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Original Article

CORRELATION OF NECK CIRCUMFERENCE WITH CARDIOVASCULAR RISK FACTORS

CORRELAÇÃO DA CIRCUNFERÊNCIA DO PESCOÇO COM FATORES DE RISCO CARDIOVASCULAR

CORRELACIÓN DE LA CIRCUNFERENCIA DEL CUELLO CON LOS FACTORES DE RIESGO CARDIOVASCULAR

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Objective: to investigate the correlation of neck circumference with other anthropometric parameters, with blood pressure, capillary glycemia and with modifiable and non-modifiable risk factors present. Method: descriptive cross-sectional study, with patients from a polyclinic, by applying a semi-structured questionnaire. Neck circumference was measured considering the natural position of the head, between cervical midpoint and anterior neck. Cardiovascular risk was determined by measurement of abdominal circumference and modifiable or non-modifiable risk factors. Results: positive correlations were found between neck circumference and muscle mass index, abdominal circumference, systolic blood pressure, capillary glycemia and age, besides identifying high cardiovascular risk in most male participants, with a tendency to be higher in individuals with hypertension, diabetes and dyslipidemias. Conclusion: neck circumference was significantly correlated with body mass index, abdominal circumference, systolic pressure, capillary glycemia and age.

Descriptors: Cardiovascular Diseases. Obesity. Anthropometry. Neck. Risk Factors.

Objetivo: investigar a correlação da circunferência do pescoço com outros parâmetros antropométricos, com a pressão arterial, com a glicemia capilar e com fatores de risco modificáveis e não modificáveis presentes. Método: estudo transversal descritivo, com pacientes de uma policlínica, mediante aplicação de questionário semiestruturado. Circunferência do pescoço aferida considerando posição natural da cabeça, entre ponto médio cervical e do pescoço anterior. Risco cardiovascular determinado pela medida da circunferência abdominal e pelos fatores de risco modificáveis ou não modificáveis. Resultados: encontradas correlações positivas entre circunferência do pescoço e índice de massa muscular, circunferência abdominal, pressão arterial sistólica, glicemia capilar e idade, além de ter sido identificado alto risco cardiovascular na maioria dos participantes do sexo masculino, com tendência de medida ser maior em indivíduos com hipertensão, diabetes e dislipidemias. Conclusão: circunferência do pescoço correlacionou-se significativamente com índice de massa corpórea, circunferência abdominal, pressão sistólica, glicemia capilar e idade.

Descritores: Doenças Cardiovasculares. Obesidade. Antropometria. Pescoço. Fatores de Risco.

Objetivo: investigar la correlación de la circunferencia del cuello con otros parámetros antropométricos, con la presión arterial, la glucemia capilar y con los factores de riesgo modificables y no modificables presentes. Método:

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estudio descriptivo transversal, con pacientes de una policlínica, mediante la aplicación de un cuestionario semiestructurado. Circunferencia del cuello medida considerando la posición natural de la cabeza, entre el punto medio cervical y el cuello anterior. Riesgo cardiovascular determinado por la medición de la circunferencia abdominal y factores de riesgo modificables o no modificables. Resultados: se encontraron correlaciones positivas entre la circunferencia del cuello y el índice de masa muscular, la circunferencia abdominal, la presión arterial sistólica, la glucemia capilar y la edad, además de haber sido identificado un alto riesgo cardiovascular en la mayoría de los participantes masculinos, con tendencia a ser mayor en individuos con hipertensión, diabetes y dislipidemias. Conclusión: la circunferencia del cuello se correlacionó significativamente con el índice de masa corporal, la circunferencia abdominal, la presión sistólica, la glucemia capilar y la edad.

Descriptores: Enfermedades Cardiovasculares. Obesidad. Antropometría. Cuello. Factores de Riesgo.

Introduction

The modern world and lifestyle changes, such as the gradual elimination of physically demanding tasks, can contribute to increased body adiposity and the establishment of chronic non-communicable diseases (CNCDs). Characterized by a multiple etiology, CNCDs share several modifiable risk factors, such as sedentary lifestyle, obesity, unhealthy diets, smoking and harmful alcohol use[1].

Of the 17 million global premature deaths from CNCDs, 37% are caused by cardiovascular diseases (CVD), including the clinical manifestations of athertotic diseases[2]. In Brazil, CVD represent 27.7% of deaths and the highest public expenditures in hospitalizations, with an increasing prevalence among the adult and elderly population[3-4].

Several discoveries have transformed the view of health professionals about adipose tissue, from a simple fat storage site to an active endocrine organ[5]. Excess fat and body distribution are related to cardiometabolic complications that confer important cardiovascular risk (CVR) to individuals, such as insulin resistance, hypertension and dyslipidemias. In this context, body mass index (BMI) is one of the anthropometric parameters most used for nutritional status assessment, despite its limitations[6]. The available imaging tests accurately assess body adiposity, but its performance is also limited and costly. Therefore, it is necessary to use simple and low-cost methods that indicate excess fat and cardiovascular risks, such as abdominal circumference (AC), waist-hip ratio and, more recently, neck circumference (NC)[7-8].

In the past thirty years, since the first use of NC in sleep apnea[7], studies have been associating this measure with adiposity in the upper body, the accumulation of fat in the walls of the carotid arteries and the components of metabolic syndrome in populations of various age groups, especially because it is not influenced by abdominal distension or respiratory movements[5,9-10].

Among the nurses' attributions in the prevention of CVD, there stands out the search for evidence-based practices for cardiovascular evaluation, since this professional is responsible for planning interventions and involving the community and the team in preventive actions, especially in the promotion of physical activity for cardiorespiratory strengthening and weight control and healthy eating. In view of the above, the present study aimed to investigate the correlation of NC with other anthropometric parameters, with blood pressure (BP), with capillary glycemia and with modifiable and non-modifiable risk factors present.

Method

This is a descriptive cross-sectional study, conducted in the polyclinic of a university center located in the municipality of Registro, state of São Paulo, Brazil, between October 2020 and January 2021.

According to the National Registry of Health Establishments (CNES, in Portuguese)[11], the place of study is inserted in the public health network. It offers the local and regional

community outpatient care provided by multidisciplinary health teams composed of students and professors from the university center.

Initially, a survey of the medical records was carried out. It was identified that, of the 974 medical records recorded during the study period, 91 were active and met the inclusion criteria. The ideal sample size was calculated, considering an interval of 95% and a significance level of 5%, which resulted in the required number of 74 participants.

The convenience sample consisted of patients who were waiting for consultations and procedures in related areas, being, at first, verbally invited to participate in the research by the researchers, clarifying the objectives of the study. Individuals of both sexes, aged between 20 and 79 years and who agreed to participate in the study were included. All signed the Informed Consent Form. Those who were unable to be measured and weighed were excluded; tumors and/or other anatomical abnormalities and/or deformities of the neck; coronary heart disease; pregnancy; liver diseases or other conditions that interfere with abdominal volume and circumference.

A semi-structured questionnaire to obtain socioeconomic, clinical and anthropometric data was applied to all participants. Gender, age, skin color, education, marital status, monthly income, level of physical activity, smoking, family and personal history of comorbidities and medications in use were the variables investigated. In the clinical and anthropometric evaluation, BP, capillary glycemia, weight, height, AC and NC were measured.

BP was measured by the oscillometric mode by a validated digital device and cuff suitable for arm circumference in a participant at rest for at least 3 minutes, sitting, with the arm resting leveled at the height of the heart and palm facing upwards. The reference values and other criteria for BP evaluation in the office, recommended by the Brazilian Society of Cardiology, were adopted[12].

Capillary glycemia was performed in all participants regardless of fasting, and the blood sample was obtained by puncture of the pulp of the middle finger and, after, inserted in disposable tape coupled to the glucometer. Random blood glucose was considered as a diabetes criterion when ≥200 mg/dl[13].

Body weight was measured in kilograms on an electronic scale of 200 kg capacity and graduation in 100 g, located in a flat place, with the participant in orthostatic position in the center of the scale, barefoot and wearing light clothing. The height was measured by a two-meter-long stadiometer attached to the scale, with the participant with his back to the stem, touching the back of the head, shoulders, buttocks, calves and heels[6].

BMI was calculated based on weight (kg) divided by height (m) squared. The value was classified as (kg/m^2): low weight (<18.5), normal weight (18.5-24.9), overweight (25-29), class I obesity (30-34.9), class II obesity (35-39.9) and class III obesity (>40)[6].

The AC was measured in centimeters, by two-meter long inelastic measuring tape, with the participant in orthostatic position, arms abducted in 45°, abdomen free of clothes and relaxed during expiration, at the midpoint between the iliac crest and the costal ridge[8]. The NC was measured considering the natural position of the head, between the midpoint of the cervical spine and the anterior neck[8]. In men with laryngeal prominence, it was measured below[9]. NC <37 cm for men and <34 cm for women were the reference values considered[9].

The increased CVR was determined by AC≥94 cm for men and ≥80 cm for women; CVR was substantially increased by AC≥102 cm for men and ≥88 cm for women[8]. In addition to AC, CVR was also determined by risk factors found during clinical evaluation (such as BP, gender, age, smoking, etc.) and/or presence of CVD that immediately set up high risk (diabetes mellitus, previous acute myocardial infarction, previous stroke, etc.)[14].

The data were tabulated in Microsoft Excel 2010 and statistical analyses were conducted in software R version 4.0.0, expressed by absolute frequency, percentage, mean and standard

deviation. Cash diagrams were created in order to observe the graphical representation of the distribution and behavior of socioeconomic data and risk factors on the quantitative dependent variable "neck circumference", represented by measurements of three quartiles, a method already seen in another study on NC[15]. Spearman's correlation was used to test NC with other quantitative variables. The level of significance adopted was 5%.

The study was approved by the Human Research Ethics Committee of the Union of Service, Teaching and Research Institutions (UNISEPE, in Portuguese) under Opinion n. 4.446.331.

Results

The final sample consisted of 74 participants, with a mean age of 43.0±17.0 years, predominantly female, white, married, with complete high school education and monthly income of one to two minimum wages. Regarding the analysis of risk factors, a high prevalence of sedentary and family history of hypertension and diabetes was observed. The presence of hypertension, diabetes and dyslipidemias was below 30%. Among these, most of them used some medication for such morbidities. Smoking was reported by a low percentage of participants (Table 1).

Table 1 – Socioeconomic characteristics and risk factors of study participants. Registro, São Paulo, Brazil – 2020. (N=74) (continued)

Variable	Frequency (n)	Percentage (%)
Gender		
Female	47	63.5
Male	27	36.5
Skin color		
White	37	50.0
Brown	30	40.5
Black	6	8.1
Yellow	1	1.4
Marital status		
Married	33	44.5
Single	23	31.1
Stable union	9	12.2
Divorced	7	9.5
Widowed	2	2.7
Education		
Complete high school	34	45.9
Complete college	22	29.7
Complete primary education	6	8.1
Incomplete primary education	6	8.1
Incomplete high school	5	6.8
Illiterate	1	1.4
Monthly income		
1 ≤2 minimum wages	35	47.3
>2 ≤4 minimum wages	24	32.4
>4 ≤5 minimum wages	10	13.5
>5 minimum wages	5	6.8
Personal history		
Hypertension	21	28.4
Diabetes	10	13.5
Dyslipidemia	12	16.2
Smoking	5	6.8
Sedentary life style	30	40.5

Table 1 – Socioeconomic characteristics and risk factors of study participants. Registro, São Paulo, Brazil – 2020. (N=74)

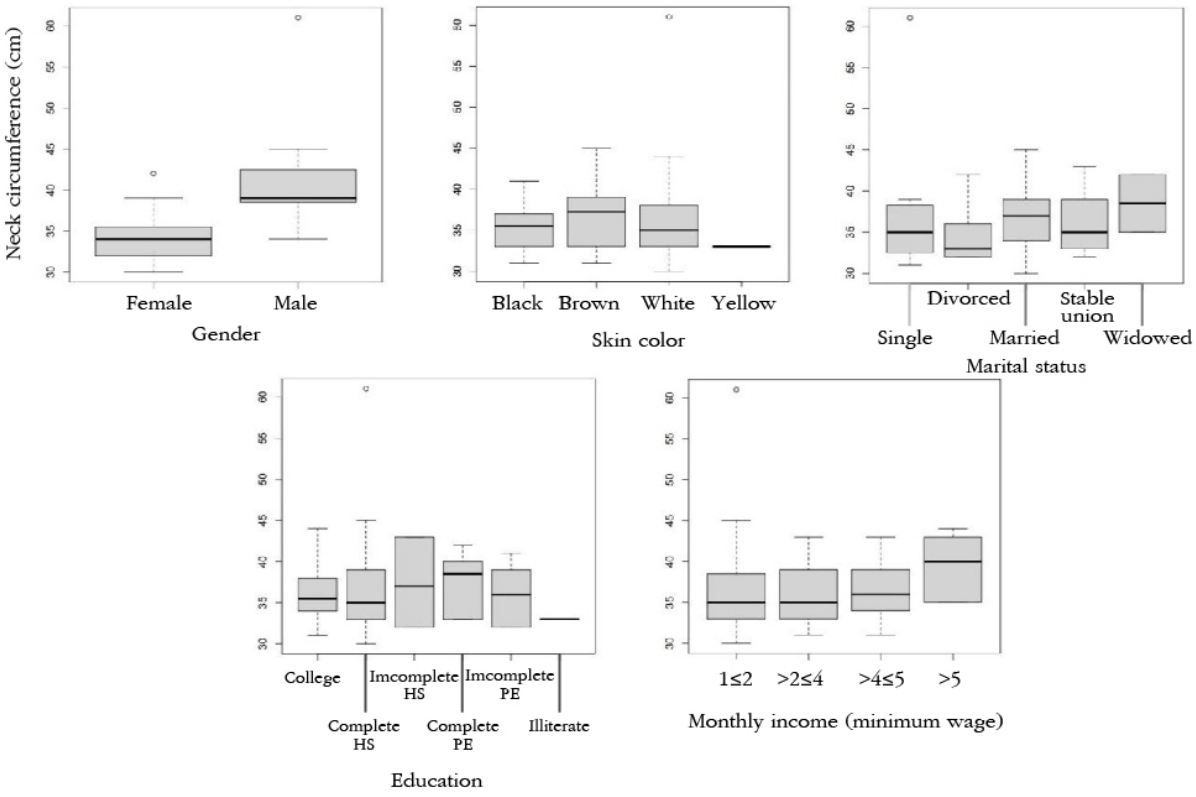
(conclusion)

Variable	Frequency (n)	Percentage (%)
Family history		
Hypertension	59	79.7
Diabetes	41	55.4
Cerebrovascular accident	20	27.0
Myocardial infarction	19	25.7

Source: Created by the authors.

The socioeconomic cash diagrams in Figure 1 show that the median NC value was higher in males, with the tendency of the data concetrating values above 37 cm, due to the asymmetric distribution of the case of this sex, higher in the 3rd quartile. It is noteworthy the variation of the median NC between skin color, level of education and marital status, with the highest values corresponding, respectively, to brown color, complete primary education and widowed, and the lowest values, yellow, without literacy and divorced. It is emphasized that there was only one illiterate participant and one yellow participant.

Figure 1 – Neck circumference and socioeconomic data cash diagrams

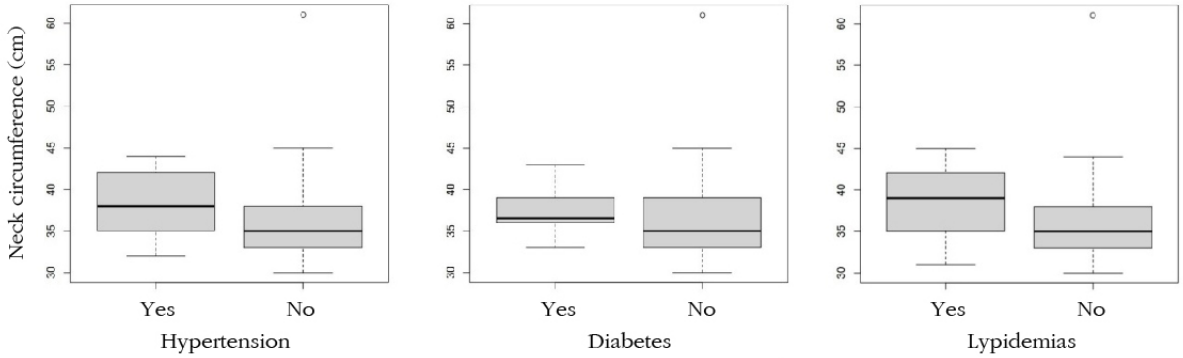


Source: Created by the authors.

PE = Primary education. HS = High school.

Regarding personal history, the cash diagrams in Figure 2 indicate a great tendency for PC to be increased in participants with hypertension, diabetes and dyslipidemias. There were no significant variations in PC with physical activity, smoking and family history of diseases.

Figure 2 – Neck circumference chest diagrams and risk factors



Source: Created by the authors.

At the time of data collection, 16.2% (n=12) of the participants were hypertensive, as well as 5.4% (n=4) had random blood glucose above 200 mg/dl. Of these, 50% (n=6) already used antihypertensive drugs and 100% (n=4) used antidiabetics (data not expressed in table).

According to BMI, there was a higher frequency of participants with normal weight (31.0%) and overweight (29.7%), with an average of 28.0±6.0 kg/m^2 (Table 2). In relation to AC, substantially increased CVR was mainly represented by female participants, with 35.1% of women with AC above 88 cm and 10.8% of men with AC above 102 cm. When analyzing NC, 81.5% of men presented NC above 37 cm, and 44.7% of women, NC above 34 cm (data not expressed in table).

Table 2 – Clinical and anthropometric characteristics of the total sample. Registro, São Paulo, Brazil – 2020. (N=74)

Variable	Frequency (n)	Percentage (%)	Mean±SD
Clinical			
Systolic blood pressure (mmHg)	–	–	124±17.8
Diastolic blood pressure (mmHg)	–	–	73±11.9
Capillary glycemia (mg/dL)	–	–	114±50.1
Anthropometric			
Muscle mass index (kg/m2)	–	–	28.0±6.0
Low weight	3	4.1	–
Normal weight	23	31.0	–
Overweight	22	29.7	–
Obesity degree I	19	25.7	–
Obesity degree II	4	5.4	–
Obesity degree III	3	4.1	–
Abdominal Circumference (cm)	–	–	90.9±15.0
Cardiovascular risk increased in men	7	9.4	–
Cardiovascular risk substantially increased in men	8	10.8	–
Cardiovascular risk increased in women	6	8.1	–
Cardiovascular risk substantially increased in women	26	35.1	–
Without cardiovascular risk	27	36.4	–
Circumference of the neck (cm)	–	–	36.4±4.7
Normal	31	41.8	–
Increased	43	58.1	–

Source: Created by the authors.

Note: Conventional signal used:
- Numerical data equal to zero not resulting from rounding up.

In the analysis of correlation of NC with other anthropometric parameters and clinical data, as described in Table 3, positively significant correlations were identified between NC and BMI (p<0.0001), AC (p<0.0001) and systolic BP (p=0.0003) and moderate correlations between NC, capillary glycemia (p=0.0259) and age (p=0.0375). No significant correlation was identified between NC and diastolic BP (p=0.0887).

Table 3 – Correlation of neck circumference with study variables. Registro, São Paulo, Brazil – 2020. (N=74)

Variables	r	p value*
Age	0.24	0.0375
Muscle mass index	0.44	<0.0001
Abdominal circumference	0.68	<0.0001
Systolic blood pressure	0.41	0.0003
Diastolic blood pressure	0.19	0.0887
Glycemia	0.25	0.0259

Source: Created by the authors.

* Spearman's correlation.

Discussion

In this study, whose objective was to investigate the correlation of NC with cardiovascular risk factors, NC was shown to be compatible with high CVR in most male participants, probably due to the pattern of men in presenting increased adipose tissue in the upper body, while women present in the gluteal region[16]. Although the percentage of increased NC was lower among female participants, this finding is still important, as it alerts us to the increasing CVR in this population, despite the male predominance, because 35.1% of the women evaluated had AC above 88 cm.

Considering that most participants reported monthly income of one to two minimum wages, the results of the 2019 Continuous National Household Sample Survey (PNAD) show that 23.86% of Brazilians have an income of up to 2 minimum wages, with an intense income inequality between 2016 and 2018, regardless of the trend of reducing inequality until 2015[17].

A significant correlation was identified between NC and BMI and AC, two other anthropometric parameters included in the study, to indicate excess and distribution of body fat, and also between NC, SBP and random glycemia, two of the components of metabolic syndrome. Such correlations are found in other studies, strengthening the use of NC to complement and even lead to the diagnosis of obesity; a value above normal may increase the risk for hypertension and diabetes[8,10,15].

To verify the distribution of body fat, the waist-hip ratio is another anthropometric option used, but hip circumference presents greater measurement errors because it is strongly associated with the structure of the pelvis and suffers variability of racial characteristics[18]. Currently, studies indicate that AC alone is safer to determine central obesity and to diagnose metabolic syndrome, as it is a simpler option with good correlation with BMI and double-energy radiological absorption[19-20].

As presented, there was an important frequency of overweight and obese participants in the present study, which is consistent with a study that evaluated the prevalence of obesity among Brazilian adults, with an increase in the proportion of obese patients from 12.5% to 17% between 2008 and 2015[21]. A good portion of the sample reported hypertension, diabetes and dyslipidemias with the tendency of NC to be higher in this portion, emphasizing that such cardiometabolic outcomes increase consistently with weight gain, as concluded a study on adipose tissue of the neck[6].

Sedentary lifestyle and smoking were two modifiable risk factors present among the evaluated participants. Although there is no relationship with NC in this study, it is known that tobacco kills over half of the people who use it regularly and is associated with the risk of cancer and coronary artery disease, while the decline in energy expenditure promoted by this new world scenario favors the establishment of CVD[22]. The results of a research conducted in 2013 also show increased NC in individuals with high consumption of lipids, cholesterol and saturated fat, in which unhealthy eating may be a marker of CVR[9].

Regarding non-modifiable risk factors, a relationship between NC and skin color was observed, since the measurement was higher in brown participants, who represent 46.8% of Brazilians, according to data from 2019 Continuous PNAD, similarly to our sample[17].

The results obtained in the present study indicate that NC is of easy measurement, low cost, reliable because it is significantly related to BMI and AC, a predictor of cardiometabolic alterations and not subject to respiratory movements, food intake and constraints for the examinee, consistent with the results of other Brazilian studies on the subject[9,10,15].

In addition to pharmacological and/or surgical treatment for CVD, it is essential that health professionals are able to develop screening and health prevention strategies, encouraging non-pharmacological treatment to increase people's adherence, because half of the hypertensive participants, at the time of data collection, did not follow treatments, and 100% of the participants who used antidiabetics had hyperglycemia, for example. Thus, it is recommended that the multidisciplinary team know how to distinguish the risk increased by central obesity from the distribution of uniform and peripheral body fat. Variations in fat distribution according to ethnicity, biotype, age and gender should also be considered.

Some limitations of the present study involve the cross-sectional design, with data collection performed in a single moment with intentional sample, lack of correlations with laboratory, imaging or anthropometric tests of higher cost, and lack of studies on the subject. Despite the limitations, it was possible to encourage the use of NC as a parameter for evaluating CVR and reflect the context of the region where the study was developed, where research is still incipient.

Conclusion

NC was significantly correlated with BMI, AC, systolic BP, capillary glycemia and age, and was also correlated with high CVR in most male participants, with the tendency of the measurement to be higher in individuals with hypertension, diabetes and dyslipidemias, acting as an important parameter for cardiovascular risk assessment.

However, more studies on neck circumference should be conducted, involving Brazilian patterns of behavior, thus contributing, like the present study, to evidence-based nursing practice and to the standardization of its reference values and its use in clinical practice, still unknown by many health professionals.

Collaborations:

1 – conception, design, analysis and interpretation of data: Natalia Castaman dos Santos;

2 – writing of the article and relevant critical review of the intellectual content: Natalia Castaman dos Santos and Gabriela Fulan e Silva;

3 – final approval of the version to be published: Gabriela Fulan e Silva.

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References

1. World Health Organization. Global health estimates 2016: disease burden by cause, age, sex, by country and by region, 2000-2016 [Internet]. Geneva; 2018 [cited 2021 Jan 14]. Available from: https://www.who.int/healthinfo/global_burden_disease/estimates/en/index1.html

2. Organização Pan-Americana de Saúde. Doenças cardiovasculares [Internet]. Brasília (DF); 2017 [cited 2021 Jan 14]. Available from: https://www.paho.org/bra/index.php?option=com_content&view=article&id=5253:doencas-cardiovasculares&Itemid=1096

3. Brasil. Ministério da Saúde. Informações de Saúde. Estatísticas Vitais [Internet]. Brasília (DF); 2016 [cited 2021 Jan 14]. Available from: http://www2.datasus.gov.br/DATASUS/index.php?area=0205

4. Lentsck MH, Mathias TAF. Internações por doenças cardiovasculares e a cobertura da estratégia saúde da família. Rev Latino-Am Enfermagem. 2015;23(4):611-9. DOI: 10.1590/0104-1169.0078.2595

5. Küçük U, Küçük HO, Cüce F, Balta S. Relação entre circunferência do pescoço e espessura da gordura epicárdica em uma população de homens saudáveis. Arq Bras Cardiol. 2016;107(3):266-70. DOI: 10.5935/abc.20160112

6. Katz I, Stradling J, Sljutsky AS, Zamel N, Hoffstein V. Do patients with obstructive sleep apnea have thick necks? Am Rev Respir Dis. 1990;141(5 Pt 1):1228-31. DOI: 10.1164/ajrccm/141.5_Pt_1.1228

7. Ben-Noun L, Sohar E, Laor A. Neck circumference as a simple screening measure for identifying overweight and obese patients. Obes Res. 2001;9(8):470-7. DOI: 10.1038/oby.2001.61

8. World Health Organization. Obesity: preventing and managing the global epidemic [Internet]. Geneva; 2000 [cited 2021 Jan 14]. Available from: https://www.who.int/nutrition/publications/obesity/WHO_TRS_894/en/

9. Frizon V, Boscaini C. Circunferência do pescoço, fatores de risco para doenças cardiovasculares e consumo alimentar [Internet]. Rev Bras Cardiol. 2013 [cited 2021 Jan 14];26(6):426-34. Available from: http://www.onlineijcs.org/sumario/26/26-6/artigo1.asp

10. Silva CC, Zambon MP, Vasques ACJ, Rodrigues AMB, Camilo DF, Antonio MARGM, et al. Circunferência do pescoço como um novo indicador antropométrico para predição de resistência à insulina e componentes da síndrome metabólica em adolescentes: Brazilian Metabolic Syndrome Study. Rev Paul Pediatr. 2014;32(2):221-9. DOI: 10.1590/0103-0582201432210713

11. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. DATASUS. Estabelecimento de Saúde. Cadastro Nacional de Estabelecimentos de Saúde. Instituto Educacional de Serviço, Ensino e Pesquisa [Internet]. Brasília (DF); 2021 [cited 2021 Jan 14]. Available from: http://cnes2.datasus.gov.br/Exibe_Ficha_Estabelecimento.asp?VCo_Unidade=3542607959850&VEstado=35&VCodMunicipio=354260

12. Sociedade Brasileira de Cardiologia. 7ª Diretriz Brasileira de Hipertensão Arterial. Arq Bras Cardiol. 2016 [cited 2021 Jul 7];107(Supl 3):1-83. Available from: http://publicacoes.cardiol.br/2014/diretrizes/2016/05_HIPERTENSAO_ARTERIAL.pdf

13. Sociedade Brasileira de Diabetes. Diretrizes da Sociedade Brasileira de Diabetes 2019-2020 [Internet]. São Paulo: Clannad; 2019 [cited 2021 Jul 7]. Available from: https://www.diabetes.org.br/profissionais/images/DIRETRIZES-COMPLETA-2019-2020.pdf

14. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Atenção Básica. Rastreamento [Internet]. Brasília (DF); 2010 [cited 2021 Jan 14]. Available from: https://bvsms.saude.gov.br/bvs/publicacoes/caderno_atencao_primaria_29_rastreamento.pdf

15. Pimenta IL, Sanches RC, Pereira JPR, Houri BF, Machado ELG, Machado FSG. Medidas das circunferências abdominal e cervical para mensurar riscos cardiovasculares [Internet]. Rev Med Minas Gerais; 2014 [cited 2021 Jan 14];24(Supl 9):16-9. Available from: http://rmmg.org/artigo/detalhes/1670#:~:text=Para%20circunfer%C3%AAncia%20cervical%2C%20valores%20maiores,para%20a%20hipertens%C3%A3o%20arterial%20sist%C3%AAmica

16. Pinho CPS, Diniz AS, Arruda IKG, Batista Filho M, Coelho PC, Sequeira LAS, et al. Prevalência e fatores associados à obesidade abdominal em indivíduos na faixa etária de 25 a 59 anos do Estado de Pernambuco, Brasil. Cad Saúde Pública; 2013;29(2):313-24. DOI: 10.1590/S0102-311X2013000200018

17. Instituto Brasileiro de Geografia e Estatística. Pesquisa Nacional por Amostra de Domicílios Contínua 2019 [Internet]. Rio de Janeiro; 2019 [cited 2021 Jan 14]. Available from: https://www.ibge.gov.br/estatisticas/sociais/trabalho/17270-pnad-continua.html?edicao=24437&t=sobre

18. Petribú MMV, Pinho CPS, Cabral PC, Arruda IKG, Melo AMCA. Métodos de avaliação da gordura abdominal [Internet]. Rev Bras Nutr Clin. 2012 [cited 2021 Jan 14];27(4):257-63. Available from: http://www.braspen.com.br/home/wp-content/uploads/2016/12/artigo-7-4-2014.pdf

19. Glaner MF, Pelegrini A, Nascimento TBR. Perímetro do abdômen é o melhor indicador antropométrico de riscos para doenças cardiovasculares. Rev Bras Cineantropom Desempenho Hum. 2011;13(1):1-7. DOI: 10.5007/1980-0037.2011v13n1p1

20. Taylor RW, Jones IE, Williams SM, Goulding A. Evaluation of waist circumference, waist-to-hip ratio, and conicity index as screening tools for high trunk fat mass, as measures by dual-energy by dual-energy X-ray absorptiometry, in children aged 3-19 y. Am J Clin Nutr. 2000;72(2):490-5. DOI: 10.1093/ajcn/72.2.490

21. Instituto Brasileiro de Geografia e Estatística. Pesquisa Nacional de Saúde 2013. Percepção do estado de saúde, estilos de vida e doenças crônicas [Internet]. Rio de Janeiro; 2014 [cited 2021 Jan 14]. Available from: http://www.dive.sc.gov.br/conteudos/agravos/publicacoes/PNS%202013%20Percep%C3%A7%C3%A3o%20do%20estado%20de%20sa%C3%BAde%20estilos%20de%20vida%20e%20doen%C3%A7as%20cr%C3%B4nicas.pdf

22. Drope J, Schluger NW. The tobacco atlas [Internet]. 6a ed. Georgia: American Cancer Society; 2018 [cited 2021 Jan 14]. Available from: https://tobaccoatlas.org/wp-content/uploads/2018/03/TobaccoAtlas_6thEdition_LoRes_Rev0318.pdf

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