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RESEARCH ARTICLE

The Effect of an Aerobic Platform on A Number of Body Components in Obese, Overweight, and Normal Children at the Age of (10-12 Years)

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Abstract
The aim of this study is to evaluate the effect of aerobic training intervention on body components in obese, overweight and normal weight children aged 10-12 years. Methods: quasi experimental pretest / posttest study design was used. The research sample was deliberately chosen from the primary school students of the ninth Kuwait School for Boys for the academic year (2022-2023), whose number is (56) students, with (10) obese children and (23) overweight children And (23) normal children. Paired independent t test Analysis was used to test the effect of the intervention between pre- and post-training. Results: The intervention significantly improved body component measurements in children with obesity or overweight when the pre-test and post-test values were compared in the research; BMI ($p<0.001$); Fat M(kg) ($p<0.001$); It was determined that there was a statistically significant difference in TR Fat M ($p<0.001$). However, in the data below, he concluded that there was no statistically significant difference between the variables;TBW(L) ($p>0.05$); PMM(%) ($p>0.05$); TR FFM ($p>0.05$); TR PMM ($p>0.05$). Conclusions: aerobic training made a significant difference in body component indices among children aged 10-12 years with obesity or overweight. Programmed aerobic training interventions can be used to improve some body component indices in obese and overweight children.

Keywords
Aerobic Training – Obesity -Overweight - Somatic Components

INTRODUCTION

Interest has recently increased in global nutrition problems (thinness, overweight, and obesity), particularly obesity, because after it was considered a problem confined to high-income countries, it has witnessed a huge increase in low-income and middle-income countries.

Obese children and adolescents are at increased risk of early onset non-communicable diseases, including musculoskeletal disorders, and some types of cancer, especially heart and metabolic diseases. The premature and long-term burden of non-communicable diseases carries significant economic consequences (Hammond & Ruth, 2010). For example, a high-fat mass percentage increases the risk of hyperlipidaemia, hypertension, and insulin resistance and promotes a long-term chronic inflammatory state (Smith et al., 2001).

As a result, excess adipose tissue increases the risk of chronic cardiometabolic diseases, such as type 2 diabetes, metabolic syndrome, coronary heart disease, and stroke (Bass & Eneli, 2015; Busnatu et al., 2022).

In general, studies indicate that overweight children and adolescents are at increased risk of coronary heart disease and cardiovascular disease in adulthood. Multidisciplinary interventions are considered effective in reducing cardiometabolic risk factors in overweight children and adolescents. These approaches mainly focus on weight reduction

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and lifestyle modification (Rajjo et al., 2017). It has been shown that cardiometabolic outcomes are significantly reduced with the decrease in weight and body mass index (BMI) following interventions based on modifying eating habits and physical activity levels. Specifically, exercise interventions in overweight children improve body composition by lowering body fat, blood sugar, and waist circumference (WC) (Busnatu et al., 2022; Özdemir, 2023). The dramatic increase in the prevalence of childhood obesity in the last decade has changed the view of childhood obesity, which is now considered a World Health Organization problem (Chin et al., 2007).

According to the World Health Organization, the prevalence of overweight and obesity among children and adolescents aged 5 to 19 years increased dramatically from 4% in 1975 to just over 18% in 2016. The increase occurred among both boys and girls. Equally, in 2016, 18% of girls and 19% of boys were overweight, while the proportion of obese children and adolescents aged 5 to 19 was only 1% in 1975. In 2016, 124 million children and adolescents (6% of girls and 8% of boys) were obese (WHO, 2021).

The majority of studies in overweight or obese children and adolescents have focused on aerobic exercise. These studies indicate that aerobic exercise has little effect on overall measures such as body weight and body mass index (BMI), but is usually associated with positive changes in body composition. . Aerobic exercise may reduce body fat, reduce the loss of lean body mass that typically appears during dietary energy restriction and mediate the accumulation of visceral adipose tissue, the latter being associated with cardiovascular risk in children (Owens et al., 1999).

Through the researcher's review of previous and similar studies, he noticed that the researchers focused on studying nutrition problems, including obesity and others, on how to get rid of weight by following a diet or training curricula, and not on how to codify appropriate exercises for this group to be a reliable database in the training and education process. This is in addition to the lack of coverage of the category that our current research dealt with, which is the category of obese, overweight, and normal children at the age of (10-12) years, as a study (Wong et al, 2008) that dealt with the effect of a twelve-week training program on aerobic fitness and body composition and blood lipids in obese males. And a study (Chumlea et al., 2007).

In which he dealt with an overview of the state of body water and the effects of body fatness and age in children and adults, and a study (Dezenberg, et al, 1999) that dealt with the body composition expected from anthropometric measurements in children before adolescence)
Through the foregoing, the current research aims to identify the effect of an aerobic platform on a number of physical components in obese, overweight, and normal children at the age of (10-12 years).

MATERIALS AND METHODS

Research Methodology

The researcher used the experimental method due to its suitability to the nature of the research. This survey research has followed ethical standards and received a certificate of research ethics feasibility from the Institute for Research and Community Service STKIP Pasundan Cimahi with Number 015 / LPPM. STKIP-Pas/ST.KL/IV/2022. Participant provided informed consent, with the volunteer form covering research details, risks, benefits, confidentiality, and participant rights. The research strictly adhered to the ethical principles of the Declaration of Helsinki, prioritizing participant's rights and well-being in design, procedures, and confidentiality measures.

Research sample

After the researcher identified the research sample consisting of children (males) at the ages of (10-12) years, obese, overweight and normal The research sample was deliberately chosen from primary school students of the ninth Kuwait School for Boys for the academic year (2022-2023) Their number is (56) students.
The first group: obese children:
The first experimental group consisted of (10) children aged 10-12 years.
The second group: overweight children:
The second experimental group consisted of (23) children aged 10-12 years.
The third group: normal children:
The third experimental group consisted of (23) children aged 10-12 years.

Devices and tools used

Treadmill electric treadmill (TMX425 Trackmaster 2004). American origin. Body

Composition Analyzer, model BC-418 MA, from TANITA. Medical Scale Detector, of American origin.

Data collection methods

The researcher used tests and measurements and means to collect data, which included the following:

Aerobic stress test (Bruce test)

Bruce test: This test found great popularity among pediatricians because it is suitable for measuring the efficiency of their circulatory system and respiratory system, so it was used by the researcher because it is suitable for the ages of the research sample.

Test objective: The test aims to reach (VO2max) in the laboratory, which is an effort based on gradient speed and incline.

Tools: Electric treadmill with speed and incline standard.

Preparation for the test: The laboratory performs a warm-up process for a period of (5) minutes by climbing on the treadmill and walking or light jogging at a speed of (6 km / h and an incline of 4%). Then a 5-minute rest period is given.

Test specifications: The test consists of seven stages, each stage has speed and incline, and each stage takes three minutes to perform (Adams, 2002).

Table 1. Shows the phases of Bruce's pneumatic stress test

Step	Time (min)	Speed (km/h)	Slope (%)
1	0.01	2.74	10%
2	3	4.02	12%
3	6	5.47	14%
4	9	6.76	16%
5	12	8.05	18%
6	15	8.85	20%
7	18	9.65	22%
8	21	10.46	24%
9	24	11.26	26%
10	27	12.07	28%

Anthropometric Measurements

Measurement of length (cm) and mass (kg)

The length and mass of the research sample were measured using a device (measuring height and mass) type (Detecto). After turning on the device and whistling it, the tester stands on the device with bare feet, and the measuring person moves the metal plate to touch the head of the tester. After installation, the indicator that represents the length of the tester in centimeters is read and measured to the nearest (0.5) centimeter. As for the mass measurement, after the reading is settled on the electronic screen The number represents the mass of the tester in kilograms and to the nearest (200) grams. Although the aforementioned device measures body weight, it was relied on to measure the weight by a body composition analyzer (Body Composition Analyzer) BC - 418 MA from the Japanese company Tanita used in the current study.

Measuring the physical components and its parts

The measurement was started after taking the following precautions

Not training for at least (12) hours before the measurement. Do not take any liquids or food before the start of the test for a period of 6 hours. Urinate before measurement. Washing the hands and bottoms of the feet and making sure they are free of water before stepping on the body composition analyzer. Taking off clothes (except for underwear) and any metallic material (watch-ring-).

The measurement steps were taken as follows

The variables were measured using the Body Composition Analyzer, as data is first entered into the computer, namely (height, gender, age, (day, month, year), weight of clothes). After that, the tester climbs onto the device (the weight is read minus clothes), and then a sign (000) appears on the screen of the device, after which the tester holds the handles, so that the device starts reading automatically.

The following measurements were chosen for the components and parts of the body

Body fat mass (kg) Fat Mass (kg) Fat M, Fat-Free Mass (kg) Fat-Free Mass FFM, Total Body Water (L) (TBW). Percent Muscle Mass (%) PMM, Trunk Fat Mass TR Fat M(k/g), TR FFM(k/g) Trunk Fat-Free Mass, Trunk Percent Muscle Mass (%)TR PMM

Aerobic training program

When designing the training curriculum, the researcher took into account the following points

Starting the training unit, by warming up to prepare the muscles of the body for work, for a period of (5) minutes. Using the jogging field as a tool for the enemy. Determine the intensity of the enemy in the interval training method, amounting to (50%-65%), which was suitable for the research sample, according to the (Karvonen) equation and the exploratory experiment. Determine the running time according to the intensity used and the pulse used, and according to the experimental experience and according to the number of heart beats of the required intensity. The training curriculum consisted of two intermediate courses, each intermediate course containing (4) Minor cycles, and the ripple movement of pregnancy was between minor cycles (3: 1). The curriculum included three training units per week. Controlling the training load in the training curriculum, depending on the intensity (50%-65%) of the maximum pulse, i.e. the gradual increase in intensity between the smaller sessions. Rest (intensity) The ratio of work to rest between one repetition and another in the low-intensity interval training method, negative rest depending on time until the pulse returns 120-130 z / d between repetitions and 90-100 z / d between exercises, and the rest time was determined by Experimental path. Finish the training unit by performing calming and relaxation exercises.

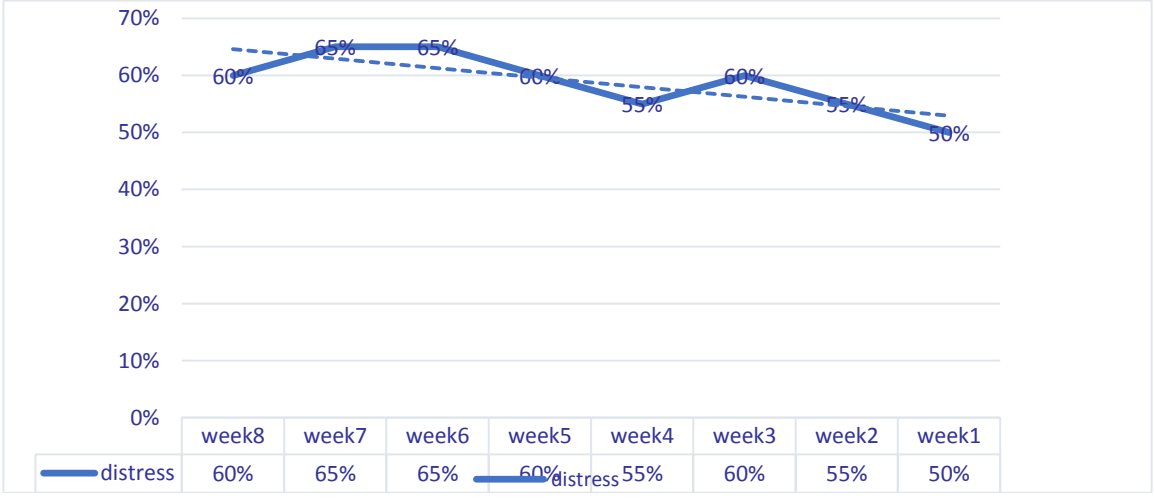

Figure 1. Shows a load movement for the aerobic training platform (intensity)

The main experience

Tribal measurements of body components and parts

For the purpose of achieving the objectives of the research, the researcher, with the help of the work team, conducted a Bruce test for aerobic effort on all members of the research sample for the period (7/1/2023-17/1/2023). The experiment was conducted according to the following sequence:

The examinee prepares for the test by wearing pants and sports shoes. A warm-up is performed by giving the tester (7-10) minutes, at a speed of (5-7) km/h, and an incline of (4-6) degrees on a treadmill. Give a rest period between the warm-up period and the start of the test (5-7 minutes) to return the functional variables to their normal state. Putting on the mask of the k5 device, after which the tester sits on a chair to take pre-measurements of the functional variables, then the subject gets on the treadmill. The lab begins to perform Bruce's test. The test continues with an increase in speed and incline until the tester reaches the stage of exhaustion. The test is stopped by pressing stop test. The data is stored automatically.

Points considered in the final experiment:

For the purpose of adjusting the research experience, the researcher took into account the following points

Wearing a tracksuit and athletic shoes on the day of the experiment. Before measuring the value of (REE) at rest, the amount of food and its calories must be taken into account, and in order to avoid this matter, the measurements were taken in the morning and on fasting for (8-12) hours and after measuring the body components. Conducting the test at a normal temperature (20-22) C by controlling it through air conditioning devices (heating and cooling). To ensure that all members

of the research sample are exposed to the same period of time between the warm-up and the start of the test, the warm-up process was arranged in a cross-work manner so that the time period between one tester and another is from (5-10) minutes (the experiment included two treadmills, one for warming up and the other for performing the test). The test procedure was taken under the same conditions in terms of place and time and in terms of the devices and tools used, as well as the sequence of functional measurements procedures for all members of the research sample. The researcher made sure that the work team is the same for all job measurements. As the experiment (pre-test) was conducted for the period from (7/1/2023-17/1/2023) at nine o'clock in the morning, the pre-measurements of the three research groups were conducted, which included the aforementioned measurements using the Body Composition Analyzer from TANITA Corporation. The data was recorded electronically by the device and then extracted from the device in the form of an Excel file.

Application of the training curriculum

The aerobic training curriculum was applied (in both the low-intensity and continuous methods) Appendix (9) for the period from (1/20/2023) to (4/22/2023) on the research sample at the rate of 3 training units per week and two medium training sessions (each session lasted 4-week course), and the researcher took into account the scientific foundations and rules during the application of the curriculum and taking into account the fluctuation of pregnancy during the training period, and the individual differences between the sample members were taken into account according to the intensity ratio used throughout the training period, and the researcher stirred up the competitive spirit between the two research groups. The training units also included On two methods of low-intensity and continuous interval training to add a factor of fun, pleasure, love of work and commitment to the training curriculum, given that the samples are from children and to avoid boredom that appears as a result of continuing the exercise at the same pace, which was observed through the exploratory experiment.

Dimensional measurements

Post-measurements were conducted, which lasted from (24/4/2023) until (2/5/2023) after completing the implementation of the training curriculum for the three groups, which are similar to the pre-measurements of the experiment, with the help of the same work team participating in the pre-measurement, and using the same procedures that were implemented After taking the necessary precautions to perform the dimensional measurements on the Body Composition Analyzer from (TANITA).

Statistical means:

The data were statistically processed using an electronic computer, using a qualitative statistical bag (Spss.v.26, Excel).

RESULTS

Displaying the results of the differences between the pre and post measurements in the values of the variables of body components and its parts for the three research samples (obese - overweight - normal)

Table 2. It shows the degree of significance between the pre and post tests of the average values of the research variables for the obese research sample

Variable	Before the Program		After the Program		t	Sig
	Mean	SD	Mean	SD		
BMI	26.7300	1.32418	25.3700	1.42287	4.015	0.003
Fat M(kg)	21.1200	4.07153	16.6300	2.98293	5.027	0.001
FFM(kg)	34.5300	3.27484	36.2200	3.49660	-2.622	0.028
TBW(L)	25.2800	2.40083	26.5300	2.56690	-2.629	0.027
PMM(%)	33.1400	3.09631	34.7300	3.29344	-2.580	0.030
TR Fat M	9.5400	1.81794	7.5500	1.27126	4.803	0.001
TR FFM	18.9300	1.71727	20.0500	1.42224	-2.446	0.037

TR PMM	18.2500	1.65143	19.3300	1.37117	-2.413	0.039

When the pre-test and post-test were compared in the study, significant findings were detected in favor of the post-test in all parameters. According to the findings: BMI (t:4.015, p<0.01); Fat M(kg) (t:5.027, p<0.01); FFM(kg) (t:-2.622, p<0.01); TBW(L) (t:-2.629, p<0.01); PMM(%) (t:-2.580, p<0.01); TR Fat M (t:4.803, p<0.01); TR FFM (t:-2.446, p<0.01); TR PMM (t:-2.413, p<0.01).

Table 3. It shows degree of significance between the pre and post tests of the average values of the research variables for the overweight research sample

variable	before the program		after the program		t	Sig
	Mean	SD	Mean	SD		
BMI	22.6261	1.14225	21.6696	0.92168	5.541	0.000
Fat M(kg)	13.4565	2.63194	11.0913	2.32064	4.868	0.000
FFM(kg)	31.9304	5.14167	32.3565	4.52024	0.953	0.351
TBW(L)	23.3826	3.76813	23.6870	3.30458	0.929	0.363
PMM(%)	30.7087	4.85620	31.0913	4.26976	0.898	0.379
TR Fat M	6.3261	1.44575	5.1087	1.40839	4.074	0.001
TR FFM	18.4435	2.29264	18.5087	1.94303	0.299	0.768
TR PMM	17.7826	2.19227	17.8522	1.86544	0.339	0.738

When the pre-test and post-test values were compared in the research; BMI (t:5.541, p<0.001); Fat M(kg) (t: 4.868, p<0.001); It was determined that there was a statistically significant difference in TR Fat M (t:4.074, p<0.001). However, in the data below, he concluded that there was no statistically significant difference between the variables; FFM(kg) (t:0.953, p<0.01); TBW(L) (t:0.929, p>0.05); PMM(%) (t:0.898, p>0.05); TR FFM (t:0.299, p>0.05); TR PMM (t:0.339, p>0.05).

Table 4. It shows he degree of significance between the pre and post tests for the average values of the search variables for the normal research sample

variable	before the program		after the program		t	Sig
	Mean	SD	Mean	SD		
BMI	18.5652	1.290739	18.35652	1.242002	2.194009	0.039
Fat M(kg)	8.2870	2.087474	7.013043	1.46359	6.220107	0.000
FFM(kg)	27.6870	4.598548	28.54348	4.64081	4.94244	0.000
TBW(L)	20.2783	3.366676	20.90435	3.404873	4.98414	0.000
PMM(%)	26.6435	4.404319	27.43478	4.429304	4.85927	0.000
TR Fat M	3.7435	1.251844	2.921739	0.817956	6.274384	0.000
TR FFM	16.8957	2.26625	16.82609	2.126076	0.608709	0.549
TR PMM	16.2957	2.178506	16.22174	2.064187	0.716522	0.481

When the pre-test and post-test values were compared in the research; BMI (t:2.1940, p<0.001); Fat M(kg) (t: 6.220, p<0.001); TR Fat M (t:4.942, p<0.001), FFM(kg) (t:4.984, p<0.01); TBW(L) (t:4.859, p>0.05); PMM(%) (t:6.274, p>0.05); It was determined that there was a statistically significant difference in TR FFM (t:0.608, p>0.05). However, it was determined that there was no statistically significant difference between the variables only in TR PMM (t:0.7165, p>0.05).
affected the reduction of fats as fuel in children who suffer from overweight and obesity.

DISCUSSION

This study aimed to present the effect of an aerobic training on a number of body components in obese, overweight, and normal children at the age of (10-12 Years). Previous research supports that the aerobic training is one of the most valid instruments to reduce overweight and obesity in children (Chen et al., 2022) and adolescents, especially when exercise is included (Tessaris et al., 2021). Bharath et al. (2018), exploring the efficacy of aerobic exercise on visceral adiposity in a group of adolescent girls with obesity, showed that aerobic exercise reduced metabolic risk factors in obese adolescents. In line with these results, our study observed an improvement in BMI (Body Mass Index - Fat M (kg) Body Fat Mass - FFM (kg) Fat Free Mass - Total Water Volume TBW - Percentage of Muscular Mass PMM) %) - trunk fat mass TR Fat M - trunk fat free mass TR FFM - trunk muscle mass ratio (TR PMM) in all the boys groups.

In addition, other authors that studied the effects of mixed exercise in children showed that exercise interventions significantly improved several cardiometabolic risk factors, such as BMI. Through the findings of the researcher, it was found that there is a statistically significant difference in the variables BMI (body mass index - Fat M (kg) body fat mass - trunk fat mass TR Fat M). The researchers concluded that there were no statistically significant differences in the variables: FFM (kg) fat-free mass - total water volume TBW - percentage of muscle mass PMM (%) - fat-free mass of the trunk TR FFM - percentage of muscle mass of the trunk TR PMM).

In interpreting the results of the research on the effect of the exercises used on reducing the percentage of fat in obese and overweight people, the researchers believe that the moderate-intensity exercises that the researcher uses in his training depend on the muscle fibers of the body. Type 1, which is characterized by containing larger numbers of mitochondria and depends on O2 to produce energy, compared to type 2 fibers, and therefore the oxygen used to oxidize fats and use them as energy will be large, and this is what

The researchers attribute the reason to the effect of the aerobic approach used on fat mass, which led to the body relying on fats to produce the energy needed to perform the effort. Exercise, which also depends on fat to produce energy for a long time, and all of this contributes to losing excess weight (Vella, et al., 2002) The researcher also attributes the reason for the decrease in fat mass in the sample to the increase in fat oxidation resulting from the aerobic work used, as long-term exercises (medium aerobics) increase fat oxidation, and several factors contribute to this, including Increased mitochondrial density in skeletal muscle leading to oxidative stress, capillary vascularization through skeletal muscle, increasing fatty acid delivery into the muscle, increased L-carnitine, which facilitates the transport of fatty acids across the mitochondrial envelope, increased fatty acid transporter proteins (Veldre, 2001) indicated that the component that most changes in the components of the human body is the fat mass, which can range from (5% to approximately 50%) of the body mass..., and there has been an increasing scientific interest in the fat mass largely because of its relationship In the health condition, especially in children, as the most obvious fat mass is in the navel, pubic and iliac region, (Rahimi, 2006) stated that the effect of training for (12) weeks using moderate intensity leads to improving body composition and reducing fat mass for overweight individuals.

Previous studies (Lindholm et al., 2019). underlined the importance of body composition evaluation in aerobic training practice. However, anthropometric measures such as BMI and bodyweight alone have insufficient sensitivity for overweight and obesity treatment and management. Moreover, fat-free mass evaluation allows for the tailoring of an exercise treatment (Yoo, 2016). Our study did not observe statistically significant variations inthe percentage of muscle mass of the trunk TR PMM boys. Future studies of longer duration are needed to clarify these aspects, or it may be useful to influence the frequency and intensity of the workouts. Nevertheless, we

observed a significant decrease in resulting from the improved sample mean values of BMI, Fat M(kg), FFM(kg), TBW(L), PMM(%), TR Fat M, TR FFM variables associated with obese. Evidence shows that objective measures of physical performance and ability can predict later health problems. This is especially important in childhood, the stage of life where we lay the foundations for health in adulthood and old age. Our study has been well validated in 10-12 year old children and it can be said that aerobic training is an effective, fast and cheap way to prevent obesity.

Although a previous study reported that an aerobic exercise program resulted in impaired muscle conditioning of children and adolescents with obesity compared to their normal-weight peers (Han et al., 2018), other authors reported that TR Fat M, TR FFM). In the group of 10-12 year old boys, this exercise intervention was observed to improve the values of the variables (related to obesity). According to the results of this study, the approach based on the examination of body components may represent an effective tool for monitoring health and evaluating the effectiveness of an exercise program in children with overweight/obesity. Further studies with larger study populations will be needed to confirm and generalize the results of this study.

Conflict Of Interest

This research no conflict of interest. No financial support was received.

Ethics Statement

This survey research has followed ethical standards and received a certificate of research ethics feasibility from the Institute for Research and Community Service STKIP Pasundan Cimahi with Number 015 / LPPM. STKIP-Pas/ST.KL/IV/2022.

Author Contributions

Study Design, HAS and SY; Data Collection, HAS and AAAID; Statistical Analysis, HAS, AAAID; Data Interpretation, HAS and AAAID; Manuscript Preparation, HAS, SY and AAAID; Literature Search, AAAID, HAS and SY. All authors have read and agreed to the published version of the manuscript.

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Conclusions

In our study, improvements were observed in all body components in 10-12 year old boys. In our opinion, these results may be statistically and clinically significant. This aerobic exercise program has been proven to be health-effective for children with overweight/obesity. In the children the data showed improvement in all body component measurement values (BMI, Fat M(kg), FFM(kg), TBW(L), PMM(%),

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