

12 - CORRELATION BETWEEN NECK CIRCUMFERENCE AND ANTHROPOMETRIC INDICES IN STUDENTS

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INTRODUCTION

The assessment of nutritional status, according to the Brazilian Society of Pediatrics (2009) is of great importance in establishing risk situations, in the nutritional, physical and motor diagnosis, for the planning of health promotion and disease prevention actions. Its importance is recognized both in primary care, to monitor the growth and development of child and adolescent health, as well as in the early detection of nutritional and motor disorders.

Routine growth monitoring in children is wisely accepted and recommended by health professionals around the world. Weight, height, head circumference, and length records, as measured by growth charts by the child's age, for example, are recommended at all medical or nutritional consultations, especially for children under 2 years of age (PANPANICH and GARNER, 2008).

Body mass index (BMI) has been scientifically validated as a good adiposity marker and detection of overweight in children, in addition to the fact that its value at in childhood can be predictive of adult BMI (TANAKA et al., 2001).

According to Cornier et al. (2011) several epidemiological and clinical practice studies employ anthropometric measurements, such as body mass index (BMI), waist circumference (WC) and neck circumference (NC), as they are more accessible, fast, non-invasive, safe and with low instrumentation costs.

Therefore, the present study aimed to analyze the correlation between neck circumference, BMI, waist circumference and fat percentage of children enrolled in the 4th grade of elementary school at the Federal School Tenente Rêgo Barros (ETRB), in Belém-PA, Brazil.

METHODOLOGY

The present study was conducted on a sample of 100 schoolchildren, 56 boys and 44 girls, aged 8 to 10 years old, attending the 4th grade of elementary school, from the Federal School Tenente Rêgo Barros, linked to the Air Force Command, from February to March 2019, in Belém-PA, Brazil.

The research is quantitative, descriptive and cross-sectional, with a statistical confidence level of 95%. Statistical treatment will consist of a Pearson correlation between neck circumference (cm) and BMI (kg/m²), bodyweight (kg), fat percentage (BFP%) and waist circumference (cm) of schoolchildren. The predictive formula for children's fat percentage was the Deurenberg, Weststrate and Seidell protocols (1991). Data were statistically analyzed using Bioestat 5.0 Software.

The field research was conducted after a lecture given to parents and/or guardians of 4th grade students, explaining the entire research methodology. Data collection was performed every morning from 7 to 8:30 am, once a week, using as working tools a 150 Kg Welmy® mechanical anthropometric scale with a stadiometer, with an accuracy of 100g and 1mm respectively, and a Sanny® metal tape measure, with an accuracy of 1 mm.

The inclusion criterion of the children of the sample was: to be properly enrolled in the school at the time of the data collection; not using medications that change bodyweight such as corticosteroids; to stand in orthostatic posture, without external help, for anthropometric evaluation; and their parents or guardians sign the Informed Consent Form (ICF), allowing data collection for the research.

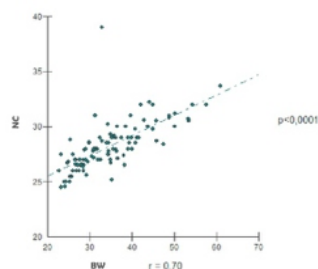
RESULTS

Table I shows the average of the anthropometric data of the students surveyed, in which the average age of 9.5 years, weight of 33.8kg, height of 136cm, BMI of 18.13kg/m², neck (NC) and waist (WC) circumferences of 27.8cm and 62cm, respectively, and average body fat percentage of 17.8% were detected. The mean percentiles (P) and weight Z-score were 66.22 and 0.77. The mean percentiles (P) and Z-score for height were 8.45 and 0.43, and BMI 64.44 and 0.72, respectively. The mean percentiles (P) and Z-scores of the above variables are within normal parameters.

Table I - Anthropometric Data of Students, ETRB, Belém-PA, 2019.

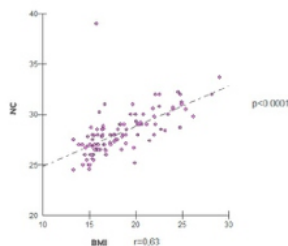
DATA	X̄	P	Z-Score
Age	9,5 ±0,6		
Weight (kg)	33,80 ±8,4	66,22	0,77
Height (cm)	136 ±5,9	58,45	0,43
BMI (kg/m ²)	18,13 ±3,5	64,44	0,72
NC (cm)	27,8 ±2,2		
WC (cm)	62 ±8,7		
% BFP	17,80 ±5,5		

Graph 1 shows Pearson's correlation between the body weight of the total sample, one hundred (100) students, and their neck circumference, with $r = 0.70$, ie, a strong correlation between these two variables, having a p -value < 0.0001 , thus a great statistical significance.



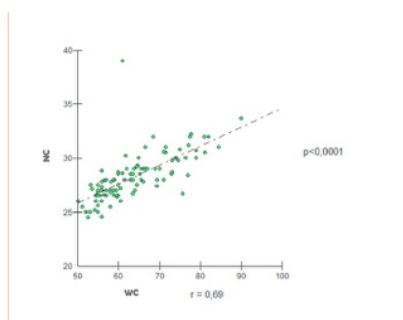
Graph 1. Pearson's correlation (r) between body weight and neck circumference.

Graph 2 shows the moderate Pearson correlation ($r = 0.63$) between neck circumference and body mass index of the total sample, with a p-value <0.0001 , therefore a great statistical significance.



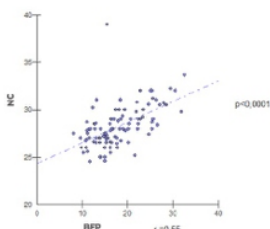
Graph 2. Pearson (r) correlation between Neck Circumference and BMI.

Graph 3 shows the moderate Pearson's correlation ($r = 0.69$) between neck circumference and waist circumference of a 100-student sample, with a p-value <0.0001 , therefore a great statistical significance.



Graph 3. Pearson correlation (r) between Neck and Waist Circumference.

Graph 4 shows Pearson's correlation between fat percentage (%BFP) and neck circumference of the total sample, with $r = 0.55$, ie a moderate correlation between these two variables, with a p-value. <0.0001 , therefore a great statistical significance.



Graph 4. Pearson's correlation (r) between Neck Circumference and %BFP.

DISCUSSION

A cross-sectional study was conducted to verify the correlation between NC and BMI of 2794 students from five schools in São Paulo (Brazil), with ages ranging from 6 to 19 years old. The researchers concluded that the NC had a significant correlation with age, BMI, WC and %BFP of the students (COUTINHO et al., 2014). It is noteworthy the students surveyed of the school Tenente Rêgo Barros (ETRB), moderate to high correlation with weight, BMI, WC and %BFP were found, thus results very similar to the research mentioned above.

A study of 324 children aged 9 to 13 years in Greece, which aimed to evaluate the association between neck circumference (NC) and various cardiovascular risk factors such as blood pressure, insulin levels and biochemical analysis of blood fat, and compare them with validated anthropometric indices, such as waist circumference (WC), body mass index (BMI), waist-hip ratio (WHR) and others, concluded that NC is associated with most risk factors for cardiovascular disease (ANDROUTSOS et al., 2012)

A study of 581 Turkish children and adolescents, aged 5 to 18 years, among them 461 schoolchildren presenting, overweight/obesity and 120 children with normal BMI, showed a significant correlation between NC, WC and BMI of pre-pubertal and pubertal children, of both sexes. Regarding cardiometabolic risk, this research found that insulin and triglyceride (TG) levels in prepubescent boys, their BP and TG levels were positively correlated with NC. The cutoff value for WC as an indicator of metabolic syndrome (MS) was 36 cm for boys and 35 cm for girls (KURTOGLU et al, 2011).

In a cross-sectional study with 1,668 adolescents from four public schools in the city of São Paulo (Brazil), the objective was to cut the NC values in overweight and obese students. The cutoff values for NC in overweight girls and boys were 31.25 and 34.25 cm and for obesity were 32.65 and 37.95 cm, respectively (FERRETI et al, 2015). Based on the above research, the average NC of the ETRB students is below the risk indicators for MS.

Silva et al. (2014) conducted a cross-sectional study with 388 children and adolescents of both sexes, between 10 and

19 years old and aimed to analyze the correlation of neck circumference and insulin resistance and the components of the metabolic syndrome. As a result, neck circumference correlated from moderate to high with waist circumference of prepubescent girls ($r = 0.51$) and boys ($r = 0.82$), with a mean correlation between genders of $r = 0.66$, very similar to the present study which was $r = 0.69$.

High neck circumference may indicate overweight and cardiometabolic risk. According to Sichieri and Souza (2008) the prevalence of obesity and, consequently, the inherent pathologies of overweight in children and adolescents, has increased sharply in the last three decades, and with multiple consequences. Its occurrence in adolescence, for example, is associated with increased blood pressure, lipid profile changes, glycide, musculoskeletal disorders, metabolic syndrome, among others.

In the present study, following the biometric parameters of BMI and %BFP of students, they are within the average for age and sex, reducing potential risks of metabolic diseases, as early as in childhood and adolescence.

In a cross-sectional study by Souza et al. (2016) with 1474 adolescents aged 12 to 17 years from public and private schools in the municipalities of Aracajú and Nossa Senhora do Socorro in Sergipe, with an aim to identify the neck circumference (NC) cutoff points to determine the excess levels of weight and prediction of cardiometabolic risk in adolescents, it was found that NC correlated positively with other adiposity indicators, such as WC ($r = 0.69$, $p < 0.001$) and BMI ($r = 0.65$, $p < 0.001$) in adolescents aged from 12 to 14. The above results are similar to those of the present study with ETRB students, although they are prepubertal, averaging 9.5 years.

According to Guo et al. (2012) a survey with Chinese children and adolescents was conducted, and evaluated the correlation between CP and blood pressure (BP) in different BMI groups. In participants with normal weight, higher NC was associated with higher risk of prehypertension (OR 1.64, 95% CI 1.29–2.08), after adjusting for age and gender. This result remained significant after adjusting for age, gender, BMI, and WC (OR 1.44; 95% CI 1.12–1.85).

CONCLUSION

Early assessment of children's overweight and/or obesity may decrease their prevalence of cardiometabolic risks, which were once restricted to adults. Thus, anthropometric assessment protocols are practical and reliable instruments that should be used by health professionals, including a Physical Education teacher, especially in the school environment, since contact with children is much more frequent than with other experts.

Therefore, the present research detected a strong correlation between neck circumference (NC) and children's bodyweight, and a moderate correlation between NC and body mass index, waist circumference and fat percentage of the students surveyed. As a result, NC may be a new anthropometric, noninvasive, practical, inexpensive, reliable and reliable index for the health monitoring and prevention of chronic noncommunicable diseases in children and adolescents in the near future.

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ABSTRACT

This study aimed to analyze the correlation between neck circumference, body mass index (BMI), waist circumference and fat percentage of children enrolled in elementary school in a school in Belém-PA, Brazil. Methodology applied in the research is quantitative, descriptive and cross-sectional, with a 95% confidence level. The present study was conducted on a sample of 100 schoolchildren, 56 boys and 44 girls, aged 8 to 10 years old, attending the 4th year of elementary school, from the Federal Elementary and High School Lieutenant Rêgo Barros, from February to March 2019, in Belém-PA, Brazil. Their guardians signed informed consent forms (ICFs). For statistical treatment, Bioestat 5.0 software was used, performing Pearson correlation coefficient between neck circumference (NC) and BMI, body weight (BW), fat percentage (BFP) and waist circumference (WC) of schoolchildren. There was, as a result, a strong correlation between NC and BW ($r = 0.7$, $p < 0.0001$), moderate correlations between NC and BMI ($r = 0.63$, $p < 0.0001$), NC and WC ($r = 0.69$, $p < 0.0001$) and NC and BFP ($r = 0.55$, $p < 0.0001$). Therefore, it was observed that neck circumference may be a new biometric marker for assessing child growth, as it has moderate to high correlations with scientifically ratified parameters in the diagnosis of malnutrition or overweight by health professionals.

Keywords: schoolchildren, neck, correlations.

RÉSUMÉ

Cette étude visait à analyser la corrélation entre la circonférence du cou, l'indice de masse corporelle (IMC), tour de taille et pourcentage de graisse des enfants inscrits dans une école primaire à Belém-PA, Brésil. La méthodologie appliquée dans la recherche est quantitative, descriptive et transversale, avec un niveau de confiance de 95%. La présente étude a été menée sur un échantillon de 100 écoliers, 56 garçons et 44 filles âgés de 8 à 10 ans, fréquentant la 4^e année du primaire, dans l'école fédérale primaire et secondaire Rêgo Barros, de février à mars 2019, à Belém-PA, au Brésil. Leurs tuteurs ont signé des formulaires de consentement éclairé (ICF). Pour le traitement statistique, le logiciel Bioestat 5.0 a été utilisé, exécutant le coefficient de corrélation de Pearson entre la circonférence du cou (CC) et l'IMC, le poids corporel (PC), le pourcentage de graisse (PG) et le tour de taille (TT) des écoliers. Il en résultait une forte corrélation entre CC et PC ($r = 0,7$, $p < 0,0001$), des corrélations modérées entre CC et IMC ($r = 0,63$, $p < 0,0001$), CC et TT ($r = 0,69$, $p < 0,0001$) et CC et PG ($r = 0,55$, $p < 0,0001$). Par conséquent, il a été observé que la circonférence du cou pourrait être un nouveau marqueur biométrique pour l'évaluation de la croissance de l'enfant, car elle présente une corrélation modérée à élevée avec les paramètres scientifiquement validés pour le diagnostic de la malnutrition ou du surpoids par les professionnels de la santé.

Mots-clés: écoliers, cou, corrélations.

RESUMEN

El presente estudio tiene por objetivo analizar la correlación entre la circunferencia del cuello, el índice de masa corporal (IMC), la circunferencia de la cintura y el porcentaje de grasa de los niños matriculados en una escuela primaria ubicada en Belém-PA, Brasil. La metodología aplicada en la investigación es cuantitativa, descriptiva y transversal, con un nivel de confianza estadística del 95%. El presente estudio se realizó con una muestra de 100 escolares, 56 niños y 44 niñas, de 8 a 10 años de edad, que cursaban el cuarto año de la escuela primaria, de la Escuela Federal Primaria y Secundaria Teniente Rêgo Barros, de febrero a marzo de 2019, en Belém-PA-Brasil. Sus tutores firmaron términos de consentimiento informado (IC). Para el tratamiento estadístico, se utilizó el software Bioestat 5.0, realizando correlaciones de Pearson entre la circunferencia del cuello (CCUE) y el IMC, el peso corporal (PC), el porcentaje de grasa corporal (%GC) y la circunferencia de cintura (CC) de escolares. Como resultado, hubo una fuerte correlación entre CCUE y PC ($r = 0.7$, $p < 0.0001$), correlaciones moderadas entre CCUE e IMC ($r = 0.63$, $p < 0.0001$), CCUE y CC ($r = 0.69$, $p < 0.0001$) y CCUE y %GC ($r = 0.55$, $p < 0.0001$). Por lo tanto, se observó que la circunferencia del cuello puede ser un nuevo marcador biométrico para evaluar el crecimiento de los niños, ya que tiene correlaciones de moderadas a altas con parámetros científicamente ratificados en el diagnóstico de desnutrición o sobrepeso por parte de los profesionales de la salud.

Palabras clave: escolares, cuello, correlaciones.

RESUMO

O presente trabalho teve como objetivo analisar correlação entre a circunferência do pescoço, índice de massa corporal (IMC), circunferência da cintura e percentagem de gordura de crianças matriculadas no ensino fundamental de uma escola em Belém-PA, Brasil. Metodologia aplicada na pesquisa é de cunho quantitativo, descritivo e transversal, tendo como o nível de confiança estatístico amostral de 95%. O presente estudo foi realizado com uma amostragem de 100 escolares, 56 meninos e 44 meninas, com uma faixa etária de 8 a 10 anos de idade, cursando o 4^o ano do ensino fundamental, da Escola Federal de Ensino Fundamental e Médio Tenente Rêgo Barros, no período de fevereiro a março de 2019, em Belém-PA-Brasil. Seus responsáveis assinaram termos de consentimento livre esclarecido (TCLE). Para o tratamento estatístico, utilizou-se o software Bioestat 5.0, realizando Correlações de Pearson entre as circunferências do pescoço (CP) e o IMC, peso corporal (PC), percentagem de gordura (G%) e a circunferência da cintura (CC) dos escolares. Como resultados, houve uma forte correlação entre a CP e o PC ($r = 0,7$, $p < 0,0001$), moderadas correlações entre CP e o IMC ($r = 0,63$, $p < 0,0001$), CP e CC ($r = 0,69$, $p < 0,0001$) e CP e a %G ($r = 0,55$, $p < 0,0001$). Logo, observou-se que a circunferência do pescoço tem possibilidade de ser um novo marcador biométrico, para avaliação do crescimento de crianças, por apresentar moderadas a altas correlações com parâmetros ratificados cientificamente, na diagnose de desnutrição ou sobrepeso de crianças e adolescentes, pelos profissionais da saúde.

Palavras Chaves: escolares, pescoço, correlações.