Population distribution of lipid profile

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Abstract

Risk factors for coronary artery disease are now well recognized, and modification of these factors can prevent heart attacks. Therefore, a population based screening for lipid profile was conducted to determine the lipid abnormalities. A retrospective analytical study performed to determine the level of total cholesterol (TC), low density lipoprotein (LDL), high density lipoprotein (HDL), and triglycerides in population and their values in relation to age and gender. The study indicated that the mean values of total cholesterol, LDL, HDL and triglyscerides were higher in male than female. In addition, the mean values were increased with age. The upper limit for cholesterol, LDL, and triglycerides were higher in male as compared to female, While the upper limit value for HDL was higher in female than in male. Although the mean values were within the reference interval, a 7.3% of individuals in younger age group demonstrated increased level of serum cholesterol. In conclusion, age and gender influence total cholesterol, LDL, HDL, and triglycerides level in Iraqi population. Thus it is recommended to implement screening for hyperlipidemia in all person twenty years of age and older. In addition, there is a need to establish a regional and national cholesterol education programs to act for detection, evaluation and treatment of high blood cholesterol in adults.

Key words: Lipid, HDL, LDL, VLDL, hyperlipidemia, blood cholesterol.

Introduction

Coronary artery disease remains the leader killer of both men and women [1]. The correlation with hyperlipidemia is alarmingly clear, more than half of cases of heart diseases are attributable to lipid abnormalities [2]. Several novel risk factors have been proposed as potential criteria for improved detection of subclinical atherosclerosis [3]. In particular, clinical interest has focused on lipid parameters. Due to clinical interest in these data and their implications for population based screening programs, this study was performed.

Materials and methods

Study population

The study population consisted of individuals attending Al Tameem General Hospital for the determination of lipid profile. For total cholesterol the analysis include all laboratory reports from January 1992 to end of December 2001. For low density lipoprotein (LDL) cholesterol, high density (HDL) cholesterol and triglycerides the analysis included laboratory reports during the period from January 1998 to end of December 2001.

Study design

Analytical retrospective study was performed and laboratory reports for individuals were analysed to determine the mean values of total cholesterol, LDL, HDL and triglycerides.

Laboratory procedures

Total cholesterol plasma level was determined according to conventional reported methods [4]. LDL, HDL and triglycerides were determined by using kits.

Statistical analysis

The arithmetic mean and standard deviation values determined according to that reported by Remington and Schorke [5]. The 95% confidence (CI) interval for mean values, lower and upper values were determined according to method described by Beaglehole et al [6]. Estimation of lower limit and upper limit values was calculated according to that reported by Beyer [7]. To determine the significance of difference between male and female and age groups student t test was applied. [6].

Results

Population distribution

The mean level of cholesterol in male was 224 +/- 42 mg/dl (95% CI 223-225) and it was higher than that in female (219+/- 36; 95% CI 218-220) and this difference was statistically significant (P<0. 005). However, the lower limit for male mean cholesterol level was lower (142 mg/dl, 95% CI 141-143) than that for female (148 mg/dl, 95% CI 146-147). In contrast, the upper limit for mean cholesterol level was higher in male (306 mg/dl, 95% CI 305-307) than female (290mg/dl, 95% CI 289-291). Table.1.

Low density lipoprotein mean value was higher in male (137 +/- 42 mg/dl; 95% CI 136-138) as that in female (129 mg/dl+/- 23; 95% CI 127-131) and the difference was statistically significant (P< 0.005). The same pattern was demonstrated for lower (male 98mg/dl;95%CI 97-99; female 84, 95%CI 82-86) and upper limit values (male 176,95%CI 175-177; female 174,95%CI 172-176). Table.1.

High density lipoprotein was lower (P<0.005) in male (52+/- 9 mg/dl, 95%CI 51-53) as compared to female (58+/- 10mg/dl, 95%CI 57.7-58.3). The same pattern was demonstrated for lower (Male 34 mg/dl, 95%CI 33-35; female 38 mg/dl,37.7-38.3) and upper (male 70 mg/dl,69-71; female 78 mg/dl, 95%CI 77.7-78.3) limit values Table.1.

Triglycerides mean value was significantly higher (P<0.005) in male (165 +/- 22 mg/dl; 95%CI 163-167) as compared to female (135 + 18mg/dl; 95%CI 134-136). In addition, the lower limit and upper limits values were higher in male (Lower 122 mg/dl, 95% CI 120-124; Upper 208 mg/dl, 95% CI 206-210) than in female. Table.1.

Population distribution according to age.

The finding concerning distribution of mean value according to age and gender for cholesterol, LDL, HDL and triglycerides are shown in Tables 2,3,4. For cholesterol, the male mean values were with significant differences as compared to that for female for age groups 20-34 years (P<0.005, Male 197+/- 35 mg/dl, 95% CI 196-198; Female 193 +/- 28 mg/dl, 95%CI 192-194), 35 – 49 years (P<0.005, Male 228 + /- 43mg/dl,95%CI 227-229; Female 214 +/- 37mg/dl,95%CI 212 –216), 50 – 64 years (P<0.005, Male 238 +/- 48mg/dl,95%CI 236-240; Female 247 +/- 45mg/dl,95%CI 245-249) and 65 years of age and above (P<0.005, Male 264 +/- 49, 95%CI 261-267; Female 254 +/- 33mg/dl,95%CI 251-257). In addition, the upper limit values were higher in male than female for all age groups except that of 50 – 64 years which was about similar (Table.2).

The LDL mean and upper limit values were significantly higher in male as compared to female for age groups 20-34 years (P<0.005, Male 115+/- 19 mg/dl,95%CI 114-116; Female 108 +/- 17 mg/dl,95%CI 105-111), 35 – 49 years (P<0.001, Male 137 +/- 17 mg/dl,95%CI 136-138; Female 124 +/- 19 mg/dl, 95%CI 122-126) and > 65 years (P<0.005, Male 167 +/- 32 mg/dl, 95%CI 165-169; Female 151 +/- 32 mg/dl, 95%CI 143-159) Table.3.

Concerning HDL, the mean values were lower in male than that in female for all age groups (P<0.005, male vs female 45 mg/dl vs 55mg/dl,51mg/dl vs 57 mg/dl, 56 mg/dl vs 62 mg/dl, 59 mg/dl vs 63 mg/dl for age groups respectively). The upper limit values were lower in male for all age groups except that > 65 years which was equal. Table.4.

For triglycerides, the mean values were with highly significant differences between male (123 +/- 24 mg/dl,95%CI 122-124; 168 +/- 24 mg/dl,95%CI 167-169; 172 +/- 16 mg/dl; 227 +/- 27 mg/dl, 95%CI 225-229 for age groups respectively) and female (104 +/- 33 mg/dl,95%CI 102-106; 124 +/- 10, 95%CI 123-125; 152 +/- 23 mg/dl,95%CI 151-153; 205 +/- 23, 95%CI 203-207 for age groups respectively) for all age groups (P<0.001). In addition, the upper limit values for all age groups were higher in male (170 mg/dl,95%CI 166-174; 215 mg/dl ,95% CI 213-217; 203 mg/dl, 95%CI 201-205; 280 mg/dl, 95%CI 274-286 for age groups respectively) than in female (168 mg/dl,95%CI 162-174; 144 mg/dl, 95%CI 143-146; 197 mg/dl,95%CI 193-201; 252 mg/dl,95%CI 246-258 for age groups respectively) . Table.5.

Discussion

Epidemiological studies have clearly shown that elevated serum level of total cholesterol are an independent risk factor for coronary heart disease (CHD) [8-11]. Most of the increased CHD risk conferred by hypercholesteraemia is due to an elevation of

LDL level. Elevated TC and LDL levels are more frequently observed in affluent countries than in developing countries [12-15]. This study indicated that TC mean value in male was higher than that in female and this finding was consistent for that reported for Tikrit, Iraq [15] and for other geographical areas [16]. However, the mean and upper limit values were within the suggested reference interval [3,4,14,17], they deserve a high risk requiring treatment. Reported studies [18] suggested that risk increases as cholesterol level increase, but at concentrations of 200 to 240 mg/dl, risk begins to accelerate at a greater magnitude. Thus the finding of this study indicated that an action was needed for intervention to treat hypercholesteremia since the mean value for TC in both sexes was above that limit. On average, each 1% reduction in cholesterol (2-3 mg/dl) results in a around 2% reduction in CHD incidence, a relationship of considerable clinical and public health significance [19,20]. The cholesterol lowering atherosclerosis study demonstrated the benefit of cholesterol lowering even in people with normal or moderately increased cholesterol concentrations and those with established disease [21]. According to multiple risk factor investigation trial, if a risk ratio of 1.0 is arbitrary assigned at cholesterol level of 200 mg/dl, the risk ratio increase to 2.0 at 250 mg/dl and to 4.0 at 300 mg/dl [18]. So this study finding indicate that there is a need for establishment of cholesterol education program panel to initiate a program for lowering hypercholesteraemia.

The LDL mean values for population sample were within the reference interval limit in both sexes. However, the upper limit values for male and female were above the high borderline value [22]. This indicate that there were a high level of LDL in a large number of examined population. So the screening was indicated for this set later and this was useful for setting primary prevention trials. The LDL mean and upper limit values were within the ranges that reported for other geographical areas [23].

The HDL mean values for both sexes were within the reference interval [3,4,22,24]. However, the lower limit of mean values for male and female were lower than the lower limit of reference interval. This finding indicate that there is a proportion of the examined population were with lower HDL and this represent a risk and in such case a follow up lipoprotein profile is needed for appropriate management. Many epidemiological and clinical studies have shown that both increased LDL and decreased HDL cholesterols are associated with increased risk of CHD [1,2,3,25,26]. Some studies showed that a reduction in LDL cholesterol is correlated with regression in the atherosclerosis [27]. The relationship between LDL cholesterol and CHD risk is continous over a broad range of LDL levels from low to high. Therefore ATP III adopts the classification of LDL cholesterol level, total cholesterol, and HDL cholesterol level [28]. Risk determinant in addition to LDL cholesterol include the presence or absence of CHD, other clinical forms of atherosclerotic factors and the major risk factors other than LDL (Cigarette smock, hypertension, low HDL, family history and age) [3]. Low HDL cholesterol levels have been found to be a risk factor for CAD. To date, the focus treating hyperlipidemia has been on lowering LDL cholesterol levels [28]. Now more and more compelling data are reported, it is time to begin focusing more energy on how to raise HDL cholesterol levels.

Triglycerides mean and upper limit values of examined population were within reference range interval for both sexes. However, the male upper limit value was on borderline , and this indicate a proportion of hypertriglyceremia in examined population [3,4,22,24]. The role of triglycerides in the development of CHD has been controversial. However, emerging evidence suggests that elevated serum triglycerides level, especially in patients with additional lipoprotein abnormalities, predict an increased risk of CAD [29].

Analysis of TC, LDL, HDL and triglycerides in sample population according to age groups indicated that their levels (mean and upper limit) were increased with age. An interesting finding of this study was that 7.3% of individuals in younger age group (20-34 years) demonstrated increase level of serum cholesterol. This was higher than that reported for USA (5%) [7]. Thus it is recommended to implement screening for hyperlipidemia in all persons 20 years of age

and older. Because the major primary prevention trials were performed in persons aged 45 years and older, no outcome data are currently available for persons 20 to 45 years of age [3].

In younger adults, CHD is rare except in those with severe risk factors . Even though clinical CHD is relatively rare in young adults coronary atherosclerosis in its early stages may progress rapidly [16]. In particular, long term prospective studies reveal that elevated serum cholesterol detected in young adults predict a higher rate of premature CHD in middle age [3]. Thus risk factor identification in young adults ia an important aim for long term prevention. This study indicated that age and gender have a positive influence on serum cholesterol level and the mean values for different age groups were within the reference interval. However, the upper limit value of cholesterol levels were with high borderline value for older adults (>65 yr) and middle aged adults. In general, men have a higher risk for CHD than do women [16]. Middle aged men in particular have a high prevalence of the major risk factors and age predisposed to abdominal obesity and the metabolic syndrome [30].

LDL mean and upper limit values as this study indicated were influenced by age. The upper limit values for all age groups were at borderline. Thus the combination of early detection and early intervention on elevated LDL cholesterol with life habit changes offer oppurtunity for delaying or preventing onset of CHD later in life. For young adults with LDL cholesterol level of > 130 mg/dl, therapeutic life style changes should be initiated and emphasized [16].Particular attention should be given to young men who smoke and have a high LDL cholesterol (160-189 mg/dl) they may be candidate for LDL lowering drugs [2]. When young adults have a very high LDL cholesterol levels (>190mg/dl), drug therapy should be considered, as in other adults [26]. A sizable fraction of all CHD in men occurs in middle age [16]. Thus many middle aged men carry a relatively high risk for CHD, and for those who do, intensive LDL lowering therapy is needed.

HDL mean, lower and upper limit values increased with age and it was higher in female than male for all age groups, but still it were within the reference interval [3,4,22,24]. The measurement of total cholesterol alone is no longer considered adequate for such screening. Thus it was recommended to add the measurement of HDL cholesterol levels along with determination of total cholesterol for initial screening for CAD in adults. In addition, although a low HDL cholesterol level (<35 mg/dl) is still considered a positive risk factor for CAD, a high HDL (>60 mg/dl) is now considered a negative risk factor [16]. Most life style modification that improve cardiovascular health also increase HDL cholesterol levels [16].

Age and gender markedly affect the serum level of triglycerides as expressed by mean and upper limit values. The mean values of serum triglycerides for both sexes were at borderline high value in 8% of tested population (their age > 65 year). However, the most important findings was that the upper limit values of serum triglycerides were at borderline high levels in 43% of tested population with age of more than 50 years. Recent meta analysis of studies indicate that elevated triglycerides are also independent risk factor for CHD [28]. Factors contributing to elevated triglycerides in the general population include obesity and overweight, physical inactivity, cigarette smoking, high carbohydrates diet, certain drugs and genetic disorders. Most of the above causes can be prevented with an aggressive life style modification program. Pharmacotherapy should be considered for patients at high risk of CHD. For all persons with borderline high or high triglycerides, the primary aim of therapy is to achieve the target goal for LDL cholesterol [26].

When triglycerides are borderline high (15-199 mg/dl), emphases should be placed on weight reduction and increased physical activity [29]. For high triglycerides (200-499 mg/dl) non HDL cholesterol becomes a secondary target of therapy [29]. A side from weight reduction and increased physical activity, drug therapy can be considered in high risk person to achieve the non HDL cholesterol goal [3].

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Table.1. Population distribution of cholesterol, low density lipoprotein, high density lipoprotein and triglycerides means (SD) and 95% confidence intervals, lower and upper limit values.

Variable ug/dl	Cholesterol	Low Density Lipoprotein	High Density Lipoprotein	Triglycerides
Mean +/- SD				
Male	224 +/- 42	137 +/- 20	52 +/- 9	165 +/- 22
Female	219 +/- 36	129 +/- 23	58 +/- 10	135 +/- 18
Mean 95% CI				
Male	223 - 225	136-138	51 – 53	163-167
Female	218 – 220	127-131	57.7-58.3	134-136
Lower limit [95%CI]				
Male	142 [141-143]	98 [97-99]	34 [33-35]	122 [120-124]
Female	146 [146-147]	84 [82-86]	38 [37.7-38.3]	100 [99-101]
Upper limit [95%CI]				
Male	306 [305-307]	176 [175-177]	70 [69-71]	208 [206-210]
Female	290 [289-291]	174 [172-176]	78 [77.7-78.3]	170 [169-171]

Table.2. Population distribution of total cholesterol according to gender and age groups.

Variable ug/dl	20 – 34 years age group	35 – 49 years age group	50 – 64 years age group	From 65 years and above age group
Mean +/- SD				
Male	197 +/- 35	228 +/- 43	238 +/- 48	264 +/- 49
Female	193 +/- 28	214 +/- 37	247 +/- 45	254 +/- 33
Mean 95% CI				
Male	196-198	227 – 229	236 – 240	261 – 267
Female	192-194	212 – 216	245 – 249	251 –257
Lower limit [95%CI]				
Male	128 [127-129]	144 [142-146]	144 [142-146]	168 [165-171]
Female	138 [137-139]	142 [140-144]	159 [157-161]	190 [187-193]
Upper limit [95%CI]				
Male	265 [264-266]	312 [311-314]	332 [330-334]	360 [357-363]
Female	247 [246-248]	286 [284-288]	335 [333-337]	318 [315-321]

Table.3. Population distribution of low density lipoprotein cholesterol according to gender and age.

Variable ug/dl	20 – 34 years age group	35 – 49 years age group	50 – 64 years age group	From 65 years and above age group
Mean +/- SD				
Male	115 +/- 19	137 +/- 17	145 +/- 23	167 +/- 32
Female	108 +/- 17	124 +/- 19	145 +/- 30	151 +/- 32
Mean 95% CI				
Male	114 – 116	136 – 138	144 – 146	165 – 169
Female	105 – 111	122 – 126	141 – 149	143 – 159
Lower limit [95%CI]				
Male	78 [75-81]	104 [102-106]	100 [97-103]	104 [97-111]
Female	75 [72-78]	87 [85-89]	86 [82-90]	88 [80-96]
Upper limit [95%CI]				
Male	152 [149-155]	170 [168-172]	190 [187-193]	230 [223-237]
Female	141 [138-144]	161 [159-163]	204 [200-208]	214 [206-222]

Table .4. Population distribution of high density lipoprotein cholesterol according to gender and age.

Variable ug/dl	20 – 34 years age group	35 – 49 years age group	50 – 64 years age group	From 65 years and above age group
Mean +/- SD				
Male	45 +/- 7	51 +/- 6	56 +/- 13	59 +/- 16
Female	55 +/- 8	57 +/- 9	62 +/- 11	63 +/- 14
Mean 95% CI				
Male	44-7 – 45.3	50.8 – 51.2	55.5 – 56.5	58 – 60
Female	54.6 – 56.4	56.6 – 57.4	61 – 63	62 – 64
Lower limit [95%CI]				
Male	31 [30-32]	39 [38-40]	31 [29-33]	28 [24-32]
Female	39 [38-40]	39 [38-40]	40 [39-41]	36 [32-40]
Upper limit [95%CI]				
Male	59 [58-60]	63 [62-64]	81 [79-83]	90 [86-94]
Female	71 [70-72]	75 [74-76]	84 [83-85]	90 [86-94]

Table .5. Population distribution of triglycerides according to gender and age.

Variable Ug / dl	20 – 34 years age group	35 – 49 years age group	50 – 64 years age group	From 65 years and above age group
Mean +/- SD				
Male	123 +/- 24	168 +/- 24	172 +/- 16	227 +/- 27
Female	104 +/- 33	124 +/- 10	152 +/- 23	205 +/- 23
Mean 95% CI				
Male	122 – 124	167 – 169	171 – 173	225 – 229
Female	102 – 106	123 – 125	151 – 153	203 – 207
Lower limit [95%CI]				
Male	76 [72-80]	121 [119-123]	141 [139-143]	174 [168-180]
Female	39 [33-45]	104 [103-105]	107 [104-110]	158 [152-164]
Upper limit [95%CI]				
Male	170 [166-174]	215 [213-217]	203 [201-205]	280 [274-286]
Female	168 [162-174]	144 [143-146]	197 [193-201]	252 [246-258]