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RESEARCH ARTICLE

Effects of age and gender on serum lipid profile in over 55 years-old apparently healthy Sudanese individuals

Tarig A. Marhoum [1], AbdElkarim A. Abdrabo*[2], Mohamed F. Lutfi[3]

[1] Department of Clinical chemistry, Faculty of Medical Laboratory Sciences, Al Neelain University- Sudan

[2] Department of Clinical chemistry, Faculty of Medical Laboratory Sciences, Al Neelain University - Sudan

[3] Department of Physiology, Faculty of Medicine and Health Sciences, Al Neelain University- Sudan

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ABSTRACT

Background: Previous data on the possible effects of age and gender on serum lipids profile of elderly people showed considerable debates.

Aim: to evaluate the effects of age and gender on serum lipids profile measurements in over 55 years-old Sudanese individuals.

Materials and methods: The study involved sixty-four males and forty age-matched females. The studied subjects were grouped according to their ages into those < 60 years, 60-69 years and ≥ 70 years. Following at least 12 hours fasting, serum triglycerides (TG), total cholesterol (TC), high density lipoprotein (HDL), low density lipoprotein (LDL) were measured. Volunteers were categorized based on their serum lipids measurements using the guidelines of the third report of the expert panel on detection, evaluation, and treatment of the high blood cholesterol in adults.

Results: lipids measurements were comparable in both genders; except HDL-cholesterol which was significantly less in males (M±SD = 45.2±13.76 mg/dl) compared to females (M±SD = 51.8±14.9 mg/dl, *P* = 0.032). Age correlated negatively with total cholesterol (CC = -0.322, *P* = 0.001) and LDL-cholesterol (CC = -0.352, *P* = 0.000). Prevalence of dyslipidemic patterns were as follows; total cholesterol ≥ 240 mg/dL: 7/104 (6.7%); LDL-cholesterol ≥ 160 mg/dL: 4/104 (3.85%); triglycerides ≥ 200 mg/dL. 5/104 (4.81%), and HDL-cholesterol < 40 mg/dL in males and < 50 mg/dL in females: 45/104 (43.30%).

Conclusion: the elderly females tend to have significantly higher HDL-cholesterol compared with the elderly males. Both total cholesterol and LDL-cholesterol are likely to decrease with age in those above 55 years old.

Keywords: Elderly, Cholesterol, HDL, LDL, Sudanese.

1. INTRODUCTION

Human longevity is mostly attributed to either lower incidence or significant delay in the onset of age-related disorders [1]. The high incidence of atherosclerosis in elderly people suggests that ageing process may be among the factors that disturb lipid metabolism; hence put elderly subjects at risk of developing cerebrovascular and/or coronary heart diseases. Actually, previous reports proposed that human with exceptional longevity have significantly larger high density lipoproteins (HDL) and low density lipoproteins LDL particle sizes [1, 2]. This in turn decreases prevalence of hypertension, the metabolic syndrome, cerebrovascular diseases and other fatal diseases which usually causes death in elderly people.

Previous data on the effect of age and gender in serum lipids levels gave mixed results. There were repeated evidences that LDL-cholesterol tend to rise with age in both sexes [3, 4]. Conversely, considerable studies prove significant negative correlation between total and/or LDL cholesterol and age [5, 6]. On the other hand, estrogens increase HDL [7, 8] but also enhance hepatic clearance of LDL [9, 10] and thus decrease LDL levels. Therefore, low postmenopausal estrogen is expected to decrease

*Corresponding author: AbdElkarim A. Abdrabo |Department of Clinical chemistry, Faculty of Medical Laboratory Sciences, Al Neelain University - Sudan | Email: abdrabokarim@hotmail.com

HDL/LDL ratio; putting elderly women at higher risk of atherosclerosis-related disorders. However, some previous studies demonstrated high HDL but low LDL in elderly women compared to men [11, 12]. The findings of such studies actually compromise the understanding of the normal actions of estrogen and deserve further researches and investigations.

The variations in the results of previous studies on the possible effect of age and gender in serum lipids levels of elderly individual could be due to studying subjects with different age groups and/or different ethnicities [13]. Sudan is a big country with various ethnic groups and the pattern of dyslipidemia among Sudanese subjects was not investigated before. The present study was conducted to estimate serum lipids profile measurements in above 55 years-old apparently healthy Sudanese people and evaluate the possible effects of age and gender on their serum lipids measurements.

2. MATERIALS AND METHODS

The study involved sixty-four males and forty age-matched females. Ages of the all volunteers ranged between 55 and 84 years. The studied subjects were apparently healthy and not on cholesterol or lipids lowering drugs. Smokers, diabetic, hypertensive, obese patients and those with diseases known to modify serum cholesterol or other lipids concentrations were excluded from the study.

Venous blood samples were collected from each volunteer in heparinised containers. All volunteer were fasting for 12-14 hours before sampling. Serum triglycerides (TG), total cholesterol (TC), HDL, LDL were measured using automated chemistry analyzer (HumaStar 600 - Germany). Cholesterol/HDL and LDL/HDL ratios were calculated by subdividing total cholesterol and LDL respectively by HDL.

The studied subjects were grouped according to their ages into three groups: < 60 years, 60-69 years and ≥ 70 years. In addition, the volunteers were also categorized based on their serum lipids measurements using the guidelines of the third report of the expert panel on detection, evaluation, and treatment of the high blood cholesterol in adults (adult treatment panel III) [14].

Statistical evaluation was performed using the Microsoft Office Excel (Microsoft Office Excel for windows; 2007) and SPSS (SPSS for windows version 19). Normal distribution of the studied variables was examined using Kolmogorov-Smirnova and Shapiro-Wilk tests. Student T-test and Mann-Whitney U test were used to assess significant difference in the means of the lipids measurements in males and females. Correlations between serum lipids profile and the age were assessed using bivariate correlations. P < 0.05 was considered statistically significant.

3. RESULTS

The ages of the males (N=40, M±SD = 66.36±6.52 years) were not significantly different when compared to the ages of the females (N=40, M±SD = 66.13±7.75 years, *P* = 0.834). Lipid profile measurements were comparable in both genders; except HDL-cholesterol which was significantly less in males (M±SD = 45.2±13.76 mg/dl in males and M±SD = 51.8±14.9 mg/dl in females, *P* = 0.032) (figure 1 and 2, table 1). All serum lipids measurements correlated negatively with age; however, only two correlations achieved statistical significance, namely those of total cholesterol (CC = -0.322, *P* = 0.001) and LDL-cholesterol (CC = -0.352, *P* = 0.000) (figure 3 and 4, table 2). The distribution of total cholesterol, triglycerides, HDL-cholesterol and LDL-cholesterol categories, according to national cholesterol education program (NCEP), among studied age groups are given in tables 3, 4, 5 and 6 respectively. The age group 60-69 achieved the highest proportion of those with either borderline high or high levels of all measured lipids (tables 3, 4, 5 and 6).

Prevalence of dyslipidemic patterns was relatively infrequent among studied subjects (total cholesterol ≥ 240 mg/dL: 7/104 (6.7%); LDL-cholesterol ≥ 160 mg/dL: 4/104 (3.85%); triglycerides ≥ 200 mg/dL. 5/104 (4.81%). However, HDL-cholesterol prevalence was exceptionally high (HDL-cholesterol < 40 mg/dL in males and < 50 mg/dL in females: 45/104 (43.30%).

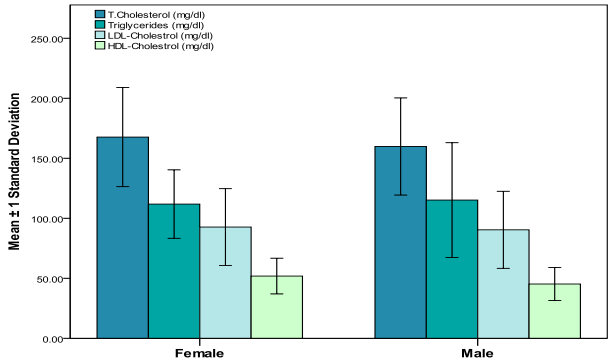

Figure 1: Means and standard deviations of serum lipids measurements in the males and the females groups

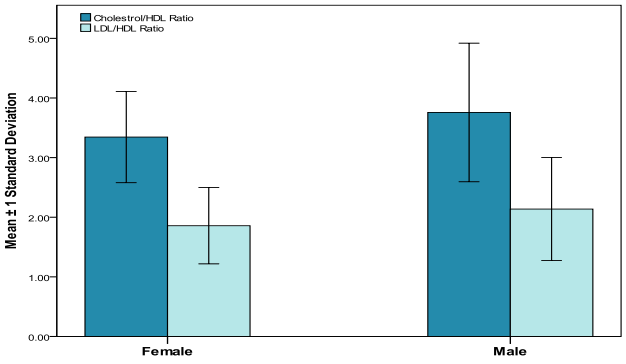

Figure 2: Means and standard deviations of cholesterol/HDL and LDL/HDL ratios in the males and the females groups

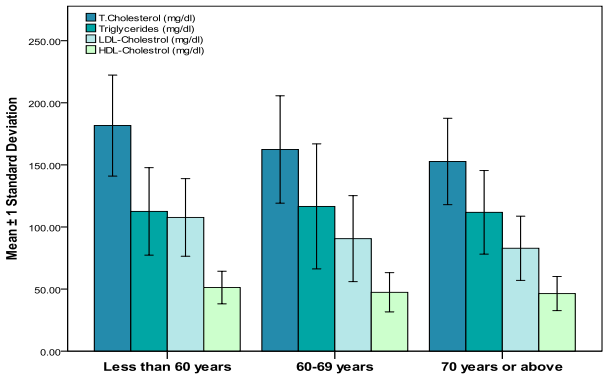

Figure 3: Means and standard deviations of serum lipids measurements in the studied age groups

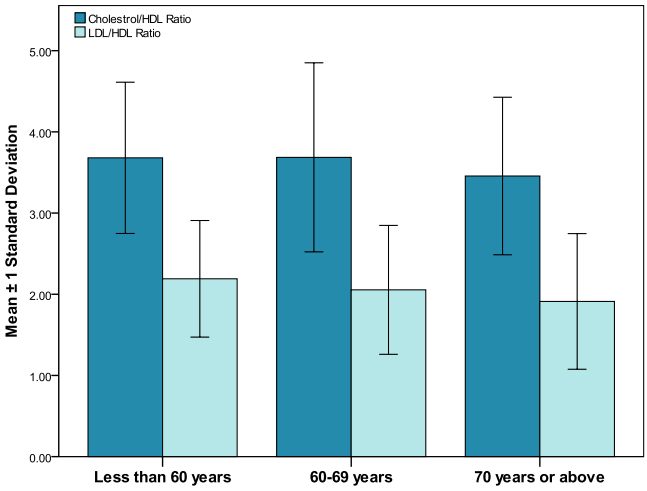

Figure 4: Means and standard deviations of cholesterol/HDL and LDL/HDL ratios in the studied age groups

	Female(N=40) M±SD	Male (N=64) M±SD	*P*
Triglycerides (mg/dl)	111.8±28.5	115.2±47.7	0.432
Total cholesterol (mg/dl)	167±41.2	159±40.4	0.346
HDL Cholesterol (mg/dl)	51.8±14.9	45.2±13.7	0.032
LDL Cholesterol (mg/dl)	92.7±31.9	90.4±32.0	0.434
Cholesterol/HDL Ratio	3.34±0.77	3.76±1.16	0.142
LDL/HDL Ratio	1.86±0.64	2.14±0.86	0.128

Table 1: Comparison of serum lipids measurements between males and females

	Correlation Coefficient	*P*
Triglycerides (mg/dl)	-0.051	0.604
Total cholesterol (mg/dl)	-0.322	0.001
HDL Cholesterol (mg/dl)	-0.119	0.230
LDL Cholesterol (mg/dl)	-0.352	0.000
Cholesterol/HDL Ratio	-0.147	0.137
LDL/HDL Ratio	-0.191	0.052

Table 2: Correlations of serum lipids measurements and the ages studied subjects

Age Group	Desirable Cholesterol level (< 200 mg/dL) N (%)	Borderline high Cholesterol level (200-239 mg/dL) N (%)	High Cholesterol level (≥ 240 mg/dL) N (%)
< 60 years	16 (18.6%)	3 (27.3%)	3 (42.9%)
60-69 years	33 (38.4%)	6 (54.5%)	4 (57.1%)
≥ 70 years	37 (43.0%)	2 (18.2%)	0 (0.0%)
Total	86 (100.0%)	11 (100.0%)	7 (100.0%)

Table 3: The distribution of total cholesterol categories among studied age groups

Age Group	Normal Triglycerides level (Less than 150 mg/dL)	Borderline high Triglycerides level (150–199 mg/dL)	High Triglycerides level (200–499 mg/dL)
< 60 years	18 (21.7%)	4 (25.0%)	0 (0.0%)
60-69 years	33 (39.8%)	5 (31.3%)	5 (100.0%)
≥ 70 years	32 (38.6%)	7 (43.8%)	0 (0.0%)
Total	83 (100.0%)	16 (100.0%)	5 (100.0%)

Table 4: The distribution of triglycerides categories among studied age groups

Age Group	Low HDL cholesterol level (less than 40 mg/dL in men and 50 mg/dL in women)	Normal HDL cholesterol level (40-59 mg/dL in men and 50-59 mg/dL in women)	High HDL cholesterol level (60 mg/dL and above)
< 60 years	7 (15.6%)	9 (24.3%)	6 (27.3%)
60-69 years	18 (40.0%)	16 (43.2%)	9 (40.9%)
≥ 70 years	20 (44.4%)	12 (32.4%)	7 (31.8%)
Total	45 (100.0%)	37 (100.0%)	22 (100.0%)

Table 5: The distribution of HDL-cholesterol categories among studied age groups

Age Group	Normal level (Less than 130 mg/dL)	Borderline high level (130–159 mg/dL)	High level (160–189 mg/dL)
< 60 years	18 (19.6%)	3 (37.5%)	1 (25.0%)
60-69 years	35 (38.0%)	5 (62.5%)	3 (75.0%)
≥ 70 years	39 (42.4%)	0 (0.0%)	0 (0.0%)
Total	92 (100.0%)	8 (100.0%)	4 (100.0%)

Table 6: The distribution of LDL-cholesterol categories among studied age groups

4. DISCUSSION

The current results revealed three main findings; first, the elderly females tend to have significantly higher HDL-cholesterol compared with the elderly males. Secondly, both total cholesterol and LDL-cholesterol are likely to decrease with age in those above 55 years old. Lastly, the age group of the subjects who achieved higher serum

lipids levels ranged between 60 and 69 years rather than those ≥ 70 years.

In the nineties of the last century considerable number of studies were conducted to evaluate the pattern of change in lipid profile in elderly people and to assess if these changes would put them at risk of dementia and coronary heart diseases [11]. In 1992, the distributions of blood lipids profile were presented for a geographically defined cohort of rural elderly Iowans aged 71 to 102 years old. The study demonstrated higher levels of total and LDL cholesterol in women compared to men, however, both measures declined with increasing age. Mean HDL cholesterol levels were also higher in women than in men, but remained relatively constant across the studied age range [12]. Another research, the Bronx Aging Study, was done in the same year to assess risk factors for the development of dementia, coronary and cerebrovascular diseases in elderly people and again demonstrated significantly higher cholesterol in women compared with men [11]. Physiologically low estrogen levels associated with menopause was proved to minimize LDL clearance by the liver and hence increase LDL-cholesterol in postmenopausal women [9, 10]. This opinion is supported by previous studies in animal models which suggest that administration of estrogen increases hepatic cell surface LDL receptors and consequently rapid clearance of LDL particles [15]. In the current study, the means of both total and LDL cholesterol were higher in females, however, the difference did not reached statistical significance; alternatively, HDL-cholesterol was significantly higher in women compared to men. The high HDL-cholesterol in elderly females disagrees with the general believe that low postmenopausal estrogen decreases HDL-cholesterol putting elderly women at higher risk of coronary heart disease, same as men [7]. Ageing in females was proved to increase high density lipoprotein subfraction 3 (HDL_3) cholesterol and decrease concentrations of high density lipoprotein subfraction 2 (HDL_2) cholesterol [8]. The high HDL-cholesterol in the females group of the current study is possibly secondary to increased HDL_3 fraction, however, further studied are needed to explain this finding.

Regarding effect of age on serum lipid profile, the current results were comparable with the findings of Honolulu Heart Program study in Japanese-American elderly men conducted by the end of the last century [5]. The prevalence of dyslipidemia of total cholesterol and LDL-cholesterol of Honolulu report were analogous to the present results. However, occurrences of HDL-cholesterol and triglycerides dyslipidemia were exceptionally high in the current study compared to Japanese-American elderly men. The same study also showed significant negative correlation between total cholesterol, LDL cholesterol, and triglyceride and age. The findings of Honolulu Heart Program study were further supported by Ettinger and his group who demonstrated significantly lower total cholesterol, cholesterol/HDL ratio and higher HDL-cholesterol in older Americans [6].

It is worth mentioning that the effects of age and gender on lipid profile may be different in those less than 60 years [3]. This hypothesis is supported by the results of the third examination cycle of the Framingham Offspring Study conducted in those with mean age 49±10 years. Framingham Offspring Study revealed higher plasma levels of LDL-cholesterol men compared with women. In addition, increased age was associated with higher plasma LDL-cholesterol, especially in women. After adjustment for age and body mass index, LDL cholesterol levels were still significantly higher in postmenopausal than in premenopausal women, indicating a hormonal effect on LDL metabolism [3]. Two years later, the effects of gender and menopausal status on plasma lipids were studied by Li *et al* [16] who examined three groups of healthy subjects: 72 premenopausal women, 74 postmenopausal women and 139 males. Li *et al* data indicated that women have significantly higher values of HDL-cholesterol, and lower values of triglyceride than men. Postmenopausal status was associated with significantly higher values of total cholesterol, LDL-cholesterol, triglyceride and lower levels of HDL-cholestrol [16]. Previous studies in the kinetics of LDL suggest that the increase in LDL with age is explained by a reduced capacity for its removal by the liver, probably secondary to reduced hepatic LDL receptor expression [17] and/or increase in cholesterol intestinal absorption [18].

It is clear from above-mentioned studies that previous reports on the effect of age in cholesterol levels give mixed results. For example, Honolulu Heart Program study in elderly Japanese-American men demonstrated significant negative correlation between total and LDL-cholesterol and age. In contrast, Framingham Offspring Study revealed positive correlation between LDL-cholesterol and age. These results variations can partly be explained by the age range of the subjects in each study. The age range for those studied in Honolulu Heart Program was between 71 and 93 years while the ages of those studied in Framingham Offspring Study were mostly below 60 years. Theoretical speaking, it seems that cholesterol levels increase with age until the sixties but start to decrease beyond that age. This hypothesis is supported by the results of the current study which showed the tendency of both total cholesterol and LDL-cholesterol to decrease with age, yet the age group of those who achieved higher serum lipids levels ranged between 60 and 69 years rather than those ≥ 70 years. However, this hypothesis remains theoretical and further researches are desirable to prove or reject it.

In conclusion, data of the present study suggest that the ageing of apparently healthy Sudanese individuals over 55 years is likely to increase both total cholesterol and LDL-cholesterol. In addition HDL-cholesterol levels were significantly higher in elderly females compared with the elderly males. These findings disagree with most previous reports on the possible effects of age and gender on serum lipids profile of elder people and should motivate researchers for further investigations on this field.

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Conflict of Interest: None Declared

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