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Serum Biochemical Markers and Anthropometric Measurements in the Brazilian Army Militaries Selected for the United Nations' Peacekeeping Mission in Haiti

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ABSTRACT

Objective: *The Brazilian Army (BA) actively participates in peacekeeping missions of the United Nations (UN), and to do so, it is necessary that their military are in minimum physical condition to face the obstacles in the course of actions within the theater of operations. The aim of this study was to analyze the associations between serum biochemical markers and anthropometric measures in BA's militaries selected for the UN peacekeeping mission.* ***Method:*** *The study included 262 male militaries from the BA, aged 19-49 years selected for the UN peacekeeping mission in Haiti in 2012. Anthropometry was performed with measurement of total body weight, height and waist and hip circumferences. The body mass index and waist-hip ratio were calculated. Blood collection was performed after fasting for 12h for analysis of biochemical markers (HDL-C, triglycerides and glucose). Data were presented as mean ± standard deviation and percentage frequency. The associations between biochemical markers and anthropometric indices were assessed by Pearson correlation.* ***Results:*** *A significant negative correlation between HDL-C and waist circumference and a positive between glycaemia, triglycerides, body mass, body mass index and waist circumference were observed. The descriptive percentage of obese military found is below the national average, but overweight number is closer to the indices of the population. Conclusion: The weak correlation between blood glucose and anthropometric parameters as well as the inverse relationship between HDL-C and waist circumference, show that indirect instruments are independent predictors of NCD.*

KEYWORDS : Anthropometry, biochemical markers, militaries.

1 INTRODUCTION

The Brazilian Army (BA) has actively participated in the United Nations (UN) peacekeeping missions since 1956, sending big men contingents to different places in the world. In order to accomplish such missions, the militaries in the BA need to be in minimal physical conditions to face any obstacles in the course of actions within the theater of operations[1].

The increase in global chronic non-communicable diseases (NCD) constitutes a worldwide problem of public health. NCD's are of multifactorial etiology and share many changeable risk factors such as smoking, sedentary lifestyle, inadequate diet, obesity, dyslipidemia and alcohol consumption[2]. The practice of physical activities is highlighted as a way of health improvement and prevention of these diseases[3]. In 2004, the World Health Organization (WHO) launched the Global Strategy on Diet, Physical Activity and Health, considering that both healthy diet and lifestyle constitute strategies that are able to diminish the occurrence and severity of NCD's[4].

The regular practice of exercises is associated with a decreased incidence of cardiovascular events due to lower blood pressure[5,6], with improvement of body weight loss, increase in insulin sensitivity[7] and reduction of inflammatory parameters[8].

WHO recommends the use of anthropometry for surveillance of risk factors of chronic diseases[9]. The clinical evaluation in epidemiologic studies of overweight and obesity has been commonly carried out through anthropometric measurements such as body weight and height, or the combination of both, for they present positive aspects like practicality, low costs and easy interpretation of the results[10]. Besides these measurements, amongst the indirect methods most used to analyze body composition, skinfold, dual emission X-ray absorptiometry (DEXA), hydrostatic weighing and bioelectrical impedance (BIA) can be highlighted[11].

Rech *et. al.*[12] state that in studies on clinical evaluation of CNDs, there are some commonly used anthropometric measurements, such as waist circumference (WC), hip circumference (HC), body mass (BM), height and body mass index (BMI) and also the waist-hip ratio (WHR), for they have low cost and easy interpretation.

Several biochemical parameters have been used to assess NCD's risk factors. The most commonly used are the serum levels of triglycerides (TG), total cholesterol, high density lipoprotein (HDL-C), low density lipoprotein (LDL-C) and glucose[13,14]. In a study performed by Claro *et al.*[15], moderate positive correlations were found between biochemical markers and anthropometric indicators, especially among waist circumference and serum levels of TG and HDL-C. The status of the physical health may be better evaluated when anthropometric measurements and biochemical markers are associated, especially issues related to obesity, such as dyslipidemia and CNDs[16].

Thus, there are several different studies of associations between anthropometric measurements and biochemical markers[17,18], but there is a gap in the military population, where it has been observed an increasing relevance of NCD studies[13]. Thus, the aim of this study is to evaluate the associations between anthropometric measures and biochemical markers in BA's militaries selected for the UN's peacekeeping mission.

2 MATERIALS AND METHODS

The research design was characterized as a transversal, descriptive and correlational study. Data was collected in July, 2012, in the 10th Motorized Infantry Battalion, in the city of Juiz de Fora, MG. Two hundred and sixty two male militaries from the BA, aging between 19 and 49 (23 ± 9 years) selected for the UN's peacekeeping mission in Haiti in 2012 participated in the study. The ones that did not pass through every step of the process, such as anthropometric evaluation and biochemical exams were excluded from the sample. The volunteers were advised not to perform high intensity physical activities in the previous day and, also, not to consume any food in the twelve hours that preceded blood collection.

The individuals were submitted to anthropometric evaluation that included measurement of total body mass, height and waist and hip circumferences. Height was measured through a GPM metallic stadiometer. BM was measured with the person being assessed in orthostatic position, with bare feet, wearing only a bathing suit over an EKS digital scale. Both WC and HC were measured with Sanny medical metric tape, with a 90 cm cutoff point for WC[17]. The WHR was calculated dividing WC by HC, with a 0.95 cutoff point[19]. The nutritional status was classified by the BMI, determined by the ratio between BM and the squared height, considering the following cutoff points: <18.5 kg/m^2 as low weight; from 18.5 to 24.9 kg/m^2 as normal weight; from 25 to 29.9 kg/m^2 as overweight; from 30 to 34.9 kg/m^2 as obese degree I, from 35 to 39.9 kg/m^2 as obese degree II; and >40 kg/m^2 as obese degree III[0]. All the anthropometric measurements were performed by the same trained evaluator and followed the contents of the Anthropometric Standardization Reference Manual[21], aiming to settle the possible oscillation among the results.

Blood was collected in the morning after 12 hours of fasting, at the biochemical lab of Juiz de Fora General Hospital. The blood sample was collected the day before the anthropometric measurements. The serum concentrations of HDL-C, TG and glucose were analyzed against established values for the military population by Silva *et al.*[17], considered as reference values for the classification of the results.

The sample was characterized through descriptive statistics. The data was presented as mean ± standard deviation and percent frequency. The normal distribution was investigated through the Kolmogorov-Smirnov test. The correlations between the biochemical markers and the anthropometric indices were evaluated through Pearson correlation. Values of $p \leq 0.05$ were considered significant. The analyses were performed with the aid of Statistics 7.0, 2009.

3 RESULTS

The studied population presented an average age of 23 ± 9 years (Table 1).On average, the individuals presented BMI compatible with the normal weight, however almost 50% presented some degree of overweight. Although the average WC and WHR were within the normality range (>90 cm and >0.95, respectively), a prevalence of almost 25% of individuals with WC ≥ 90 cm and 7% of individuals with WHR > 0.95 could be observed (Table 2). In general, biochemical parameters' averages were within the proposed reference ranges, with few individuals presenting altered values (Table 1). Positive and significant associations between the anthropometric measurements and glucose and TG concentrations were observed (Figure 1). Additionally, the HDL-C concentrations were negatively associated only with WC (Figure 2).

4 DISCUSSION

NCD increase is notorious in different populations and age groups due to the social and economic changes that took place in the last decades, such as increasing industrialization, technologic innovations, increase in life expectancy, change of dietary habits and reduction of caloric expenditure. As a result of these factors, the prevalence of overweight and obesity increases considerably, just like diabetes, arterial hypertension, cardiovascular diseases and several types of cancer, which bring changes in the populations' morbidity and mortality distribution patterns[22].

The militaries under study presented an average BMI of 24.6 kg/m^2, compatible with normal weight, although almost 50% of them showed some degree of overweight according to the BMI. A similar result was obtained by Neves[18], who observed prevalence of overweight in more than 50% of the militaries in his study. It is recognized in the literature that one of the draw backs of the BMI is to consider the body mass as a whole, not distinguishing fat mass and lean mass. Taking into account that 85% and 97% of the militaries showed WC and WHR, respectively, within the values considered adequate (WC < 90 cm and WHR < 0.95), it is possible that the high prevalence of militaries classified as overweight according to the BMI can be related to the higher amount of muscle mass of the subjects evaluated, considering their profession's singularities. In the present study, 7.5% of them presented BMI > 30 kg/m^2, being classified as obese. However, the prevalence of obesity was lower in the military population when compared to the prevalence of obesity in the Brazilian population (17.5%)[23].

In relation to the group studied, the average values of TG, HDL-C and glycaemia were found below the cutoffs established in the study on militaries" NCD. Thus, we may suggest that the studied population presented low risk of developing metabolic symdrom[18].

A negative and significant correlation was observed between HDL-C and WC, as also reported by Lee *et al.* in 2006[24]. Still in this research, positive associations between glycaemia, BM, BMI and WC were found, just as in Oliveira[22], who also involved the military population. Positive correlations were also observed between TG and BM, BMI, WC, WHR, also found in other studies[22,25].

Divergences were observed between the anthropometric measurements and the association with serum biochemical markers of militaries in different age ranges. This suggests a different behavior concerning the increase in body mass and alterations in glycaemia and plasmatic lipids in militaries with advanced ages. Although fragile, BMI and, mostly, WC were the variables that presented most associations with biochemical markers. Such finding can state that BMI and WC are the most important variables when assessing the metabolic risk behavior in militaries.

The weak correlation between glycaemia and the anthropometric parameters, as well as the inverse correlation between HDL-C and WC, point out that both indirect instruments are independent predictors of NCDs. One thing that does not occur with the variable height, for it does not correlate significantly with any other variable. It is suggested that a monitoring of the militaries' dietary habits should be performed, along with promoting healthier practices aiming to reduce the prevalence of obesity within our population.

Table 1: General characteristics, anthropometry and biochemical profile of the studied individuals

Variable	Mean ± SD	Min – Max
Age	23 ± 9	19 – 49
Height(m)	173 ± 5.92	1.56 – 1.93
Body mass (kg)	75.3 ± 11.3	47 – 114
BMI (kg/m^2)	24.7 ± 3.2	17.4 – 36.6
WC (cm)	81 ± 8	64 – 108
WHR	0.85 ± 0.07	0.74 – 1.51
HC (cm)	96 ± 6	48 – 122
HDL-C (mg/dl)	57 ± 10	30 – 96
TG (mg/dl)	72 ± 55	20 – 459
Glucose (mg/dl)	84 ± 10	25 – 117

BMI = Body Mass Index, WC = Waist Circumference, WHR = Waist-Hip Ratio, HC = Hip Circumference, HDL-C = High Density Lipoprotein, TG = Triglycerides.

Table 2: Percent values of Anthropometric Variables

Variable	Index	Quantity	%
BMI	Low weight	3	1.1
	Normal weight	137	52.5
	Overweight	102	38.9
	Obesity I	18	6.8
	Obesity II	2	0.7
	Extremely Obese	0	0
WC	< 90 cm	225	85
	> 90 cm	37	25
WHR	> 0.95	255	97.3
	< 0.95	7	3.7
BMI = Body Mass Index (kg/m²), WC = Waist Circumference (cm), WHR = Waist-Hip Ratio.			

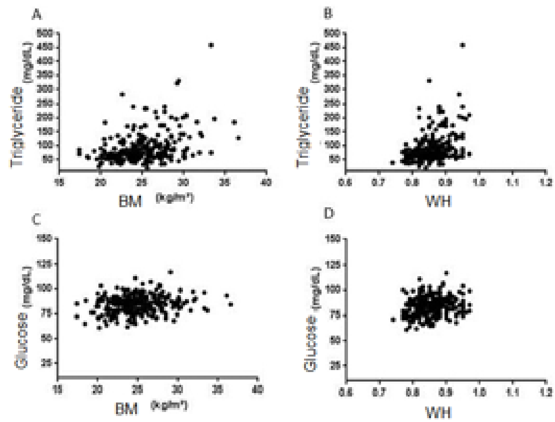

Figure 1: Associations between BMI and serum concentrations of (A) Triglycerides(r = 0.40) and (C) Glucose (r = 0.20); between WHR and serum concentrations of (B) Triglycerides (r = 0.48) and (D) Glucose (r = 0.15); $p < 0.05$ obtained through Pearson correlation.

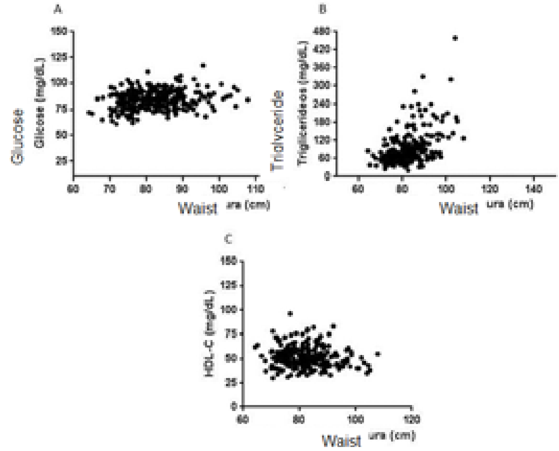

Figure 2: Associations between waist circumference and serum concentrations of (A) Glucose (r = 0.24), (B) Triglycerides (r = 0.50) and (C) HDL-C (r = - 0.13); $p < 0.05$ obtained through Pearson correlation.

REFERENCES

1. Rosa SE, Neves EB. Prevalência de desordens psicológicas e processo de seleção dos militares brasileiros para as forças de manutenção da paz no Timor Leste. Revista Giro do Horizonte. 2009; v. 2, p. 20. | | 2. Malta DC, Moura EC, Castro AMd, Cruz DKA, Morais Neto OLd, Monteiro CA. Padrão de atividade física em adultos brasileiros: resultados de um inquérito por entrevistas telefônicas, 2006. Epidemiologia e Serviços de Saúde. 2009;18:7-16. | | 3. Bicalho PG, Hallal PC, Gazzinelli A, Knuth AG, Velásquez-Meléndez G. Atividade física e fatores associados em adultos de área rural em Minas Gerais, Brasil. Revista de Saúde Pública. 2010; 44(5):884-93. | | 4. Global strategy on diet, physical activity and health. Fifty-seventh world health assembly [monograph | on the Internet] [WHA57.17]. Available from http: //www.who.int/gb/ebwha/pdf_files/WHA57/A57_R17- en.pdf | | 5. Brum PC, Forjaz CLM, Tinucci T, Negrão CE. Adaptações agudas e crônicas do exercício físico no sistema cardiovascular. Rev Paul Educ Fís. 2004;18:21-31. | 6. Nunes A, Rios ACS, Cunha GA, Barretto ACP, Negrão CE. Efeitos de um programa de exercício físico não supervisionado e acompanhado a distância, via Internet, sobre a pressão arterial e composição corporal em indivíduos normotensos e pré-hipertensos. Arq Bras Cardiol. 2006;86(4):289-96. | | 7. Meex RCR, Schrauwen-Hinderling VB, Moonen-Kornips E, Schaart G, Mensink M, Phielix E, et al. Restoration of muscle mitochondrial function and metabolic flexibility in type 2 diabetes by exercise training is paralleled by increased myocellular fat storage and improved insulin sensitivity. Diabetes. 2010;59(3):572. | | 8. Teodoro BG, Natali AJ, Fernandes SAT, Peluzio MdCG. A influência da intensidade do exercício físico aeróbio no processo aterosclerótico. Revista Brasileira de Medicina do Esporte. 2010;16:382-7. | | 9. Dee Onis M, Habicht JP. Anthropometric reference data for international use: recommendations from a World Health Organization Expert Committee. The American journal of clinical nutrition. 1996;64(4):650. | | 10. Rech CR, Petroski EL, Silva RCR, Silva JCN. Indicadores antropométricos de excesso de gordura corporal em mulheres. Revista Brasileira de Medicina do Esporte. 2006;12(3):119-24. | | 11. Monteiro A, Fernandes Filho J. Análise da composição corporal: uma revisão de métodos. Revista Brasileira de Cineantropometria e Desempenho Humano. 2002;4(1). | | 12. Rech CR, et al. Indicadores antropométricos de excesso de gordura corporal em mulheres. Revista Brasileira de Medicina do Esporte. 2006; 12(3): p. 119-124. | | 13.Martinez EC. Fatores de Risco de Doença Aterosclerótica Coronariana em Militares da Ativa do Exército Brasileiro com idade superior a 40 anos. 2004. 217 (Mestrado). Centro de Estudos da Saúde do Trabalhador e Ecologia Humana, Escola Nacional de Saúde Pública, Rio de Janeiro. | | 14. Martinez EC, Fortes MSR, Anjos LA. Influência do estado nutricional e do VO2max nos níveis de adiponectina em homens acima de 35 anos. Arq. Bras. Cardiol. [online]. 2011; vol.96, n.6, p. 471-476. | | 15. Claro LV; Zarzecki M, Almeida LC, Kirsten V R. Análise crítica da aferição da gordura corporal de militares por dois métodos de avaliação antropométrica. Anais do Salão Internacional de Ensino, Pesquisa e Extensão.2012;v. 4, n.3. | | 16. Mietus-Snyder M, Krauss RM. Lipid metabolism in children and adolescents: Impact on vascular biology. J Clin Lipidol. 2008; 2 (3), p.127–137. | | 17. Silva, JMC. Prevalência e fatores associados à síndrome metabólica em militares do Exército Brasileiro em 2001: um estudo transversal [dissertação de mestrado].ENSP.2011. | | 18. Neves EB. Prevalência de sobrepeso e obesidade em militares do Exército Brasileiro: associação com hipertensão arterial. Cienc. Saúde coletiva. Rio de Janeiro.2008; v.13, n.5. | | 19. Pereira RA, Sichieri R, Marins VMR. Razão cintura/ quadril como preditor de hipertensão arterial.Cad Saúde Pública 1999; 15:333-44. | | 20. Associação Brasileira para o Estudo da Obesidade e da Síndrome Metabólica.Diretrizes brasileiras de obesidade; 2010. Disponível em:http://www.abeso.org.br/pdf/diretrizes_brasileiras_obesidade_2009_2010_1.pdf | | 21.Lohman TG; Roche AF; Martorell R, editors. Anthropometric Standardizations reference Manual. Champaing,IL: human Kinetics Books; 1998. | | 22. Oliveira MAM, Fagundes RLM, Moreira EAM, Trindade EBSM; Carvalho T. Relação de Indicadores Antropométricos com fatores de risco de doença cardiovascular; 2009.Arq. Bras. Cardiol; v.94, m.4, p.478-485. | | 23. Malta DC, et al. Trends in prevalence of overweight and obesity in adults in 26 Brazilian state capitals and the Federal District from 2006 to 2012. 2014.Rev Bras Epidemiol. p. 267-76. | | 24. Lee S, Bacha F, Arlanian S A. Waist circumference, blood pressure, and lipid components of the metabolic syndrome. J Pediatr. 2006;149(6):809-816.