

Research Article

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Apolipoprotein B/Apolipoprotein A1 (APO B/APO A1) and LDL/HDL Cholesterol Ratios - Indicators of Metabolic Syndrome

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Abstract

The purpose of this study is to investigate the relations between Apo B/Apo, LDL/HDL and the metabolic syndrome. Apolipoprotein B, APO B/APO A1 ratio and the ratio LDL/HDL cholesterol can be used as indicators of metabolic syndrome. The ratios APO B/APO A1 and LDL/HDL cholesterol allow for more accurate risk assessment of metabolic syndrome.

Introduction

Apolipoprotein B (Apo B), Apolipoprotein A1 (Apo A1), the ratio Apo B/Apo A1 and the ratio LDL / HDL cholesterol are strong metabolic syndrome (MetS) clinical indicators [1]. Finding a connection between ratios Apo B/Apo A1, LDL / HDL and metabolic syndrome components is an indication for necessity of through assessment of risk profile and individual risk for myocardial infarction, stroke and diabetes development [2].

Methods

Study population

During years 2011-2012 prospective study in 82 clinically healthy people (40.2% men and 59.8% women), inhabitants of Pleven region in Republic of Bulgaria was conducted. The inclusion criteria are: age above 18 years, without medical history of cardiovascular diseases (myocardial infarction – MI, stroke, etc.) and not suffering from diabetes mellitus. Exclusion criteria are: cardiovascular diseases (stable angina pectoris, myocardial infarction or stroke), planned coronary revascularization (PCI or CABG), diabetes mellitus, pregnancy, renal failure, neoplasm.

Standard individual interview and measurement of waist, hip, height and body mass index (BMI) were performed. Arterial blood pressure of the participants is also measured. The following biomarkers are tested (fasting): apolipoprotein B, apolipoprotein A1, blood glucose, HDL-cholesterol, serum triglycerides (TG), LDL-cholesterol. People with MetS are determined according to International Diabetes Federation criteria.

Statistical analysis

The difference between the groups is analyzed by one way ANOVA test and multiple comparison test of means. Adjusted estimations of 95% confidence interval (CI) are done. Apo B, Apo A1, the ratio Apo B /Apo A1, HDL-cholesterol, LDL-cholesterol and the ratio LDL / HDL are included in the multiple logistic regression analyses.

Results

Apo B (HR 0.48, 95% CI 0.27-0.85) and total cholesterol (TC) levels are significantly connected with MetS components. Apolipoprotein B, the ratio Apo B/Apo A1 and the ratio LDL/HDL appear as independent risk factors for metabolic syndrome.

Mean values, standard deviations and confidence interval (CI) of Apo B levels, Apo A1 levels in men and women with and without MetS are presented in Table 1.

The box plots for 1-way ANOVA test of Apo A1 (Figure 1) indicates significant differences between men and women.

The ANOVA F-statistic is 6.03 with p-value 0.0009. The mean of group men with MetS minus the mean of group women with MetS is estimated to be -35.23, and the 95% CI for the true mean is [-67.58, -2.87].

The box plots for 1-way ANOVA test of Apo B (Figure 2) indicate significant differences between people with MetS and without MetS.

The ANOVA F-statistic is 3.36 with p-value 0.023. A multiple comparison test of means shows that the mean of the group of men with MetS minus the mean of the group of men without MetS is estimated to be 25.95, and CI=95% for the true mean is [0.28, 51.63], and consequently the difference is significant.

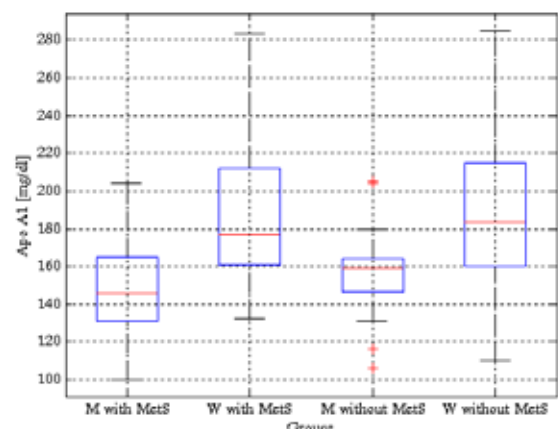


Figure 1: Box plots for 1-way ANOVA test of Apo A1.

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Parameter		Total			With MetS			Without MetS		
		Total	Men	Women	Total	Men	Women	Total	Men	Women
Apo B [mg/dl]	Mean	92.66	91.09	93.83	104.87	109.0	102.26	85.24	81.74	88.11
	SD	29.57	27.83	31.05	24.79	32.01	19.49	29.98	20.45	36.70
	CI	34.70 150.62	36.54 145.64	32.97 154.69	56.28 153.46	46.26 171.74	64.06 140.46	26.48 144.00	41.66 121.82	16.18 160.04
Apo A1 [mg/dl]	Mean	171.87	153.91	185.23	170.68	149.83	183.84	172.59	156.04	186.18
	SD	37.27	24.61	39.63	37.74	28.06	37.68	37.35	22.98	51.65
	CI	98.82 244.92	105.67 202.15	107.56 262.90	96.71 244.65	94.83 204.83	109.99 257.69	99.38 245.80	111.00 201.08	84.95 287.41

Table 1: Mean values, standard deviations and confidence interval.

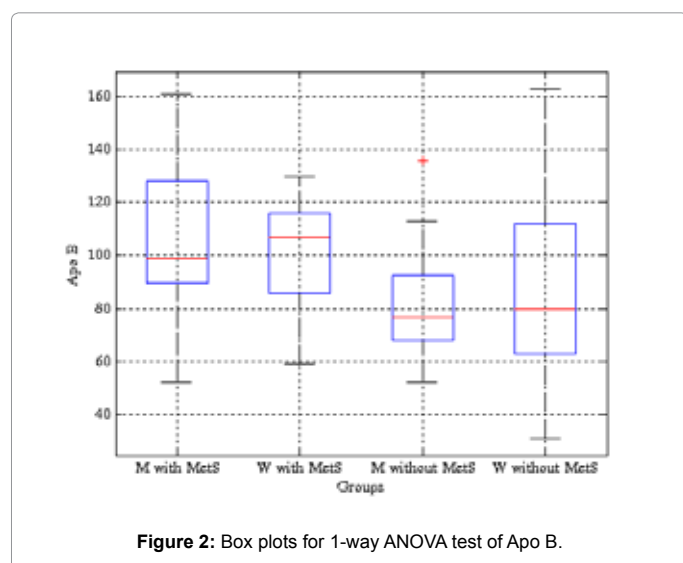


Figure 2: Box plots for 1-way ANOVA test of Apo B.

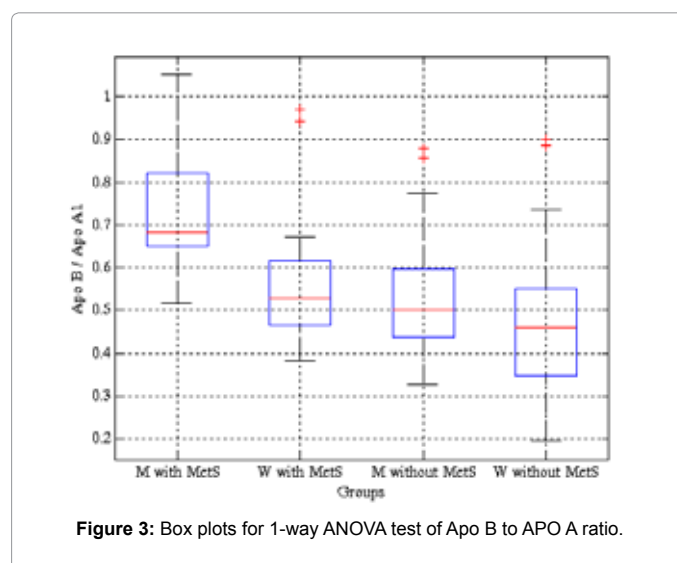


Figure 3: Box plots for 1-way ANOVA test of Apo B to APO A ratio.

Deviations	SS	DF	Average	F-statistics	p-value
between groups	0.527173	3	0.175724	6.294708	0.000694
Within groups	2.205382	79	0.027916		
Total	2.732555	82			

Table 2: ANOVA analysis of Apo B to APO A ratio.

First group	Second group	CI	Difference between the mathematical expectation	CI
Men with MetS	Women with MetS	-0,01053	0,147308	0,305146
Men with MetS	Men without MetS	0,036662	0,188822	0,340983
Women with MetS	Women without MetS	-0,03836	0,091976	0,222317
Men with MetS	Women without MetS	-0,07294	0,050462	0,173866

Table 3: Data multicomponent analysis of LDL / HDL-cholesterol by gender.

The box plots for 1-way ANOVA test of Apo B to Apo A1 ratio (Figure 3) indicate significant differences between men and women as well as between people with MetS and without MetS.

The result of ANOVA analysis of Apo B to APO A ratio is shown in Table 2.

The ANOVA F-statistic is 6.29 with p-value 0.0007. The data in Table 2 shows that with sufficient statistical significance could reject the hypothesis of uniformity of the average Apo B to APO A ratio.

The results of the multi-analysis are shown in Table 3.

The mean of the group men with MetS minus the mean of the group of men without MetS is estimated to be 0.189, and CI=95% for the true mean is [0.037, 0.341] and hence the difference is significant.

The box plots for 1-way ANOVA test of LDL to HDL ratio (Figure

4) indicate significant differences between men and women as well as between people with MetS and without MetS.

The result of ANOVA analysis of LDL/HDL ratio is shown in Table 4.

The data in Table 4 shows that with sufficient statistical significance could reject the hypothesis of uniformity of the average ratio LDL/ HDL-cholesterol. The results of the multi-component analysis showed that the difference between the averages of the two groups was 0.93 with a confidence interval $1,374964 \div 0,481174$. The separation by sex can be rejected the hypothesis of equality of mean LDL/HDL-cholesterol groups.

The results of the multi-analysis are shown in Table 5.

The data in the Table 5 show that differences in average attitudes were statistically significant between both groups of men with and

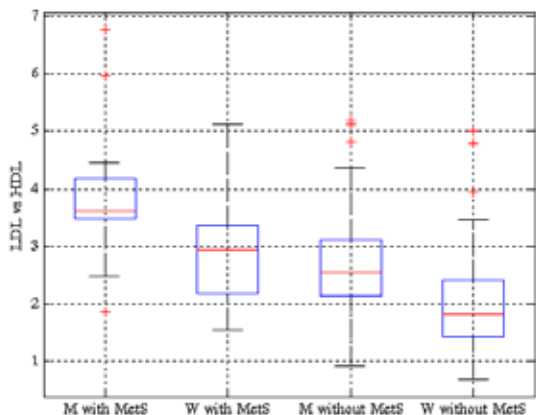


Figure 4: Box plots for 1-way ANOVA test of LDL to HDL ratio.

Deviations	SS	DF	Average	F-statistics	p-value
between groups	20.47649	1	20.47649	16.95945	7.68×10 ⁻⁵
Within groups	125.5675	104	1.20738		
Total	146.044	105			

Table 4: ANOVA analysis of LDL/HDL cholesterol ratio.

without Mets and between groups of women with and without Mets. The difference in averages is greater in men (1.07) than in women (0.85).

First group	Second group	CI	Difference between the mathematical expectation	CI
Men with MetS	Women with MetS	-0.02508	0.904441	1.833959
Men with MetS	Men without MetS	0.175617	1.065563	1.955509
Women with MetS	Women without MetS	0.137612	0.853156	1.5687
Men with MetS	Women without MetS	0.028707	0.692034	1.355361

Table 5: Data multicomponent analysis of LDL / HDL-cholesterol by gender.

Conclusions

The most significant factors for metabolic syndrome in men and women are apolipoproteins and HDL-cholesterol. These factors are of a great importance in men as compared in women.

Apolipoprotein B, APO B/APO A1 ratio and the ratio LDL/HDL cholesterol can be used as indicators of metabolic syndrome.

The ratios APO B/APO A1 and LDL/HDL cholesterol allow for more accurate risk assessment of metabolic syndrome.

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