

Effects of a multidisciplinary approach on the anthropometric and body composition responses of obese adolescents

Efectos de un abordaje multidisciplinario sobre las respuestas antropométricas y de composición corporal de adolescentes obesos

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Abstract. Introduction: The sedentary lifestyle in adolescence, combined with unhealthy eating habits, leads to the accumulation of body fat and the development of non-communicable chronic diseases (NCDs). Objective: To investigate the effects of the multidisciplinary project on the anthropometric and body composition responses of adolescents with obesity and to compare the intervention responses according to gender. Methods: forty-eight adolescents aged 12-17 years old were evaluated: [male ($n = 19$) and female: ($n = 29$)]. Body mass, height, waist (WC), hip (HC), neck (NC), arm (AC), circumference, and waist-to-hip ratio (WHR) were measured. Body mass index (BMI), BMI z-score, body fat percentage (BF%), fat mass (FM), lean mass (LM), fat-free mass (FFM), skeletal muscle mass (SMM), and visceral fat were evaluated. Body composition was assessed via bioelectrical impedance InBody 570[®]. Data were compared via paired t-test (comparison between pre- and post-intervention between the adolescents) and analysis of variance (ANOVA two-way): comparison between gender in pre- and post-interventions, both assuming ($p < 0.05$) was performed. Results: A time effect was identified with significant reductions in body mass, WC, HC, BMI, BMI z-score, BF%, FM, and visceral fat in the post-intervention period ($p < 0.05$). However, no significant differences were identified for NC, AC, LM, FFM, SMM, and WHR ($p > 0.05$) after the intervention. Conclusion: Multiprofessional interventions effectively improved male and female adolescents' anthropometric aspects and body composition. However, no differences were observed between them.

Keywords: Primary Health Care; Child obesity; Health promotion; Adolescent Health.

Resumen. Introducción: El sedentarismo en la adolescencia, combinado con hábitos alimentarios poco saludables, conduce a la acumulación de grasa corporal y al desarrollo de enfermedades crónicas no transmisibles (ECNT). Objetivo: Investigar los efectos del proyecto multidisciplinario en las respuestas antropométricas y de composición corporal de adolescentes con obesidad y comparar las respuestas de intervención según género. Métodos: se evaluaron 48 adolescentes de 12 a 17 años: [varones ($n = 19$) y mujeres: ($n = 29$)]. Se midieron masa corporal, altura, circunferencia de la cintura, circunferencia de la cadera, circunferencia del cuello y circunferencia del brazo, y relación cintura-cadera (RCC). Se calcularon el índice de masa corporal (IMC), z-score, porcentaje de grasa corporal (GC%), masa grasa (MG), masa magra (MM), masa libre de grasa (MLG), masa muscular esquelética (MME) y grasa visceral. La composición corporal se evaluó mediante impedancia bioeléctrica InBody 570[®]. Los datos se compararon mediante prueba t emparejada (comparación entre pre y post intervenciones entre los adolescentes) y ANOVA bidireccional (comparación entre género en pre y post intervenciones), ambos asumiendo $p > 0.05$. Resultados: Se identificó un efecto temporal con reducciones significativas de la masa corporal, circunferencia de la cintura, cadera, IMC, z-score, GC%, MG y grasa visceral en el período post-intervención ($p < 0,05$). Sin embargo, no se identificaron diferencias significativas para circunferencia del brazo y cuello, MM, MLG, MME y RCC ($p > 0,05$) después del período de intervención. Conclusión: Las intervenciones multiprofesionales fueron efectivas para mejorar los aspectos antropométricos y la composición corporal de adolescentes y adolescentes. Sin embargo, no se observaron diferencias entre entonces.

Palabras Clave: Atención Primaria de Salud; Obesidad Pediátrica; Promoción de la Salud; Salud del Adolescente.

Introduction

Overweight and obesity during childhood and adolescence are worrying aspects of public health (Umer et al., 2017). Obesity is defined as the excessive accumulation of body fat (Pulgaron & Delamater, 2014) and brings significantly more significant complications associated with

adult morbidity and mortality, with the advancement of non-communicable chronic diseases (NCDs), such as type 2 diabetes mellitus (T2DM), neoplasms, systemic arterial hypertension (SAH), cardiovascular diseases (CVD's), dyslipidemias and chronic respiratory diseases (Vukovic et al., 2019). If treated early in life, obesity has a less negative impact on health, quality of life, and health care costs in the medium and long term (de Oliveira et al., 2021; Branco et al., 2021).

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The association between these risk factors and fat distributions can be assessed through anthropometry, imaging techniques, and body composition assessment through the bioelectrical impedance (Guedes & Calabrese, 2019). The most used anthropometric index at the epidemiological level is the body mass index (BMI), and the literature indicates that the higher the BMI, the greater the chances of developing diseases related to being overweight (Censin et al., 2019; Millard et al., 2019; Ruiz-Ariza et al., 2021). However, body fat distribution can vary considerably in everyone (Kuk & Ross, 2007). Some individuals store more fat around the visceral organs (abdominal fat) and others in the thighs and hips (Emdin et al., 2017). Excess abdominal fat is termed central obesity (CO). CO can estimate CVD risk through waist circumference (WC) and waist/hip ratio (WHR). The cited circumference measurements play a relevant role in CVD etiology (Vukovic et al., 2019; Rodriguez-Canales et al., 2022).

WC is associated with increased visceral, intra-abdominal, and liver fat (Smith, 2015; Rodriguez-Canales et al., 2022). The high accumulation of visceral fat increases the risk of changes in hormonal, inflammatory, and endothelial levels (Seravalle & Grassi, 2017). Consequently, the increase in WC is correlated with changes in the lipid profile, insulin resistance, and SAH (Fontana & Giannini, 2014). Therefore, the early adoption of lifestyle changes, with the stimulus to increase the level of physical activity and improve the dietary pattern through multidisciplinary actions, becomes substantial to recovering the health conditions of children and adolescents (Branco et al., 2019; de Oliveira et al., 2021; Branco et al., 2021). Accordingly, targeting interventions for the treatment of obesity according to the sex of adolescents can improve perceived physical competence. In addition to increasing adherence to physical exercise and promoting greater health benefits, if significant differences are identified according to the sex (Morano et al., 2016).

Given this and considering the seriousness of the problems related to overweight in adolescence, different multidisciplinary obesity treatment groups work to promote healthy weight loss, as well as the promotion of quality of life (Branco et al., 2019) through the participation of physicians, biomedics, physical education professionals, physiotherapists, psychologists, and nutritionists (Branco et al., 2019; Branco et al., 2021). Thus, with the practice of physical exercise and the acquisition of new healthy habits, it is possible to work with the non-pharmacological treatment of obesity and NCDs (Figueiras & Sawaya, 2018). Thus, due to the concern with the development of NCDs in adolescence and adulthood, the primary objective of the present study was to investigate the effects of a multidisciplinary approach on the anthropometric and body composition responses of adolescents with obesity (both sexes) and

how secondary objective, comparing intervention responses according to gender (males *versus* females adolescents).

Methodology

Experimental design

This study presents a longitudinal and quasi-experimental design. Data collection took place between 2018 and 2019. The interventions were carried out by physical education professionals, nutritionists, and psychologists and lasted 12 weeks. The Ethics and Local Research Committee approved this research under the number 2.505.200/2018. All adolescents who participated in the research signed the consent form (CF), and their guardians signed the free and informed consent form (ICF). It is also noteworthy that resolution 466/2012 of the Ministry of Health was thoroughly followed.

Participants

Forty-eight adolescents (male $n = 19$; female $n = 29$) were recruited for the research, aged between 12 and 17 years old, female and male, residents of Maringa (southern Brazil) and the metropolitan region.

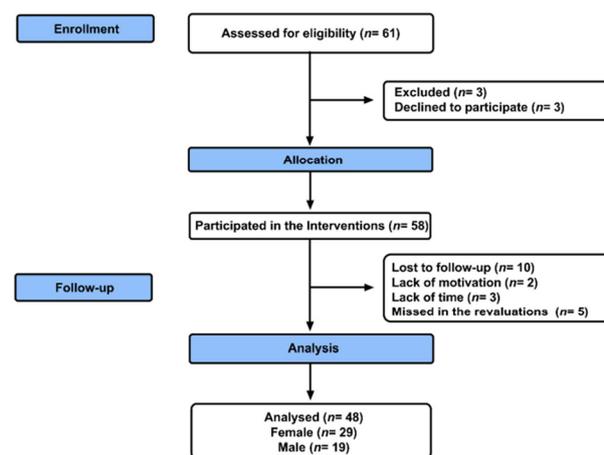


Figure 1. Flowchart of the present study.

Measures

With the data of height and body mass, the BMI was calculated, dividing the body weight (kg) by the height in square meters [$BMI = W/(H^2)$]. Height was measured using a Sanny[®] stadiometer (São Paulo, Brazil), and the body mass was measured by the equipment InBody 570[®] (model 570[®], Body Composition Analyzers, South Korea). With the results of BMI and age of each participant, the percentiles were classified according to the cut-off points established for overweight (percentile between $e > 85$ and < 95) and obesity (percentile $e > 95$) (Who, 1995).

To assess body composition, the InBody 570[®] electrical bioimpedance was used, with the analysis of the follow-

ing variables: a) body weight (kg); b) body fat mass (kg); c) skeletal muscle mass (SMM) (kg); d) fat-free mass (FFM) (kg); e) body fat percentage (BF%); and f) visceral fat. For the measurement, the adolescents were previously asked to follow the following guidelines: *I* - fasting of solids and liquids for 12 hours; *II* - do not use diuretic substances in the 24 hours before the procedure; *III* - not to do moderate or high-intensity physical exercise on the day before the test; *IV* - avoid the consumption of caffeine-based beverages in the 12 hours before the test; *V* - urinate and, if necessary, evacuate 30 minutes before taking the measurement; *VI* - do not use any earring, metal or accessory at the time of collection; and finally, *VII* - wearing light clothing at the time of assessment (Guedes, 2013).

Circumference measurements were performed using an anthropometric measuring tape (Cescorf[®], Brazil), with a capacity of 2 meters and an accuracy of 0.1 cm. For the evaluations, the adolescents were instructed to wear light clothing and the measurements of the waist circumference (WC), hip circumference (HC), arm circumference (AC), and neck circumference (NC) (WHO, 2000). Subsequently, the WHR was calculated by dividing the WC by the HC.

Procedures

The interventions were carried out three times a week, on Mondays, Wednesdays, and Fridays, over 12 weeks, totaling three months. The meetings began with theoretical activities, and then physical exercises carried out practical activities. The intervention had the participation of a nutrition and psychology team, with activities once a week (lasting 30 minutes) and physical activities three times a week (lasting from 60 to 90 minutes). Additionally, interventions were directed towards behavior change and obe-

sity treatment. During the nutritional activities developed in groups, the project's nutritionists aimed to reeducate food through changing eating habits through theoretical and practical classes. Psychology held group meetings with psychologists, with the central theme of using cognitive and behavioral strategies to promote normalizing eating habits, emotional eating, and eating compulsions. In addition, to developing strategies for controlling anxiety in adolescents. In turn, through physical education professionals, the physical activities consisted of resistance training for the main muscle groups during the 12 weeks, focusing on improving health-related physical fitness parameters.

Data analysis

Data were tabulated in Excel (Microsoft, United States of America), and the mean, standard deviation, and confidence interval (95%CI) were calculated. To compare the pre- and post-intervention responses, the paired t-test was used. An analysis of variance (ANOVA two-way) was also applied to compare male and females adolescents (to verify the possible difference between group effect, time effect and/or interaction effects), using a Bonferroni *post-hoc*. If a significant difference was detected, all analysis assumed a ($p < 0.05$). Mauchly's test of sphericity was used to verify the equality of statistical variables, and the Greenhouse-Geisser correction was applied, if necessary. All statistical analyses were performed in the Excel program (version 2016, Microsoft, United States of America).

Results

48 adolescents of both sexes, with a mean age of 13.88 \pm 1.72 years, were evaluated. The general characteristics of the sample are shown in table 1.

Table 1
Anthropometry and body composition of adolescents participating in this study.

Variables	PRE		POST	
	Mean (\pm) SD	IC 95%	Mean (\pm) SD	CI 95%
Age (years old)	13.88 \pm 1.72	13.39 - 14.36	14.00 \pm 1.74	13.51 - 14.49
Female (n = 29)	14.48 \pm 1.60	14.03 - 14.93	14.59 \pm 1.68	14.11 - 15.06
Male (n = 19)	12.95 \pm 1.51	12.52 - 13.37	13.11 \pm 1.45	12.70 - 13.52
Body mass (kg)*	89.05 \pm 20.69	83.19 - 94.90	87.41 \pm 20.12	81.72 - 93.10
Height (m)*	1.63 \pm 9.69	1.61 - 1.66	1.64 \pm 9.94	1.61 - 1.67
BMI (kg/m ²)*	33.08 \pm 5.94	31.40 - 34.76	32.09 \pm 5.72	30.47 - 33.70
BMI z-score*	2.86 \pm 0.77	2.64 \pm 3.07	2.75 \pm 0.78	2.53 - 2.97
WC (cm)*	94.27 \pm 11.18	91.10 - 97.43	91.58 \pm 10.27	88.67 - 94.49
HC (cm)*	109.13 \pm 11.55	105.89 - 112.39	107.24 \pm 11.18	104.08 - 110.41
NC (cm)	35.79 \pm 2.87	34.93 - 36.55	36.05 \pm 2.92	35.22 - 36.87
AC (cm)	34.50 \pm 4.02	35.22 - 36.87	34.54 \pm 4.06	33.39 - 35.64
WHR (cm)	0.87 \pm 0.07	0.85 - 0.89	0.86 \pm 0.07	0.84 - 0.88
Visceral fat (%)*	16.98 \pm 3.77	15.91 - 18.05	16.19 \pm 4.14	15.02 - 17.36
BF % (%)*	43.95 \pm 5.98	42.26 - 45.64	42.35 \pm 6.98	40.38 - 44.32
FM (kg)*	39.49 \pm 12.50	35.95 - 43.03	37.41 \pm 11.89	34.05 - 40.77
LM (kg)	46.34 \pm 9.02	43.79 - 48.89	46.80 \pm 9.38	44.14 - 49.45
FFM (kg)	49.30 \pm 9.47	46.62 - 51.98	49.72 \pm 9.47	46.89 - 52.55
SMM (kg)	27.12 \pm 5.55	15.20 - 42.10	27.42 \pm 5.93	13.00 - 46.00

Note: n = number of adolescents; \pm = standard deviation; 95% CI = 95% Confidence Interval; BMI = Body Mass Index; WC = Waist Circumference; HC = Hip Circumference; NC = Neck Circumference; AC = Right Arm Circumference; WHR = Waist-Hip Ratio; BF% = Body fat percentage; FM = Fat Mass; LM = Lean Mass; FFM = Fat Free Mass; SMM = Skeletal Muscle Mass; * = significantly different values ($p \leq 0.01$) pre- vs post-intervention.

Among the 48 adolescents evaluated, 60.42% were female ($n = 29$) and 39.58% were male ($n = 19$). Significantly lower values for body weight, height, BMI, and z-score were observed after the intervention period ($p < 0.001$). Likewise, WC and HC also showed significantly lower values ($p < 0.001$). However, no significant differences were found for NC, AC, and WHR after 12 weeks of intervention ($p > 0.05$). Visceral fat was significantly reduced post-intervention ($p = 0.01$). The BF% and FM were also significantly reduced ($p < 0.001$). However, no significant differences were found for LM, FFM, and SMM ($p > 0.05$).

There was a time effect with significantly lower values for body weight, height, BMI, z-score BMI, WC, HC, WHR, visceral fat, BF%, FM, and males and females after the intervention period ($p < 0.001$). Furthermore, an interaction was observed for WC, with lower values for males and females, when compared between pre- and post-intervention moments ($p < 0.001$). On the other hand, no significant differences were identified for NC, AC, LM, FFM, and SMM ($p > 0.05$).

Discussion

As the main objective of this study was to investigate the effects of a multidisciplinary approach on the anthropometric responses and body composition of obese adolescents, the results found post-intervention were: (1) reduction in body weight; (2) increase in height; (3) decrease in BMI; (4) decreased z-score BMI; (5) reduction in WC; (6) decrease in HC; (7) reduction in visceral fat; (8) decrease in BF%; (9) reduction in fat mass. On the other hand, the other variables analyzed in this study showed no significant difference (LM, FFM, SMM, NC, AC e WHR).

Considering the psychological, social, and health problems related to overweight, such as the development of NCDs, reducing and controlling body weight in childhood and adolescence becomes essential (Silva et al., 2018) because excessive weight at a young age remains for adulthood and leads to more severe health problems (Silva et al., 2018; Rodriguez-Canales et al., 2022). Thus, incorporating multidisciplinary approaches involving the adoption of physical exercise, health education, and healthy eating are essential to improve the quality of life and promote health (Saboya et al., 2016).

With the results of the present study, such as the reduction of body weight, it is believed that the multidisciplinary project aimed at adolescents over 12 weeks was effective, contributing to the control of diseases related to the overweight. Even with the short intervention time, the participants' height change can be explained by the growth spurt that affects individuals in this age group. Chipkevitch (2001), the spurt lasts approximately three to four years and represents the gain of approximately 20% of height reached in adulthood. The results that these variables, body weight and height, directly influenced BMI findings. Although the BMI showed a significant difference after the intervention period, the z-score remained in the classification of severe obesity. Regardless of changes in the BMI z-score classification, multidisciplinary programs can improve other factors, such as circumferences and body composition of overweight adolescents (Branco et al., 2021).

Alves et al. (2019) identified that interventions lasting ten weeks, using multicomponent training (3x weekly), were beneficial for changes in young people's body composition and physical fitness. Likewise, longer duration, such as 12 weeks, demonstrate significant results when the

Table 2
Comparison between male and female adolescents participating in this study.

Variables	Male ($n = 19$)				Female ($n = 29$)			
	PRE		POST		PRE		POST	
	Mean (\pm) SD	CI 95%	Mean (\pm) SD	CI 95%	Mean (\pm) SD	CI 95%	Mean (\pm) SD	CI 95%
Age (years old)	12.95 \pm 1.51	12.27 – 13.63	13.11 \pm 1.45	12.45 – 13.76	14.48 \pm 1.60	13.90 – 15.06	14.59 \pm 1.68	13.97 – 15.20
Body mass (kg)*	83.71 \pm 21.96	73.83 – 93.58	82.34 \pm 20.86	72.96 – 91.72	92.54 \pm 19.41	85.48 – 99.61	90.73 \pm 19.26	83.72 – 97.74
Height (m)*	1.64 \pm 13.59	1.58 – 1.70	1.65 \pm 13.90	1.59 – 1.71	1.63 \pm 6.16	1.60 – 1.65	1.63 \pm 6.36	1.61 – 1.66
BMI (kg/m ²)*	30.48 \pm 4.17	28.61 – 32.36	29.51 \pm 4.15	27.64 – 31.37	34.78 \pm 6.37	32.46 – 37.10	33.78 \pm 6.03	31.58 – 35.97
BMI z-score*	2.65 \pm 0.54	2.41 – 2.89	2.54 \pm 0.59	2.27 – 2.81	2.99 \pm 0.87	2.67 – 3.31	2.88 \pm 0.87	2.56 – 3.20
WC (cm)*	95.02 \pm 10.57	90.27 – 99.78	90.94 \pm 9.16†	86.82 – 95.06	93.77 \pm 11.72	89.51 – 98.04	92.00 \pm 11.08†	87.96 – 96.03
HC (cm)*	108.45 \pm 9.61	104.13 – 112.77	105.97 \pm 10.21	101.38 – 110.56	109.57 \pm 12.81	104.91 – 114.2	108.08 \pm 11.88	103.76 – 112.40
NC (cm)	36.23 \pm 2.93	34.91 – 37.55	36.76 \pm 2.86	35.47 – 38.05	35.42 \pm 2.84	34.38 – 36.45	35.58 \pm 2.91	34.52 – 36.64
AC (cm)	33.14 \pm 2.96	31.81 – 34.47	33.68 \pm 3.34	32.18 – 35.18	35.40 \pm 4.41	33.79 – 37.00	35.10 \pm 4.43	33.49 – 36.71
WHR (cm)*	0.88 \pm 0.07	0.84 – 0.91	0.86 \pm 0.07	0.83 – 0.89	0.86 \pm 0.07	0.83 – 0.89	0.85 \pm 0.07	0.83 – 0.88
Visceral fat (%)*	15.63 \pm 4.76	13.49 – 17.77	14.53 \pm 4.57	12.47 – 16.58	17.86 \pm 2.70	16.88 – 18.84	17.28 \pm 3.50	16.00 – 18.55
BF% (%)*	40.59 \pm 4.91	38.39 – 42.80	38.87 \pm 6.39	36.00 – 41.75	46.15 \pm 5.64	44.10 – 48.20	44.63 \pm 6.47	42.27 – 46.98
FM (kg)*	34.42 \pm 11.12	29.42 – 39.42	32.48 \pm 9.88	28.04 – 36.92	42.81 \pm 12.41	38.29 – 47.33	40.64 \pm 12.13	36.23 – 45.06
LM (kg)	46.28 \pm 11.84	40.96 – 51.60	47.13 \pm 12.20	41.65 – 52.62	46.38 \pm 6.82	43.90 – 48.86	46.58 \pm 7.21	43.95 – 49.20
FFM (kg)	49.44 \pm 12.42	43.86 – 55.03	50.14 \pm 13.08	44.26 – 56.02	49.20 \pm 7.16	46.60 – 51.81	49.45 \pm 7.62	46.68 – 52.22
SMM (kg)	27.20 \pm 7.20	23.96 – 30.44	27.61 \pm 7.69	24.15 – 31.06	27.07 \pm 4.29	25.50 – 28.63	27.30 \pm 4.57	25.64 – 28.97

Note: n = number of adolescents; \pm = standard deviation; 95% CI = 95% Confidence Interval; BMI = Body Mass Index; WC = Waist Circumference; HC = Hip Circumference; NC = Neck Circumference; AC = Right Arm Circumference; WHR = Waist-Hip Ratio; BF% = Body fat percentage Fat; FM = Fat Mass; LM = Lean Mass; FFM = Fat Free Mass; SMM = Skeletal Muscle Mass; * = time effect ($p < 0.01$) pre vs post-intervention; † = interaction with lower intragroup values after the intervention period ($p < 0.001$).

same variables are evaluated (Branco et al., 2019; Magnani Branco et al., 2020; Vanhelst et al., 2011). Although this study did not assess physical fitness, the training approach used in other areas of health confirmed positive impacts on circumferences and body composition of adolescents, even though no significant decrease in NC, AC, and a significant increase in LM, FFM e SMM.

Thus, body composition assessment becomes a great ally in obesity treatment programs. Cederholm et al. (2015) point out that the use of BMI requires caution in the analysis of interventions via physical exercise, as changes in body composition are observed with weight loss or gain. Additionally, Generoso Junior and Silveira (2017) concluded that the improvement of these aspects of body composition impacts the reduction of the prevalence of NCDs in individuals in this age group. This reduction in the risks associated with NCDs helps prevent the progression of comorbidities into adulthood (Silva et al., 2018). Excess weight is related to reduced quality of life, eating disorders, psychosocial difficulties, depression, and anxiety (Eckel et al., 2016). Moreover, visceral fat also changes according to lifestyle (Sahakyan et al., 2015).

According to our findings, the multidisciplinary approach proved to reduce visceral fat. However, the best predictor of its assessment has been discussed in the literature. In this sense, (Kuk & Ross, 2007) point out that the best predictors for estimating visceral fat are WHR, WC, and BMI. On the other hand, Janssen et al. (2002) point out that WHR, WC, BMI, and body weight are good predictors of visceral fat. Nevertheless, Kuk & Lee (2019) found that only body weight, WC, and BMI can be effective for this diagnosis.

In line with the findings, the present study showed significant results in reducing body weight, WC, and BMI, supporting the potential relationship between reducing these factors and changes in visceral fat. Even though no difference was found in the WHR results, Kuk & Ross (2007) report that with weight loss, fat is mobilized both from the abdominal region and towards the hip; thus, the decrease in WHR over the weeks may remain unchanged. In addition, the WHR values may be inadequate in children and adolescents because the WHR is proportionally higher than the WC, making the correlation between WHR and intra-abdominal fat low (Freedman et al., 1999). Therefore, WHR becomes a predictor of visceral fat that requires caution in interpreting their results (Sahakyan et al., 2015). Hence, it is vital to report that changes in body weight, BMI, and WC effectively impact the level of abdominal fat in adolescents with obesity. However, the WC values the post-intervention were above the recommended reference values for adolescents, according to the specific percentiles of race, sex, and age (Freedman et al., 1999). Adolescents

evaluated have CO, which is a predictor of cardiometabolic diseases. Thus, if comorbidities were not treated, their risks may ensue into adulthood (Skinner et al., 2015).

Our findings are like the study by Morano et al. (2016), who did not observe differences between sex for the anthropometric and body composition variables (within a similar age group). Because of this, it is believed that adolescents between pre-pubertal to pubertal stages within the first stages of the pubertal stage do not differ (anthropometrically and concerning body composition parameters). However, further studies with hormonal measures, wrist radiography, and other measures that seek to identify the biopsychosocial distinctions of adolescents of both sexes are recommended. Given this, the issue related to the homogeneity of the sexes against the age group is also listed, i.e., between 12-14 years old. Finally, obesity treatment involves programs that prioritize weight loss and weight maintenance. Because of multidisciplinary programs to help combat the obesity pandemic and improve the health conditions of the population (Fildes et al., 2015; Branco et al., 2021). Thus, programs for weight loss in adolescence, based on lifestyle change through health education, physical exercise, and healthy eating (Saboya et al., 2016; Branco et al., 2021), are substantial to promote health in primary care.

In this study, we can highlight as a strong point that the adoption of a healthy lifestyle through a multidisciplinary project, through healthy eating and physical exercise, contributed to the improvement of anthropometric responses and body composition. Thus, it is understood that the project can contribute to short- and long-term health improvement in adolescents. Then, this methodology can be replicated in more extensive studies in different contexts, such as after-school activities, sports centers, clubs, and basic health units. In this sense, this methodology can represent a health promotion strategy at a lower cost since the activities performed were carried out in groups (more people are treated together, thus being a cost-effective approach). However, as a limiting factor, visceral fat measured via bioelectrical impedance is listed (Zamrazilová et al., 2010), as studies evaluating the accuracy of this device for measuring visceral fat in adolescents in different age groups.

Consequently, new studies that assess the accuracy of visceral fat in bioelectrical impedance can be carried out. Furthermore, the absence of a control group can be justified, as the interventions carried out work to recover health conditions in adolescents with obesity. Because of this, a control group for interventions to combat obesity that were unable to receive the benefits of the intervention would not be recommended, as adolescents with obesity would be limited to maintaining an unhealthy daily routine (Hecksteden et al., 2018).

Conclusion

The interventions resulted in positive changes to reduce body weight, decrease BMI, decrease z-score BMI, decrease WC, decrease HC, decrease visceral fat, decrease BF% and decrease FM for adolescents of both sexes (between 12 and 14 years old). In line with the aspects listed above, it is concluded that developing programs with a multidisciplinary approach to promote health and quality of life decreases the prevalence of overweight and obesity in adolescents of both sexes.

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