Association between Anthropometric, Biochemical and Hemodynamic Variables in Cardiac Patients

Mayara Negrão Gomes, Michel Garcia Maciel, Rosileide de Souza Torres, Socorro Nazaré Araújo Almeida Barbosa

Universidade do Estado do Pará - Fundação Hospital de Clínicas Gaspar Vianna – Programa de Residência Multiprofissional em Atenção à Saúde Cardiovascular – Belém, PA – Brazil
Universidade de Brasília – Faculdade de Ciências da Saúde – Brasília, DF – Brazil
Universidade Federal do Pard – Hospital Universitário João de Barros Barreto – Serviço de Nutrição e Dietética – Belém, PA – Brazil
Universidade do Estado do Pará – Fundação Hospital de Clínicas Gaspar Vianna – Serviço de Nutrição e Dietética – Belém, PA – Brazil

Abstract

Background: Cardiovascular diseases (CVD) are one of the leading causes of morbidity and mortality in the world and, in Brazil, they have been the first cause of death for at least four decades. They are a major cause of prolonged hospital stay and are responsible for the primary allocation of public funds in hospitalizations in Brazil. The analysis of anthropometric, hemodynamic and biochemical variables may show their importance as risk factors for CVD.

Objective: To assess the correlation of anthropometric, biochemical and hemodynamic variables of cardiac patients with chances of a new cardiovascular event.

Methods: A prospective, cross-sectional study with 50 patients ≥45 years of age, of both sexes, from April to July 2014, at Fundação Hospital de Clínicas Gaspar Vianna, in Belém, PA. Information relating to stages of life, lifestyle, anthropometry, laboratory tests and hemodynamic profile were collected.

Results: The following the anthropometric, biochemical and hemodynamic indicators were significantly high: body mass index (BMI), waist circumference (WC) and blood glucose and triglycerides (TG). There was a positive and significant correlation between the following variables: BMI with WC, systolic blood pressure (SBP), diastolic blood pressure (DBP), total cholesterol (TC) and LDL with blood glucose. BMI was the variable that most correlated in the study; WC with glucose; SBP with DBP and LDL; TC with TG and LDL.

Conclusions: BMI was the measure that most correlated with other anthropometric, biochemical and hemodynamic variables. The chances of a new cardiovascular event increase as BMI and its correlation with the other variables increase as well.

Keywords: Cardiovascular diseases; Anthropometry; Risk factors; Heart diseases

Introduction

Cardiovascular diseases (CVD) are one of the leading causes of morbidity and mortality in the world, significantly growing in developing countries. In Brazil, they have been the first cause of death for at least four decades and, according to the Ministry of Health, they were the most frequent cause of death in 2009, with 31.3%. According to forecasts for the year 2020, CVD will remain the leading cause of mortality and disability.

There is consensus among experts that CVDs have a multifactorial origin and participate in the genesis of the so-called risk factors, defined as causative agents that predispose to the emergence of heart diseases. Identifying these factors is essential for clinical practice and for the development of public health strategies for primary and secondary prevention of CVD.

According to studies, the greater the number of risk factors either present or associated the greater will be...
cardiovascular morbidity and mortality. In these cases, the identification and control of variables predicting risk factors such as anthropometric, biochemical and hemodynamic variables are fundamental in the prevention of future cardiovascular events.

Obesity and overweight are increasing problems in many countries, including Brazil, with concomitant increase in the number of cases of dyslipidemia (DLP), type 2 diabetes mellitus (T2DM), systemic arterial hypertension (SAH) and, therefore, CVD. The accumulation of fat in the abdominal region, determined by waist circumference (WC) has better predictive ability compared to body mass index (BMI) on the outcome of diseases, such as myocardial infarction (AMI). These anthropometric parameters have the advantage of easy measurement and low cost, useful in public health and clinical practice.

From an epidemiological point of view, it has been demonstrated that there is a correlation between plasma cholesterol and triglyceride levels and the increase of CVD. Dyslipidemias are risk factors related to the development of CVD as well as being the primary cause in the outcome of atherosclerosis.

The rise in serum triglycerides is associated with increased risk of coronary artery disease, thus arising evidence that hypertriglyceridemia is an independent risk factor for coronary artery disease. Hypertriglyceridemia is associated with four pathogenic conditions that accelerate the development of atherosclerosis: decreased HDL levels in serum; increased remnant lipoproteins; small rise in LDL; increase in thrombogenic conditions.

Although some aspects are still controversial, changes in lifestyle can significantly improve the development of CVD, thus being inexpensive interventions compared to the rising costs of medical treatments highly dependent on technology. The objective of this study was to evaluate the correlation between anthropometric, biochemical and hemodynamic variables of cardiac patients treated at Fundação Hospital de Clínicas Gaspar Vianna, in Belém, PA.

Methods

Observational, cross-sectional, quantitative, prospective study performed with cardiac patients treated at the nutrition clinic at the Hospital de Clínicas Gaspar Vianna, in Belém, PA.

This study has been approved by the Research Ethics Committee under no. CAAE03218512.0.2001.0016. All participants signed an Informed Consent Form (ICF).

Adults and the elderly, of both sexes, cardiac patients aged ≥45 with any evidence of coronary artery disease (CAD), patients with ischemic stroke, peripheral arterial disease in the last 10 years; current or previous hospitalization for unstable angina were included in the study. Those unable or refusing to participate in the study and sign the ICF have been excluded from the study.

Data collection was conducted from May to July 2014 through a research form with the following data: identification of the patient (sex and age); comorbidities: SAH, DLP and DM; presence of family history of DAC; life habits such as smoking and lifestyle; laboratory tests: fasting glucose, total cholesterol (TC), high-density lipoprotein (HDL), low-density lipoprotein (LDL) and triglycerides (TG); blood pressure; anthropometry: weight, height, BMI and WC.

The reference standards for TC, HDL, LDL and TG were the values recommended by the IV Brazilian Guidelines on Dislipidemias; for fasting glucose, the values adopted by the Brazilian Society of Diabetes; and for blood pressure, the values adopted by the VI Brazilian Guidelines on Hypertension.

The anthropometric variables analyzed were: BMI and WC. BMI was defined as the ratio [weight(kg)/height²(m)], whose values were compared to the reference standard for adults and elderly. Waist circumference was measured with the patient standing at the medium point between the last rib and the iliac crest using an inelastic measuring tape, with no pressure applied. Reading was taken at the time of expiration. The cutoff point used to classify WC was the one recommended by the Ministry of Health.

For hemodynamic variables, blood pressure was measured in the device G.TECH Monitor Digital Pressão Arterial (Onbo Electronics Co., China). The measurement was performed on the left arm only once after the patient had been sitting for two minutes, at rest.
The program Bioestat version 5.0 was used. The mean, standard deviation, minimum and maximum values were calculated. The Student’s t test and Pearson’s correlation coefficients were applied for the anthropometric, biochemical and hemodynamic variables. A significance level of 5% (p<0.05) was adopted for all statistical tests.

**Results**

Of the 50 individuals evaluated, 72.0% were males (n=36) and 28.0% were females (n=14). Most of the elderly population (66.0%) were 62 years old on average (45-83 years). Regarding comorbidities, it was found that 96.0% had SAH, 32.0% had T2DM and 94.0% had DLP. Family history of CAD was found in 68.0% of the population. As for lifestyle, 57.14% were physically inactive and 70.0% were smokers.

As for anthropometric indicators, the following was found: mean BMI of 28.71 kg/m² for both sexes and WC of 98.78 cm for males and 96.55 cm for females. The mean anthropometric variables found are not significantly greater than the recommended (Table 1).

The mean values found for the biochemical and hemodynamic variables were: blood glucose (119.22 mg/dL); TC (189.14 mg/dL), and TG (188.81 mg/dL). Serum LDL was 101.93 mg/dL for both sexes and HDL was 47.60 mg/dL for females and 52.50 mg/dL for males. Average systolic blood pressure was 126.72 mmHg and diastolic pressure was 81.20 mmHg. Blood glucose and TG were significantly higher (Table 1).

| Variables                  | Mean±SD     | Recommended values* | Student’s t-test** | p      |
|---------------------------|-------------|---------------------|--------------------|--------|
| Blood glucose (mg/dL)     | 119.22±41.19| < 100               | 3.4359             | 0.0012*|
| TC (mg/dL)                | 189.14±48.30| < 200               | -1.429             | 0.1594 |
| LDL (mg/dL)               | 101.93±39.32| < 160               | -9.7366            | < 0.0001*|
| TG (mg/dL)                | 188.81±129.90| < 150              | 2.1453             | 0.0369*|
| HDL (mg/dL)               | 52.50±9.44  | > 50 ♀             | 0.5943             | 0.5625 |
|                           | 47.60±9.91  | > 40 ♂             | 3.8227             | 0.0006*|
| SBP (mmHg)                | 126.72±20.68| < 130              | -1.0873            | 0.2822 |
| DBP (mmHg)                | 81.20±13.98 | < 85               | -1.8714            | 0.0672 |
| BMI (kg/m²)               | 28.71±4.82  | < 25               | 5.4406             | < 0.0001*|
| WC (cm)                   | 96.55±16.06 | < 80 ♀            | 3.8549             | 0.0020*|
|                           | 98.78±9.82  | < 94 ♂            | 5.3613             | < 0.0001*|

TC — total cholesterol; LDL — low-density lipoprotein; TG — triglycerides; HDL — high-density lipoprotein; SBP — systolic blood pressure; DBP — diastolic blood pressure; BMI — body mass index; WC — waist circumference; (♀) male sex; (♂) female sex; SD — standard deviation

*According to the Guidelines of the Brazilian Society of Diabetes; IV Brazilian Guidelines on Dyslipidemia and Prevention of Atherosclerosis; VI Brazilian Guidelines on Hypertension; World Health Organization.

**Student’s t-test p<0.05 significant differences.
Table 2 presents data about the analysis of correlation between anthropometric, biochemical (TC, HDL, LDL and glucose) and hemodynamic (SBP and DBP) variables. There was a positive and significant correlation among the following variables: BMI with WC, SBP, DBP, TC, LDL with blood glucose; WC with glucose; SBP with DBP and LDL; TC with TG and LDL.

Some correlations presumable in the literature were observed, since there are inseparable variables, such as total cholesterol and LDL, in which the first corresponds to the sum of all lipoproteins (LDL+HDL). Others such as systolic and diastolic blood pressure are markers of blood pressure and the alteration of a value usually interferes with the other.

Table 2
Correlation between anthropometric, biochemical and hemodynamic variables of the study population

|          | BMI | WC  | SBP | DBP | TC  | TG  | LDL | HDL |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| BMI      |     |     |     |     |     |     |     |     |
| p value  |     |     |     |     |     |     |     |     |
| WC       | 0.8214 |     |     |     |     |     |     |     |
| p value  | <0.0001* |     |     |     |     |     |     |     |
| SBP      | 0.3223 | 0.2337 |     |     |     |     |     |     |
| p value  | 0.0308* | 0.1222 |     |     |     |     |     |     |
| DBP      | 0.3443 | 0.2703 | 0.6095 |     |     |     |     |     |
| p value  | 0.0205* | 0.0724 | <0.0001* |     |     |     |     |     |
| TC       | 0.4151 | 0.253 | 0.1512 | 0.1109 |     |     |     |     |
| p value  | 0.0045* | 0.0935 | 0.3214 | 0.4683 |     |     |     |     |
| TG       | 0.0952 | 0.1402 | 0.168 | 0.1671 | 0.4841 |     |     |     |
| p value  | 0.5338 | 0.3582 | 0.2699 | 0.2725 | 0.0007* |     |     |     |
| LDL      | 0.3088 | 0.2102 | 0.3401 | 0.0645 | 0.4301 | 0.1198 |     |     |
| p value  | 0.0389* | 0.1657 | 0.0222* | 0.6739 | 0.0032* | 0.4329 |     |     |
| HDL      | -0.1521 | -0.2634 | 0.0599 | -0.0104 | -0.0306 | -0.1695 | 0.1294 |     |
| p value  | 0.3184 | 0.0804 | 0.6957 | 0.9458 | 0.842 | 0.2657 | 0.3969 |     |
| Blood glucose | 0.3684 | 0.3273 | 0.1022 | -0.0221 | 0.06 | 0.2895 | 0.0221 | -0.2861 |
| p value  | 0.0127* | 0.0281* | 0.5041 | 0.8855 | 0.6953 | 0.0537 | 0.8853 | 0.0566 |

*p<0.05 — significant correlations (Pearson’s correlations)

TC — Total cholesterol; LDL — low-density lipoprotein; TG — triglycerides; HDL — high-density lipoprotein; SBP — systolic blood pressure; DBP — diastolic blood pressure; BMI — body mass index; WC — waist circumference
Discussion

The prevalence of male patients found here is consistent with other studies involving cardiac patients, such as in Quiri et al.\(^{18}\) (65.0\%), Lobato et al.\(^{19}\) (58.0\%) and Marcadenti et al.\(^{20}\) (71.4\%). By analyzing cardiovascular risk, it is observed that men have a higher risk in initial evaluation\(^{21}\). One of the pioneers in research on inequality of the sexes, the Framingham study identified a set of factors that predisposed to a higher risk of developing atherosclerosis, including, among the most important ones, male sex\(^{22}\).

The average age of patients was 62. This result resembles those of the studies of Chang et al.\(^{23}\) and Santos et al.\(^{24}\), who found values of 65.7 years and 67.0 years, respectively. Age has been identified as an independent risk factor for CVD. The elderly are more vulnerable to degenerative diseases of insidious beginning, such as the cardiovascular diseases\(^{25}\).

Among the comorbidities found, the most prevalent was SAH, the same finding observed in the studies of Chang et al.\(^{23}\) (77.6\%) and Lemos et al.\(^{26}\) (75.7\%), both involving patients with CAD. These results confirm the importance of SAH as a risk factor for the occurrence of ACS\(^{21}\).

A prevalence of family history of CAD was found in most of the population, agreeing with the findings of Chagas et al.\(^{27}\) (72.0\%), Lemos et al.\(^{28}\) (56.6\%) and Soares et al.\(^{29}\) (52.7\%) in studies involving cardiac patients.

In this study, most of the population self-reported as physically inactive. Feijó et al.\(^{29}\) found the same prevalence in their study (75.0\%). Other similar results were observed by Quirino et al.\(^{18}\) (78.0\%) and Lemos et al.\(^{26}\) (86.8\%). The findings reinforce the estimate that a physically inactive lifestyle, although depending on other factors, accounts for 22.0\% of ischemic heart diseases\(^{30}\).

Smoking increases the risk of premature death and physical limitations from coronary heart diseases, among others\(^{31}\). In this study, most patients self-reported as a smoker, which is consistent with the studies of Chagas et al.\(^{27}\) (55.5\%) and Chang et al.\(^{23}\) (65.7\%).

Several anthropometric indices have been proposed to determine the association between overweight and cardiovascular risk factors. Among the anthropometric parameters used to assess the nutritional status, the most widely used in clinical practice today is BMI because of the sensitivity in identifying generalized obesity\(^{31}\).

A common manifestation in patients with heart disease is increase in BMI, which was confirmed with the findings of this study. Quirino et al.\(^{18}\) in their study also obtained higher average BMI than recommended. According to Carneiro et al.\(^{25}\), in the aging process, BMI >27 kg/m\(^2\) indicates obesity, becomes a risk factor for hypertension, favoring the appearance of cardiovascular events in this group.

Average WC was above the recommended, being statistically significant for both sexes, proving to be a marker in this population. WC is a measure that indicates central obesity, characterized by fat accumulation in the mesenteric region and associated with increased risk of CVD. This measure has been considered one of the best predictors of cardiovascular risk\(^{33}\).

In the study of Avezum et al.\(^{1}\), the average fasting plasma glucose was statistically high, similar to that found in this study, compared to the recommendations of the Brazilian Society of Diabetes\(^{13}\). There is increasing evidence to suggest that the mere presence of glucose intolerance during fasting is considered a cardiovascular risk factor\(^{13,34}\).

As for metabolic evaluation, there was a significantly high average of TG, similar to the results found by Martins et al.\(^{35}\). Several studies determined an association between high triglyceride levels and cardiovascular disease. However, it remains controversial whether high levels of triglycerides directly promote cardiovascular disease or whether they represent only one risk biomarker\(^{35}\).

In this study, among the anthropometric variables studied, BMI was the one that most correlated with other variables. There was a significant positive correlation between BMI and WC, also found in other reference studies\(^{36,36}\). It is known that excess weight associated with the accumulation of fat in the mesenteric region is associated with increased risk of atherosclerotic disease\(^{37}\).

Obesity is highly associated with other cardiovascular risk factors such as SAH, DM and DLP\(^{38}\). The findings of this study corroborate the literature, since there was a statistically positive correlation between BMI and blood pressure (SBP \(r=0.3223, p=0.0308\); DBP \(r=0.3443, p=0.0205\)) BMI and blood glucose \(r=0.3684 (p=0.0127)\); BMI and CT \(r=0.4151 (p=0.0045)\); BMI and LDL \(r=0.3088 (p=0.0389)\).

In this study, we observed that TC and LDL-c correlated most significantly with BMI, suggesting that total body
fat seems to be more relevant in relation to these variables (TC and LDL-c) than the fat deposit in the central area of the body. These findings were similar to the results found by other researchers7,39,40.

The literature states that excessive deposition of visceral abdominal fat is associated not only with increased risk of coronary events, but also to the development of T2DM in both sexes and in different ethnicities22. In this study, there was a positive and significant correlation between WC and glucose \( r=0.3273 \) (p=0.0281).

The reduction of TC values can contribute to reducing other risk factors associated with it, such as LDL-c and TG, a result found in this study between TC and TG, \( r=0.481 \) (p=0.0007); and TC and LDL \( r=0.4301 \) (0.0032). Although the values of biochemical variables are not significantly high (except for TG), they were positively correlated in most cases.

The mechanisms by which the levels of plasma lipoproteins and BP do not seem to be entirely clear in the literature. Guedes and Guedes4 suggest a predominance of fat in the central region of the body as a causal factor, in which the central provision of body fat may represent an increase in size and/or number of metabolically more active intra-abdominal or visceral fat cells. There was a significantly positive correlation of SBP with DBP, \( r=0.6095 \) (p<0.0001) and LDL \( r=0.3401 \) (0.0222).

According to Soares et al.28, despite these findings, knowledge about the prevalence of risk factors in different populations is still small, so the most effective way to reduce the impact of cardiovascular disease at the population level is the development of preventive actions and treatment of risk factors.

**Conclusion**

In conclusion, BMI is the measure that most correlated with the other anthropometric and biochemical and hemodynamic variables.

These data support the hypothesis that the chances of a new cardiovascular event increase with increasing BMI, since all variables studied are associated with risk factors for cardiovascular disease.

**Conflict of Interest**

This study has no relevant conflicts of interest.

**Sources of Funding**

This study had no external funding sources.

**Academic Association**

This manuscript is part of the Final Term Paper (TCC) of the Multidisciplinary Residency Program in Cardiovascular Health Care of Mayara Negrão Gomes, from Universidade do Pará, in association with Fundação Hospital de Clínicas Gaspar Vianna.

**References**

1. Avezum A, Piegas LS, Pereira JCR. Fatores de risco associados com infarto agudo do miocárdio na região metropolitana de São Paulo: uma região desenvolvida em um país em desenvolvimento. Arq Bras Cardiol. 2005;84(3):206-13.
2. Rique ABR, Soares E de A, Meirelles C de M. Nutrição e exercício na prevenção e controle das doenças cardiovasculares. Rev Bras Med Esporte. 2002;8(6):244-53.
3. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Análise de Situação em Saúde. Saúde Brasil 2010: uma análise da situação de saúde e de evidências selecionadas de impacto de ações de vigilância em saúde/ Ministério da Saúde, Secretaria de Vigilância em Saúde, Departamento de Análise de Situação em Saúde. Brasília: Ministério da Saúde; 2011. Série G. Estatística e Informação em Saúde.
4. Guedes DP, Guedes JERP. Distribuição de gordura corporal, pressão arterial e níveis de lipídios-lipoproteínas plasmáticas. Arq Bras Cardiol. 1998;70(2):93-8.
5. Oliveira GHM, Farmer JA. Novos fatores de risco cardiovascular. Rev SocERJ. 2003;16(2):183-93.
6. Girotto E, Andrade SM, Cabrera MAS, Ridão EG. Prevalência de fatores de risco para doenças cardiovasculares em hipertensos cadastrados em unidade de saúde da família. Acta Sci Health Sci. 2009;31(1):77-82.
7. Oliveira MAM, Fagundes RLM, Moreira EAM, Trindade EBS, Carvalho T. Relação de indicadores antropométricos com fatores de risco para doença cardiovascular. Arq Bras Cardiol. 2010;94(4):462-70.
8. Marti B, Tuomilehto J, Salomaa V, Kavatza V, Korhonen HJ, Pietinen P. Body fat distribution in the Finnish population: environmental determinants and predictive power for cardiovascular risk factor levels. J Epidemiol Community Health. 1991;45(2):131-7.
9. Castro LCV, Franceschini SCC, Priore SE, Pelúzio MCG. Nutrição e doenças cardiovasculares: os marcadores de risco em adultos. Rev Nutr. 2004;17(3):369-77.
10. Araújo SF, Macedo CB, Ribeiro D, Marques M, Macedo SF, Cunha R. Aterosclerose, lipoproteínas e exercício aeróbio. EFdeportes.com/ Revista Digital. Buenos Aires. 2009;14(139). [acesso em 2015 jan. 12]. Disponível em: <http://www.efdeportes.com/efd139/aterosclerose-lipoproteínas-e-exercício-aerobico.htm>
11. Nakaya N. [Hypertriglyceridemia as a cause of atherosclerosis]. Nihon Rinsho. 2002;60(5):860-7.
12. Sposato AC, Caramelli B, Fonseca FA, Bertolami, MC, Afuene Neto A, Souza AD, et al. Sociedade Brasileira de Cardiologia. IV Diretriz brasileira sobre dislipidemias e prevenção da aterosclerose. Departamento de Aterosclerose da Sociedade Brasileira de Cardiologia. Arq Bras Cardiol. 2007;88(supl. 1):2-19.
13. Sociedade Brasileira de Diabetes. Diretrizes da Sociedade Brasileira de Diabetes 2009. 3a ed. Itapevi, SP: Araújo Silva Farmacêutica; 2009.
14. Sociedade Brasileira de Cardiologia; Sociedade Brasileira de Hipertensão; Sociedade Brasileira de Neufrologia. VI Diretrizes Brasileiras de Hipertensão. Arq Bras Cardiol. 2010;95(1 supl. 1):1-51. Erratum in: Arq Bras Cardiol. 2010;95(4):553.
15. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Atenção Básica. Orientações para a coleta e análise de dados antropométricos em serviços de saúde: norma técnica do sistema de Vigilância Alimentar e Nutricional – SISVAN. Brasília: Ministério da Saúde; 2011.
16. Lipschitz DA. Screening for nutritional status in the elderly. Prim Care. 1994;21(1):55-67.
17. Ayres M, Ayres M Jr, Ayres DL, Santos AS. BioEstat 5.0: aplicações estatísticas nas áreas das ciências biológicas e médicas. Belém: MCT; IDSM; CNPq; 2007.
18. Quirino CSP, Maranhão RVA, Giannini DT. Síndrome metabólica em pacientes atendidos em programa de reabilitação cardíaca. Rev Bras Cardiol. 2014;27(3):180-8.
19. Lobato TAA, Torres RS, Gutierres AS, Mendes WAA, Maciel AP, Santos FC, et al. Indicadores antropométricos de obesidade em pacientes com infarto agudo do miocárdio. Rev Bras Cardiol. 2014;27(3):203-12.
20. Marcadenti A, Oliveira VG, Bertoni VM, Wittke E, Dourado LP, Souza RB, et al. Resistência à insulina e indicadores antropométricos em pacientes com síndrome coronariana aguda. Rev Bras Cardiol. 2013;26(4):259-66.
21. Galvão NL, Vilela RFJTJ, Orlandi BMM, Ferraz RF, Costa FAA, Fagundes DJ. Determinação do risco cardiovascular em população de check-up espontâneo através do escore de Framingham. Rev Bras Cardiol. 2013;26(5):536-63.
22. Silva JL, Barbosa DS, DE Oliveira JA, Guedes DP. Distribuição centrina da gordura corporal, sobrepeso e apnéia cardiorrespiratória: associação com sensibilidade insulínica e alterações metabólicas. Arq Bras Endocrinol Metab. 2006;50(6):1034-40.
23. Chang VY, Handa KK, Fernandes M, Yacoub C, Pastana A, Caramelli B, et al. Improving cardiovascular prevention through patient awareness. Rev Assoc Med Bras. 2012;58(5):550-6.
24. Santos JC, Rocha MS, Araújo MS. Determinantes prognósticos em pacientes com síndrome coronariana aguda sem elevação do segmento ST. Arq Bras Cardiol. 2013;100(5):412-21.
25. Zaslavsky C, Gus I. Idoso. Doença cardíaca e comorbidades. Arq Bras Cardiol. 2002;79(6):635-9.
26. Lemos KF, Davis R, Moraes MA, Azzolin K. Prevalência de fatores de risco para síndrome coronariana aguda em pacientes atendidos em uma emergência. Rev Gaucha Enferm. 2010;31(1):129-35.
27. Chagas P, Caramori P, Barcelos C, Galdino TP, Gomes I, Schwanke CH. Associação de diferentes medidas e índices antropométricos com a carga aterosclerótica coronariana. Arq Bras Cardiol. 2011;97(5):397-401.
28. Soares JS, Souza NRM, Nogueira Filho J, Cunha CC, Ribeiro GS, Peixoto RS, et al. Tratamento de uma coorte de pacientes com infarto agudo do miocárdio com supradesnivelamento do segmento ST. Arq Bras Cardiol. 2009;92(6):644-71.
29. Feijó MKEF, Lutkmeier R, Ávila CW, Rabelo ER. Fatores de risco para doença arterial coronariana em pacientes admitidos em unidade de hemodinâmica. Rev Gaucha Enferm. 2009;30(4):641-7.
30. Martins LN, Souza LS, Silva CF, Machado RS, Silva CEF, Vilagla MM, et al. Prevalência dos fatores de risco cardiovascular em adultos admitidos na Unidade de Dor Torácica em Vassouras, RJ. Rev Bras Cardiol. 2011;24(5):299-307.
31. Machado SP, Rodrigues DG, Viana KD, Sampaio HA. Correlação entre o índice de massa corporal e indicadores antropométricos de obesidade abdominal em portadores de diabetes mellitus tipo 2. Rev Bras Prom Saude. 2012;25(4):512-20.
32. Carneiro G, Faria AN, Ribeiro Filho FF, Guimarães A, Lérrão D, Ferreira SRG, et al. Influência da distribuição da gordura corporal sobre a prevalência de hipertensão arterial e outros fatores de risco cardiovascular em indivíduos obesos. Rev Assoc Med Bras. 2003;49(3):306-11.
33. Coelho SP, Assis MAA, Moura EC. Aumento do índice de massa corporal após os 20 anos de idade e associação com indicadores de risco ou de proteção para doenças crônicas não transmissíveis. Arq Bras Endocrinol Metab. 2009;53(9):1146-56.
34. Deedwania PC, Fonseca VA. Diabetes, prediabetes, and cardiovascular risk: shifting the paradigm. Am J Med. 2005;118(9):939-47.
35. Costa MAS, Figueiredo Neto JA, Sousa JCB, Almeida AL, Casanovas RC. Apolipoproteínas, lipídeos, proteína-C ultrassensível e gravidade da doença arterial coronariana. Rev Bras Cardiol. 2013;26(3):158-66.
36. Sinha MS, Russel SA, Chida Y, Uchida Y, Okada Y, et al. Influence of physical activity and exercise on cardiovascular disease risk: a systematic review and meta-analysis. JAMA. 2012;308(20):2186-99.
37. Mendes WAA, Carmin SEM, Pinho PM, Silva ACM, Araújo MS. Relação de variáveis antropométricas com os signos pressóricos e lipídicos em adultos portadores de doenças crônicas não transmissíveis. Rev Bras Cardiol. 2012;25(3):200-9.
38. Lima CG, Basile LG. Estado nutricional como fator de risco para doenças cardiovasculares entre funcionários de uma universidade privada. Rev Inst Cienc Saúde. 2009;27(3):233-6.
39. Dalton M, Cameron AJ, Zimmet PZ, Shaw JE, Jolley D, Dunstan DW, et al; AusDiab Steering Committee. Waist circumference, waist-hip ratio and body mass index and their correlation with cardiovascular disease risk factors in Australian adults. J Intern Med. 2003;254(6):555-63.

40. Lemos-Santos MG, Valente JG, Gonçalves-Silva RM, Sichieri R. Waist circumference and waist-to-hip ratio as predictor of serum concentration of lipids in Brazilian men. Nutrition. 2004;20(10):857-62.