ESTABLISHING THE REFERENCE VALUES FOR BLOOD GLUCOSE AND LIPID FROM THE STUDENT POPULATION IN NASARAWA STATE UNIVERSITY, KEFFI –NIGERIA

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Abstract

This study was conducted to assess the Lipid Profile (LP) and Fasting Blood Sugar (FBS) of apparently healthy students of Nasarawa state University, Keffi. Four hundred apparently healthy subjects, who were diagnosed and certified free from hepatitis A, B and C, HIV and diabetes, were studied. Total cholesterol (TC), triacylglycerols (TG), low density lipoprotein–cholesterol (LDL–C), high density lipoprotein – cholesterol (HDL–c) and fasting blood sugar (FBS) levels were assayed using standard biochemical methods. The mean FBS, HDL–C, LDL–C levels were lower in the male compared to female subjects, though these were not significant (P ≤ 0.05). The result of this study has shown that males have a higher prevalence of desirable Fasting blood sugar, Total cholesterol and LDL–cholesterol level, while the females have the highest prevalence of desirable triacylglycerol and HDL–cholesterol. This result shows no significant gender difference in the lipid and glucose metabolism among the sampled population, indicating that both sexes are not predisposed to cardiovascular disease. From the total of 400 subjects sampled the result shows a high frequency of desirable value of 94 % total cholesterol, 73 % triacylglycerol, 72 % LDL–cholesterol, 74 % Fasting blood sugar, and 61 % HDL–cholesterol. The high mean ± SD lipid and glucose levels observed may be due to nutrition and efficient hormonal function among the sampled population.

***Keywords**: Triacylglycerol, lipoprotein, blood sugar, cholesterol, brain lipids.*

INTRODUCTION

Lipids play a critical role in almost all aspects of biological life. They are the structural components in cells and are involved in metabolic and hormonal pathways (Crook, 2006). Lipids and lipoprotein abnormalities are well known risk factors for heart disease. Elevated levels of triacylglycerols (TG), cholesterol, and low density lipoprotein–cholesterol (LDL–C) are documented as risk factors for atherogenesis (Adaramoye *et al*., 2005). The blood level of high density lipoprotein–cholesterol (HDL–C) in contrast bears an inverse relationship to the risk of atherosclerosis and coronary heart disease (Tao *et al.,* 1992; Khor *et al.,* 1997). Genetic factors and diet both play a major role in regulating cholesterol and triacylglycerol levels in the plasma (Schaefer *et al.,* 1995). High levels of cholesterol, particularly LDL–cholesterol, are mainly responsible for hypercholesterolemia (Krieger, 1998). Hypercholesterolemia is known to be associated with enhanced oxidative stress related to increased lipid peroxidation (Adaramoye *et al.,* 2005). Increased generation of oxidized LDL–C is a major factor in the vascular damage associated with high cholesterol levels (Pritchard *et al.,* 1995). Nutritional inhibition or reduction of hypercholestrolaemic conditions is considered to be an important therapeutic approach and efforts have been made to identify medicinal plants with these functions (Adaramoye *et al.,* 2008; Visavadiya & Narasimhacharya, 2007; Hu *et al.,* 2006; Tomotake *et al.,* 2006).

The blood sugar concentration or blood glucose level is the amount of glucose (sugar) present in the blood of a human or animal. Normally in mammals, the body maintains the blood glucose level at a reference range of between 3.6 and 5.8 mM or 64.8 and 104.4 mg/dL (Wikipedia, 2012). The human body naturally tightly regulates blood glucose levels as a part of metabolic homeostasis. Blood sugar levels outside the normal range may be an indication of a medical condition (Wikipedia, 2012). A persistently high level is referred to as hyperglycaemia whereas low levels are referred to as hypoglycaemia. Diabetes mellitus is characterized by persistent hyperglycaemia from any of several causes, and is the most prominent disease related to failure of blood sugar regulation. A temporarily elevated blood sugar level may also result from severe stress, such as trauma, stroke, myocardial infarction, surgery, or illness (Wikipedia, 2012). Genetics, nutritional pattern and drug intake determine the blood glucose level of an individual and by extension a population.

Some medical health conditions associated with the blood lipids and blood sugar concentrations are now rampant. For example, Cholesterol and other fatty substances combine in the bloodstream and are deposited in the blood vessels to form a plaque. The

increase in lipids can cause plaques to grow over time, leading to obstructions in blood flow. If an obstruction occurs in the coronary arteries, it could result in a heart attack. And, if an obstruction occurs in the arteries of the brain, it could lead to stroke (Crook, 2006). Normally, the body keeps blood sugar levels within a narrow range through the coordinated work of several organs and glands and their hormones, primarily insulin and glucagon. But factors such as disease or a poor diet can disrupt the mechanisms that regulate this sugar levels. Too much glucose results in hyperglycemia, one of the major symptoms of diabetes. The causes of hyperlipidemia can include heredity and certain medications. However, it has been deduced that the greatest, modifiable risk factor could be diet; a poor diet is one with a fat intake greater than 40 percent of total calories, saturated fat intake greater than 10 percent of total calories; and cholesterol intake greater than 300 milligrams per day (Durrington, 2003). Therefore it is imperative to determine the prevalence of the health related risk associated with lipid and glucose among the student population in Nasarawa State University, Keffi. This information will be relevant as a reference point for Nutritionists/Physicians handling the students' dietary or health related matters.

MATERIALS AND METHODS

Prior to this study ethical clearance was sought and obtained from the research and ethical committee of the Federal Medical Centre Keffi and the Nasarawa State University clinic. A total number of 400 blood samples were randomly collected from apparently healthy individuals, who were diagnosed and certified free from hepatitis A, B and C, HIV and diabetes, with the help of clinical personnel at the Nasarawa State University Health Centre Keffi. The blood samples were aseptically collected with syringes and needle by venipuncture and carefully dispensed into a labelled plain container. The samples were allowed to clot, after which they were carefully dislodged with a dropper pipette (avoiding lyses) and centrifuged at 1,000 rpm for 10 mins. Clear sera were separated immediately (with the aid of a Pasteur pipette) into clean containers with corresponding labels.

Five Biochemical parameters were determined on the sera specimens: Fasting blood glucose (FBG), total cholesterol (TC), triacylglycerol (TAG), high density lipoprotein (HDL) and low density lipoprotein (LDL). All the assays were performed based on the standard operating procedures (SOPs), as reported in Kwiterovich (1997), Friedwald *et al.* (1972).

RESULT AND DISCUSSION

The general results obtained from this research are as shown in Table 1. This indicates that the mean ± SD values of total cholesterol, triacylglycerol, LDL–cholesterol, HDL–cholesterol and fasting blood glucose were 134.45±43.30, 105.10±48.46, 77.60±39.06, 35.86±13.17 and 81.85±26.42 mg/dl respectively. These values are within the normal reference range of < 200 (Tchol), < 40 (HDL), < 150 (TRIG), < 100 (LDL–chol) and 63–104 (FBG) (NCEP, 2007). The existence of normal levels of the parameters tested (Tchol, TRIG, LDL–chol, HDL–chol and FBS) is of clinical significance considering the fact that sustenance of normal ranges of LDL – chol minimizes the risk of developing arthrosclerosis and that of FBS minimises the occurrence of hyperglycaemia or hypoglycaemia. However, the FBS levels of more than 70 % of the sampled population were at the borderline, indicating a potential risk of hyperglycaemia, if the cause and possible remedy of the situation is not ascertained.

Table 1: The mean value of the biochemical parameters of the sampled population

Parameters	Mean ± SD	Max	Min	P – Value
TC (mg/dl)	134.45 ± 43.29	2820	40.7	31.06
TG (mg/dl)	105.10 ± 48.46	197.2	16.8	21.69
HDL (mg/dl)	35.86 ± 13.17	72.6	10.0	27.23
LDL (mg/dl)	77.60 ± 39.06	222.3	6.3	19.87
FBS (mg/dl)	81.85 ± 26.42	217.8	5.2	30.98

Table 2: Analyses of the biochemical parameters among males

Parameter	Mean ± SD	Desirable (%)	Borderline (%)	High (%)
TC(mg/dl)	134.77 ± 41.26	(<200) 94.3	(200–239) 1.9	(≥ 240) 3.8
TG(mg/dl)	116.54 ± 48.44	(<150) 63.5	(150–199) 36.5	(200–499) 0
HDL(mg/dl)	34.59 ± 11.50	(<40) 67.3	(40 –59) 32.7	(≥ 60) 0
LDL(mg/dl)	76.88 ± 39.10	(<100) 75	(100 – 159) 23	(≥160) 2
FBS(mg/dl)	81.41 ± 28.00	(< 63) 7.7	(63 – 104) 84.6	(≥ 105) 7.7

Table 3: Analyses of the biochemical parameters among females

Parameter	Mean ± SD	Desirable (%)	Borderline (%)	High (%)
TC(mg/dl)	134.10 ± 45.86	(<200) 93.8	(200–239) 4.2	(≥ 240) 2
TG(mg/dl)	92.71 ± 45.83	(<150)83.3	(150–199) 16.7	(200–499) 0
HDL(mg/dl)	37.24 ± 14.97	(<40) 54.2	(40 –59) 39.6	(≥ 60) 6.2
LDL(mg/dl)	78.40 ± 39.42	(<100) 68.8	(100 – 159) 29.2	(≥160) 2
FBS(mg/dl)	84.25 ± 22.27	(< 63) 8.3	(63 – 104) 70.8	(≥ 105) 20.9

Tables 2 and 3 show the separate results obtained for the males and females in the sampled population. Although mean ± SD values of the biochemical parameters obtained for both groups fall within the normal reference ranges, there exist variations in TG where male population have higher mean ± SD values than females and HDL with females having slightly higher mean ± SD than the males. The mean ± SD value of fasting blood sugar, HDL–cholesterol and LDL–cholesterol were found to be higher in female compared to the male, but the difference is insignificant at $p \leq 0.05$.

These results are in agreement with previous findings by Must and Tybor (2005), Tremollieres *et al.* (1999) and Li *et al.* (1996). This suggests that lipoprotein and glucose level are higher in female than in male due to decreased physical activity and increased sedentary behaviour. The mean ± SD total cholesterol and triacylglycerol were lower in female compared to the male, though these were not significant ($P \leq 0.05$). This is also in agreement with earlier research by Tremollieres *et al.* (1999) and Li *et al.* (1996). Table 3 shows that there is a higher number of females with optimal LDL–cholesterol and more females with high HDL–cholesterol compared to men, and this agrees with a research conducted by Li *et al.* (2003). There exists a zero prevalence of high triacylglycerol, hence low incidence of atherosclerosis (Cullen, 2003) and related diseases in both sexes, as indicated by the result of this finding, even as there was higher frequency of desirable triacylglycerol in females than in males. There is also a low frequency of the people having the desirable FBS in both groups and low the frequency of high FBS in male group as compared to the female group which has 20.83 %. This was earlier suggested by Must and Tybor (2005) to be due to the decreased physical activity and increased sedentary behaviour of the females. There is however the possibility of having the incidence of hyperglycaemia in this community, as more than 70 % of both males and females in the sampled population were having the borderline values of FBS.

CONCLUSIONS

This study had clearly shown the lipid profile and glucose level of the student population in the Nasarawa State University, Keffi. The result showed that males have a higher prevalence of desirable fasting blood glucose, total cholesterol and LDL–cholesterol level while the females have a higher prevalence of desirable triacylglycerol and HDL–cholesterol. This result did not show significant ($p \leq 0.05$) gender difference in the lipid and glucose metabolism among the males and females in the sampled population.

This finding has also succeeded in showing that the subjects sampled for this study were less predisposed to diabetes and cardiovascular diseases. It suffices to say therefore, that the maintenance of healthy levels of these parameters can be attained by practice of a healthy lifestyle which includes adequate exercise (Fahey, 2005; Becque *et al*., 1988) quitting the use of tobacco and decreasing the intake of alcohol and good eating habits, limiting saturated fats and foods high in cholesterol (Gailliot *et al*., 2007). For optimum dietary changes, however, foods low in saturated fat such as fish and other lean meats, whole grain foods, lots of fruits and vegetables, and foods high in fibre should be taken, while organ meats such as liver, lunchmeats, and wieners, high–fat dairy products and egg yolks should be avoided (Gailliot *et al*., 2007). Education is a very important factor in our search for freedom from diseases, concerted efforts should therefore, be made to continuously educate the populace on the menace of cardiovascular diseases and diabetes, with particular attention to their relationship with feeding habits and life styles. We therefore, recommend the adoption of more aggressive strategies for maintaining normal blood sugar, lowering cholesterol and related molecules and regular screening of students of Nasarawa State University, Keffi, for lipid disorder.

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