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REVIEW PAPER

The Effects of Different Exercise Programmes on Body Composition and Body Mass in Adults: A Review Article

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Abstract

The present systematic review will compile, analyse, and synthesize current results regarding the effects of various exercise programmes on body composition and body mass. Method: searching electronic databases such as PubMed, MEDLINE, Google Scholar, ScienceDirect, ERIC and compiling studies on the effects of various exercise programmes on reduction of body mass and changes to body composition. The range of the dates of publication is 1994–2020. The studies included healthy adult individuals and excluded values for body weight. Results: based on 16 analysed studies outlining the advantages of aerobic programmes for reductions in body mass and endurance resistance programmes for improvement in body composition parameters, a combined type of exercise is recommended as the best option. The recorded intensity of exercise ranged from 40–80% of maximum heart rate (MaxHR), with a weekly workout frequency of 3–5 times for 40–60 min, for six to 48 weeks. Moderate-intensity aerobic training of 60% MaxHR gave the best results for reducing body mass, while interval training with greater intensity of 80% MaxHR showed inconsistent results. Circuit resistance training indicated both positive and negative results for improvement in body composition parameters; exercise intensity varied from 50–70% MaxHR. Conclusion: various exercise programmes provide an effective group type of work, leading to significant effects in reducing body mass and positive changes in body composition.

Keywords: *body composition, physical activity, effects, exercise programmes, weight loss*

Introduction

Physical activity is connected to body weight, body composition, and physical fitness and is defined as any movement made by activating the skeletal muscles, which causes energy consumption (Caspersen, Powell, & Christenson, 1985). Physical exercise is defined as a planned and systematic activity whose aim is to maintain or improve health, body composition, and mass (Caspersen et al., 1985). In addition, physical exercise is one of the most important types of behaviour that controls and regulates body mass in the long run (Wadden et al., 1997; Pronk & Wing, 1994). In contrast to that, a sedentary lifestyle, changes in diet and, as the most important factor, physical inactivity, lead to obesity. Obesity is an illness defined as increased mass depots in the human body, leading to health issues (World Health Organization, 2000). Being overweight is not the only problem caused by physical inactivity; there are also changes to body composition to be considered. The relative values of the muscles, fat, water, bone content, as well as the other vital parts of the human body as the parameters of body composition, precisely indicate the state of health of individuals, and as such must be monitored and analysed during physical exercise programmes (Corbin, Pangrazi, & Franks, 2000).

Various physical exercise programmes have been applied and studied over time; most of them are aerobic (Drobnik-Kozakiewicz, Sawczyn, Zarebska, Kwitniewska, & Szumilewicz, 2013; Patel et al., 2017), strength endurance

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training (Bryner et al., 1999; Faigenbaum & Westcott, 2009), and combined training types (Ballor, Harvey-Berino, Ades, Cryan, & Calles-Escandon, 1996; Kim et al., 2016). There are also various types of training, such as circuit training, which includes various stations at which exercises are performed sequentially and for which rest depends on each exercise. Each station covers a different region of the body and only one set of exercises (Kim et al., 2018; Mosher, Underwood, Ferguson, & Arnold, 1994). Interval training focuses attention on high-intensity intervals, which are reduced during training, after which short breaks or lower intensity exercise is implemented (Bishop, 2013; Pourabdi, Shakeriyan, Pourabdi, & Janbozorgi, 2013; Elmer, Laird, Barberio, & Pascoe, 2016).

Since being overweight has gone global as a problem, numerous researchers have studied the effects of various forms of exercise programmes on the changes in body composition and reduction in body mass. In order to draw conclusions from a large number of existing studies, it is necessary to provide a systematic review and generate a conclusion. Thus, this systematic review aims to compile, analyse, and synthesize existing research results that focus on the effects of various exercise programmes on body composition and reduction in body mass.

Methods

To search the existing literature, the following electronic databases were used: PubMed, MEDLINE, Google Scholar, ScienceDirect, ERIC, from 1994 to 2020. The search was carried out using the following key terms: body composition, physical activity, effects, exercise programmes, and weight loss. The research strategy was modified for each electronic database, where possible, to increase sensitivity. Furthermore, all the titles and abstracts were reviewed for potential studies that could be included in the systematic review. In addition, the lists of references of previous reviews and original research papers were also analysed.

The relevant studies were obtained following a detailed overview by three authors if they met the criteria for inclusion. The inclusion and exclusion criteria will be described.

Inclusion criteria

Type of study

Non-controlled randomized and non-randomized longitudinal studies of the effects of different exercise programmes on body composition and reduction of body mass, along with studies written in English, were all included in the analysis.

The sample of participants

The participants included both sexes, age 19–63 years: their health status was healthy without deformities and chronic diseases that affect normal movement functions and performing different exercises. The exception to the disease that was included was the overweight subjects.

Type of intervention

Studies that determine the effects of different exercise programmes on body composition and body-weight reduction.

Type of output results

Studies were included if effects and changes after the application of different exercise programmes to body composition and weight reduction are shown.

The exclusion criteria

The exclusion criteria included: a) studies that included participants younger than 19 and older than 63 years; b) studies that examined only the impact of diet; c) if the study did not analyse the effect of at least one exercise programme of the subjects.

Results

The search identified 756 potentially relevant studies, and another eight were identified by reviewing the references. After the duplicate studies were removed and the titles and abstracts analysed, 75 studies remained. Finally, by reviewing their entire texts, according to the criteria for inclusion, 16 studies remained. Figure 1 represents the schematics of the process for compiling, analysing and eliminating studies.

In Table 1 are shown 16 studies, which are presented by references-years, subjects, type of exercise programme, method-test and results.

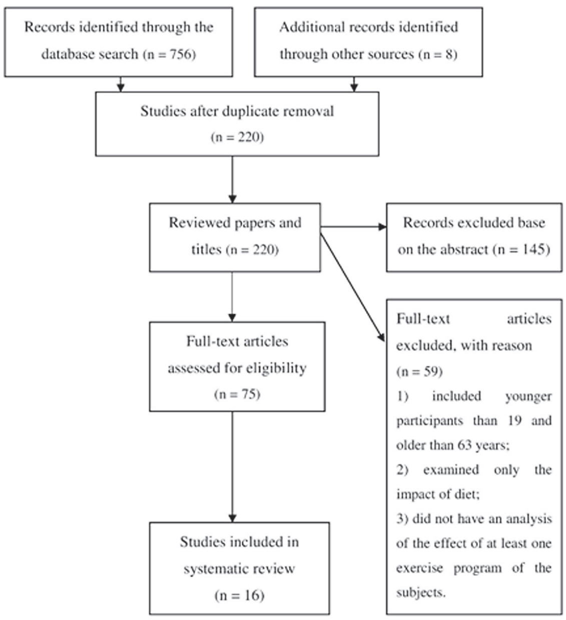

FIGURE 1. A diagram of the course of analysis of the papers

Table 1. Systematic review and characteristic of included studies

Author and year	Subjects				Exercise program	Method and measured variables	Results
	n	Gender (M F)	Age	Group-Type of program	Duration and description	Test	
Geliebter et al. (1997)	65	M-25 F-40	19-48	E1-20-Tr S+Dc; E2-23-A Tr+Dc; E3-22-Dc	8 W (3 times per W by E1-60 min and E2-30 min)- 8 exercises 3 sets × 6 reps; I-70% MaxHR	RMR, BS, BM, PsT, BC, ST, Dc and VO2peak BIA, MMS, Q, Ca, Ds, Treadmill and Cycle ergometer	↓ BM between groups no statistically significant result, E1 smallest ↓ FFM (p=0.05) relative to E2 and E3, in all 3 groups ↓ BF, E1, ↑ MM in arms (p < 0.05) relative to E2 and E3.
Ballor et al. (1996)	18	M-8 F-10	61±1	E1-9-Tr S; E2-9-A Tr	12 W (3 times per W by E1-60 min and E2-20-60 min)- 8 exercises 3 sets × 6 reps; I-50% MaxHR	RMR, BC, Du, 1RM and VO2peak BIA, MMS and Treadmill.	↓ BM in E2 (p<.05), (-2.5 -+ 0.6 kg) relative to E1 (0.4 -+ 0.9 kg)(p=0,05). In E2, 8 out of 9 subjects were additionally ↓ BM, and 6 out of 9, in E1 ↑ BM ↑ 1RM in E1 (p=0,05), FFM in E1 (1.5 -+ 0.8) are different (p<0.05) from E2 (-0.6 +_ 0.4). ↓ BF in E2 (p<0.05) for 5%, while in ↨ E1.
Kim et al. (2016)	28	M-17 F-11	19-35	E1-10-A Tr; E2-10-Tr S; C-8	8 W (5 times per W by E1and E2-60 min)- 11 exercises 3 sets × 10-12, I-65-80% of 1RM reps; I-65-80% MaxHR	RMR, BS, PsT, WC, MM, BC, MS, Du and VO2peak BIA, Ultrasound, Q, Treadmill, Cycle ergometer, MMS, ISO and Ds.	E1and E2 have significant differences in BC, BM, BMI, BF, MM relative to C. There are negative r between BS and BF (r=−0.407, p=0.031).
Elmer et al. (2016)	12	M-12	19-23	E1-6-A Tr; E2-6-A Tr	8 W (3 times per W by E1and E2-30 min)- I-70% -80%; and intervals-1min 50%-100%	BS, BC, MS, Du, VVO2max and VO2peak Treadmill, DEXA, Ds and St.	E2, ↓ in android type BF, 36.78 ± 9.60 to 34.18 ± 11.39 % (p=0.046). While in E1, ↨ (34.98 ± 8.23–33.13 ± 9.87 %, p=0.24) or between groups, (p=0.67), or not in BM inside and between groups (E1- 81.9 ± 10.0–80.6 ± 9.5 kg, p = 0.24; E2-90.2 ± 21.1–90.6 ± 21.9 kg, p=0.65; between groups, p = 0.21), %Fat (E1-28.23 ± 7.03–27.32 ± 7.66 %,p=0.21; E2- 27.90 ± 7.97–26.37 ± 9.01 %, p=0.10; between groups, p=0.55), also in gynoid type BF (E1-33.97 ± 6.45–33.97 ± 7.38 %, p=1.00; E2 32.15 ± 7.63–31.13 ± 8.43 %, p=0.55, between groups, p=0.55), Lbm (E1- 24.1 ± 4.4–26.3 ± 8.1 kg,p=0.54; E2 32.0 ± 10.2–31.3 ± 10.9 kg, p=0.93).
Wadden et al. (1997)	128	F-128	41.1±8.6	E1-29-Dc; E2-31-A Tr+Dc; E3-31-Tr S+Dc; E4-29-A Tr,Tp S+Dc	48 W (3 and 2-3 times per W by E2, E3 and E4-60 min)- 10 exercises 2 sets × 10-14 reps; moderate I	REE, BC, BM and Dc BIA, MMS, St and Ds.	E1, E2, E3 and E4 had average value of ↓ BM, 16.5 ± 6.8 kg in 24th W, which ↑15.1 ± 8.4 kg in 48th W, p=0.001. All subjects had significant changes in FFM and BF.
Kostrzewa-Nowak et al. (2015)	34	F-34	19-24	E1-10; E2-12 and E3-12-A Tr (by BMI)	12 W (3 times per W by E1, E2 and E3-60 min)- I-50%-65% MaxHR.	BS, BM, BC, BMI, ST, Du,VO2peak and VO2/AT BIA, Ca, Cycle ergometer, and Ds.	A Tr in all E1, E2 and E3 ↓ BM (for 4.3 kg, p=0.003), BMI (for 1.3 kg/m2, p=0.003), FFM (for 2.1 kg, p=0.002), total water (for 0.4 kg, p=0.036), %fat (for 3%, p=0.002), ST ↓E1 in BM (for 4.2 kg, p=0.005), BMI (for 0.9 kg/m2, p=0.005), ST (for 3.3 mm, p=0.028
Drobnik-Kozakiewicz et al. (2013)	19	F-19	19-21	E1-19-A Tr	10 W (3 times per W by E1-60 min)-I-70% MaxHR.	BM, BC, BMI and VO2peak BIA, Cycle ergometer, ISO and Ds	↨ BC and BMI.

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Table 1. Systematic review and characteristic of included studies

Author and year	Subjects				Exercise program	Method and measured variables	Results
	n	Gender (M F)	Age	Group-Type of program	Duration and description	Test	
Pourabdi et al. (2013)	26	F-26	19-23	E1-16-A Tr; C-10	6 W (3 times per W by E1-30 min)-interval 4 sets by 4 min and 30s, I- 60-75% MaxHR.	BM, BC, BMI, ST, Du and VO2peak BIA, Treadmill, Ca and Ds	↓ E1 for %BF, 35.72±1.67% to 34.34±1.7 %, (p≤0.05). Mean and St.deviation at ↓BM 69.88±6.11 and 65.5±6.15, and also ↓ at BMI, (p≤0.05), ↨ in Lbm (p=0.234).
Fleck et al. (2006)	12	F-12	39-44	E1-12-A Tr+Tr S	14 W (3 times per W by E1-60 min)-11 exercises 1-3 sets × 8-12 reps; I-60-70% MaxHR	BM, BC, BMI, MS, 1RM, VO2peak and Du Treadmill, DEXA and Ds.	↑ in7-th W before and training time (13.1%–17.8%), between training time and after (10.8%–14.1%), and between, before and after training time (25.5%–30.9%), ↓ % BF (1.4%) and Lbm (2.2%), (p≤0.05). Positive r before and after test in 1RM in 3 exercise and Lbm (r=0.58–0.90)
Paoli et al. (2010)	40	M - F	56±2.7	E1-10-Tr S; E2-10-A Tr+Tr S; E3-10-A Tr+Tr S; C-10	12 W (3 times per W by E1, E2 and E3-50 min)-6 exercises 3 sets × 15 reps; I-65-75% MaxHR	BM, BC, BMI, MS, BS, 1RM, WC, VO2peak and Du Treadmill, Ca and Ds	↓ E2 and E3 relative to C in BM, ↓ E3 in %BF relative to E1 and E2, ↓ E3 in WC relative to C, (p=0.05).
Mosher et al. (1994)	33	F-33	18-23	E1-17-A Tr +Tr S; C-16	12 W (3 times per W by E1-45 min)-15 exercise I-40-50% of 1RM; I-75-85% MaxHR	BM, BC, BMI, MS, 1RM, ST, Du and VO2peak Treadmill, Ca and Ds.	A Tr (interval) +Tr S, ↑ BC, while ↓ ST and %BF (p≤0.05).
Butts & Price (1994)	95	F-95	30-63	E1-68-Tr S; C-27	12 W (3 times per W by E1-60 min)-12 exercises 3 sets × 8-12 reps	BM, BC, MS, ST and Du Hydrostatic tank, Ca and Ds	↓E, in %BF and ST, (p<0.001) while ↑ BC-FFM, and ↨BM, ↑MS shows most progress in body parts that had weakest results on initial measurement.
Kim et al. (2018)	20	F-20	20-27	E1-10-Tr S; C-10	12 W (3 times per W by E1-60 min)-10 exercises 3 sets × 8-12 reps I-50-70% MaxHR	BM, BC, BS, BMI, MS, WC and FI BIA, ISO and Ds	↓E1, in BM (F=11.954, p<0.05), %BF (F=15.110, p<0.05), and BMI (F=12.182, p<0.05) relative to C, but ↨ Lbm (F=0.088, p=0.968).
Sperlich et al. (2017)	19	F-19	21-25	E1-11-Tr S+A Tr; C-8	9 W (3 times per W by E1-60 min)-3 sets × 20-60s reps, I-65% MaxHR	BM, BC, BMI, WC, MS, BS, PsT and VO2peak BIA, Q, Treadmill, and Ds	Both types of programs ↑ BM, BMI, WC, FM and FFM (p<0.05).
Kerksick et al. (2009)	161	F -161	38.5±8.5	E1-11-Du+Tr S; E2-17; E3-48; E4-37 and E5-41-Dc+Tr S; C-7	14 W (3 times per W by E1-30 min)-14 exercises 2 sets × 30 s reps, I-60-80% MaxHR	BM, BC, BMI, WC, REE, MS, DT, PsT, BS, 1RM, DI(controlled) and VO2peak Treadmill, DEXA, MMS, Q and Ds	All E groups with Tr S and any type of D had changes relative to C, for ↓ WC (p<0.05 – 0.001), ↓ BM in E2, E4 and E5 (p<0.05 – 0.001) relative to other groups.↓ FM in E3 the most (95% CI: -5.2, -3.2 kg), E4 (-4.0, -1.9 kg) and E5 (-3.8, -2.1 kg) relative to other groups. ↓ %BF in E3, E4 and E5.
Bryner et al. (1999)	20	M-3 F-17	38	E1-10-Dc+Tr S; E2-10-Dc+A Tr	12 W (4 times per W by E1and E2-60 min)-10 exercises 3 sets × 8-15 reps; I-free choice	BM, BC, BMI, RMR, 1RM, Dc and VO2peak Treadmill, MMS and Ds	↑E1 and E2, ↓BM more in E2 then E1 (p=0.01), in ↓E1 for Lbm (51.3±10.7 to 47.3±7.0) (p=0.05), while ↨E2.

Legend: E-experimental group; C-control group; Tr S-strength training (endurance with interval and circuit type) for (whole body with 6-11 exercises by 2-3 sets by 6-15 reps); A Tr-aerobic training (intensity are moderate-high, 50-80% MaxHR and interval type, 1-4 min intervals); Dc-diet controlled; Du- diet uncontrolled; I-intensity; BIA-bioelectrical impedance; Ds-digital scale; Ca-caliper; ST-skinfold thicknesses; BM-body mass; WC–waist circumference; BC-body composition (BF-body fat; MM-muscle mass; MS-muscle strength; Lbm-lean body mass-ratio of BM and BF; FM-free fat; FFM-fat-free mass; AF–abdominal fat; DT-tissue density); MaxHR-maximal heart rate; ISO-isokinetic strength by dynamometer; Fl-flexibility; VO2peak-peak oxygen consumption; VVO2max-maximal aerobic velocity; VO2/AT-anaerobic threshold; 1RM-one repetition maximums; RMR-resting metabolic rate; REE-resting energy expenditure; BS-parameters of blood sample; PsT-psychological test; Q-questionnaire; St-stadiometer; DEXA– duel energy X-ray absorptiometry; MMS-metabolic measurement system; BMI-body mass index; M-man; F-female; W-week; n-number of subjects; r–corelation; p-statistical significance; s–seconds; m–meter; Kg–kilogram; min-minute; ↓-decrease; ↑-increase; ↨-no changes

Discussion

Participating in physical activity and adequate exercise programmes can ensure a positive effect on the body composition parameters, as well as help maintain body weight within the framework of normal values. Aerobic exercise programmes and strength endurance training, which is either circuit or interval in nature, contribute to that aim (Wadden et al., 1997).

Based on the results compiled from existing studies, we can unambiguously conclude that overweight individuals, individuals with a disbalance in the homeostasis of body composition, and individuals trying to prevent obesity should participate in prescribed physical exercise programmes. In addition, we should mention the trend indicated in existing literature in which the monitoring and control of one's diet accompanied with physical exercise contribute to achieving the best effects (Bryner et al., 1999).

The results of studies that focused on aerobic exercise programmes indicate positive effects on the reduction in body mass and improvement in the parameters of body composition (Pourabdi et al., 2013; Kostrzewa-Nowak et al., 2015; Elmer et al., 2016). For example, Pourabdi et al. (2013) implemented an interval training programme on 16 participants for a six-week period. Four sets on a treadmill, with interval intensity ranging from 60–75% of MaxHR three times a week, led to positive effects. The results also indicate a significant decrease in the percentage of body fat from 35.72±1.67% to 34.34±1.7%, (p≤0.05), the average value of body mass 69.88±6.11 and 65.5±6.15, and values of BMI (p≤0.05).

Elmer et al. (2016) implemented an eight-week exercise programme on a small sample of participants (12). It also included an interval method on the treadmill, with an interval intensity of 1 min at a tempo of 50% and the second min at 100%, then 50% up to 110%, and another moderate-intensity method, which ranged from 70% to 80% of the maximum aerobic running speed. The results of the moderate programme indicate a significant decrease in the android type of participants in terms of the percentage of body fat 36.78±9.60 up to 34.18±11.39%, (p=0.046). Unlike in previous results, this interval method did not lead to significant changes (34.98±8.23–33.13±9.87%, p=0.24) either between groups (p=0.67), or in body mass within and between groups (E1(interval)- 81.9±10.0–80.6±9.5 kg, p=0.24; E2(moderate)- 90.2±21.1–90.6±21.9 kg, p=0.65; between groups p=0.21), nor in the gynoid type for the percentage of body fat (E1 (interval)- -33.97±6.45–33.97±7.38 %, p=1.00; E2 (moderate) 32.15±7.63–31.13±8.43 %, p=0.55, between groups p=0.55), lean body mass (E1(interval) - 24.1±4.4–26.3±8.1 kg, p=0.54; E2 (moderate) 32.0±10.2–31.3±10.9 kg, p=0.93).

In contrast to the results obtained by Elmer et al. (2016), the results of Kostrzewa-Nowak et al. (2015) followed 12 weeks of interval method training indicate positive effects on 34 female participants in three variations of training intensity, which were ascribed to groups of participants based on their BMI. The intensity was 50%, 55%, 60%, and 65% of the maximum heart rate. The results for all the participants indicate a significant decrease in body mass (by 4.3 kg, p=0.003), BMI (by 1.3 kg/m2, p=0.003), FFM (by 2.1 kg, p=0.002), total water content (by 0.4 kg, p=0.036), percentage of body fat (by 3%, p=0.002), skinfolds, while the group with normal BMI values did not show significant changes, and instead maintained the same values. Changes in the undernourished group of female participants in terms of values of body mass improved (by 4.2 kg, p=0.005), BMI (by 0.9 kg/m2, p=0.005), skinfolds (by 3.3 mm, p=0.028).

In contrast to the previous findings, Fleck et al. (2006) did not determine significant changes in the decrease of body mass and BMI, nor did Drobnik-Kozakiewicz et al. (2013) in the parameters of body composition and BMI. Fleck et al. (2006), in addition to aerobic training of an intensity of 60-70% of MaxHR, included three sets of full-body strength endurance training for 60 min but still did not obtain positive effects among their female participants. The only significant decrease was noted in the percentage of body fat (1.4%) and lean body mass (2.2%), (p≤0.05). An increase in strength was noted along with regional changes in upper body composition (p≤0.05). In the study of Drobnik-Kozakiewicz et al. (2013), a step aerobics programme at 70% of MaxHR over 10 weeks did not lead to significant changes in the BMI or body mass.

The second group of studies focused on the effects of strength endurance training (J. W. Kim, Ko, Seo, & Y. P. Kim, 2018; Butts & Price, 1994). Butts and Price (1994) implemented full-body circuit training on adult female participants (68) for 12 weeks, three times a week for 60 min. Like the results of the aerobic programme, these results also indicate positive effects on the reduction of the percentage body fat and skinfolds (p<0.001). In addition, an increase in the FFM parameter of body composition was noted, body mass remained the same, while an improvement in the muscle power of the body parts, which were the weakest at the initial testing, was determined. The same results were noted in the study of Kim et al. (2018), which also included female participants (10), based on full-body strength endurance training, which was carried out over three weekly sets of 60 min each for 12 weeks. The intensity of training was set at 50-70% of MaxHR. A significant decrease was noted in: body mass (F=11.954, p<0.05), percentage body fat (F=15.110, p<0.05), WC (F=13.951, p<0.05) and BMI (F=12.182, p<0.05) compared to the control group.

Interesting strength training and aerobic training combinations were also studied (Sperlich et al., 2017; Kim et al., 2016; Mosher et al., 1994; Paoli et al., 2010). A combination of both training programmes in the study of Sperlich et al. (2017) was implemented on female participants (10) during a nine-week programme. The intensity of the strength-endurance training was set at 65% of MaxHR, and moderate intensity, as defined on the Borg scale. Both types of programmes significantly decreased body mass, BMI, waist circumference, and FM, and led to an improvement in FFM and muscle strength (p<0.05). A study of similar duration was carried out by Kim et al. (2016) for eight weeks, with training sessions five times a week for 60 min, in which the participants trained following prescribed programmes. The same intensity of 65-80% of the maximum load was set. The results confirmed the positive effects of both types of programmes on body composition parameters, BMI, reduction in body mass, amount of body fat, and muscle mass compared to the control group (p<0.005). In addition, a positive correlation was noted between haematological parameters and muscle mass (r=0.432, p=0.022) and a negative correlation between haematological parameters and body fat (r=−0.407, p=0.031). A higher intensity combination training of 85% 1RM for 12 weeks with 60 min training sessions was included in the study of Mosher et al. (1994), which showed positive changes among the female participants. A significant increase in maximum oxygen uptake, muscle strength, improvement in body composition, decreased skinfolds, and percentage of body fat (p≤0.05) was also noted. A greater mixed sample of participants in Paoli et al. (2010), following the same programme duration at an intensity of 65% of MaxHR, also experienced an improvement in body mass, percentage body fat, and waist circumference compared to the control group (p=0.05).

Extensively detailed studies that included controlling the participants' diet and their calorie intake along with combined or individual aerobic programmes and strength endurance training have also noted positive changes (Geliebter et al., 1997; Wadden et al., 1997; Kerksick et al., 2009; Bryner et al., 1999). A study was carried out on a large sample of female participants (161) divided into five groups (Kerksick et al., 2009). It included full-body strength endurance training divided over two sets at an intensity of 60–80% of MaxHR over 14 weeks, combined with five different diets. Significant changes were noted for all groups compared to the control, including waist circumference (p<0.05–0.001) and body mass, for groups E2, E4, and E5 (p<0.05 – 0.001) compared to others. In addition, the greatest loss decrease noted for FM for group E3 (95% CI: -5.2, -3.2 kg), E4 (-4.0, -1.9 kg) and E5 (-3.8, -2.1 kg) relative to other groups. In addition to a decrease in the percentage of body fat for groups E3, E4 and E5, all groups exhibited an improvement in muscle strength, (p<0.05). A complex study that analysed and included 128 female participants lasted the longest, for 48 weeks, and included diets and combined exercisers programmes, aerobic and strength endurance training for four groups (Wadden et al., 1997). Moderate training intensity, which included 40 min of aerobic and 60 min of circuit resistance training over two sets, proved to have significant effects on all groups, leading to a decrease in the mean values of body mass of 16.5±6.8 kg in week 24, which increased to 15.1±8.4 kg in week 48, p=0.001. All of the participants showed signs of significant changes in body composition-FFM and body fat. The difference noted between the aerobic and strength endurance training programmes was reflected in the significant decrease in energy consumption at rest in week 24, favouring the aerobic programme group.

Overall, the results indicate generally positive effects of various programmes on the reduction of body mass and changes in body composition of the participants, except for the results obtained in two studies, Geliebter et al. (1997) and Fleck et al. (2006), which showed no signs of a reduction in body mass.

Conclusion

Based on all analysed studies, a general conclusion was defined, indicating that both aerobic exercise programmes and strength endurance training programmes have a very effective group type of work, which leads to a positive impact on body weight loss and improvements in body composition parameters. The advantage of aerobic exercise is the possibility of greater weight loss, while the advantage of strength training is the greater improvement in the parameters of body composition, made possible by the decrease in the percentage of body fat while maintaining body weight in the normal value range for adult participants. Both types of exercise programmes, for 12 weeks, three times per week with moderate intensity 50-75% MaxHR, had shown better results than others programme variations. It can also be noted that a short programme protocol of six to eight weeks of interval type aerobic training leads to similar positive effects on body weight with the same training duration and frequency.

Finally, based on all the results of the studies, we can conclude that different physical exercise programmes contribute to the decrease in overweight mass and to maintaining normal body weight by reducing the amount of adipose tissue and improving metabolic processes in the human body, which leads to reductions in the body mass index values, thus lowering the risk of obesity and improving all the haematological parameters and quality of life of adults.

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Conflict of interest
The authors declare that there are no conflicts of interest.

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