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Effect of aerobic exercise interventions on body composition in obese females: A systematic review

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***Abstract*---**Global enhancement in the prevalence of obesity was associated with modifiable lifestyle factors, including a lack of daily physical activity involvement. Therefore, the preventive as well as management strategies are required to treat obesity. The purpose of the study was to review the scientific evidences for the effect of an aerobic exercise programmes' on body composition of obese female. For this purpose 307 research articles were reviewed from different data resources i.e. Research Gate, Pub Med, Google Scholar, Springer, Scopus, Web of Science and sample of 47 research articles were selected for the study by following the predefined inclusion criteria. Further, this study was given a direction that aerobic exercise interventions were significantly beneficial for body composition management. And, the findings of the study were concluded that low to high intensity structured daily physical exercise regime practices significantly improves body weight, waist to hip ratio, body mass index, fat percentage, fat mass, lipid profile, lean body mass and body composition in obese females.

***Keywords*---**exercise interventions, obesity, visceral fat, body composition, lipid profile.

Introduction

The worldwide expansion of the prevalence of obesity has prompted an expanded need for assessment tools for research, management, and treatment of obese person. The physical size, varieties in body structure from that of normal weight, and complex psychopathology poses enormous difficulties in the evaluation of an obese person. Typically, two types of obesity are founded in men and women, android and gynoid respectively (Vague et al., 1985). In these obesity types, the distribution of body fat (adipose tissues) is located in the peripheral and concentric abdominal region. The Visceral adipose tissue (VAT) usually stores in the abdominal region that increases the risk of cardio metabolic diseases, where subcutaneous adipose tissue (SAT) stores in the hips and upper thighs, the peripheral region (Snijder et al., 2004). And, Lee (2008) founded the significant correlations between BMI and chest circumference, seated hip breadth, hip circumference, thigh circumference, and waist circumference. However, Pryce (2013) concluded that more of the body mass and volume is concentrated in the trunk region. Further, Pryce (2013) and Chambers et al. (2010) identified that the mass in the trunk region increases in relative proportion in young and older adults both by 3 % body mass for less than 65 years age group individuals and 4 % body mass in 65 years and above age group individuals respectively. As per the report of Gordon and Bradtmiller (2012) the average seated abdominal augmentation profundity is anticipated to have expanded 24 mm for males and 42 mm for females in recent 25 years. In the peripheral obesity the adipose tissues stores at hips and upper thigh, and some were also accumulate at abdominal region which influences the centre of mass of any individual that directly influences the gate patterns, workload, and load bearing ability (Abe et al. (2004).

Jastreboff et al. (2019) stated that fat is directly associated with the nutritional status of the body and adequate amount of fat is useful, but if its goes surplus in the body, it causes disease. Further, Seidell (1997) reported male and female overweight (obese) and contender for various chronic diseases if their fat percentage is more than 25% and 30% respectively. Additionally, according to Cavuoto and Nussbaum (2014), the 1.5 billion adult population having body mass index (BMI) greater than 25kg/m^2 worldwide and as per the BMI scale they were lied in overweight category. As per the W.H.O. report, 650 million adults aged above18 years are obese from the total adult's population of 1.9 billion who are overweight in 2016. Further, Over 340 million children and adolescents aged 5-19 were overweight or obese in 2016 and 39 million children under the age of 5 were overweight or obese in 2020. The prevalence of obesity increases three times since 1975 to 2016. Moreover, it was also reported that about 13% worldwide adult population were obese in 2016 in which 11% were male and 15% were female.

Furthermore, Kumar (2015), reported that the10–20% child population in India are suffering from obesity and this percentage increases to 30% among adolescents, which means that 2/3rd of the population of obese children continues this obesity till their adulthood. Additionally, Ramachandran and Snehalatha (2010) observed that 20% of Indian adults are not obese as per the BMI scaling but they had abdominal obesity. However, Welling and Nitsure (2015) advocated in their study that obesity prevalence were founded 135, 153 and

107 million in Indian states i.e. Tamil Nadu, Maharashtra, Jharkhand and one Union Territory with general obesity, abdominal obesity and central obesity respectively. Whether, Prentice (2006), Sinha and Kapoor (2010) reported that the causes and co-morbidities of overweight or obesity are widespread and have numerous shared traits among populaces. In spite of the fact that distinguishing firm reasons for this pandemic is a troublesome errand, the most clear factors prompting overweight or obesity are unreasonable admission of energy-dense food, inactive lifestyle, and lace of physical activity.

Regular physical exercise bring direct benefits on the obesity. Prevention stratagems such as physical exercise during childhood and adolescence could reduce fat accumulation which lowers the obesity rate and healthier lipid profile. A few techniques have been concocted to make physical exercise more eye-catching; however, Bond et al. (2015) expressed that couple of training protocols have been efficient to increase adherence among young people such as appropriate diet and aerobic exercise for 60 to 90 minutes in 5 to 7 days a week increase the level of VO2 max and HDL and decreased waist circumference. Gholinejad et al. (2019), Le et al. (2016), Abazar et al. (2015), Ahmad and Rosli (2015), Mann et al. (2014) also reported that aerobic exercise is more successful than different activities in lessening muscle to fat ratio. However, Martins et al. (2010) reported that Many Studies showed that aerobic interval training may induce significant changes in the parameters of body composition--body weight, body mass index, body fat mass, and blood lipids but earlier studies show inconsistent results of various methods of aerobic exercise causing unaltered TC, HDL-C or LDL-C due to the various attributes of exercise i.e. frequency, intensity, time, and type. To address these queries and information is significant and enlighten the overall society about what are the approaches to treat body weight, over weight and obesity other than medical prescription, the impact of exercise and which kind of physical activity or exercise is effective to treat obesity. Thus, this article was emphasised in a later study article on the effect of exercise interventions and obesity (Overview in Table 1.0).

Methodology

The available literature on aerobic exercise intervention on body composition in obese females were considered for the present study. A Total 307 research articles were reviewed and 47 sample papers were taken for this study from the available resources i.e. Research Gate, Pub Med, Google Scholar, Springer, Scopus, and Web of Science.

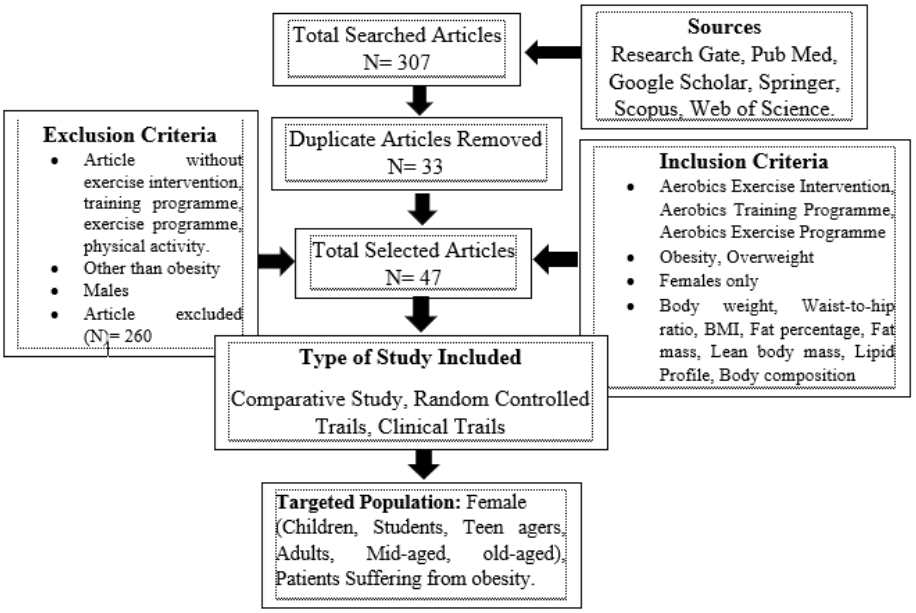

Figure 1. PRISMA Flow Chart of the Study

Findings

Table 1
Effect of Aerobic Exercise Interventions on Body Composition in Obese Females

S. No.	Author	Place of Study	Sample	Design of Study	Type Of Aerobics Exercise	Intervention Period	Sampling Method	Variables	Findings
1.	Abadi, H. F. et al. (2017)	University Pendidikan Sultan Idris	N=50	Pre and Post Test Intervention	Aqua Aerobics	12 Weeks	Purposive	Weight, BMI, and WHR	Significant
2.	Abazar, E. et al. (2015)	Isfahan University And Shahin Shahr, Iran	N=24	Pre and Post Test Intervention	Aerobics Training	12 Weeks	Simple Random	BMI, WHR, Body Fat Percentage, Weight Body Fat Mass, and Lipopro	Significant

								tein	
3.	Adrien, N. et al. (2019)	University Of Burundi, Burundi	N=35	Longitudinal	Running And Swimming	8 Weeks	Purposive	Lipid profile	Significant
4.	Afsharmand, Z. et al. (2017)	Islamic Azad University, Tehran, Iran	N=26	Pre and Post Test Intervention	Walking Or Running On A Treadmill	6 Weeks	Purposive	Anthropometric Markers, Serum IL-6 and Cardiovascular Risk Factors	Significant
5.	Aghaei, F. et al. (2018)	Islamic Azad University, Alborz, Iran	N=30	Clinical Trial	Aerobics Training	8 Weeks	Purposive	Body Composition and Lipid Profile	Significant
6.	Ahmad, F. M. and Rosli, A. A. M. (2015)	University Of Technology MARA, Malaysia	N=14	Pre and Post Test Intervention	Dance Aerobics	6 Weeks	Purposive	Cardiovascular Level and Body Weight	Significant
7.	Akbarpur, M. et al. (2019)	Qazvin (Alborz City) Iran	N=40	Pre and Post Test Intervention	Walking, Running and Flexibility Exercises	8 Weeks	Purposive	Lipid Profile	Significant
8.	Ammar, T. (2015)	Cairo University, Cairo, Egypt	N=45	Randomized Trial	Walking On Treadmill	3 Months	Purposive	Blood Pressure and Lipid Profile	Significant
9.	Baharlo, S. et al. (2014).	Islamic Azad University, Isfahan, Iran	N=23	Randomized Controlled Trial	Aerobic Exercise	12 Weeks	Purposive	Body Composition (weight, BMI, waist	Significant

								ratio, WHR) and Lipid Profile Levels (LDL-C, CRP and TSH)	
10.	Berge, J. et al. (2021).	Tønsberg, Norway	N=82	Randomized Controlled Trial	Cycling, Walking, or Running	8 Weeks	Purposive	Body Weight, BMI, Waist Circumference, Fat-Free Mass (FFM), and Fat Mass.	Significant
11.	Botero, P. J. (2014)	Federal University Of Sao Carlos, Brazil	N=32	Randomized Controlled Trial	Cycling	12 Weeks	Purposive	Anthropometry, Body Composition, Lipid Profile, Glucose	Significant
12.	Chaudhary, S. et al. (2010).	Guru Nanak Dev University, Amritsar, Punjab, India	N=30	Pre and Post Test Treatment	Exercise On Treadmill	6 Weeks	Simple Random	High Density Lipoprotein (HDL), Triglycerides, Anthropometric Parameters, BMI and Body Fat Percentage	Significant
13.	Emerenziani, G. P. et	Italy	N=220	Pre and Post Test	Walking Speed Intensit	4-Month	Simple Random	Body Composition	Significant

	al. (2018).			Treatment	y Exercises				
14.	Farbod, M. et al. (2020).	Islamic Azad University, Tehran	N=32	Pre and Post Test Treatment	Running And Walking	12 Week	Simple Random	Serum Resisting and Lipid Profile	Significant
15.	Farsani, A. P. and Rezaeimanesh, D. (2011)	Islamic Azad University Abadan, Iran	N=15	Pre and Post Intervention	Aerobic Intermittent Training	6 Week	Simple Random	Body Weight, Waist Circumference, Body Mass Index, Triglycerides	Significant
16.	Flack, D. K. et al. (2018).	North Dakota, Usa	N=36	Randomized Controlled Trial	Treadmill Walking	12 Weeks	Purposive	Body Fat Percentage	Significant
17.	Friedenreich, M. C. et al. (2015).	University Of Alberta, Canada	N=400	Randomized Clinical Trial	Walking, Cycling, Elliptical Trainers And Home Bases Aerobics Exercises	12-Month	Purposive	Subcutaneous Abdominal Fat, Intra-Abdominal Fat and Waist To Hip Ratio, Weight	Significant
18.	Gappmaier, E. et al. (2006).	USA	N=38	Pre and Post Intervention	Walking On Land, Swimming And Walking In Water	13 Weeks	Purposive	Body weight, Abdomen Circumference, Hip Circumference, Thigh Circumference, Body Fat Percent	Significant

								age, and Skinfold	
19.	Gholinejad, M. P. et al. (2019).	Aliabad Katoul University, Iran	N=42	Quasi-Experimental	Spinning, Steppes, Bud Scalping, And Pilates	4 Weeks	Simple Random	Body Composition	Significant
20.	Heijden, V. D. G-J., et al. (2010).	Baylor College Of Medicine, Houston, Texas, USA	N=29	Pre and Post Intervention	Exercise On A Treadmill, Elliptical Or A Bicycle	12 Weeks	Purposive	Visceral, Hepatic, And Intramayocellular Fat Content	Significant
21.	Karbalamahdi, A. et al. (2019)	Islamic Azad University. Mahallat, Iran	N=32	Pre and Post Test Intervention	Activities On Treadmill	8 Weeks	Purposive	Body weight, BMI, and Lipid Profile	Significant
22.	Kizilay, F. et al. (2016)	Inonu University, Malatya, Turkey	N=40	Pre and Post Test Intervention	Run-Walk Exercise	8 Weeks	Purposive	BMI, WHR, Body Fat Percentage (BFP), Body Fat Mass (FM) And Lean Body Mass (LBM)	Significant
23.	Kostrzewa-Nowak, D. et al. (2015)	Gdansk University Of Physical Education And Sport,	N=34	Pre and Post Test Intervention	Electronically Braked Cycle Ergometer	12 Weeks	Purposive	Body Composition, and Blood Lipid Profile	Significant

		Gdansk, Poland							
24.	Le, S. et al. (2016)	Shanghai, China	N=27	Randomized Controlled Trial	Nordic Walking, Flexibility and Group Exercise	8 Month	Purposive	Central Adiposity	Significant
25.	Mandlik, D. M. and Mehta, A. (2016)	Maharashtra, India	N=30	Pre and Post Test Intervention	Brisk Walking, Cycling, Stair Climbing	8 Weeks	Purposive	Weight	Significant
26.	Marandi, M. S. et al. (2013)	Iran	N= 45	Pre and Post Test Intervention	Flexibility and Body Movement Exercises	10 Weeks	Purposive	Body Composition and Serum Lipid Profile	Significant
27.	McTiernan, A. et al. (2007)	Seattle, Washington	N=202	Randomized, Controlled Clinical Trial	Sports, Recreational, And Walking	12 Month	Purposive	Body Composition	Significant
28.	Moazami, M. and Askari, A. (2018)	Mashhad, Iran	N=15	Pre and Post Test Intervention	Walking, Jogging, and Aerobic Movements	6 Month	Purposive And Convenience	Lipid Profile, Cardiovascular Risk Factors, And Inflammatory Markers	Significant
29.	Mustedanagić, J. et al. (2016)	University Of Nis, Serbia	N=50	Pre and Post Test Intervention	Aerobics	12 Weeks	Purposive	Body Composition (BMI, Skinfolds, Body Fat %, Muscle	Significant

								Mass % and Lean Body Mass %.)	
30.	Nasim, H. (2010)	University Of Guilan, Rasht , Iran	N=40	Pre and Post Test Intervention	Walking	2 Months	Purposive	Body Water, Body Fat Percentage and Lean Mass	Significant
31.	Nassis, P. G. et al. (2005)	Harokopio University, Athens, Greece	N=19	Pre and Post Test Intervention	Running, Step Benching, Stair Climbing, Jump Rope And Participation In Game	12 Weeks	Purposive	Body Weight, Body Fat, and Adiponectin,	Significant
32.	Nastiti, L. C. et al. (2019)	Indonesian Education University, Bandung, Indonesia	N=20	Randomized Pre and Post Intervention	Water Aerobics And Dance Aerobics	6 Weeks	Accidental Sampling	BMI and Fat Percentage	Significant
33.	Nawaz, R. et al. (2020)	Tonsa (Punjab), Pakistan	N=30	Pre And Post-Test Intervention	Aerobics	4 Weeks	Purposive	Body Fat Percentage, Anthropometric And 3-Site Skin Fold Measurements	Significant
34.	Okura,	Tsukub	N=209	Clinical	Walking	14-	Purposi	Body	

	T. et al. (2005)	a, Japan		Trial	, Dance And Step Aerobics	Week	ve	weight, Height, BMI, Fat Mass, Absolute Total Fat Mass (Kg) and Fat-Free Mass (Kg)	Significant
35.	Sanal, E. et al. (2013)	Denizli, Turkey	N= 65	Randomized Clinical Trial	Brisk walking, Running and Bicycle Ergometer	12 Weeks	Purposive	Body Composition	Significant
36.	Saputro, B Z. et al. (2019)	State University Of Surabaya, Indonesia	N=19	Pre-Post Treatment	Fun Aerobic Gym	6 Weeks	Purposive	Lipid Profile	Significant
37.	Sawyer, J. B. et al. (2015)	Arizona State University, Phoenix, Arizona	N=81	Random Control Trial	Treadmill Walking	12-Week	Purposive	Body Composition	Significant
38.	Shahdadi, A. and Molaei, K. (2016)	Zahedan, Iran	N=34	Pre-Post Treatment	Rhythmic Aerobics	8 Weeks	Purposive	Lipid Profile	Significant
39.	Silva, S. A. D. et al. (2014)	Florianópolis, State Of Santa Catarina, Brazil	N=36	Randomized Pre and Post Test Treatment	Cycle Ergometer Training	12-Week	Purposive	Body Composition and Lipid Profile	Significant

40.	Siqiang, G. (2018)	Zhaoqing University, China	N=100	Pre and Post Treatment	Rope Skipping And Swimming	12 Weeks (4 Times A Week)	Purposive	Weight, WHR, BMI, Body Fat Content, and Blood Lipid Level	Significant
41.	Skrypnik, K. et al. (2015)	University Of Medical Sciences, Poznan, Poland	N=44	Randomized Control Trial	Cycling	3 Month	Simple Random	Body Mass, BMI, Waist and Hip Circumference, Total Body Fat, and Total Body Fat Mass	Significant
42.	Utter, C. A. et al. (1998)	Boone, North Carolina	N=91	Pre and Post Test Repeated Measure Design	Walking	12 Weeks	Purposive	Body Composition	Significant
43.	Vatansev, H. And Çakmakçi, E. (2010)	Selcuk University, Konya, Turkey	N=29	Cross-Sectional Study	Step Aerobics	8 Weeks	Purposive	Body Composition (BW, BFP, BMI, WHR, SBP and DBP) and Blood Lipid profile	Significant
44.	Waked, S. I. (2019)	Cairo University,	N=54	Randomized Controll	Training On Electro	12 Weeks	Purposive	Anthropometry, Lipid	Significant

		Egypt		ed Trial	nic Bicycle Ergometer			Profile, and Body Composition	
45.	Wei-wei, Z. and Ling, Y. (2021)	Central South University, Changsha, Hunan, China	N=60	Randomized Controlled Trial	Jogging, Flexibility Exercises; Running, Brisk Walks, Climbing Mountains, Climbing And Sports	4 Months	Purposive	Body Composition	Significant
46.	Wiklund, P. et al. (2014)	Jyva¨Skyla¨ Central Finland	N=90	Randomized Controlled Trial	walking	6 Weeks	Purposive	Body Composition, and Lipids	Significant
47.	Zapata-Lamana, R. et al. (2018)	University Of Concepcio, Chile	N=64	Randomized Controlled Trial	Cardio Exercises	12 Weeks	Purposive	Body Composition, and Lipid Profile	Significant

Table 1.0 exhibits the reviewed studies on the effect of aerobics exercise interventions on body composition in obese females. Further the table also revealed the Authors name, Place of the study, sample size, Design of the study, Type of aerobic exercise, intervention period, sampling method, variables (body weight, waist to hip ratio, body mass index, fat percentage, fat mass, lipid profile, lean body mass and body composition) and findings of all the selected reviewed articles.

Discussion of Findings

Obesity or overweight is the most common and huge problem in worldwide. Overweight and obesity are the fifth foremost threat of deaths, globally around 2.8 million of adult's demises consistently every year, additionally, 44% of the diabetes trouble, 23% of the ischaemic coronary disease, and somewhere in the range of 7% and 41% of certain malignancy loads are inferable from overweight or obesity (W.H.O., 2013). As per the report of NFH (2005-07), India has more than 30 million obese people and the number is increasing alarmingly with every

passing years. Further, NFHS (2007) facts shows that the problem of obesity is more critical among women than men. In urban India, more than 23% of women are either overweight or obese on the other hand in rural areas this rate is only7%, which is higher than the prevalence among men (20%). However, Gouda and Prusty (2014), reported that more than one-sixth of women in urban area are overweight, and around 6% of women are obese and this issue is more severe in the non-poor ($1/5^{th}$) females than poor females (less than $1/10^{th}$) i.e. 7% of non-poor and only 2% of poor women are obese in urban part of the India. Furthermore, they reported that among mega cities in India, Chennai has the highest (39%) proportion of overweight or obese urban women, followed by Hyderabad (34%), and Kolkata (30%).

Medical science have several treatments for obesity but they are not as much effective but aerobic exercises are more beneficial and can be used as a preventive measure for those who is suffering from cardiovascular diseases due to obesity (Chaudhary et al., 2010). Exercise is generally endorsed as a methods for lessening metabolic complexities and improving cardiorespiratory limit, muscle strength and functional capacity. Ho et al. (2011), demonstrated that 30-min moderate intensity aerobic or resistance exercise improves the issue of cardiovascular disease among overweight and obese adults. Further, significant decreases also reported in body weight, BMI, body fat (%), abdominal obesity as anthropometric marker, affects lipid profile and reduced the risk of cardiovascular disease by participating in aerobic training programme(Afsharmand et al., 2017). Furthermore, Garrow, and Summerbell, (1995) and Baharloo et al. (2014) also reported that aerobic exercises reduced the body composition, low density cholesterol, cardiovascular disease among overweight and obese females. Moreover, Park (2001) described that aerobic plus muscular resistance combined training was more effective in reducing visceral fat than food intake restriction only. Additionally, Delevatti, et. al. (2015) reported that glycaemia and lipids profile gets improved through aquatic exercise training in upstanding position.

However, Willis et al. (2012), stated that the 3 days/week aerobic training is much effective than combined training for weight loss among overweight and obese. But Ross et al. (2000) and Jakicic et al. (2003), founded that intensity of the exercise can change the body composition rather than type or session of training. Chiu et al. (2017), added a high-intensity exercise with high energy expenditure for 12-week are more effective in reducing the body weight, body fat, waist circumference, and waist to hip ratio, whereas a low-intensity exercise reduce body weight and body fat significantly. On the other hand some studies identified that an aerobic exercise programme can reduce fatty tissue as well but the type of Aerobic Exercise and the duration of the intervention should be considered. (Janssen et al., 2002; Hiklová, and Gába, 2019).

Aghaei et al. (2018) further added that aerobic training for 8 weeks decreased the harmful lipids (cholesterol and LDL) in overweight women. Likewise, the effect of regular physical activity on the amount of serum lipid profile, visceral adipose tissue, triglycerides and body fat element incited to examine the impacts of aerobic exercise (Kelley and Kelley, 2007; Rahmaninia et al., 2008; Socha et al. 2008; Ismail et. al., 2012; and Mann et. al. 2014). Exercise has appeared to reduce the lipid levels and fat stockpiling which helps in controlling and forestall

a portion of these threat factors (Cerizza et al., 2008; Hübner-Woźniak et al., 2008; Janiszewski and Ross, 2007; Kodama et. al., 2007; Thompson et al., 2003). Additionally, Kelley et al. (2005) founded that aerobic training has been proposed as a compelling system for improving cardiovascular insurance, with preparing bringing about decreases of 2% on all out cholesterol (TC), 2% on low-thickness lipoprotein cholesterol (LDL-C) and 9% on fatty oils (TG), and increments of 3% on high-thickness lipoprotein cholesterol (HDL-C) in men 18 years old and more established. Similarly, it was also shown that physical activity instigated muscle to fat ratio and weight decreases joined add to securing the cardiovascular framework and to controlling the serum lipid profile (Berg, et al., 2002). Additionally, Kim et. al. (2019) stated that exercise influence triglycerides larger than LDL and HDL.

Conclusion

On the basis of the findings it is concluded that low to high intensity structured aerobic exercise regime practice significantly improves the body composition variables and lipid profile in obese females.

Outcomes

Overall, the data included in this review confirm the beneficial effects of regular aerobic exercise on body composition, body weight, body mass index, waist-to-hip ratio, fat mass, fat percentage, lipid profile and lean body mass. Secondly, existing knowledge will serve as an aid for prevention and management of obesity along with declined coronary artery disease and strokes among the population.

Future Application

There are different mind-sets regarding exercise, eating, fasting and obesity. Many individuals are not shown enough interest in exercise especially the middle-class female population. They still hesitate to join exercise class, gym and perform the exercises regularly that results excess body weight and fat bulges. Further, these issues should be addressed widely with fact findings among female population. And, these scientific fact findings will help all the professionals to develop tailor-made exercise interventions in such a mode to motivate and involve females' for its maximum potential as prevention and management. Moreover, the findings of the present review study supports the obesity management clinicians to give a distinct emphasis on regular aerobic physical activity practice of moderate levels among female population.

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