Effect of Age and Gender On Lipid Profile In Healthy Rural Population of Edo State, Nigeria

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Abstract:

There are contradicting information on the influence of age and gender on blood lipid profile, some researchers believe the levels of total cholesterol and other components of lipid profile increase with age, others have proved significant negative correlation between total cholesterol, low density lipoprotein cholesterol and age. In this cross sectional study we looked at the effect of age and gender on lipid profile in a rural population. A total of one hundred and fifteen (115) healthy subjects between the ages of 21 and 80 years were recruited for this study. Forty-four of the subjects were male and seventy-one females. Serum lipid profile (total cholesterol, triglyceride, low density lipoprotein cholesterol and high density lipoprotein cholesterol) were estimated using standard laboratory techniques. The mean value of triglyceride was significantly higher in males than females (p-value 0.02) but the mean values of total cholesterol and low density lipoprotein cholesterol, though higher in the male subjects than the females, the differences were not statistically significant (p-value 0.60 and 0.59). The mean value of high density lipoprotein cholesterol was higher in the female than male subjects, although the difference was not statistically significant (p-value 0.25). The highest percentage of subjects with dyslipidaemia was seen in the age group between 61-70 years in all the parameters assessed. There was positive correlation between Age, total cholesterol, (0.273, p-value 0.003) triglycerides (0.29, p-value 0.002), high density lipoprotein cholesterol (0.107, p-value 0.25) and low density lipoprotein cholesterol (0.07, p-value 0.48). Lipid profile is affected by age and sex, dyslipidaemia is commonest in 61-70 years age group and post menopausal women.

Keywords: Dyslipidaemia, Coronary heart disease, gender, postmenopausal

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Introduction

The term lipid is used to include all fats and substances of fat like nature. Lipids act as energy stores and important structural components of cell membrane.[1]

Blood lipid levels are influenced by nutrition, body weight, physical activities, medications and genetic factors[2,3], circulating lipoproteins contain triglyceride, cholesterol and its esters and phospholipids, in addition to specific proteins. The low density lipoprotein cholesterol (LDL-C) carries cholesterol from the liver to peripheral tissues, while the high density lipoprotein cholesterol (HDL-C) carries cholesterol in the reverse direction from the periphery tissues to the liver in a process termed reverse cholesterol transport, as a result of these functions, increased levels of LDL-C increase the risk of cardiovascular diseases (CVD) while HDL-C is a vessel-protective agent, preventing the formation of atherosclerotic changes[4]. Independent of other risk factors, hypercholesterolaemia has been associated with a greater risk of CVD and coronary heart disease (CHD)[5]. Some clinical trials involving both primary and secondary prevention have showed that reduction in total cholesterol, LDL-C and modification of other lipoproteins profiles significantly reduces CHD.[6] Of the major classes of lipoproteins, the LDL fraction is the major atherogenic class[6]. Although, hypertension and hypercholesterolaemia are important and independent risk factors for the development of atherosclerotic vascular disease, hypercholesterolaemia is seen as a much stronger indicator of future myocardial events[7]. In patients with both hypertension and dyslipidaemia, the risk of CVD is not only additive but also synagestic[7]. Unlike the positive relationship between total cholesterol, LDL-C and CHD, there is a probable protective inverse relationship between HDL-C AND CHD.[4] furthermore, some studies indicate the possibility that triglyceride; the main component of VLDL is an independent risk factor for CHD[8]. Similarly, some researchers are of the opinion that hypertriglyceridaemia is causally related to CHD because of associated low levels of serum HDL-C, increased atherogenic LDL-C or elevated clotting factors in patients with high plasma triglyceride[4].

The protective role of oestrogen in pre-menopausal women was associated with significantly lower LDL-C and triglyceride and higher HDL-C compared with men[9]. These trends are however, often

reversed in post-menopausal women[10].

Human longevity is mostly attributed to either lower incidence or significant delay in the onset of age-related disorders[11]. Previous studies on the effect of age and gender on plasma lipid levels gave mixed results. There were repeated evidences that LDL-C tend to rise with age in both sexes[12]. In this present study, we looked at the effects of age and gender on lipid profile in healthy rural population in Edo state, Nigeria, to ascertain the group of people who are more at risk of dyslipidaemia in this environment.

Materials and Methods:

This study was carried out at Ekosodin village and Iguiye community both in Ovia North East Local Government Area of Edo State and university of Benin Teaching Hospital, Benin City, Edo State. One hundred and fifteen healthy volunteers; forty four (44) males and seventy-one (71) females were recruited for this study. Twenty three (23) of the volunteers were in the age bracket of 21-30 years, while twenty five (25) of them were in the age bracket of 31-40 years. Thirty-two (32) of the volunteers were in the age bracket of 41-50 years and twenty-three (23) were in the age bracket of 51-60 years. Eight (8) of the volunteers were between 61-70 years old and only 4 of the volunteers were between 70-80 years old.

Subjects with diabetes mellitus, hypertension and other chronic medical conditions were excluded from this study.

The volunteer subjects were asked to fast overnight for about 12 hours, 4-5mls of veinous blood was obtained from each subject and put into a plain container. The blood was centrifuged for 15 minutes at 3,000 revolutions per minute. The separated serum was stored at – 20^{0}C until analysis was carried out within 48 hours of collection.

Serum total cholesterol and triglyceride concentrations were determined by enzymatic spectrophotometric method[13]. Serum high density lipoprotein cholesterol (HDL-C) was determined enzymatically after precipitating other lipoproteins as described by Burstein et al[14], while low density lipoprotein cholesterol (LDL-C) was calculated using the friedewald equation[15].

The data were entered into and analyzed using SPSS version 16.0 (Chicago, IL, USA). Continuous variables were presented as mean ± standard deviation. The differences in mean were compared using the student t-test. Statistically significant p-values were set at <0.05.

Results

A total of 115 subjects (n= 115) within the age range of 22 – 80 years with a mean age of 44.66 ± 13.39 years, consisting of 44 (38.3%) males and 71 (61.7%) females were recruited for this study. Twenty three (n = 23) of the subjects were within the age bracket of 21-30 years, while twenty five (n = 25) were in the age bracket of 31 – 40 years. Thirty-two (n = 32) of the subjects were within the age bracket of 41 – 50 years and twenty three (n = 23) were in that age bracket of 51 – 60 years and eight (n = 8) were within the age bracket of 61 - 70 years. Only four (n = 4) were within the age bracket of 71 – 80 years.

Table 1: Age and sex distribution of subjects

Age group	Male	Female	Total
21 – 30	7 (15.9)	16 (22.5)	23 (20.0)
31 – 40	11 (25.0)	14 (19.7)	25 (21.7)
41 – 50	12 (27.3)	20 (28.2)	32 (27.8)
51 – 60	6 (13.6)	17 (23.9)	23 (20.0)
61 – 70	5 (11.4)	3 (4.2)	8 (7.0)
71 – 80	3 (6.8)	1 (1.4)	4 (3.5)
Total	44 (100.0)	71 (100.0)	115 (100.0)

Table 2: Mean values of lipid profile in male and female subjects

Lipid Profile	Males Mean ± SD	Females Mean ± SD	P value
TC	172.7 ±59.8	167.2 ± 50.2	0.599
TGA	107.2 ± 58.7	84.6 ± 40.3	0.016
HDL	43.7 ± 24.8	48.4 ± 22.5	0.249
LDL	91.8 ± 47.4	87.4 ± 37.9	0.585

Table 3: Lipid Profile levels in the various age groups

	TGA		TChol		HDL-C		LDL-C	
Age group	Normal (%)	Dyslipidaemia (%)	Normal (%)	Dyslipidaemia (%)	Normal (%)	Dyslipidaemia (%)	Normal (%)	Dyslipidaemia (%)
21 –30	22 (95.7)	1 (4.3)	16(69.6)	7 (30.4)	8 (34.8)	15 (65.2)	22 (95.7)	1 (4.3)
31 – 40	23 (92.0)	2 (8.0)	16(64.0)	9 (36.0)	11(44.0)	14 (56.0)	23 (92.0)	2 (8.0)
41 – 50	28 (87.5)	4 (12.5)	16 (50.0)	16 (50.0)	18(56.2)	14 (43.8)	26 (81.2)	6 (18.7)
51 – 60	22 (95.7)	1 (4.3)	10(43.5)	13 (56.5)	12(52.2)	11 (47.8)	19 (82.6)	4 (17.4)
61 – 70	5 (62.5)	3 (37.5)	2 (25.0)	6 (75.0)	4 (50.0)	4 (50.0)	5 (62.5)	3 (37.5)
71 – 80	4 (100.0)	0 (0.0)	2 (50.0)	2 (50.0)	2 (50.0)	2 (50.0)	4 (100.0)	0 (0.0)
Total	104(90.4)	11 (9.6)	62(53.9)	53 (46.1)	55(47.8)	60 (52.2)	99 (86.1)	16 (13.9)

Table 4: Correlation of age and lipid profile in the study group

		TC	TGA	HDL	LDL
Age	R	0.273	0.289	0.107	0.067
	P value	0.003	0.002	0.254	0.480
TC	R		0.479	0.547	0.595
	P value		0.000	0.000	0.000
TGA	R			0.198	0.368
	P value			0.034	0.000
HDL	R				0.407
	P value				0.000

Discussion

In this study, the upper limit for serum total cholesterol level was pegged at 170mg/dl (4.36mmol/L) compared to the commonly accepted upper limit of 200mg/dL (5.13 mmol/L) in this population[16]. A study done in the Northern part of Nigeria had earlier reported that none of the subjects in the five hundred studied population had a serum total cholesterol level of up to 5.2mmol/L[17]. Some researchers have argued that the desired range for serum cholesterol concentrations as advocated for developed countries may have to be modified for developing countries.[18] The suspicion by such researchers is that subjects in developing countries could be prone to developing complications associated with hypercholesterolaemia at a lower serum plasma cholesterol level[18,19].

The upper limit for serum triglyceride was fixed at 150mg/dL (1.69mmol/L), while that of LDL-C was fixed at 130mg/dL (3.36mmol/L) and the upper limit for HDL-cholesterol was pegged at 40mg/dL (1.03mmol/L). The mean values of total cholesterol, triglyceride and LDL cholesterol were higher in males than female but mean HDL cholesterol value was higher in female than males, this finding is in agreement with those of other authors[20] but other researchers[12] found no gender-related differences in the concentrations of total cholesterol, triglycerides, HDL-C and LDL-C[21,22]. The mean triglyceride of the male subjects was significantly higher than that of the female subjects (p-value 0.016).

The highest percentage of subjects with dyslipidaemia was seen in the 61-70 years age group in all the parameters assessed, this is in agreement with the findings of Essig et al[23] who found body fat content of Tg, TC and LDL-C to increase in men and women with age (61-70 vs. 21-30 years of age). These age-related changes in the lipid profile were due to an increasing content of visceral fat, McNamara et al[24] also reported that postmenopausal status was associated with significantly higher values of total cholesterol, triglycerides, LDL-cholesterol and lower levels of HDL-cholesterol. Physiologically low oestrogen levels associated with menopause was proved to minimize LDL-cholesterol clearance by the liver and hence increase LDL-cholesterol levels in post menopausal women[25], this opinion is supported by previous studies in animal models which suggest that administration of oestrogen increases hepatic cell surface LDL-cholesterol receptors ad consequently rapid clearance of LDL-cholesterol particles[26]. In this current study the mean LDC-cholesterol level gradually rises in postmenopausal female subjects (from 92.9 ± 40.0mg/dL in 51-60 years age group to 136.0 ± 58.1mg/dL in 61-70 years age group) while there is a decline in the mean serum HDL-cholesterol level in the same category of subjects (from 48.2 ± 31.5mg/dl in 51-60 years age group to 42.0 ± 22.3mg/dl in 61-70 years age group), since low postmenopausal oestrogen decreases HDL-cholesterol, putting elderly women at higher risk of coronary heart disease, same as men[27].

There was positive correlation between age, total cholesterol (0.273, p-value-0.003), triglycerides (0.289, p-valued – 0.002), HDL-cholesterol (0.107, P-value – 0.254) and LDL-cholesterol (0.067, p-value-0.480). This further gives credence to the fact that the levels of total cholesterol and other components of lipid profile increase with age[11,12]. Conversely, considerable studies prove significant negative correlation between total cholesterol, LDL-cholesterol and age.[28]

Conclusion

In this study, we demonstrated that gender and age have effects on lipid profile and dyslipidaemia is commonest in 61-70 years age group and postmenopausal women. Although similar findings have been reported by other researchers in blacks, we have also been able to demonstrate it in our local population. In view of this finding, we recommend that these categories of people should be monitored regularly for dyslipidaemia and its complications.

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References

1. Crook A.M. Clinical chemistry and metabolic medicine. *Edward Arnold, UK, 8th ed 2012; pp201-214.*
2. The Expert Panel Report of the National Cholesterol Education Program on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. *Arch Intern Med 1998; 148 (1): 36-39.*
3. Hunt Sc, Hasstedt SJ, Kuida H, stults BM, Hopkins PN, Williams RR. Genetic heritability and common environmental components of resting and

stressed blood pressures, lipids, and body mass index in Utah pedigrees and twins. *Am J. Epidemiol 1989; 129 (3): 625-38.*

4. Hertzberg GR. Aerobic exercise, lipoproteins and cardiovascular disease: benefits and possible risk. *Can J. Appl. Physio 2004; 29: 800 – 807.*

5. Klag MG, Ford DE, Mead LA. Serum cholesterol in young men and subsequent cardiovascular disease. *N Engl J Med 1993; 328; 313 - 318.*

6. Oberman A. Epidemiology and prevention of cardiovascular disease. William N Kelly, ed. Textbook of internal medicine, *3rd Edn. Lippincott Raven publishers, Philadelphia. 1997; pp. 158-163.*

7. Marcus DW, Wart CW. Hypertension: Are beta blockers and diuretics appropriate first line therapies. *Ann pharmacother 1994; 340: 115 -126.*

8. Austin MA. Plasma triglyceride as a risk factor for cardiovascular disease. *Can J. cardio 1998; 14: 14B – 17B.*

9. Garelnabi M, Veledar E, Abramson J, White-Welkley J, Santanam N, Weintraub W, Parthasarathy S. Physical inactivity and cardiovascular risk: baseline observation from men and premenopausal women. *J Clin lab Anal. 2010; 24: 100 – 105.*

10. Barzilai N, Atzmon G, Schechter EJ, Cupples AL, Lipton R, Cheng S, Shuldiner AR. Unique lipoprotein phenotype and genotype associated with exceptional Longevity. *JAMA 2003; 290 (15): 2030 – 2040.*

11. Schaefer EJ, Lamon-Fava S, Cohn SD, Schaefer MM, Ordovas JM, Castelli WP, Wilson PW. Effects of age, gender and menopausal status on plasma low density lipoprotein cholesterol and apolipoprotein B levels in the Framingham offspring study. *J Lipid Res 1994; 35 (5):779-792.*

12. Mc Auley MT, Wilkinson DJ, Jones JJ, Kirkwood TB. A whole body mathematical model of cholesterol metabolism and its age associated dysregulation. *BMC Syst Biol 2012; 6:130-6.*

13. Richmond N. Methodology for determination of cholesterol. *Clin Chem 1973; 19:1350-1356.*

14. Burstein M, Scholnick HR, Morfin R: Rapid Method for the isolation of lipoproteins from human serum by precipitation with polyanions. *Scand J clini Lab Invest 1980; 40: 583-595.*

15. Friedwald WT, Levy RI, Fredrickson DS. Estimation of the concentration of low density lipoprotein cholesterol in plasma. *Clin Chem 18: 499-502*

16. Youmbissi TJ, Djoumessi S, Nouedoui C. Profile lipidique d'un groupe d' hypertendus camerounais noir Africans. *Medicine d'Afrique-Noire 2001; 31: 114 – 118.*

17. Okesina AB, Oparinde DP, Akindoyin KA, Erasmus RT. Prevalence of some risk factors of coronary heart disease in a rural Nigerian population. *East Afr Med J 1999;76:212-216.*

18. Singh RB, Rastogi V, Ghosh S. Serum cholesterol and coronary artery disease in population with low cholesterol levels: The Indian Paradox. *Int J cardiol 1998; 65:81 – 90.*

19. Idemudia JO. Dyslipidaemia in hypertensive in South-South, Nigeria. *Bri J med Res. 2014; 4 (28): 4742-4750.*

20. Wallace RB, Colsher PC. Blood lipid distribution in older persons. Prevalence and correlates of hyperlipidaemia. *Ann Epidermiol 1992; 2 (1-2): 15 - 21.*

21. Ardern CL, Katzmarzyk PT, Janseen I, Leon AS, Wilmore JH, Skinner JS et al. Race and sex similarities in exercise induced changes in blood lipids and fatness. *Med Sci Sports Exerc 2004; 36:1610 - 1615.*

22. Habib SS, Aslam M, Hameed W. Gender differences in lipids and lipoprotein (a) profiles in healthy individuals and patients with type 2 diabetes mellitus. *Pak J physiol 2005; 1:15-19.*

23. Essig F. Sinclair D, Hare J, Moreillon J, Funk D, Swank AM. Cross-sectional analysis of cardiovascular factors for participants of a university, faculty and staff wellness program. *J Exerc physiol. 2004; 7:37-43.*

24. Li Z, Mc Namara JR, Fruchart JC, Luc G, Bard JM, Ordovas JM et al. Effects of gender and menopausal status on plasma lipoprotein subspecies and particle sizes. *J Lipid Res. 1996; 37(a): 1886 – 1896.*

25. Granfore A, Campos H, Mc Namara JR, Schaefer MM, Lamon-Fava S, Ordovas JM et al. Effects of oestrogen replacement on plasma lipo-proteins and apolipoproteins in post menopausal dyslipidaemic women. *Metabolism 1992; 41: 1193-1198*

26. Kovanen PT, Brown MS, Goldstein JL. Increased binding of low density lipoprotein to liver membranes from rats treated with 17-alphaethinyl estradiol. *J Biol Ch. 1979; 154:11367 – 11373.*

27. Eapen DJ, Kaira GL, Rifai L, Eapen CA, Merchant N, Khan BV. Raising HDL-cholesterol in women. *Int J Women's Health. 2010; 1:181-191.*

28. Ettinger WH, Wahl PW, Kuller LH, Bush TL, Tracy RP, Manolio TA et al. lipoprotein lipids in older people: results from the cardiovascular heart study. *Circulation 1992; 86: 858-867.*