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Research Article

Association of Anthropometric Measures with cardiovascular risk features in children and teenagers in Albania

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Abstract

We performed this study to establish the association among anthropometric amplitudes with cardiovascular hazard aspects and metabolic syndrome (MetS) in normal-weight Albanian children and adolescents. We examined the data of 3,658 children and adolescents (46.8% boys), aged 10-17 years, with a normal BMI (4th-83th percentile) obtained from a 'Childhood and Adolescence Monitoring and Prevention of Adult Non-communicable Disease' study. The International Diabetes Federation agreement classified the diagnostic criteria for MetS. The prevalence of MetS for 10- to 12.5-year-old boys, 14- to 17-year-old boys, 10- to 13.7-year-old girls, and 14- to 17-year-old girls were 1.3, 2.4, 2.1, and 2.9%, correspondingly. After adjusting age and sex, each item's expansion in BMI (within normal range) and waist circumference enhanced the odds of MetS from 4 to 65 % and from 1 to 17 %, consequently. The main pattern of dyslipidemia among the respondents was elevated triglycerides and low high-density lipoprotein cholesterol. Our study strengthened the latest research on the elevated frequency of metabolic risk factors among normal-weight individuals in the pediatric age group.

Keywords: Anthropometric, Cardiovascular, Metabolic syndrome, Children, Adolescents.

1. Introduction

Obesity has reached a pandemic point, demonstrating a considerable association with metabolic syndrome (MetS), one of the main risk factors for type 2 Diabetes Mellitus (T2DM) and cardiovascular disease (CVD).
Recent surveys have verified that the increased prevalence of obesity among adults expands to the adolescent population, too, and childhood obesity has become a new challenge for pediatric care (Batsis, Nieto-Martinez and Lopez-Jimenez, 2019).

Reduced levels of physical activity and rising caloric intake has been recommended as a reason for the increasing rate of obesity in children and teenagers (Luepker, 2020; Harper, 2021).

Childhood obesity is linked not only with important inferences for the hazard of childhood diseases but with augmented risk of chronic disease and reduced life expectancy in adult life, too (Williams and Strobino, 2019). The correlation between childhood obesity and MetS has been estimated in current years (Mehrkesh M, Kelishadi R, Mohammadian S, Mousavinasab F, Qorbani M, Fazl Hashemi ME, 2022) Several studies have compared the prevalence of cardiometabolic risk factors across weight groups among children, and it documents that risk factor bunching is enhanced among weight classes (Camhi and Katzmarzyk, 2018).

Nevertheless, in these articles, a cluster of normal-weight children and adolescents with metabolic risk factors affected the augmentation of the MetS (Cook S, Weitzman M, Auinger P, Nguyen M, Dietz WH, 2017; Messiah, Arheart, Luke, Lipshultz and Miller, 2018).

Since then, much data has recommended a high prevalence of this phenotype in the general population. It illustrates that these persons have an increased proportion of visceral fat and a lower lean body mass and respond positively to caloric constraints (Xu YQ and Ji CY, 2019).

Our study aimed to evaluate the relationship of anthropometric measures with risk factors of CVD and MetS in a national representative pattern of Albanian normal-weight children and adolescents.

2. Research methods

We obtained the data for this study from the survey of the 'Childhood and Adolescence Observation and Prevention of Adult Non-Transmissible Disease' (CASPIAN) study carried out in 2018. The CASPIAN is a countrywide longitudinal school-based course for examining risk manners due to risk features of chronic sicknesses among children and teenagers.

Regarding the third investigation of the CASPIAN study (Li YP, Yang XG, Zhai FY, Piao JH, Zhao WH, Zhang J, Ma GS, 2005-18), nearly 5,012 students aged 10–17 years were chosen by multistage random cluster sampling from urban and rural regions in different parts of the country. In this study, three thousand six hundred fifty-eight subjects had fulfilled documentation and average weight about the BMI of the Centers for Disease Control and Prevention (CDC).

We performed the cutoffs of the CDC (Kelishadi R, Cook SR, Motlagh ME, Gouya MM, Ardalan G, 2008) because the initial inspection of the CASPIAN was implemented among 19,108 children and teenagers. This study showed a big concurrence of cutoffs provided for Albanian children and adolescents with cutoffs of the CDC (Ruderman NB, Schneider SH, Berchtold P, 2008) We clarified the survey intentions and procedures to the participants and their parents. We provided written informed consent from the parents and the students, correspondingly. The ethical committee of

the University of Medicine of Tirana approved our study.

3. Anthropometric and Biochemical Amplitudes

Qualified research staff evaluated the teenagers' height and weight related to standardized criteria. We evaluated blood pressure (BP) before blood sampling and in a quiet condition using mercury sphygmomanometers after no less than 5 min of relaxation in the sitting location. We captured all readings in duplicate in the right arm. Venous blood samples were accumulated from all study participants and distributed to the laboratory on the day of blood gathering. After centrifuging the blood samples, we instantly carried them to the laboratory. We determined the HDL-C after dextran sulfate-magnesium chloride precipitation of non-HDL-C. Low-density lipoprotein cholesterol (LDL-C) was analyzed in serum samples with TG ≤ 400 mg/dl (Katsuki A, Sumida Y, Urakawa H, Gabazza EC, Murashima S, 2010).

4. Statistical Analyses

We offered the records as mean ± standard deviation (SD). We used an independent t-test to assess BMI and WC between the participants with and those without risk factors. We analyzed the relationship between adiposity (BMI and WC) measures and probable risk factors through multiple logistic regression, integrating age and gender in each model as potential confounders. We executed all statistical analyses using the statistical package SPSS version 22.0 for Windows.

5. Results

This countrywide study consisted of 3,658 participants (46.8 % boys) aged 10–17 years, with a mean age of 14.64 (2.49) years, while 50.6 % of them were 10–13.9 years old.

Table 1. Main characteristics of normal-weight participants according to gender and age group

	Boys		Girls	
	10–13.9 years (n = 765)	14–17 years n = 954	10–13.9 years (n = 784)	14–17years (n = 918)
BMI, kg/m2	18.21 (2.13)	20.5 (2.05)	13.72 (2.17)	19.35 (1.84)
WC, cm	62.05 (7.55)	68.13 (7.58)	62.14 (8.54)	71.39 (7.25)
Height, cm	137.68 (10.64)	151.42 (6.54)	142.94 (10.36)	158.02 (7.84)
Weight, kg	37.67 (7.63)	51.54 (7.02)	35.84 (8.47)	53.63 (7.80)
SBP, mm Hg	96.75 (11.85)	101.38 (11.66)	97.13 (12.65)	104.03 (12.06)
DBP, mm Hg	61.73 (9.64)	64.04 (9.64)	62.44 (10.07)	65.36 (10.49)
FBS, mg/dl	86.05 (10.09)	70 (12.15)	82.12 (11.38)	85.76 (13.21)
TC, mg/dl	148.57 (28.74)	148.72 (30.25)	134.16 (30.05)	129.40 (27.45)

HDL-C, mg/dl	45.46 (13.28)	44.06 (13.26)	44.02 (12.65)	41.18 (13.05)
LDL-C, mg/dl	84.66 (26.85)	84.85 (24.02)	82.05 (25.67)	64.04 (21.34)
TG, mg/dl	91.84 (36.86)	92.28 (35.82)	84.77 (32.75)	84.64 (34.46)

Table 1 shows the demographic and metabolic aspects of the respondents. The lipid results of the two age clusters of boys were similar. On the other hand, there was significant refusal in TC and LDL-C with elevating age in girls. TC and LDL-C of 10-13.9-year-old girls were 145.18 and 82.17 and decreased to 126.37 and 71.09 in 14- to 18-year-old girls, respectively.

We represented the components of dyslipidemia, MetS, and risk aspects of CVD in diverse age and sex groups in Table 2. The sample of risk aspects bunch was similar to 10- to 14-year-old boys and girls. The majority of 10- to 14-year-old boys did not have any of the sections of MetS (54%); nevertheless, more than half of the girls at the same age had as a minimum one atypical metabolic factor (51.8%).

In the individuals aged 14–18, normal-weight teenage boys were expected to have more risk factors than girls. While more than half of the boys in this series age (52.6 %) did not have any components of MetS, 64.9% of the girls had one or more sections of MetS.

Table 2. Prevalence of dyslipidemia, metabolic syndrome elements, and cardiovascular risk aspects of normal-weight participants according to gender and age group

Number of components	DLP	MetS	Risk factors CVD
Boys			
10–13.9 years (n = 772)			
0	62.2	52.0	54.0
1	29.6	32.8	38.7
2	5.7	10.2	5.9
3	2.3	1.6	0.0
4	0.2	0.0	–
14–178 years (n = 1,021)			
0	52.4	50.6	53.4
1	33.3	37.2	40.9
2	6.9	8.8	7.7
3	1.9	2.6	0.2
4	0.2	0.2	–
Girls			
10–13.9 years (n = 843)			
0	61.0	46.6	50.5
1	30.2	39.6	42.1
2	7.3	11.5	7.4
3	1.1	1.7	0.0

4	0.4	0.6	–
14–18 years (n = 929)			
0	52.6	35.1	37.3
1	42.0	46.3	48.0
2	4.8	15.3	14.1
3	0.4	3.0	0.6
4	0.2	0.3	–

6. Discussion

Our study shows the prevalence of metabolic risk factors in Albanian children and adolescents with average weight. Considering several studies in the past, the results of our study revealed that there are children and teenagers with MetS and risk components of CVD who are not obese compared to the BMI percentiles. Although we chose individuals with normal BMI for this study, the adiposity indices (BMI and WC) were significantly dissimilar in subjects with and without including metabolic risk factors. It is the leading model of dyslipidemia among normal-weight children in our population.

Although the acknowledgment of the MetS dates back some decades, it has drawn more awareness recently. The rising eruption of T2DM and CVD drew much attention to the Mets as a primary issue in managing these illnesses. We have recognized for many years the affiliation between obesity and increasing metabolic risk factors.

Adipose tissue plays a significant role regarding the influence on insulin resistance, which is the fundamental reason and essential component of MetS. However, more studies revealed that adipose tissue can also negatively impact the participants who are not obese, related to classic weight charts. This concept expanded the meaning of MetS beyond the edges of obesity. Metabolic risk factors linked to adipose tissue can increase in people with average weight. Before the global pandemic of these hazardous aspects, we should increase the screening programs to involve normal-weight individuals. Considering that it has been the conception of MONW in adults, such understanding is scarce in population-based studies held between teenagers. However, studies launching a prevalence of metabolic risk component grouping within children and adolescent weight clusters proposed that the model of MONW can extend to children.

Recently, some surveys have targeted childhood overweight and individual health in the future. There is data that obese teenagers are more indicated to have improper metabolic risk aspects than their normal-weight matching parts. Nevertheless, it does not mean that normal-weight children and teenagers are inevitably on the reliable side. Cook et al. (Kelishadi R, Heshmat R, Motlagh ME, Majdzadeh R, 2013) mentioned that the prevalence of MetS in US normal-weight children and teenagers was 0.1% from 1988 to 1994. A similar study conducted from 1999 to 2002 reported a prevalence of 1% for an identical group (Kuczmarski RJ, Ogden CL, Grummer-Strawn LM, 2006).

Concerning the relative hazards of MetS in overweight and obese Chinese children with their normal-weight peers, Li et al. (Kelishadi R, Ardalan G, Gheiratmand R, Majdzadeh R, Hosseini M, 2008) referred to the prevalence of MetS as 15.5% among normal-weight boys versus 18.8% in girls. In our previous study, which assessed the frequency and delivery of the MetS in children with dissimilar obesity, MetS was less than 2% among normal-weight subjects. In this study, more than half of the population generally had as a minimum, one risk factor of MetS (Kelishadi R, Cook SR, Amra B, Adibi A, 2009). The latest survey showed that lipids, lipoproteins, and oxidative pressure were alike in obese children.

The study mentioned that children with an equal BMI class but high cardio-respiratory strength had lower WC than those with low cardio-respiratory fitness. The authors claimed the preventive role of cardio-respiratory health and obesity in causing MetS (Lara M, Bustos P, Amigo H, Silva C, Rona RJ, 2012).

The results of this study present undeniable evidence that WC, combined with BMI, does not anticipate an increase in obesity-associated health risk better than BMI. The high co-linearity between these two measures is accountable. Consequently, there is no crucial benefit of applying both amplitudes of obesity for population observation, because their autonomous involvement is only secondary (France MW, Kwok S, McElduff P, 2003).

In our study, the principal structure of the unusual lipid profile was high TG and low HDL-C. It reveals the primary prototype of dyslipidemia among Albanians related to Western countries. It has been observed in several studies on adults and children (Zhang L, Qiao Q, Tuomilehto J, Janus ED, Lam TH, 2010).

Additionally, Asian Indians reveal an unfavorable lipid pattern of low HDL-C and high TG (Lambert M, Delvin EE, Levy E, O'Loughlin J, Paradis G, 2008). Pediatric studies monitored an equivalent pattern. The pertinent values for females were 30.0, 31.3, 5.4, and 3.6%. Botton et al. (2021) in their assessment of cardiovascular risk factors among French children, reported the proportion of children with elevated degrees of TC, LDL-C, HDL-C, and TG to be 9, 5.6, 0.5, and 3.7% among normal-weight participants, respectively. In a study on kids in a rural Georgia region, 26% showed high TC, 20% had increased LDL-C, 13% had high TG, and 43% had low HDL-C (Botton J, Heude B, Kettaneh A, Borys JM, Lommez A, 2007).

On the other hand, the lipid profile of teenagers in Eastern countries is diverse. Serum HDL-C levels of Turkish post-pubertal teenagers, as in the adult population, are extremely lower than in Europeans and North Americans (23). A huge level of hepatic lipase pursuit and protein mass has been submitted to explain the low HDL-C levels among Turkish people (Davis CL, Flickinger B, Moore D, Bassali R, Domel Baxter S, 2007). In a study to assess serum lipid patterns and the prevalence of dyslipidemia in school kids in Eastern Iran, the most ordinary form of dyslipidemia was a minor HDL-C level and hypertriglyceridemia (Fesharakinia A, Zarban A, Sharifzadeh GR, 2008).

High TG and low HDL, an attribute of the insulin resistance lipid phenotype, is the main prototype of dyslipidemia among normal-weight children in Albania's population.

It can be a source for recognition related to a re-evaluation of cardiovascular risk deduction in our group.

7. Conclusion

The large pattern dimension of this study permitted us to acknowledge the metabolic risk factors among normal-weight children and adolescents. The study's cross-sectional nature and the lack of establishing the pubertal condition of the contributors were the main restrictions of this survey. This study concluded that metabolic risk aspects are recurrent between normal-weight children and teenagers, and normal BMI does not inevitably remove children from screening programs for MetS. We discovered that small raises in adipose tissue, still within average BMI values, can place children at an increased hazard of developing MetS. The remarkable prevalence of high TG and low HDL-C in normal-weight children may be referable to lifestyle factors. Consequently, in addition to the prominence of controlling childhood overweight for the initial prevention of non-transmissible diseases, the meaning of a healthy lifestyle and fitness in normal-weight children and teenagers should be underscored.

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