
Triglycerides (mg/dl)	165.5±18.79	115.0341.87	8.052	0.02

Table 1: *Mean ±SD values of Serum Total Cholesterol, HDL-Cholesterol, LDL-Cholesterol and Triglyceride in Obese Subjects and Lean Subjects.*

Table 1 Shows that the mean values of serum total cholesterol (216.48±28.42mg/dl),Triglyceride(165.5±18.79mg/dl),low density lipoprotein (155.15±10.67mg/dl) and high density lipoprotein(45.68±7.47mg/dl) of obese subjects was significantly different(P=0.003, P=0.02, P=0.0001 and P=0.0001) when compared with the mean value of serum total cholesterol(164.18±11.94mg/dl), triglyceride(115.03±41.87 mg/dl,), low density lipoprotein(82±4.49 mg/dl) and high density lipoprotein(58.88±8.97 mg/dl) of lean subjects. When the mean values of the lipid profile variables in obese subjects was compared with the mean values of the lipid profile variables in lean subjects it was found that the mean values of serum total cholesterol, triglyceride and LDL was increased in obese while serum HDL was increased in lean.

Parameters	ObeseMale n=20	Lean Male n=20	T-Value	P-Value
Total Cholesterol (mg/dl)	162.95±20.29	155.5±10.21	6.768	0.0001
HDL-Cholesterol (mg/dl)	47.7±5.14	57.2±4.35	4.567	0.002
LDL-Cholesterol (mg/dl)	84±7.36	77±8.36	7.362	0.0001
Triglycerides (mg/dl)	156.95±18.34	155.6±10.49	9.243	0.0001

Table 2: *Mean ±SD values of Serum Total Cholesterol, HDL-Cholesterol, LDL-Cholesterol and Triglycerides in Obese Male and Lean Male Subjects.*

Table 2 Shows that the mean values of serum total cholesterol (162.95±20.29mg/dl),Triglyceride(156.95 ±5.30mg/dl), low density lipoprotein (84±7.36mg/dl) and high density lipoprotein(47.7±5.14mg/dl) of obese male subjects was significantly different (P=0.0001, P=0.0001, P=0.0001 and P=0.002) when compared with the mean value of serum total cholesterol (155.5±10.21mg/dl), triglyceride (155.6±10.49 mg/dl,), low density lipoprotein (77±8.36 mg/dl) and high density lipoprotein (57.2±4.35 mg/dl) of lean male subjects. When the mean values of the lipid profile variables in obese male subjects was compared with the mean values of the lipid profile variables in lean male subjects it was found that the mean values of serum total cholesterol, triglyceride and LDL was increased in obese male subjects while serum HDL was decreased in lean male subjects .

Parameters	Obese Female n=20	Lean Female n=20	T-Value	P-Value
Total Cholesterol (mg/dl)	200.15±16.69	155.5±16.21	6.438	0.0001
HDL-Cholesterol (mg/dl)	42.0±6.89	47.2±4.35	-9.546	0.002
LDL-Cholesterol (mg/dl)	125±13.86	77±8.36	5.342	0.0001
Triglycerides (mg/dl)	165.25±10.36	155.6±10.49	8.513	0.0001

Table 3: *Mean ±SD values of Serum Total Cholesterol, HDL-Cholesterol, LDL-Cholesterol and Triglycerides in Obese Female and Lean Female Subjects.*

Table 3 Shows that the mean values of serum total cholesterol (200.15±16.69mg/dl),Triglyceride(165.25±10.36mg/dl), low density lipoprotein (125±13.86mg/dl) and high density lipoprotein(42.0±6.89mg/dl) of obese female subjects was significantly

different (P=0.0001, P=0.0001, P=0.0001 and P=0.002) when compared with the mean value of serum total cholesterol (155.5±16.21mg/dl), triglyceride (155.6±10.49 mg/dl,), low density lipoprotein (77±8.36 mg/dl) and high density lipoprotein (47.2±4.35 mg/dl) of lean female subjects. When the mean values of the lipid profile variables in obese female subjects was compared with the mean values of the lipid profile variables in lean female subjects it was found that the mean values of serum total cholesterol, triglyceride and LDL was increased in obese female subjects while serum HDL was decreased in lean female subjects .

Parameters	Obese male n=20	Obese Female n=20	T-Value	P-Value
Total Cholesterol (mg/dl)	162.95±13.69	200.15±18.61	3.345	0.001
HDL-Cholesterol (mg/dl)	47.7±7.89	42.0±4.35	6.227	0.001
LDL-Cholesterol (mg/dl)	84±2.96	125±18.36	4.388	0.001
Triglycerides (mg/dl)	156.95±14.38	165.25±17.29	7.478	0.001

Table 4: *Mean ±SD values of Serum Total Cholesterol, HDL-Cholesterol, LDL-Cholesterol and Triglycerides in Obese Male and Female Subjects.*

Table 4 Shows that the mean values of serum total cholesterol (162.95±13.69mg/dl),Triglyceride(156.95±14.38mg/dl), low density lipoprotein (84±2.96mg/dl) and high density lipoprotein(47.7±7.89mg/dl) of obese male subjects was significantly different (P=0.0001, P=0.0001, P=0.0001 and P=0.001) when compared with the mean value of serum total cholesterol (200.15±18.61mg/dl), triglyceride (165.25±17.29 mg/dl,), low density lipoprotein (125±18.36 mg/dl) and high density lipoprotein (42.0±4.35 mg/dl) of obese female subjects. When the mean values of the lipid profile variables in obese male subjects was compared with the mean values of the lipid profile variables in obese female subjects it was found that the mean values of serum total cholesterol, triglyceride and LDL was increased in obese female subjects while serum HDL was decreased in obese female subjects .

Discussion:

In the majority of the developed and developing globe, obesity is becoming a major public health concern for people of all ages. When compared to the mean values of serum total cholesterol, triglyceride, low density lipoprotein, and high density lipoprotein of lean subjects, the mean values of these parameters were significantly different for obese subjects (P=0.003, P=0.02, P=0.0001, and P=0.0001) in this study. When the mean values of the lipid profile variables in lean and obese subjects were compared, it was found that the mean values of serum HDL were significantly lower in lean subjects and the mean values of serum total cholesterol, triglycerides, and LDL were significantly higher in obese subjects.

Obesity raises the risk of coronary heart disease in obese people by being linked to higher blood pressure, blood lipids, and blood glucose levels [7]. The estimation of total cholesterol, HDL, and triglycerides has received a lot of attention among the lipid components; however, many workers have also expressed interest in other components such as total lipids, LDL, and VLDL, as well as chylomicrons. This study examined the impact of obesity on different lipid components. It is evident from the total lipid data that obese people have much greater levels than controls [16]. In obese people, it has produced comparable outcomes. Higher cholesterol levels may indirectly contribute to atherosclerosis, which is linked to coronary heart disease.. There might be various reasons for finding higher levels of total lipids and lipoproteins in obese persons. The obese subjects have the habit of overeating and less consumption of calories and also have sluggish pattern of life. Increased levels of cholesterol have also been reported in obese persons and the present study also showed significantly increased levels of cholesterol in obese person. It confirmed that weight gain is associated with higher cholesterol levels. Similar results have been reported by [10]. Higher levels of triglycerides are found in obese persons, this increase is statistically significant and correlate with the findings of [17], who suggested that triglyceride levels are the most important factor leading to CHD as almost 50% of patients with asymptomatic atherosclerosis were hypertriglyceridemia. It has also found strong positive correlation of triglycerides with obesity. HDL estimation showed significantly decreased levels in obese as compared to the controls. This is considered as the single major risk factor for predicting the risk of atherosclerosis and CHD. These results are in conformity with those of [9] . LDL levels were also increased statistically in obese persons as compared to the controls,

When the mean values of the lipid profile variables in obese male subjects was compared with the mean values of the lipid profile variables in lean male subjects it was found that the mean values of serum total cholesterol, triglyceride and LDL was significantly increased in obese male subjects while serum HDL was significantly decreased in lean male subjects at $p<0.05$ respectively. The mean values of the lipid profile variables in obese female subjects was compared with the mean values of the lipid profile variables in lean female subjects it was found that the mean values of serum total cholesterol, triglyceride and LDL was significantly increased in obese female subjects while serum HDL was significantly decreased in lean female subjects at $p<0.05$ respectively. The mean values of the lipid profile variables in obese male subjects was compared with the mean values of the lipid profile variables in obese female subjects it was found that the mean values of serum total cholesterol, triglyceride and LDL was significantly increased in obese female subjects while serum HDL was significantly decreased in obese female subjects at $P<0.05$.

Male subjects were found to have more favorable plasma lipid profile (lower LDL-C and higher HDL-C) than the females [18].

Although a significant percentage of the population were involved in social habits that may predispose them to CVD, such as cigarette smoking (5.9%) and alcohol consumption (23.9%), few were involved in physical activities (9.3%). Although the higher prevalent rate of overweight and obesity among male subjects observed in the present study was in corroboration with the findings of [19], it contrasted the findings of some studies that reported a higher prevalence of overweight and obesity in females than in males. The disparities in these findings may best be explained by differences in the subjects studied. However, it has been shown that men gain more weight than women until the perimenopausal period, when the trend is reversed. The finding from this study has an important health implication [4].

A more favorable lipid profile of the male subjects in comparison with their female counterparts observed in the present study raises some gender-related questions in the metabolism of lipids, and suggests that males in this population may be more protected from CVD than the females. Although the reason for unfavorable lipid profile in women in the present study is obscure, it may not be unconnected with unhealthy lifestyle, such as eating of “fast foods” and low level of physical activity [20]. Low physical activity and consumption of diet with high contents of carbohydrate and saturated fatty acids, such as “fast foods,” have been associated with dyslipidemia. Habitually active men and women are less likely to have hypertriglyceridemia and low HDL-C concentrations. Although dyslipidemia was a significant feature in the present study, the plasma lipid profile was better (except for TC) than that reported by [21] in which 5% of the study population had hypercholesterolemia, 23% elevated total serum cholesterol, 51% elevated LDL-C and 60% low HDL-C, with females recording better overall lipid profile. It may be argued that our study population in general may be a bit protected from CVD, as reduced HDL-C was observed only in 8.8% of the study population, with the general population having lipid profile within the NCEP reference values. However, with significant percentage of the population involved in social habits that may predispose them to CVD, such as cigarette smoking (5.9%) and alcohol consumption (23.9%), with few involved in physical activities (9.3%), such protection may not be sustained.

When the mean values of the lipid profile were compared according to age group, it was observed that the lipid profile levels in obese male subjects who were within 25-35 years was significantly different when compared with the mean value of lipid profile level of obese male subjects who were within 36-50 years of age at $p<0.05$. furthermore, when the individual lipid profile parameters were differentiated, it was discovered that the mean value of serum total cholesterol, triglycerides and LDL was significantly increased in obese male subjects who were within 36-50 years when compared with the mean value of serum total cholesterol, triglycerides and LDL in those who were below 35 years at $p<0.05$. in contrast to the above, the mean value of serum HDL in those within 25-35 years was significantly higher when compared with the mean value of serum HDL in those above 35 years at $P<0.05$ respectively

When the mean values of the lipid profile were compared according to age group, it was observed that the lipid profile levels in obese female subjects who were within 25-35 years was significantly different when compared with the mean value of lipid profile level of obese female subjects who were within 36-50 years of age at $p<0.05$. Furthermore, when the individual lipid profile parameters were differentiated, it was discovered that the mean value of serum total cholesterol, triglycerides and LDL was significantly increased in obese female subjects who were within 36-50 years when compared with the mean value of serum total cholesterol, triglycerides and LDL in those who were below 35 years at $p<0.05$. In contrast to the above, the mean value of serum HDL in those within 25-35 years was significantly higher when compared with the mean value of serum HDL in those above 35 years at $P<0.05$ respectively

Conclusion:

In conclusion, lipid profile may serve as a biomarker in obesity and it makes the obese individuals prone to several cardiovascular diseases.

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