CODEN [USA]: IAJPBB **ISSN: 2349-7750**

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES
http://doi.org/10.5281/zenodo.3376282

Available online at: http://www.iajps.com ***Research Article***

EFFECTS OF INTERVAL TRAINING ON FUNCTIONAL CAPACITY, MUSCLE MASS AND STRENGTH IN OVERWEIGHT ADULTS

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Article Received: June 2019 **Accepted:** July 2019 **Published:** August 2019

Abstract:

The primary objective was to investigate the effectiveness of interval training and to evaluate the best available method for measuring body composition and functional capacity. Thirty overweight subjects voluntarily participated in the current study. They ranked sedentary according to their level of activity (>30-minute moderate physical activity 3days/wk). The training sessions were divided into the warm-up phase, training phase and a cool-down phase. The training programs were completed 3days/week for 12 weeks. Body composition was calculated by skinfold thickness method and bio-impedance before and after training. Similarly, aerobic capacities were measured by lactate threshold testing and by Astrand submaximal testing. A significant effect of interval training on the body composition and functional capacities of overweight adults. BMI and body fat mass were reduced significantly ($P < 0.05$). Maximum oxygen uptake (VO2 max) was significantly improved in participants ($P < 0.05$). Similarly, significant changes were seen in the lactate threshold level ($P < 0.05$). Interval training is a useful method to improve body composition and functional capacities. Moreover, it is evaluated that Bioimpedance and Lactate threshold testing provides more detailed information and is more useful exercise testing techniques as compared to skinfold thickness and Astrand submaximal test

Key Words: *Obesity, interval training, Body composition, Exercise testing.*

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Please cite this article in press Muhammad Mustafa Qamar et al., ***Effects of Interval Training On Functional Capacity, Muscle Mass And Strength In Overweight Adults.,*** *Indo Am. J. P. Sci, 2019; 06[08].*

INTRODUCTION:

Obesity is ascertained the leading source of health problems across the globe. In one decade from 1991 to 2001, its prevalence increased by 74%. [1] By 2020, it is expected that half of the population will be overweight or obese [2] .Sedentary lifestyle, physical inactivity or lack of poised energy intake and energy utilization results in overweight/obesity. The changing lifestyle in the modern era has a profound impact on health and exercise tolerance[3]. Apart from mobility, extra weight may be the contributory factor of exercise intolerance[4] hypertension, type II diabetes mellitus, hypercholesteremia and cardiovascular disorder [5]. An increased metabolic demand of obese adults is due to having an excess load, rather than lower cardio-respiratory fitness[6, 7]. Contrarily, a few studies suggested that overweight subjects have significantly lowered heart rate reserve [8-11]. The available literature on the effectiveness of aerobic training indicates the usefulness of aerobic training, not only in improving cardiovascular function but also managing or normalising body weight by reducing extra body fat [12, 13]. Overweight adults feel difficulty in executing aerobic training due to several reasons, including early fatigue [6]. Endurance training has been suggested to have a vital role in weight management [14, 15]. However, it failed to preserve muscle mass and strength [16]. Accordingly, the combined effect of aerobic and strength training can be gained by interval training to manage weight and improve functional capacity, muscle mass and strength. For quantifying physiological and anthropometrical characteristic, a number of the method are being used in a targeted population. Skinfold body composition analysis, bio-impedance and a standard, progressive exercise testing were devised in an obese population [14]. Norman and his colleagues used cycle ergometer, fitness testing for overweight adults as it was unwieldy for them to carry testing at treadmill due to heavyweight.VO_2 max and Heart rate was observed at rest, and they concluded that at lactate threshold level both obese and non-obese adults had comparable absolute O_2, but they get early fatigued as they have to carry heavyweight as compared to non-obese adults[6].

In the presence of a variety of conflicting data related to use of specific exercise testing method, we conducted a study to investigate the effectiveness of interval training on hypercholesteremia, physiological and anthropometrical characteristics in obese adults. Furthermore, to determine the effects of interval training on body composition and functional capacities by utilizing appropriate physiological, anthropometric methods. For this purpose, we will select forty hypercholesteremia diagnosed overweight subjects and trained them interval aerobic training for 12 weeks, 30 minutes/day. The anthropometrical and aerobic capacitates values were taken before and after the proposed study period. This study provides an evidence-based regimen of interval training to manage weight and improve functional capacity, muscle mass and strength in obese adults. A well-planned interval training program could be cost-effective and provide better results without any side effects or hazards. This study will also provide the best available testing battery for evaluation of anthropometrical, physiological and functional measurements.

METHODS:

A randomised trial was conducted in 12 weeks of Interventional study. Thirty obese (BMI>30) hypercholesteraemic participants voluntarily participated and divided equally into two groups. Interventional group and control group. The interventional group had performed interval training for 12 weeks, 3day/week, whereas the control group performed the routine physical tasks (fig 1). Obese and sedentary subjects were selected. They sedentary conferring to activity level (>30-minute, 3days/weeks, moderate-intensity physical activity). They were not participated in any interval training program before participating in the study from six months. Written consent was taken after demonstration of the purpose, procedure, and related pros and cons. They were instructed to participate regularly in interval training. An ethical review committee approved the study according to the Declaration of Helsinki.

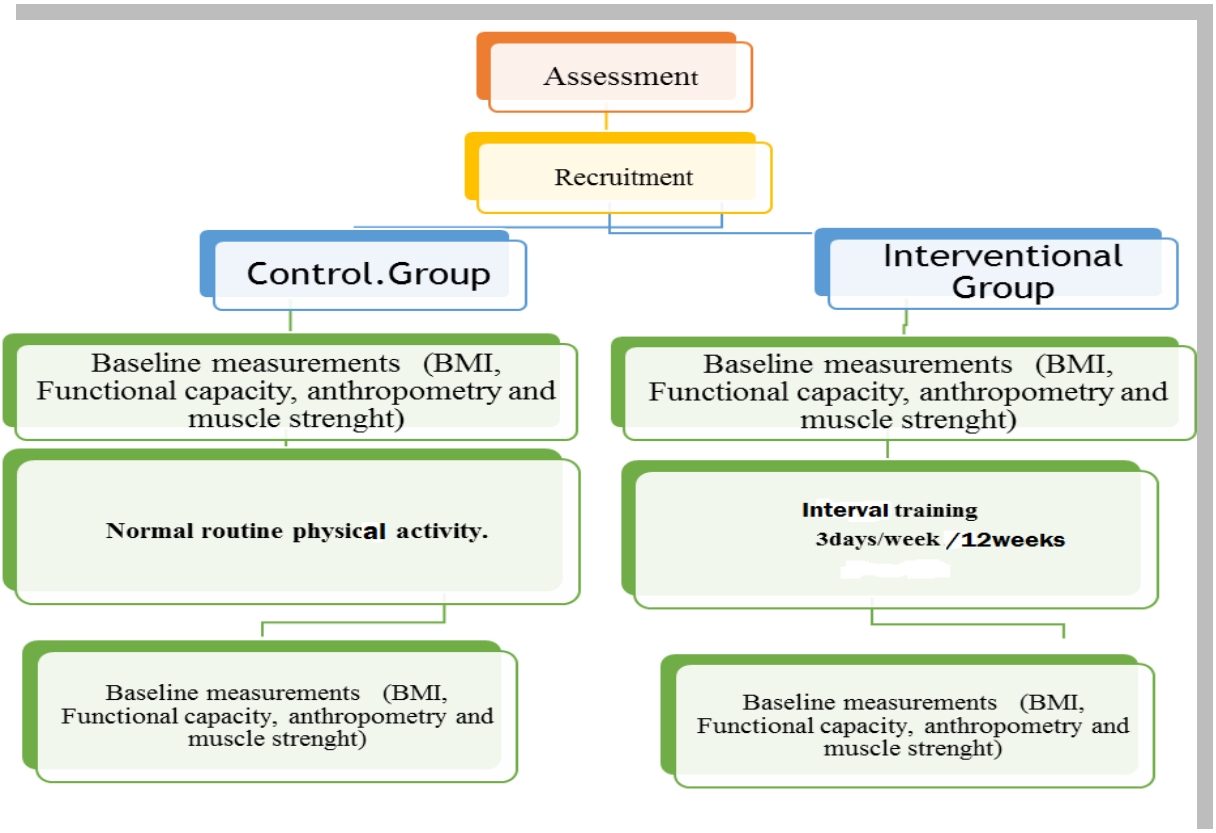

Fig.1 Roadmap of Study Disposition

Regimen of interval training: All individual participated in an interval training program, which comprised of 3 days/week for twelve weeks. A booklet was given to each participant containing instructions and guideline about interval training. The interval training program was introduced as prescribed previously [17]. After the workout, a cool-down period of 5 minutes was given during which they perform paddling with low speed. All training program was supervised by a qualified physical therapist. The measurement was taken at pre-and post-study. Anthropometric measurement (BMI, Lean body mass, Body fat %,) was recorded by skinfold calliper method and bio-impedance. The functional capacity was assessed by lactate threshold level and by Astrand -submaximal testing by using standardised protocol.

RESULTS:

Assessment of body composition by using skinfolds thickness method: There was a significant effect of 12 weeks' aerobic exercise on body fat %. However, no significant changes were seen in lean body mass and BMI (fig-2).

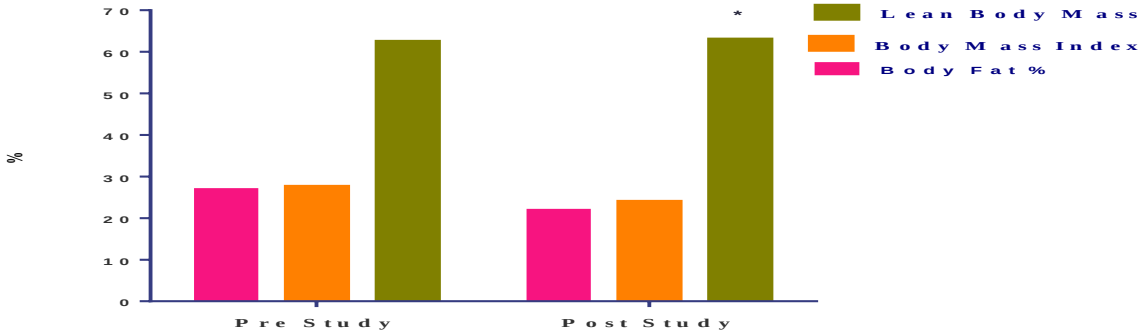

Fig-2, Mean anthropometrical values by using skinfold Thickness method, before and after the intervention.
*statistical significant <0.05

Assessment of body composition by using Bioimpedance Method: Bioimpedance is useful methods which give a detailed description of the body composition. Marked changes were observed in body composition, especially in BMI, fat percentage and weight after the 12 weeks of interval training (Table -1).

	Baseline Values	Post-study values
Weight (Kg)	79.3	67.5*
Fat %	25.2	22.5*
Fat mass (Kg)	20.1	17.1
Fat-free mass (Kg)	56.2	53.9
Muscle mass (Kg)	53.4	55.8
TBW %	54.5	55.5
Bone mass (Kg)	2.9	2.92
Metabolic age (Year)	35.3	30.35
Visceral fat rating	7.7	6.9
BMI	27.6	24.01*

Table 1. Mean anthropometrical values (Bioimpedance Method) before and after the intervention.
*statistical significant <0.05

Assessment of aerobic capacity by using Lactate threshold testing: A significant improvement in aerobic capacity was seen in participants. The pre-study onset of blood lactate accumulation (OBLA) in participants was near to 11 Km/hr. However, after aerobic conditioning, the OBLA point near 15 Km/hr (Fig-3).

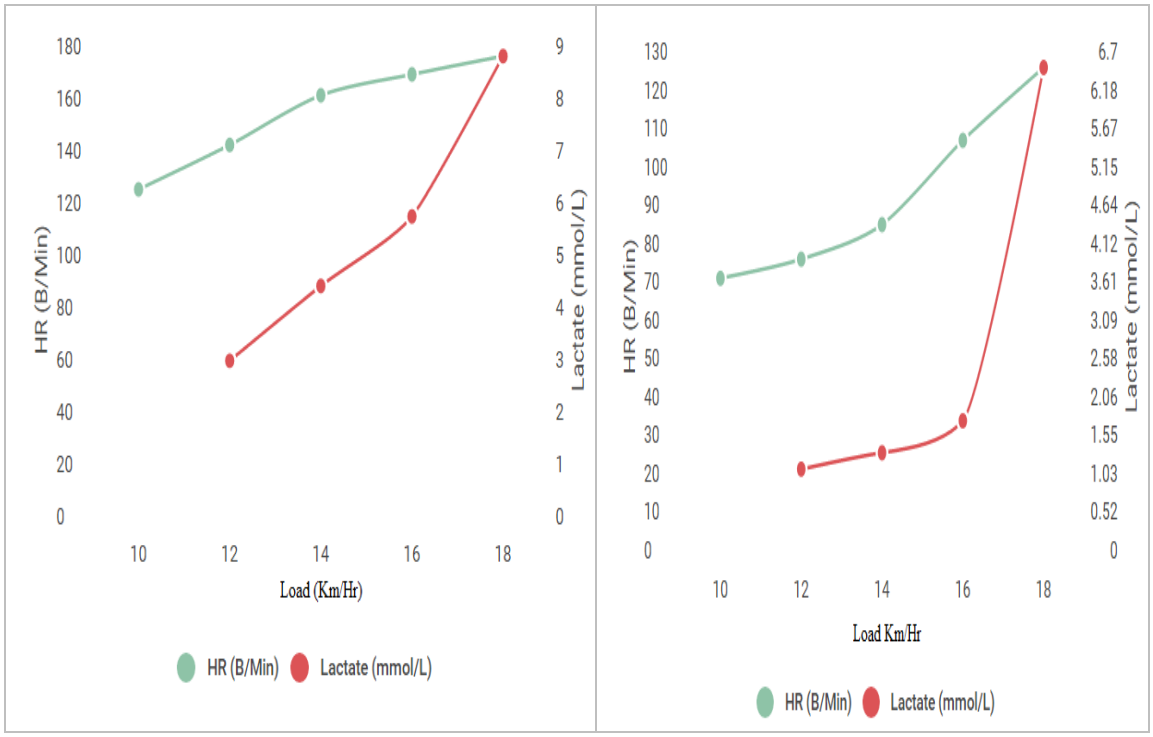

Fig-3, *Lactate level (mmol/l) and Heart rate (Beats/Min) association in participants at baseline and post-study*

Assessment of aerobic capacity by using Astrand sub-maximal testing: Aerobic conditioning markedly improved the aerobic capacity of participants. Maximum oxygen consumption increases by about 32 % (Table 2).

Minutes	Load (Watt)	Pre- Study- Mean Heart rate (bmp)	Post-Study- Mean Heart rate (bmp)	Relative oxygen uptake (ml/kg/min)	
1	100	85	72	Baseline	Post-study
2	100	116	89		
3	100	119	97		
4	100	168	107		
5	100	131	114		
6	100	135	116		
				38ml/kg/min	57ml/kg/min*

Table-2: *oxygen uptake before and after the study period, according to Astrand submaximal test.*
**statistical significant <0.05*

DISCUSSIONS:

Obesity is a major concern around the globe. In this study, we investigated the effect of interval training on physiological variables of overweight individuals. We observed that interval training has a positive impact on body composition and fitness of overweight adults. Body Mass Index was assessed by using the skinfold thickness method and by introducing the bio-impedance technique. While aerobic capacity was assessed by introducing lactate threshold testing and by Astrand sub-maximal test.

The improvement in body composition and functional capacity was concurrent with the previous studies, studying the impact of exercise [14, 18, 19]. We incorporate skin thickness and Bioimpedance method for assessing body composition. Skin thickness is a simple and cheap procedure. While Bio-impedance is expensive but less time taking procedures. In the skinfold calliper method, proper exposure is required, which may be a hurdle in some societies due to their norms. Moreover, the standardisation of the procedure is also difficult. In bio-impedance, the hydrated status of the subjects is very important as it may influence the results.
Lactate threshold and Astrand submaximal test were used to assess functional capacity. Lactate testing is an accurate but expensive tool to record functional performance [20]. Our participants were mainly overweight. So, they fatigued early and were not comfortable on the treadmill. Astrand sub-maximal testing is an economically affordable and simple test for predicting functional capacity [21]. In summary, there is a marked improvement in physical fitness or cardiovascular endurance of overweight individuals after endurance training. Bio-impedance and Lactate threshold testing give a detailed picture and more accurate results as compared with skinfold thickness method and Astrand sub-maximal method.

CONCLUSION:

A well-planned interval training program could be cost-effective and provide better results in improving functional capacity without any side effects or hazards.

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