Prevalence and Cardiovascular Risk Factors at a University Community in Armenia–Colombia

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Abstract

Objective: This work sought to identify the prevalence and cardiovascular risk factors within a university community in Armenia, Quindío.
Methods: A descriptive cross-sectional study was conducted during 2015, which used as population 216 individuals from a university community in Armenia, Quindío, including students, faculty, and administrative staff. The variables included were socio-demographic, lipid profile, glycaemia, nutritional variables, habits like exercise, cigarette smoking, and history of diabetes and hypertension. The variables were analysed for mean, standard deviation, and confidence intervals with a comparative analysis by gender. The differences among the groups were calculated with multiple regression analysis and chi square for the analysis of categorical variables.
Results and Conclusions: This study found that the risk of having a cardiovascular episode in the next 10 years within a university population with a mean age of 33.64 years was 2.54%, according to the Framingham scale, which corresponded to 97.7% of the participants in the study. Only 2.3% of the participants had medium and high risk, which corresponded to the administrative staff group. The main factor that differentiates the groups with regard to cardiovascular risk is age; another risk factor identified in this study was glycaemia. With respect to habits, cigarette smoking and consumption of bakery goods were identified as cardiovascular risk factors.

Keywords: Cardiovascular risk, Framingham scale, Metabolic risk, Nutritional risk, Risk factors

Introduction

Cardiovascular disease constitutes a health event which can be prevented and detected at an early stage, which is prevalent in the population and which implies high costs of all types when not managed in an adequate and timely manner.[1]

In the world, in Colombia, and in Quindío cardiovascular diseases have persistently occupied the first cause of morbidity and mortality and comprise an important disease burden within the last 10 years, making it necessary to consider not only its treatment, but also its early detection and prevention.[2]

Cardiovascular risk (CVR) incubates from childhood, with hereditary, cultural, family, nutritional factors, and other habits that may constitute protection or risk factors of developing high blood pressure and/or any of its consequences; however, it is with the passage of time that the disease develops.

The possibility of early detection of cardiovascular risk permits incorporating healthy habits into daily life , which can counteract this risk, having a beneficial impact upon health, quality of life, and health costs for individuals, families, and society.[3]

The situation of the population at Universidad del Quindío regarding cardiovascular risk is not known, which is why some questions emerge, such as: What are the cardiovascular risk factors in this population and what is its prevalence? The project sought to detect, describe, and prevent cardiovascular risk in the university community. All these reasons motivated the work group to formulate this proposal.

Methods

A descriptive, cross-sectional study was conducted, seeking to describe, detect, and prevent cardiovascular risk in a university population from the Department of Quindío, Colombia.

Population and sample

A population of approximately 9000 individuals was considered from the community of a public university in the city of Armenia in Colombia, including students, faculty, and administrative staff. A sample was calculated with 95% confidence interval and 5% error for n=384; 45% more people were invited to prevent the lack of response identified in previous studies, that is 700 people. The sample was weighted according to mentioned groups and obtained randomly on the database provided by the Planning Office. The principal selection criterion was volunteer participation; those who signed the informed consent were included in the study.

Collection of information

The researchers collected the information during 2015 in the primary source with an instrument designed for said purpose with all the study variables.

A clinical history was made for the participants (students, faculty, and administrative staff) selected randomly and who signed the informed consent; this included socio-demographic variables (age, gender, marital status, educational level). Anthropometric variables were measured, including weight, height, body mass index (BMI), and abdominal perimeter. In a blood sample, laboratory variables were measured, including HDL cholesterol values (mg/dl), total cholesterol (mg/dl), cholesterol triglycerides (mg/dl), LDL (mg/dl), glycemia (mg/dl), and creatinine. Also included were risk factors, such as exercise and cigarette smoking.

All the participants received information on the risk factors and protective factors, nutritional assessment and counselling and were referred to physical exercise.

Processing and analysis of the information

Excel® was used to systematize the information and it was analyzed in the Stat graphics Centurion® software. A descriptive analysis was performed and the mean, standard deviation, and confidence intervals were calculated, with comparative analysis by gender.

Differences among groups were calculated with multiple regression analysis or a chi square test for the analysis of categorical variables. A value of $p<0.05$ was considered significant.

Bioethical aspects

In all cases, this study complied with the ethical principles of the 1964 declaration of Helsinki and its modifications until 20084 and resolution 8430 of 1993 of the Colombian Ministry of Social Protection.[5]

The Bioethics Institutional Committee at Quindío University approved this project, with resolution no. 50 of 2013. All procedures used in patients and controls were performed after signature of an informed consent.[6]

Results

Population and sample

To detect cardiovascular risk in individuals from the university community, the sample was calculated with n=384; 335 individuals signed an informed consent and attended consultation at the university's Health Center to promote healthy habits (physical exercise and nutrition). Finally, 216 people participated in the project: 101 students, 27 faculty members, and 88 administrative staff. It is important to note that with respect to the initial calculation of the sample, the sampling error is increased to 7%. Also note that the selection of study subjects was by random sample and the participants were those who signed the informed consent form.

Description of the variables with the information is shown separately by quantitative and qualitative variables, by gender, and by group with mean ± standard deviation, 95%CI and p value. Groups of related variables are described. As noted in Table 1, mean age was 33.64 years and the body mass index was 24.98, without significant differences by gender. Blood pressure and abdominal perimeter were within normal limits with significant differences by gender.

Lipid profile was within normal limits, except for HDL, which was below recommended limits with differences by gender in women with a mean of 44.26 and in men with 37.95 ($p=0.01$). Triglycerides showed significant differences by gender ($p=0.01$).

When comparing the variables among the participating groups from the university community: students, faculty members, and administrative staff, significant differences were found in the following variables (Table 2): Mean age in students was 21.08 years, 47.25 years in faculty members, and 43.88 years in administrative staff, with $p \leq 0.01$.

Mean systolic blood pressure was 106.81 mmHg in students, 111.85 mmHg in faculty members, and 114.95 mmHg in administrative staff; mean body mass index was normal in students (23.52) and overweight in faculty members (25.87) and administrative staff (26.38).

The mean abdominal perimeter was 78.22 cm in students, 91.25 cm in faculty members, and 87.51 cm in administrative staff. Regarding mean values of the lipid profile, HDL was below normal levels, without significant differences among the groups; however, LDL found within normal limits show significant differences ($p \leq 0.01$) among students (96.2 mg/dl), faculty members (109.01 mg/dl), and administrative staff (112.84 mg/dl). Triglycerides were at normal limits for students (100.13 mg/dl) and above the normal value for faculty members and administrative staff (172.68 mg/dl and 167.69 mg/dl, respectively). Mean glycaemia and creatinine values were within normal limits, with

significant differences among the three groups; the lowest values were found in the students.

Mean waist-hip ratio values showed significant differences between the group of students and the other two groups (p=0.01).

Risk factors were identified among the participants (Table 3). Participants were identified as 60.64% females and 39.35% males. Of all the participants, 93.53% were non-smokers and 6.46% were smokers; no significant differences were noted among the different groups. Regarding physical exercise, 36.11% engage in its practice and sedentary behavior was detected in 63.9% of the participants. No significant differences were found among the groups with respect to physical exercise.

To identify risk, several approaches were carried out. For cardiovascular risk, groups of variables were analyzed to identify risk according to the Framingham scale; for metabolic risk, the abdominal perimeter variable was analyzed; and for nutritional risk, the waist-hip ratio was identified; likewise, body mass index was identified. All these are shown in Table 4.

Cardiovascular risk

The variables of the Framingham scale, which measures the risk of having a cardiovascular event in the next 10 years,[7] were identified. The recommended score was assigned according to gender and age for each: age, gender, systolic and diastolic blood pressure, total cholesterol, HDL cholesterol, diabetes mellitus, and smoking. The scores were added, the corresponding percentage was assigned, and risk was classified as low for 97.7%, moderate for 1.3%, and high for 0.93% of the participants.

Metabolic risk

Cardiovascular risk has been related to metabolic syndrome, whose principal indicator is increased abdominal perimeter, which according to the Latin American Diabetes Association (ALAD, for the term in Spanish)[8] is normal for the Latin American population with up to 88 cm for women and up to 94 cm for men. This study found 58.8% participants within normality (without risk), 0.93% at the limit, and 40.2% at risk.

Nutritional risk

An indicator of cardiovascular risk, from the nutritional point of view, is the waist-hip ratio, which shows higher risk as it reaches one (1).[9] We found 62.5% were within normality (without risk), 5.55% at the limit, and 31.95% at risk.

Body mass index

Body mass index, measured as the weight/height ratio,[2] has become an indicator par excellence of nutritional status and metabolic and cardiovascular risk.[10] Body mass index is normal (between 20 and 25) in 32.41% of the group of students and the highest percentage of overweight and obesity is in the group of administrative staff (23.15%), with a statistically significant difference (p=0.01).

Table 5 shows risk by groups. Upon differentiating cardiovascular risk with the Framingham scale by groups, the only group with medium to high risk in the next 10 years is the administrative staff group. The group that presents increased cardiovascular, metabolic and nutritional risk is the administrative group, with statistically significant differences.

Relations among variables

An analysis of variance (ANOVA) was performed to relate BMI indicators with abdominal perimeter, finding a statistically significant relationship (p=0.01), as seen in Figure 1. An ANOVA was performed to relate percentage of cardiovascular risk measured with the Framingham scale and by waist-hip ratio, finding a statistically significant relationship (p=0.01), as seen in Figure 2. However, the Framingham scale levels risk with a minimum of 1% for those under 30 years of age. This is why an ANOVA was conducted based on the score, not on the percentage, which permits identifying the risk in all ages, including those under 30 years of age, observing that the relation improves substantially (Figure 3) and evidencing that the principal factor that differentiates the groups identified is age.

Identification of risk factors related to cardiovascular risk

A multiple regression was performed to identify the relationship between cardiovascular risk based on the Framingham scale and lipid profile, glycemia, creatinine, and total protein variables, noting that the glycemia, albumin, and total protein variables show significant difference with respect to the others in this study. The explained variation (R^2) of cardiovascular risk with respect to these variables is 33.65% (Table 6).

The ANOVA permitted identifying the relationship between cardiovascular risk based on the Framingham scale and the variables of food intake, alcohol consumption, cigarette smoking, and physical exercise. A significant p value was found on cardiovascular risk with cigarette smoking (p=0.01), intake of bakery goods (p=0.03) and eggs (p=0.05) (Table 7).

Discussion

This study found that the risk of having a cardiovascular episode in the next 10 years in a university population with mean age of 33.64 years was low (2.53%), according to the Framingham scale, corresponding to 97.7% of the study participants. Only 2.3% of the participants presented medium and high risk, corresponding to the administrative staff group.

Although this cross-sectional study was conducted in a university campus, it adds to the knowledge of cardiovascular risk of this community is compared below with other studies of local and national context.

Alvarez et al. found a moderate cardiovascular risk measured with the Framingham scale (11.36 ± 8.25), in a population of a health institution in Armenia, Colombia.[11]

Machado and Machado found a prevalence of cardiovascular risk in Colombia; the mean probability of developing a cardiovascular episode at 10 years was 14.0%, in 311 individuals (56.4%) women, with global mean age of 64.9 ± 10.8 years.[12]

In a Peruvian population, low cardiovascular risk prevailed, but cardiovascular risk increased in men living in cities with higher economic development.[13]

Muñoz et al. validated the Framingham model for a population in Colombia and identified that the relationship between the proportion of events expected and the proportion of events actually observed is different according to the risk group, considering that in the low and moderate risk categories the proportion of events expected was 2.26% and 2.3%, respectively. However, in the high-risk category the difference between proportion of events expected and observed was 17.4%.[14]

The applicability of the Framingham cardiovascular risk prediction algorithm has been questioned and different measurement scales have been applied.[14] Studies, like that by DeFilippis et al., when comparing five risk rating scales, including the AHA-ACC-ASCVD score, showed overestimation of risk (25% to 115%) in a multi-ethnic cohort and consider that overestimation of risk can have important implications for individual patients and for the healthcare system.[15]

Upon observing other risk indicators related to cardiovascular risk, a continuum can be noted in which the BMI indicator on overweight and obesity was at 43.97%; followed by the abdominal perimeter related to metabolic risk found at 40.2%, and followed by the nutritional risk indicator, expressed by the waist-hip ratio, at 31.95%.

The HDL variable was affected earliest in all groups, finding it below normal levels and confirming results from prior studies in the region.[16]

Obesity and metabolic syndrome are identified as a growing phenomenon in the whole population.[17,18] In Armenia, a prevalence of 48.71% of metabolic syndrome was found in drivers of public transportation vehicles.[19] In Bogotá a prevalence of metabolic syndrome of 27, 35% was found in a population with hypertensive disease, according to criteria from ATP III, 19.29% in men and 30.05% in women.[20]

In this study, the participating population came from three groups; the group of students had a mean age of 21.08 ± 3.99 years, that is, below 30 years of age, which corresponds to the study by Framingham.[4] The Framingham scale levels risk with a minimum of 1% for those under 30 years of age. This is why the ANOVA was performed based on the score, besides the percentage, which permits identifying risk in all ages, including those <30 years of age, observing that the relation improves notably (Figure 3). This is evidence that age is the principal factor that differentiates the groups identified.

Another risk factor identified in this study was glycemia. Regarding habits, cigarette smoking and consumption of bakery goods were identified as cardiovascular risk factors.

Cigarette smoking is a habit recognized as a cardiovascular risk factor throughout the world.[21] In this study, it presented a statistically significant value, in spite of the low percentage of smokers (6.01%). Studies, like that by Mallaina,[22] confirm that in Europe smoking is the most important cardiovascular risk factor, as in this study.

Consumption of bakery goods is a risk factor related to carbohydrates that have a negative impact through increased glycemia, which in turn triggers the inflammatory cascade, as stated in the text by Dr Perlmutter.[23] However, recent studies approach the relationship between bread intake, blood pressure inhibitors, glucose metabolism and endothelial function without conclusive results.[24] Niklas et al. found that consumption of snacks was not associated with cardiovascular risk[25] and recommend education to improve their consumption in terms of nutrients. Nash[26] debates on the tendency generated by “a popular book that holds that current recommendations of a diet high in cereals and low in fats underlie much of today’s chronic health problems and that a diet low in carbohydrates and high in fats and cholesterol is ideal”. That is, this finding of consumption of bakery goods in the university community as a risk factor contributes to a heated debate. This case implies an educational process that diminished their intake to help to diminish its cardiovascular, metabolic, and nutritional risk.

Conclusion

This study found that the risk of having a cardiovascular episode in the next 10 years in a university population with a mean age of 33.64 years was low (2.54%), according to the Framingham scale, which corresponded to 97.7% of the study participants. Only 2.3% of

the participants presented medium and high risk, corresponding to the administrative staff group.

In the end, this study found in relation to the prevention of coronary risk that consumption of carbohydrates in bakery products, which is recognized as a risk factor for obesity and diabetes, is associated with increased risk of cardiovascular events in this population.

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Table 1: Baseline demographic and clinical characteristics of the study population (n=216).

VARIABLES	MEAN ± STANDARD DEVIATION	95%CI	FEMALE	MALE	ANOVA (p)
AGE	33.64 ± 14.01	31.75-35.53	33.48 ± 13.4	33.9 ± 15.17	0.82
BMI	24.98 ± 3.81	24.47-25.49	24.65 ± 3.59	25.48 ± 4.10	0.11
SYSTOLIC PRESSURE	110.9 ± 11.34	109.31-112.49	108.01 ± 10.55	115.18 ± 11.17	0.01
DIASTOLIC PRESSURE	74.55 ± 8.97	73.29-75.81	72.38 ± 8.82	77.93 ± 8.29	0.01
ARTERIAL PRESSURE	110/74		108/72	115/77	
WAIST	83.63 ± 11.89	82.04-85.23	79.3 ± 9.14	90.31 ± 12.56	0.01
HIP	101.25 ± 7.75	100.21-102.29	100.8 ± 7.82	101.93 ± 7.83	0.29
WAIST-HIP RATIO	0.82 ± 0.08	0.81–0.83	0.78 ± 0.06	0.88 ± 0.07	0.01
TOTAL CHOLESTEROL (mg/dl)	173.97 ± 37.74	34.36-41.36	174.6 ± 37.1	173.06 ± 38.86	0.77
HDL CHOLESTEROL (mg/dl)	41.69 ± 12.04	40.01-43.37	44.26 ± 12.47	37.95 ± 10.37	0.01
LDL CHOLESTEROL (mg/dl)	104.89 ± 32.48	100.30-109.48	105.23 ± 31.01	104.39 ± 34.72	0.85
TRIGLYCERIDES	143.10 ± 91.63	130.29-155.91	129.18 ± 69.15	163.39 ± 114.39	0.01
VLDL (mg/dl)	26.57 ± 11.94	24.88-28.25	24.55 ± 10.48	29.53 ± 13.33	0.01
CREATININE (mg/dl)	1.07 ± 0.16	1.05-1.09	0.98 ± 0.11	1.21 ± 0.14	0.01

GLYCEMIA (mg/dl)	87.47 ± 11.95	85.80-89.14	85.46 ± 11.64	90.38 ± 11.86	0.01

Table 2: Quantitative variables by groups (mean, standard deviation, 95% CI ANOVA).

VARIABLE	STUDENTS	FACULTY	ADMINISTRATIVE STAFF	ANOVA (P)
AGE (years)	21.08 ± 3.99	47.25 ± 10.58	43.88 ± 9.6	0.01
	(20.02-22.15)	(45.20-49.31)	(42.74-45.02)	
SYSTOLIC PRESSURE (mmHg)	106.81 ± 9.98	111.85 ± 10.66	114.94 ± 11.51	0.01
	(105.22–128.41)	(108.96–114.73)	(113.29–116.58)	
DIASTOLIC PRESSURE (mmHg)	72.86 ± 9.04	78.33 ± 8.08	75.12 ± 8.81	0.01
	(71.55–74.17)	(75.96–80.70)	(76.46–73.48)	
ARTERIAL PRESSURE	107/73	112/78	115/75	
BMI	23.52 ± 3.58	25.87 ± 2.91	26.38 ± 3.72	0.01
	(23.02–24.01)	(24.91-26.83)	(25.85–26.91)	
WEIGHT (Kg)	63.04 ± 13.01	71.98 ± 10.79	66.4 ± 11.9	0.01
	(61.33–64.75)	(68.77–75.28)	(67.81–71.47)	
HEIGHT (meters)	1.63 ± 0.8	1.66 ± 0.6	1.62 ± 0.8	0.07
	(1.62–1.64)	(1.64–1.68)	(1.60–1.63)	
WAIST (cm)	78.22 ± 10.03	91.25 ± 11.0	87.51 ± 11.4	0.01
	(76.73–79.71)	(88.38-94.13)	(85.91–89.10)	
HIP (cm)	98.55 ± 7.74	103.18 ± 6.27	103.75 ± 7.19	0.01
	(97.53–99.57)	(101.21–105.15)	(102.65–104.84)	
WAIST-HIP RATIO	0.70 ± 0.06	0.88 ± 0.07	0.84 ± 0.08	0.01

	(0.78–0.80)	(0.86–0.90)	(0.83–0.85)	
TOTAL CHOLESTEROL (mg/dl)	158.83 ± 30.4	180.43 ± 39.01	187.42 ± 36.2	0.01
	(153.54-163.13)	(170.93-189.93)	(182.06-192.77)	
HDL CHOLESTEROL (mg/dl)	42.71 ± 10.57	38.13 ± 11.24	41.58 ± 13.53	0.22
	(40.92-44.51)	(34.9-41.3)	(39.96–43.59)	
LDL CHOLESTEROL (mg/dl)	96.2 ± 29.42	109.01±30.08	112.84 ± 33.15	0.01
	(91.47-100.94)	(100.51-117.51)	(107.53–117.75)	
TRIGLYCERIDES (mg/dl)	100.13 ± 45.69	172.68 ± 76.68	167.69 ± 111.49	0.01
	(87.6–112.66)	(150.19–195.67)	(165.01–190.36)	
VLDL (mg/dl)	19.93 ± 9.21	33.28 ± 12.79	31.46 ± 10.68	0.01
	(18.38–21.48)	(30.49-36.07)	(29.85–33.07)	
CREATININE	1.03 ± 0.14	1.14 ± 0.17	1.09 ± 0.18	0.01
	(1.01–1.06)	(1.1–1.19)	(1.06–1.11)	
GLYCEMIA (mg/dl)	83.56 ± 7.34	93.5 ± 13.33	89.56 ± 13.94	0.01
	(81.85–85.27)	(90.43–96.56)	(87.83–91.29)	

Table 3: Risk factors by groups (Frequency and percentage).

Variable	**Students**	**percentage**	**Faculty**	**percentage**	**Administrative staff**	**percentage**
Gender						
Female	61	60.3	10	37.03	60	68.18
Male	40	39.9	17	62.96	28	31.81
Smoking						
Yes	5	4.9	3	11.11	5	5.68

No	85	84.1	24	88.88	79	89.77
No answer	11	10.8	0	0	4	4.54
Physical exercise						
Yes	38	37.62	11	40.74	29	32.95
No	63	62.37	16	59.25	59	67.04
Total	101	100	27	100	88	100

Table 4: Identification of the risk.

TYPE OF RISK	IDENTIFICATION OF THE RISK	FREQUENCY	PERCENTAGE
CARDIOVASCULAR RISK	Low Risk	211	97.70%
(Framingham scale)	Medium Risk	3	1.30%
	High Risk	2	0.93%
METABOLIC RISK	No Risk	126	58.33%
(Abdominal perimeter)	Metabolic risk	88	40.74%
	Borderline risk	2	0.93%
NUTRITIONAL RISK	No Risk	135	62.50%
Waist/hip ratio	Nutritional risk	69	31.95%
	Borderline risk	12	5.55%
BODY MASS INDEX (BMI)	Thin acceptable	2	0.93
	Thin moderate	1	0.46
	Normal weight	118	56.02
	Overweight	75	34.72
	Degree of obesity I	18	8.33
	Degree of obesity II	1	0.46

Degree of obesity III	1	0.46	

Table 5: Identification of the risk by group.

TYPE OF RISK	STUDENTS	FACULTY	ADMINISTRATIVE STAFF	Chi square (p)
Framingham CVR				
Low Risk	101	27	83	0.11
Medium Risk			3	
High Risk			2	
METABOLIC CVR Abdominal perimeter				
No Risk	90	9	27	0.01
Cardiovascular risk	11	18	59	
Borderline risk			2	
NUTRITIONAL CVR Waist/hip				
No Risk	78	11	46	0.01
Cardiovascular risk	17	15	37	
Borderline risk	6	1	5	
CVR X BMI				
Thin acceptable	2	-	-	0.01
Thin moderate	1	-	-	
Normal weight	70	10	38	
Over weight	25	14	36	
Dgree of obesity I	2	3	13	

Degree of obesity II	-	-	1
Degree of obesity III	1	-	-

Table 6: Relationship of biochemical variables with the Framingham percentage scale.

VARIABLE	Mean ± SD	p value	Coefficient
Total cholesterol	158.83 ± 30.4	0.16	1.38
HDL cholesterol	42.71 ± 10.57	0.1	-1.61
LDL cholesterol	96.2 ± 29.42	0.32	-0.98
VLDL cholesterol	19.93 ± 9.21	0.71	0.36
Triglycerides	100.13 ± 45.69	0.35	-0.92
Glycemia	83.56 ± 7.34	0.01	5.37
Creatinine	1.03 ± 0.14	0.68	0.41

Table 7: Relationship of habits with the Framingham percentage scale (ANOVA).

Variable	Mean Square	F-Ratio	P-Value
Smoking habit	67.17	9.96	0.01
Consumption of eggs	14.01	2.08	0.05
Bakery goods	16.1	2.39	0.03

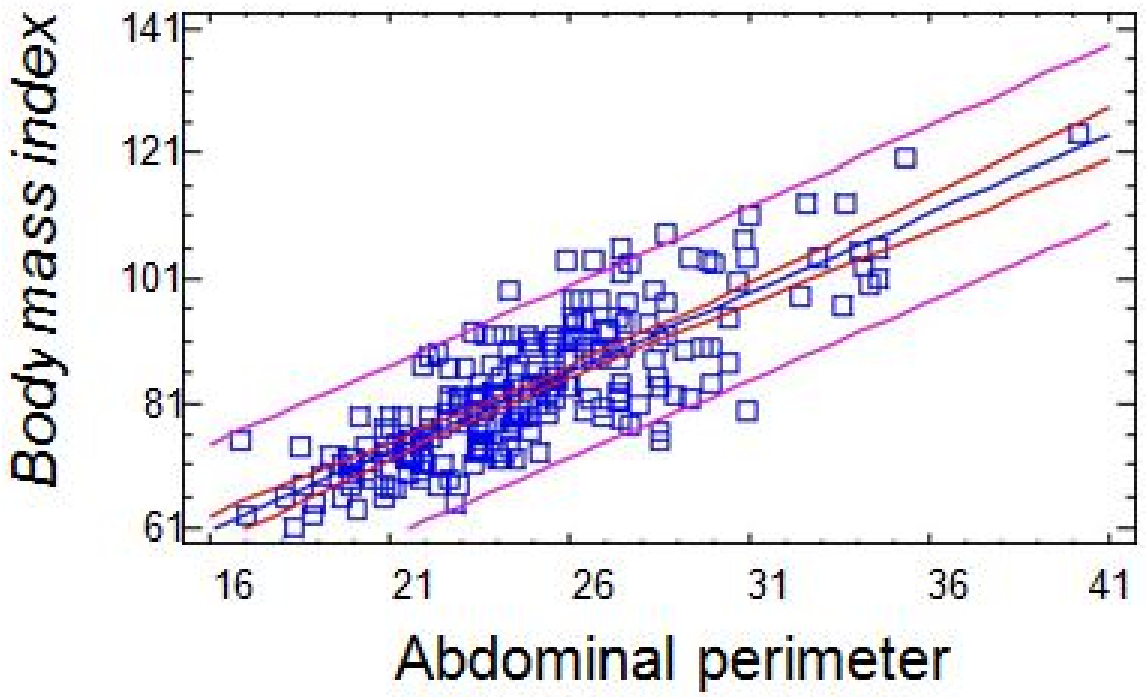

Figure 1: Relation of abdominal perimeter and body mass index.

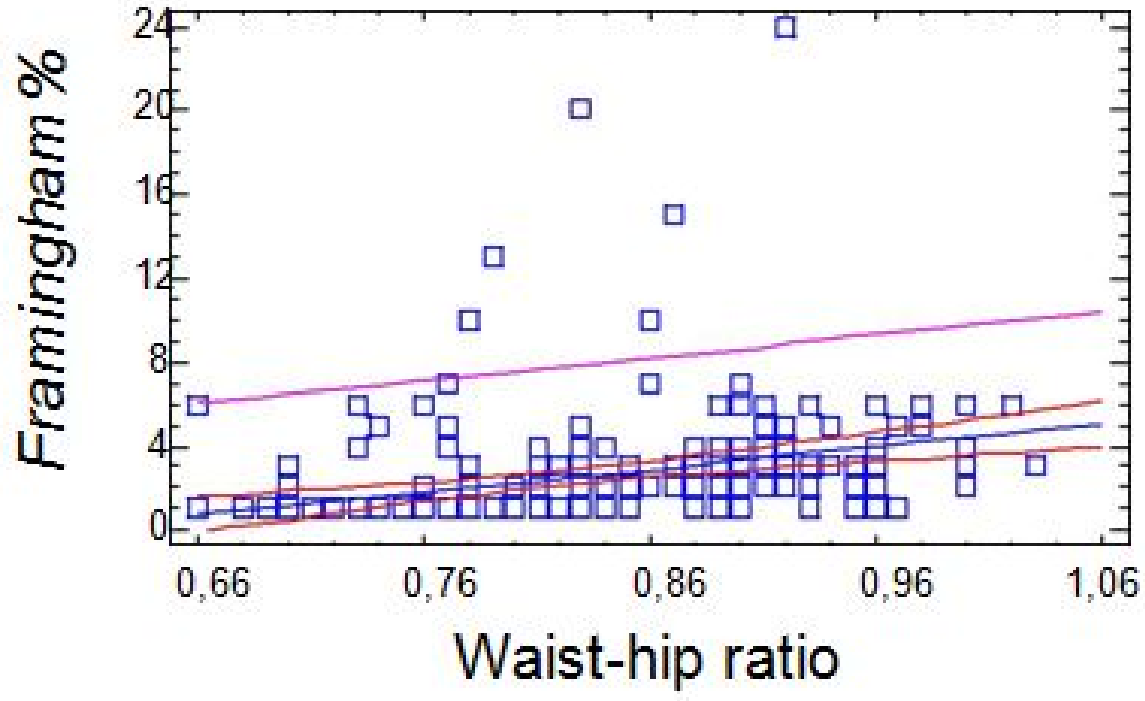

Figure 2: Relation of CVR by Framingham percentage *vs* waist-hip ratio.

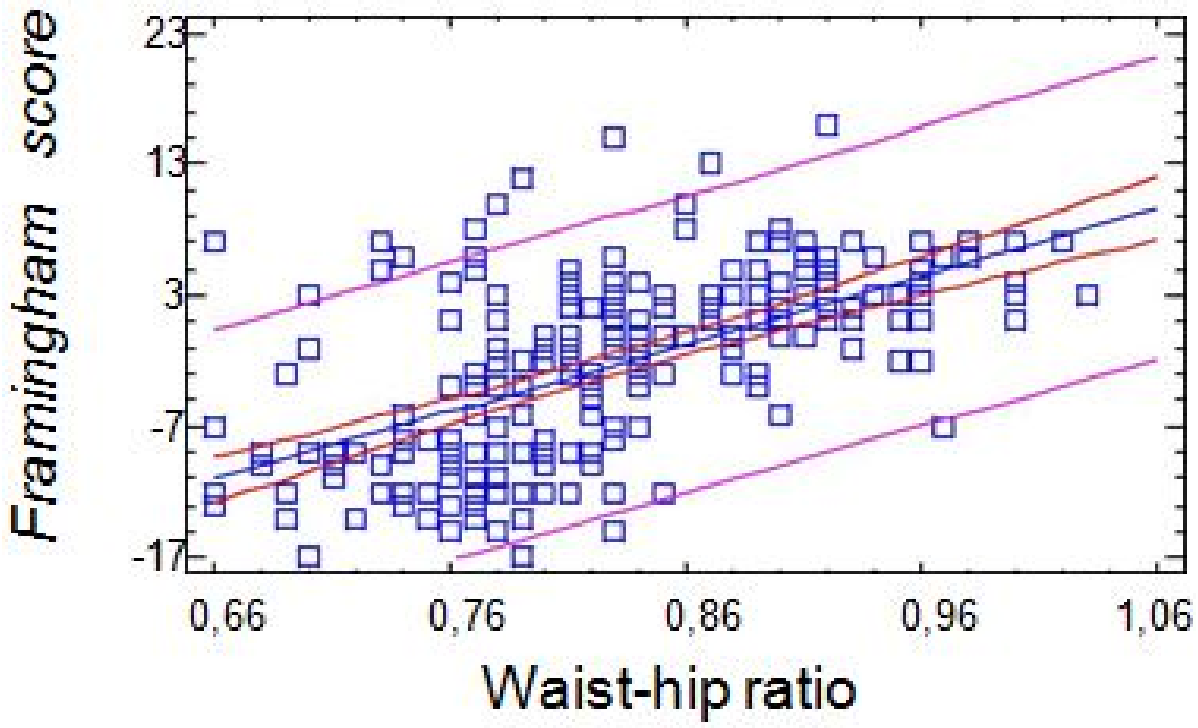

Figure 3: CVR relation by Framingham score *vs* waist-hip ratio.