

PLASMA CHOLESTEROL AND LIPOPROTEINS PROFILE IN HEALTHY SAUDI PERSONS

Mohamed A. Abdulrahman¹, Mahmoud M. Hassan² and Ali A. Ibrahim³

¹Hospital laboratory and blood bank, Alqunfudah General Hospital, Alqunfudah, Kingdom of Saudi Arabia.

²Faculty of Agriculture and Natural Resources, University of Bakht Er-Ruda, Sudan.

³Department of chemistry, Alqunfudah Teachers College, Alqunfudah, Kingdom of Saudi Arabia.

ABSTRACT

Objectives: to study the differences in the concentrations of plasma total cholesterol (TC), triglycerides (TG), LDL-C and HDL-C in normal healthy Saudi persons according to gender, age and lifestyle.

Methods: For all tested research group the blood was drawn after an overnight fasting period (12-14hrs) using heparinized tubes. Enzymatic colorimetric method were used for analyse and the mean values and standard deviation for all parameters were obtained.

Results: The results showed lower T.C, TG and LDL-C levels through childhood group (<1-14 years) for both sexes with no significant differences between rural and urban areas. With the exception of HDL-C, other parameters increased with increasing of age for both sexes, indicating the effect of diet and lifestyle. However, HDL-C decreases during adolescence reaching its lowest level at the age of 40 years. It remains constant up to the age of 55 years in both sexes, and then it started to rise to a constant level at later ages. This coincided with significant increase of total cholesterol, triglycerides and LDL-C that approached the dangerous levels in both city males and females above 40 years of age.

Conclusion: This study suggests that differences in dietary habits and lifestyle were much more effective in the adult groups who lived in cities at an age above 40 years to be at risk of coronary heart disease. This was in line with the significantly higher levels of bad cholesterol and lower levels of the good one.

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INTRODUCTION

Almost all living organisms have been found to contain some types of steroids. However, cholesterol is found exclusively in animals and humans, virtually in all cells and body fluids. Cholesterol, is an alcohol of high molecular weight, and it is the initial starting point in many metabolic pathways. Cholesterol present in the intestinal wall comes from three sources, the diet, the bile and intestinal secretions (John, 1977). Animal products especially meat, egg yolk, seafoods and whole fat-dairy products provide the bulk of dietary cholesterol. Practically all cholesterol in the intestine is present in the unesterified (free) form (Cox *et al.*, 1995).

Although a portion of the body's cholesterol is derived from dietary intake, the liver and gut synthesize the bulk of cholesterol endogenously from simpler molecules, particularly acetate. Peripheral cells and other organs depend on cholesterol delivery from circulation (Weggemans *et al.*, 1999). Some of the important cholesterol functions include the production of cell membranes, manufacturing of vitamin D and production of sex hormones, such as oestrogen and testosterone. Cholesterol is also the precursor for other steroids in animals such as bile acids (Mayes, 2000).

Cholesterol is the most prominent member of the steroid family and is famous among the public because of the relationship between the elevated levels of serum cholesterol and an increased risk of cardiovascular diseases. Cholesterol and other fats cannot dissolve in the blood; they have to be transported to and from the cells by special carriers called lipoproteins. High levels of cholesterol, particularly LDL-cholesterol, cause many difficulties for human health (ischemic disease). Too much LDL-cholesterol can clog the arteries and thus increases the risk of heart attack and stroke (Thomas, 2002). There are a number of dietary and exercise approaches that are beneficial in reducing total and LDL cholesterol levels (Lee *et al.*, 1991; Millen *et al.*, 1996). The aim of this study is to investigate the lipid profile (total cholesterol, triglycerides, HDL-cholesterol, LDL-cholesterol) in healthy normal Saudi people of different age, gender and life style.

MATERIALS AND METHODS

Questionnaire

A questionnaire was randomly distributed to volunteers of different sex, age and lifestyle. It consisted of two parts one for personal information and a second part associated with factors affecting cholesterol levels.

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Blood Sampling and Plasma Isolation

Blood was drawn after an overnight fasting period (12-14 hours) and collected in tubes containing heparin (final concentration up to 75 U/ml). The blood was centrifuged at 4000 rpm for 10-15 minutes by labofuge centrifuge, (model 400, Germany). The resulting plasma was kept on ice and the analysis was performed within a period not exceeding two hours.

For all tests required (total Cholesterol, HDL-C, LDL-C, triglycerides) enzymatic methods, and a Hitachi autoanalyser (model 911) instrument with ready to use Boehringer Mannheim kits were used. The instrument was calibrated and controlled pre-running the samples.

Calibration

Cholesterol and triglycerides were standardized using a calibrator for automated systems (c.f.a.s). For high-density lipoprotein cholesterol (HDL-C) and low-density lipoprotein cholesterol (LDL-C) c.f.a.s lipids were used.

Quality Control

For plasma cholesterol (total) and triglycerides, two levels of controls were often assayed at least once a day, Precinorm U as low control, and Precipath U as high control. Precinorm L and Precipath L were used as low and high levels respectively, for each HDL-C and LDL-C.

RESULTS

In this study 873 healthy Saudi persons were divided into two groups (475 males and 398 females) were examined for lipid profile. Each of these two groups was further divided into two categories (rural and urban) that were classified into six subgroups according to the ages ([<1-14], [15-24], [25-40], [41-55], [56-69], [70+]) years. Means for total cholesterol, triglycerides, HDL-cholesterol and LDL-cholesterol were given for both males and females, between [<1 to70+ years old.

Table (1) shows the male lipid profile measurements for both city people and villagers in each age group to find out the effects of lifestyle. At birth and during early years of life (infants and children) in both males and females there were no significant differences in all tested parameters (total cholesterol, HDL-C, LDL-C, triglycerides). This may be due to close similarity in dietary habits and activities taken between rural and urban children. On the other hand, in both sexes, it seems that differences of dietary habits and

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lifestyle were much highly effective in the adults groups. The mean values of lipids profile (T.C, HDL-C, LDL-C, TG) showed significant differences ($P \leq 0.05$) between villagers and city population through all adult age groups. Similar to males, mean values for all lipid profile in the female subjects showed significant differences between villagers and city population through all adult age groups, (table 2). This suggests that differences in dietary habits and life style practiced by city people were behind the relatively elevated levels of plasma lipids profile, except HDL-C.

This was evident when total cholesterol exceeded the desirable limit of 200 mg/dl in both city males and females at the age of 40 years and above. However only slight increase was observed in males and females living in the villages at the age of 55 and above. LDL-C started to elevate above the optimal level of 100mg/dl in both males and females of city and villages earlier at the ages of 25 years and above. It exceeded the tolerable limit 130 mg/dl in both males and females in the city at the age of 56-69 years. Female villagers had optimum levels of HDL-C of over (60 mg/dl) in all age ranges. in males although it was slightly less but remained at a constant level. In city males and females HDL-C was high at early childhood and started to decline reaching its lowest levels at the age of 41-55 years. Triglycerides were all normal or below 150 mg/dl for all ages, gender and lifestyle.

Saudi people who lived in villages had normal cholesterol and lipoproteins profile at all ages. Those who live in cities particularly at the age of 56-69 had highest levels of T.C, LDL-C, T.G and lowest levels of HDL-C. Therefore Saudi people who live in cities are at high risk of cardiovascular diseases above 40 years of age and above. The potential risk can be prevented or minimized by diet control, physical exercise and medication, when needed.

Table (1): Comparison of plasma lipids healthy Saudi males at different ages and Lifestyle. The results are expressed in mg/dl and the values are mean \pm SD.

Age	Lifestyle	Mean (mg/dl)				No. of people examined
		T.C.	HDL-C	LDL-C	TG	
<1-14	City	146 \pm 16	54 \pm 4	82 \pm 9	62 \pm 12	39
	Village	142 \pm 14	56 \pm 4	78 \pm 7	58 \pm 10	42
15-24	City	170 \pm 11	50 \pm 4	98 \pm 7	100 \pm 12	36
	Village	160 \pm 13	56 \pm 3	90 \pm 8	84 \pm 11	37
25-40	City	191 \pm 11	49 \pm 4	119 \pm 7	128 \pm 17	40
	Village	179 \pm 10	57 \pm 3	111 \pm 6	108 \pm 15	42
41-55	City	206 \pm 11	48 \pm 5	130 \pm 7	150 \pm 18	42
	Village	194 \pm 13	58 \pm 3	120 \pm 6	130 \pm 16	45
56-69	City	220 \pm 12	55 \pm 3	140 \pm 7	142 \pm 15	41
	Village	210 \pm 11	59 \pm 3	130 \pm 7	118 \pm 12	41

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70+	City	210±15	55±3	140±10	132±15	33
	Village	200±14	59±4	130±9	116±13	37

Table (2): Comparison of plasma lipids healthy Saudi males at different ages and Lifestyle. The results are expressed in mg/dl and the values are mean ± SD.

Age	Lifestyle	Mean (mg/dl)				No. of people examined
		T.C	HDL-C	LDL-C	TG	
<1-14	City	154±15	58±6	88±10	59±13	30
	Village	148±14	62±4	84±7	53±11	32
15-24	City	175±11	54±3	104±5	97±12	33
	Village	165±10	60±4	96±4	79±12	31
25-40	City	202±12	54±3	120±5	118±14	39
	Village	188±12	60±3	110±4	94±13	38
41-55	City	222±9	52±3	130±5	135±17	35
	Village	208±12	62±3	120±6	109±16	37
56-69	City	225±10	56±2	140±7	138±15	31
	Village	215±13	64±2	130±6	118±12	30
70+	City	230±13	57±3	150±8	142±15	31
	Village	220±14	63±4	140±10	126±14	31

DISCUSSION

Consuming animal products and saturated vegetable oils are gaining importance worldwide as lifestyle is becoming more complicated. Reducing LDL-C and total cholesterol levels have improved survival and prevented heart attacks in people with or without heart diseases. This is correlated with a number of variables grouping these factors into genetic, behavioural and nutritional (Crouse *et al.*, 1995; Pedersen, 2001).

In this study, healthy Saudi persons from city and villages both males and females of different ages were examined for plasma lipids profile. Means for total cholesterol, LDL- cholesterol, HDL-cholesterol, and triglycerides, were given for both males and females, between <1-70 years old. At birth and during early childhood (<1-14 years) in both males and females there were no significant differences in all tested parameters between children in city and villages. This indicates the close similarity in dietary habits and lifestyle between rural and urban people for infants and children. It has been reported that preschool children responded significantly to diets with unsaturated fats and low cholesterol on serum lipids and lipoproteins; with boys responding significantly higher than girls (Boulton *et al.*, 1995; Rask-Nissila *et al.*, 2000). Differences in dietary habits and lifestyle were more highly effective in the adults groups. Total cholesterol exceeds the desirable limit in both city males and females at the age of 40 years and above. Slight increase was observed in males and females living in the villages at the age of 55 and above. In city females LDL-

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C started to rise above the optimal level in both males and females of city and villages earlier at the ages of 25 years and above. It exceeded tolerable limit in both males and females in the city at the age of 56-69 years. Cox *et al.* 1995 reported that total cholesterol and LDL were significantly higher in diets containing saturated oils from butter and coconut oil than from safflower with HDL did not significantly differ in all the three diets. HDL-C in female villagers was optimal in all age ranges but in males although it was slightly less but remained at a constant level. In city males and females it was higher at early childhood and started to decrease reaching its minimum level at the age of 41-55 years. Triglycerides were normal for all ages, gender and lifestyle.

It has been suggested that people who change their diet to improve cholesterol levels and reduce the risk for heart diseases are more successful when they follow a regular aerobic exercise programme. Men respond significantly higher to exercise than women do (Crouse *et al.*, 1995; Imamura *et al.*, 2000). With the increase of age, total cholesterol, triglycerides and particularly LDL-C have the tendency to rise in adult Saudi people who live in cities. This may affect subsequent generations as Rosengren *et al.* (2003) found a strong association between serum cholesterol concentration in fathers and sons at middle age.

The bulk of dietary cholesterol is provided by animal products such as meat, egg yolk and whole fat dairy products. Saudi population in majority have a strong desire and tendency towards consuming rice and animal products in addition to coffee (Roojy, *et al.* 1995). There are a number of dietary approaches that are beneficial in reducing total and LDL cholesterol levels. These include consuming unsaturated fats, fibre-rich foods such as whole grains and fresh fruits and vegetables and skimmed dairy products (Bakhsh and Chughtia 1984; Sonnenberg *et al.*, 1996). On serious cases, statins are now the standard agents for most people who require LDL-lowering therapy. It is recommended along with diet and exercise for people with LDL of 160 mg/dl or greater, who have no existing heart disease but two or more risk factors (Pedersen, 2001).

This study suggests that dietary habits and lifestyle play a crucial role in the control of plasma lipid profile. The effect of other risk factors including family history, diabetes, hypertension and smoking were not investigated in this study.

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: الملخص

مستويات الكلسترول والبروتين الدهني عند السعوديين الأصحاء

محمد علي عبد الرحمن¹، محمود محمد حسن² وعلي أحمد إبراهيم³

¹بنك الدم، مستشفى القنفذة العام-المملكة العربية السعودية

²كلية الزراعة والموارد الطبيعية، جامعة بخت الرضا، الدويم-السودان

³كلية المعلمين القنفذة، المملكة العربية السعودية

الخلاصة

في هذه الدراسة تم بحث تأثير الجنس (ذكر/أنثى)، العمر وأسلوب الحياة على معدلات الكلسترول والبروتين الدهني عند سعوديين أصحاء. لجميع الأشخاص عينة البحث، أخذت عينات الدم بعد فترة صيام ليلي تراوحت بين 12 - 14 ساعة. استخدمت طريقة قياس الألوان الإنزيمية وتم أخذ متوسطات نتائج التحليل.

أظهرت النتائج انخفاضاً في مستويات كلسترول الدم الكلي، الدهن ثلاثي الجليسرول وكلسترول البروتين الدهني منخفض الكثافة عند الأطفال حتى عمر 14 سنة مع ارتفاع ملحوظ في كلسترول البروتين الدهني عالي الكثافة ومن دون فروقات معنوية بين الجنسين من سكان الريف والحضر. على العكس فعند تقدم العمر أظهرت النتائج ارتفاعاً ملحوظاً في كل أنواع الدهن المذكورة آنفاً باستثناء كلسترول البروتين الدهني عالي الكثافة مع ظهور فروقات معنوية بين البالغين من سكان الريف والحضر. كلسترول البروتين الدهني عالي الكثافة ينخفض بوضوح بين الرجال والنساء في المدن حيث يصل أدنى مستوياته عند عمر 40 عاماً فأكثر. يتزامن ذلك مع زيادة معنوية في معدلات الكلسترول الكلي وكلسترول البروتين الدهني منخفض الكثافة والدهن ثلاثي الجليسرول حيث تقترب جميعها من حد الخطورة بينما تبقى المستويات العادية للجنسين من سكان الريف.

أثبتت هذه الدراسة أن نوع الغذاء وأسلوب الحياة يعملان على زيادة مستويات الكلسترول والبروتين الدهني الضار مع انخفاض ملحوظ في مستويات البروتين الدهني الحميد عند سكان المدن البالغين من الجنسين في المملكة العربية السعودية. وعلية عند بلوغ سن الأربعين للأصحاء يجب متابعة تحليل الدهن والكلسترول في الدم لتفادي الإصابة بأمراض القلب والشرابيين