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Effect of an aerobic curriculum on a number of physical components and functional variables for overweight children aged (10-12 years)

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Abstract

The researchers conducted this study to identify the effect of an aerobic curriculum on a number of physical components and functional variables for overweight children aged (10-12 years). Researchers used experimental method due to its suitability, research sample included male children aged (10-12 years). Research sample was deliberately selected from primary school pupils of the Ninth Kuwait School for Boys for the academic year (2022-2023), (23) of overweight children. Researchers reached the following results after applying aerobic training program
Results showed that there is a statistically significant difference in variables BMI (body mass index - Fat M (kg) body fat mass - FFM (kg) fat-free mass).

- There are significant differences in values of a number of functional variables between pre- and post-test in (rest) stage for overweight children aged (10-12 years) in following variables: - (RQPre), as the moral value of (t) was less than or equal to From probability level (0.05).
- There were significant differences in values of a number of functional variables between pre- and post-test in (threshold) stage for overweight children aged (10-12 years) in following variables: (VCO2 TH), (VO2 TH), (Time TH), as significant value of (t) is less than or equal to probability level (0.05).
- There are significant differences in values of a number of functional variables between pre- and post-test in (post-exertion) stage for overweight children aged (10-12 years) in following variables: (VO2Post), (VCO2Post), (HRPost), (Time Post).), as significant value of (t) was less than or equal to probability level (0.05).
- There are significant differences in values of a number of functional variables between pre- and post-test during (recovery) stage for overweight children aged (10-12 years) in following variables: (VO2Reco), (RQReco), (RQReco), as significant value For (t) is less than or equal to probability level (0.05).
- There are significant differences in values of a number of functional variables between pre- and post-test for overweight children aged (10-12 years) in variable of (VO2MAX. mL/kg·min), as the moral value of (t) was less than or equal to Probability level (0.05).

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اثر منهاج هوائي في عدد من المكونات الجسمية والمتغيرات الوظيفية لدى الأطفال ذوي الوزن الزائد بعمر (١٠-١٢ سنة)

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مستخلص البحث

أجرى الباحثان هذه الدراسة للتعرف على تأثير برنامج هوائي على عدد من المكونات البدنية والمتغيرات الوظيفية لدى الأطفال ذوي الوزن الزائد بعمر (١٠-١٢ سنة). استخدم الباحثان المنهج التجريبي ليتناسب مع طبيعة البحث الحالي، وشملت عينة البحث عينة من الأطفال (الذكور) الذين تتراوح أعمارهم بين (١٠-١٢ سنة) من ذوي الوزن الزائد. تم اختيار عينة البحث بطريقة قصدية من طلاب المرحلة الابتدائية بمدرسة الكويت التاسعة للبنين للعام الدراسي (٢٠٢٢-٢٠٢٣) والذين بلغ عددهم (٢٣) طفلاً من ذوي الوزن الزائد. وقد توصل الباحثان إلى النتائج التالية بعد تطبيق برنامج التدريب الهوائي على:

ومن خلال النتائج التي توصلت إليها الباحثان تبين أن هناك فرق ذو دلالة إحصائية في متغيرات مؤشر كتلة الجسم) مؤشر كتلة الجسم – الدهون م (كجم) كتلة الدهون في الجسم FFM – (كجم) الكتلة الخالية من الدهون.(

•توجد فروق ذات دلالة إحصائية في قيم عدد من المتغيرات الوظيفية بين الاختبار القبلي والاختبار البعدي في مرحلة (الراحة) للأطفال ذوي الوزن الزائد بعمر (١٠-١٢ سنة) في متغيرات(RQPre) : كما وكانت القيمة المعنوية لـ (t) أقل من أو تساوي من مستوى الاحتمال.(0.05)

•وجود فروق ذات دلالة إحصائية في قيم عدد من المتغيرات الوظيفية بين الاختبار القبلي والاختبار البعدي في مرحلة (العتبة) للأطفال ذوي الوزن الزائد بعمر (١٠-١٢ سنة) في متغيرات(VCO2 TH) :، (VO2 TH)، (Time TH)، كما كانت القيمة المعنوية لـ (t) أقل من أو تساوي مستوى الاحتمال.(0.05)

•توجد فروق ذات دلالة إحصائية في قيم عدد من المتغيرات الوظيفية بين الاختبار القبلي والاختبار البعدي في مرحلة (بعد المجهود) للأطفال ذوي الوزن الزائد بعمر (١٠-١٢ سنة) في متغيرات(VO2Post) :، (VCO2Post)، (HRPost)، (Time Post)حيث أن القيمة المعنوية لـ (t) كانت أقل من أو تساوي مستوى الاحتمال (٠.٠٥) (.

•توجد فروق ذات دلالة إحصائية في قيم عدد من المتغيرات الوظيفية بين الاختبار القبلي والاختبار البعدي في مرحلة (التعافي) للأطفال ذوي الوزن الزائد بعمر (١٠-١٢ سنة) في متغيرات(VO2Reco) ، RQReco) إذ كانت القيمة المعنوية لـ (t) أقل من أو تساوي مستوى الاحتمال (٠.٠٥)

•توجد فروق ذات دلالة إحصائية في قيم عدد من المتغيرات الوظيفية بين الاختبار القبلي والاختبار البعدي للأطفال ذوي الوزن الزائد بعمر (١٠-١٢ سنة) في متغير (VO2MAX) مل/ كجم·دقيقة، كما أن الدلالة المعنوية كانت قيمة (t) أقل من أو تساوي مستوى الاحتمال.(0.05)

الكلمات المفتاحية : التدريب الهوائي – الوزن الزائد

Introduction and research objective:

Obese children and adolescents are at increased risk of premature development of non-communicable diseases, including musculoskeletal disorders, some cancers, and especially cardio-metabolic diseases. This premature and long-term burden of non-communicable diseases carries significant economic consequences. (Hammond, 2010) (Lal A et al, 2012) In general, studies indicate that overweight children and adolescents are at increased risk of coronary heart disease and cardiovascular disease in adulthood, as there has been a dramatic increase in the prevalence of childhood obesity in the last decade. It changed the view on childhood obesity, which is now considered one of the problems of the World Health Organization (Chin A paw, et al, 2007).

Children in our current era are among the people most exposed to obesity due to sitting for long periods in front of the television and electronic gaming devices and eating a lot of fast food, soft drinks and sweets. Bray et al., 2002,))

There is evidence indicating that sports activity has declined in recent decades, which has led to an increase in the prevalence of obesity, and there is an Australian study comparing the normal activity of children aged (10-11) years from 1985 to 1997 indicating that there is a significant decrease in physical activity, and that the relationship There is an inverse relationship between obesity and physical activity. (Young & Hills, 2007)

The benefits of aerobic physical exercise on individuals' health have been well proven, through improving cardio-respiratory fitness, body composition, and psychological and social well-being, as physical exercise has been used as an important tool in the prevention and treatment of obesity (Guinhouya, 2012,).

Through the researcher's review of previous and similar studies, he noticed that the researchers focused on studying nutritional problems, including obesity and others, on how to lose 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 addressed, which is the category of obese, overweight, and normal children aged (10-12) years,

such as the study (Wong et al, 2008), which dealt with the effect of a twelve-week training program on aerobic fitness, body composition, and blood fats in children. Males suffering from obesity. And the study (Chumlea et al., 2007), which dealt with a general overview of body water status and the effects of body obesity and age in children and adults, and the study (Dezenberg, et al, 1999), which dealt with the body composition expected from anthropometric measurements in pre-adolescent children.

Hence, the importance of the current research lies in the effect of an aerobic approach on a number of values of functional variables during the performance of a regulated aerobic effort, such as: (Bruce's test), as well as in identifying the values of these variables at rest, during aerobic effort, at the time of the anaerobic differential threshold, as well as in the phase. The maximum oxygen consumption for overweight children aged (10-12) years, before and after the training curriculum, as it is a clear necessity in order to reach a scientific base on which exercises and training units can be built in a way that is compatible with the capabilities of these ages through identification and comparison of research variables. It also contributes, even if only slightly, to knowledge in this direction, which requires research, investigation, and adapting the results to serve the teaching and training process to achieve better performance and achievement and good physical dealings with this important group.

Through the above, the current research aims to identify the effect of an aerobic curriculum on a number of physical components and functional variables in overweight children aged (10-12 years).

Search procedures :

Research Methodology :

The researcher used the experimental method because it suits the nature of the research

Research sample: After the researcher determined the research sample consisting of overweight children (males) aged (10-12) years, the research sample was deliberately selected from the primary school students of the Ninth Kuwait School for Boys for the academic year (2022-2023), who numbered (2022-2023). 23) A student.

Devices and tools used:

• Electric Treadmill (TMX425 Trackmaster 2004). American origin.

• Body Composition Analyzer, model BC-418 MA, from TANITA.

• Height and weight measuring device (Medical Scale Detector) of American origin.

• K5 Cosmed, a wearable metabolic device of Italian origin, with all its accessories

Data collection methods:

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

Air stress test (Bruce test): Bruce test

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

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

- Tools: An electric Treadmill with a speed and incline standard.

- Preparing for the test: The tester conducts a warm-up for (5) minutes by getting on the treadmill and doing a light walk or jog at a speed of (6 km/hour and an incline of 4%). He is then given a rest period of (5) minutes.

- Test specifications: The test consists of seven stages, each stage has a speed and incline, and each stage takes three minutes to perform. Table (1) shows the stages of the Bruce air stress test.

Table (1) shows the phases of Bruce's pneumatic stress test.

Step	Time(min)	Speed (km/h)	Slope(%)
1	0	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%

(Adams, 2002, 255)

Anthropometric measurements

- Measuring the length (cm) and mass (kg) of the body:

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

- Measuring bodily components and parts:

The measurement was started after taking the following precautions:

• Not training for at least 12 hours before the measurement.

• Do not consume any liquids or food for 6 hours before the start of the test.

• Urinate before measuring.

• Wash the hands and bottoms of the feet and make sure they are free of water before boarding the body composition analysis device.

• Remove clothing (except underwear) and any metal item (watch, ring).

The measurement steps were carried out as follows:

The variables were measured using a body composition analyzer. The data is first entered into the computer, namely (height, gender, age, (day, month, year), weight of clothing). The tester then climbs onto the device (the weight is read minus the clothes) and then the signal (000) appears on the device screen. The tester then holds the handles and the device begins 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) (kg) Fat-Free Mass FFM

Functional measurements

Measure respiratory variables

Data on functional variables were obtained by implementing the Bruce stress test and by using a number of attached devices in the following manner:

The functional variables were measured in a laboratory manner using a gas analyzer using the open method using the Metabolic Measurement System (K5).

- Functional variables:

• Heart rate- Hr (beats/minute)

• Pulmonary ventilation (Ventilation-VE) (L/min)

• Volume of absolute oxygen (VO2) (L/min)

• Volume of carbon dioxide (VCO2) (l/min)

• Ventilation coefficient (Respiratory Equivalent-RQ)

• Measure the maximum value of oxygen consumption (liters/minute)

Maximum Oxygen Consumption (Vo2max)

Aerobic training program:

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

١. Start the training unit with a warm-up to prepare the body's muscles for work for (5) minutes.

٢. Using the running field as a running tool.

.٣Determine the intensity of the sprint in the interval training method (50%-65%), which was appropriate for the research sample, according to the (Karvonen) equation and the exploratory experiment.

.٤Determine the running time according to the positive intensity used and the pulse used, according to the exploratory experience and according to the number of heartbeats for the required intensity.

٥The training curriculum consisted of two intermediate courses, each intermediate course contained:

(٤) Minor cycles, and the movement of convection was undulating between the minor cycles.(٣:١)

.٦The curriculum includes three training units per week.

.٧Controlling the training load in the training curriculum, depending on the intensity (50% - 65%) of the maximum pulse, that is, the gradual increase in intensity between the smaller sessions.

.٨Rest (intensity): the ratio of work to rest between one repetition and another in the low-intensity interval training method, passive rest based on time until the pulse returns, 120-130 rpm between repetitions and 90-100 rpm between exercises. The rest time was determined by Exploratory experiment method.

٩. End the training unit by performing calming down and relaxation exercises.

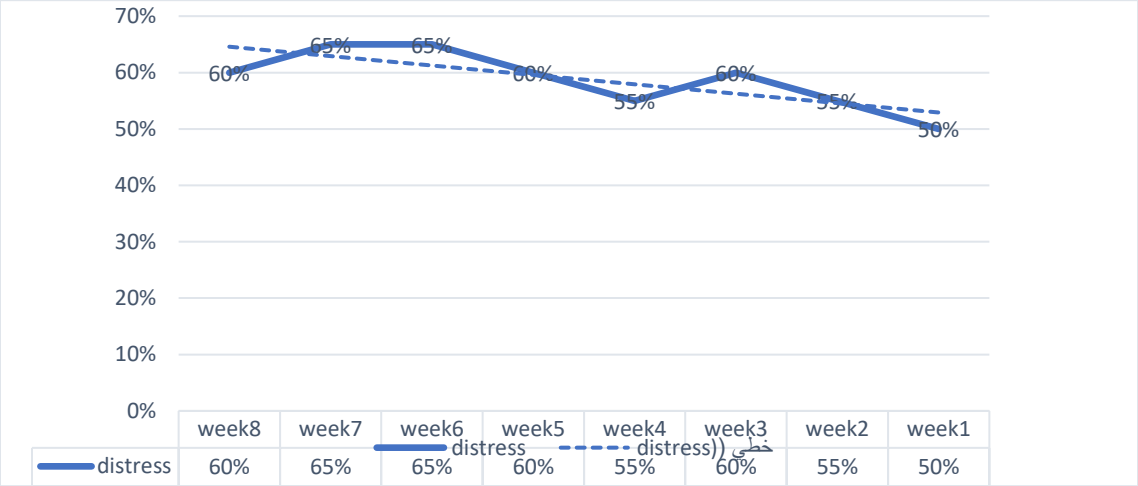

Figure (1) shows a load movement for the aerobic training curriculum (intensity)

Main experience:

Pre-measurements of bodily components, parts, and functional variables:

For the purpose of achieving the research objectives, the researcher, with the assistance of the work team, conducted the Bruce aerobic stress test on all

members of the research sample for the period (1/7/2023 - 1/17/2023). The experiment was conducted according to the following sequence:

١. The subject prepares for the test by wearing pants and athletic shoes.

٢. A warm-up is performed by giving the tester 7-10 minutes at a speed of 5-7 km/hour and an incline of 4-6 degrees on the treadmill.

٣. Give a period of rest between the warm-up period and the start of the test (5-7 minutes) so that the functional variables return to normal.

٤. Put on the mask of the K5 device, then the tester sits on a chair to take pre-measurements of the functional variables, then the subject gets on the moving treadmill.

٥. The laboratory begins performing the Bruce test.

٦. The test continues with increasing speed and incline until the tester reaches the stage of exhaustion of effort.

٧. The test is stopped by clicking on stop test. The data is stored automatically.

Points taken into account in the final experiment:

For the purpose of controlling the research experiment, the researcher took into account the following points:

١. Wear tracksuits and athletic shoes on the day of the experiment.

٢. Before measuring the REE value at rest, the amount of food and its calories must be taken into account. In order to do this, measurements were taken in the morning, while fasting for (8-12) hours, and after measuring the body components.

٣. Conduct the test at a normal temperature (20-22) °C by controlling it through air conditioning devices (heating and cooling).

٤. To ensure that all members of the research sample were exposed to the same period of time between the warm-up and the start of the test, the warm-up process was arranged in an overlapping work style so that the time period between one laboratory and another was (5-10) minutes (the experiment included two moving treadmills, one for warming up and the other for performing the test).

٥. The test was conducted under the same conditions in terms of place, time, devices and tools used, as well as the sequence of functional measurements procedures for all members of the research sample.

٦. The researcher made sure that the work team was the same for all functional measurements.

The experiment (pre-test) was conducted for the period from (1/7/2023 - 1/17/2023) at nine in the morning. Pre-measurements were conducted for the three research groups, which included the previously mentioned measurements using a body composition analysis device (Body Composition Analyzer) from... Company (TANITA). 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 (in both low-intensity and continuous interval methods) was applied for the period from (1/20/2023) to (4/22/2023) on the research sample at a rate of 3 training units per week and two medium training sessions (each session lasted 4 weeks) The researcher took into account the scientific foundations and rules during the application of the curriculum and took into account the fluctuation of the load during the training period. The individual differences between the sample members were also taken into account according to the percentage of intensity used throughout the training period. The researcher also stoked the competitive spirit between the two research groups. The training units also included two methods of training. The low-intensity, continuous period is to add a factor of fun, pleasure, love of work, and commitment to the training curriculum, given that the samples are children and to avoid boredom that appears as a result of continuing to exercise at one pace, which was observed through the exploratory experiment.

Dimensional measurements:

The post-measurements were conducted and lasted from (4/24/2023) until (5/2/2023) after completing the implementation of the training curriculum for the three groups. They are similar to the pre-measurements of the experiment and 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 dimensional measurements on the Body Composition Analyzer from TANITA.

Statistical methods:

The data was processed statistically using an electronic computer, and using a qualitative statistical package (Spss.v.26, Excel

statistical analysis

results:

Table (2)
It shows the arithmetic means, standard deviations, calculated (t) values, and the degree of significance between the pre- and post-tests for the average values of the research variables for the research sample. Overweight children.

Variables	pre		post			
	Mean	s.d	Mean	s.d	t	Sig
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

*Significant difference at probability level(٠,٠٥) ≥

Through the results reached by 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 - FFM (kg) fat-free mass).

Table (3)
It shows the arithmetic means, the standard deviations, the calculated (t) values, and the degree of significance between the pre- and post-tests for the average values of the functional variables in the stages of (rest - threshold, anaerobic band - end of effort - recovery) of the research for the research sample. Overweight children.

Variables	Measurement	Mean	s.d	t	Sig
VE(rest) (L.min^{-1})	pre	7.569	1.278	1.853	0.098
	post	8.330	0.984		
VE (threshold) (L.min^{-1})	pre	48.911	12.935	1.710	0.101
	post	44.075	12.133		
VEPost (L.min^{-1})	pre	49.774	14.413	-0.040	0.969
	post	49.920	11.324		
VE(recovery) (L.min^{-1})	pre	15.960	3.305	-1.738	0.096
	post	17.971	3.922		
VO2 (rest) (ml.kg^{-1}.min^{-1})	pre	375.530	80.983	0.836	0.412
	post	358.578	67.973		
VO2 (threshold) (ml.kg^{-1}.min^{-1})	pre	1951.510	427.976	5.843	0.000
	post	1334.110	333.291		
VO2Post	pre	1978.255	436.390	4.138	0.000

($ml.kg^{-1}.min^{-1}$)	post	1495.720	325.217		
VO2(recovery) ($ml.kg^{-1}.min^{-1}$)	pre	632.953	158.501	3.560	0.002
	post	467.445	126.238		
VCO2(rest) ($ml.kg^{-1}.min^{-1}$)	pre	268.048	63.568	-0.510	0.615
	post	276.235	49.318		
VCO2 (threshold) ($ml.kg^{-1}.min^{-1}$)	pre	1949.993	427.433	5.462	0.000
	post	1362.662	366.886		
VCO2Post ($ml.kg^{-1}.min^{-1}$)	pre	1978.247	473.063	3.586	0.002
	post	1539.142	346.531		
VCO2(recovery) ($ml.kg^{-1}.min^{-1}$)	pre	568.936	137.849	0.314	0.757
	post	555.017	161.583		
RQ(rest)	pre	0.712	0.058	-3.821	0.001
	post	0.773	0.050		
RQ (threshold)	pre	1.010	0.139	-0.218	0.830
	post	1.018	0.088		
RQPost	pre	0.993	0.064	-1.535	0.139
	post	1.031	0.091		
RQ(recovery)	pre	0.904	0.047	-7.634	0.000
	post	1.189	0.165		
HR(rest) ($b.min^{-1}$)	pre	89.895	11.509	0.945	0.355
	post	87.600	9.230		
HR (threshold) ($b.min^{-1}$)	pre	179.445	8.936	1.504	0.147
	post	175.162	14.805		
HRPost ($b.min^{-1}$)	pre	185.169	10.032	-3.422	0.002
	post	191.997	10.401		
HR(recovery) ($b.min^{-1}$)	pre	119.435	1.037	0.295	0.771
	post	119.295	2.311		
VO2MAX mL/min	pre	2380.236	259.118	-1.418	0.170
	post	2456.598	313.940		
VO2MAX mL/kg·min	pre	52.902	6.414	-3.433	0.002
	post	57.104	8.897		
Time TH)Min(	pre	6.06	1.13791	-٣,٣٣٨	0.003
	post	7.4507	2.18271		
Time Post)Min(	pre	7.3551	٠.84827	-٤,١١٥	0.000
	post	9.2210	2.55211		
Time(recovery)	pre	2.0359	٠.43535	٣,٢٩٠	0.003

)Min(	post	1.2000	٠.45227

*Significant difference at probability level(٠,٠٥) ≥

From Table (3) the following is evident:

• There are significant differences in the values of a number of functional variables between the pre-test and the post-test in the (rest) stage for overweight children aged (10-12 years) in the variables: - (RQPre), as the moral value of (t) was less than or equal to From the probability level (0.05).

• There were significant differences in the values of a number of functional variables between the pre-test and the post-test in the (threshold) stage for overweight children aged (10-12 years) in the variables: (VCO2 TH), (VO2 TH), (Time TH), as they were The significant value of (t) is less than or equal to the probability level (0.05).

• There are significant differences in the values of a number of functional variables between the pre-test and the post-test in the (post-exertion) stage for overweight children aged (10-12 years) in the variables: (VO2Post), (VCO2Post), (HRPost), (Time Post).), as the significant value of (t) was less than or equal to the probability level (0.05).

• There are significant differences in the values of a number of functional variables between the pre-test and the post-test in the (recovery) stage for overweight children aged (10-12 years) in the variables: (VO2Reco), (RQReco), (RQReco), as the significant value was For (t) is less than or equal to the probability level (0.05).

• There are significant differences in the values of a number of functional variables between the pre-test and the post-test for overweight children aged (10-12 years) in the variable (VO2MAX. mL/kg·min), as the moral value of (t) was less than or equal to Probability level (0.05).

Discussing the results:

The researcher attributes these positive improvements to the use of an aerobic training curriculum in both low-intensity interval and continuous training methods. These aerobic exercises have proven their ability to achieve significant changes in the components of the body comprehensively, with a focus on running as a comprehensive exercise for most parts of the body, including the legs, arms, and torso, which affected the research variables (BMI, Fat M, FFM,) and for each

part of the body. Parts of the body as well, we notice that these proportions change significantly and in favor of dimensional measurement.

The researcher attributes the effect of the aerobic program used on fat mass to the body's dependence on fat to produce the energy needed to perform the effort. Recent studies indicate that when using low intensity, most of the energy is obtained from fat, in addition to the energy required for the body to return to its normal state after exercise, which also depends on fat to produce energy for a long period. All of this contributes to losing excess weight." (Vella , et al, 2002,), and (Loitongbam & Takhellambam, 2021) believe that aerobic training for 8 weeks regularly for 3 days leads to a reduction in body fat mass, and these results are consistent with the results of a study (Regaieg, 2013), in which the results showed a significant improvement in Body composition and aerobic capacity in obese children who underwent an aerobic training program. (Ghorbani, et al, 2014) states that exercising for six weeks significantly improves cardiovascular strength, mental health, and body mass index.

As for the variable volume of oxygen consumed (VO2), the value of the volume of oxygen consumed decreased in the post-test compared to the pre-test. The researcher may attribute the reason to the fact that aerobic exercise works to enhance cardiovascular health, thus improving blood flow and distributing oxygen to tissues and organs better. Which enhanced the growth and development of muscles, and increased their ability to use oxygen more during effort, and this is consistent with what was stated by (Haff & Triplett, 2015) that aerobic endurance training produces many changes in cardiovascular functions, including an increase in maximum cardiac output. Stroke volume increases and heart rate decreases at rest and during near-maximal exercise. In addition, capillary density in muscle fibers increases as a result of aerobic endurance training, which supports oxygen delivery and carbon dioxide removal.

(Bassett & Howley, 2000) state that aerobic endurance training leads to an increase in the activities of mitochondrial enzymes, which improves performance by enhancing fat oxidation and reducing the accumulation of lactic acid, which is an important factor in increasing maximum oxygen consumption (VO2max).

(John, 2019) confirms that aerobic training leads to an enlargement of the left ventricle, its strength, and an increase in the thickness of its walls, while the adaptation that occurs in table athletes is the expansion of the size of the left

ventricular chamber. (John, 2019, 12), and (Flannery M et al, 2019) state that the decrease in resting heart rate that characterizes athletes undergoing endurance training is related to internal adaptations in the sinus node.

Some studies, including the study (Balady, et al, 2010) and the study (Schutte, 2016), mention that exercise training leads to improving cardiorespiratory fitness by about 10% to 25% in individuals who were previously inactive, and this improvement varies greatly between individuals. Even with a standard training program, genetic factors determine approximately 50% of the VO2 response to training. It is noted that recovery time has decreased compared to the pre-test. The reason may be attributed to the fact that aerobic training enhances blood flow to the muscles and various tissues in the body, and this increases... Transporting oxygen and nutrients to the damaged tissues, which enhances the healing process, and by improving blood flow, the body can get rid of these wastes faster after exercise. The study (Tomlin & Wenger, 2001) indicates that there is a link between aerobic fitness and the speed of lactate removal after exercise.

Conclusions

• There are significant differences in the values of a number of functional variables between the pre-test and the post-test in the (rest) stage for overweight children aged (10-12 years) in the variables: - (RQPre), as the moral value of (t) was less than or equal to From the probability level (0.05).

• There were significant differences in the values of a number of functional variables between the pre-test and the post-test in the (threshold) stage for overweight children aged (10-12 years) in the variables: (VCO2 TH), (VO2 TH), (Time TH), as they were The significant value of (t) is less than or equal to the probability level (0.05).

• There are significant differences in the values of a number of functional variables between the pre-test and the post-test in the (post-exertion) stage for overweight children aged (10-12 years) in the variables: (VO2Post), (VCO2Post), (HRPost), (Time Post).), as the significant value of (t) was less than or equal to the probability level (0.05).

• There are significant differences in the values of a number of functional variables between the pre-test and the post-test in the (recovery) stage for overweight children aged (10-12 years) in the variables: (VO2Reco), (RQReco), (RQReco), as the significant value was For (t) is less than or equal to the probability level (0.05).

• There are significant differences in the values of a number of functional variables between the pre-test and the post-test for overweight children aged (10-12 years) in the variable (VO2MAX. mL/kg·min), as the moral value of (t) was less than or equal to Probability level (0.05).

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