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COMPARATIVE ANALYSIS ON THE EFFICACY OF AEROBIC CAPACITY IN CARDIAC REHABILITATION OBESE AND NON-OBESE PHASE II PATIENT

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ABSTRACT

Background: Aerobic Exercise is a host of health benefits to reduce vigor risk and maintain body weight. The purpose of the present investigation is to determine the influence of aerobic exercises on body weight and Metabolic Equivalent of Task (MET) activity among cardiac rehabilitation phase II patients. The objective of the study is to investigate the impact of obesity on the efficacy of aerobic capacity.

Methods: Fifteen obese (ten males, five females) and fifteen non-obese (eleven males, four females) participants of phase II cardiac rehabilitation were selected from a tertiary care hospital by their Body Mass Index (BMI). They were divided into two groups by simple random technique. Aerobic exercises were given for 12 weeks for post-CABG cardiac rehabilitation phase II obese and non-obese (healthy and overweight) patients. BMI and the Metabolic equivalent of task activity of cardiac rehabilitation phase II patients are measured by enrolling a patient in 12 weeks of aerobic exercises program.

Results: The aerobic exercise shows a positive result in both obese and non-obese patients. Aerobic exercises improved metabolic equivalent of task in both obese (4.6667 ± 0.65134 ; < 0.05) and non-obese patients (4.6923 ± 0.48038 ; < 0.05) significantly. But aerobic exercises were more effective in enhancing the efficacy of aerobic capacity in obese patients.

Conclusion: It is evident that aerobic exercises are more effective for obese patients to maintain or reduce weight. Higher MET activity was observed in obese patients.

Keywords: Aerobic exercise, Obese Patients, Non-Obese Patients, Body Mass Index, Metabolic equivalent of task, Cardiac Rehabilitation, Phase II Patient.

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INTRODUCTION

Obesity and overweight have become a global problem with high prevalence in the current era [1,2]. Although the degree of Obesity has been associated with health-related quality of life [3,4] correspondingly Concomitant with significant medical comorbidities [5] and shortens lifespan [6]. Until now, BMI calculation is the only method being followed for the classification of obesity. According to the World Health Organization (WHO) classification of BMI, Participants with a BMI below 18.5 kg/m² is labeled as underweight. Adults with BMI between 18.5 kg/m² to 24.9 kg/m² categorized as healthy weight population, 25 kg/m² and 29.9kg/m² reflect overweight population. An adult who has a BMI of 30kg/m² or higher is considered obese [7]. Prevalence of obesity is rising rapidly in developed [8,9] as well as in developing countries [1,10]. BMI is a predictive indicator for individual entering a cardiac rehabilitation program after Coronary Artery Bypass Grafting (CABG) surgery [11].

Cardiac rehabilitation is a structured program of education and activities guided towards lifestyle modification, increasing functional capabilities and peer support [12]. A study by Blair and colleagues have revealed that sedentary adults incorporate short bouts of moderate-intensity activity into their daily routines as an approach for lifestyle modification [13]. Regular aerobic exercise can bring remarkable changes not just to your body, your metabolism, and your heart, but also to your spirits. Aerobic exercises are one of the integral parts of cardiac rehabilitation and also known as cardio exercises. Aerobic exercise is a physical exercise of low to high intensity that depends primarily on the aerobic energy-generating process. Aerobic means "relating to, involving, or requiring free oxygen" and refers to the use of oxygen to adequately meet energy demands during exercise via aerobic metabolism [14]. Peak VO₂ is either directly measured during the exercise test or estimated from the maximal exercise capacity in METS. Endorsing the appliance of aerobic exercises in post CABG patients means that, it will increase the health status of cardiac patients. A study shows that changes in body weight should be considered as an essential clinical outcome in cardiac rehabilitation program [15-17].

E Pamela in the year 2000 where Reybrouck T et al. in 1987 showed that two groups were enrolled in a cardiac rehabilitation program one with a sedentary lifestyle and categorize as obese participants and another one with an active lifestyle. In obese patients, there is a 10 % reduction in the mean maximal aerobic power per decade, the reduction with an active lifestyle being less than 5% [13,18]. It has recently been evidenced that aerobic fitness is the primary factor influencing future health outcome [19-21], although, the physiological basis of this concept remains unclear. The above study, both obesity, and aerobic fitness are prone to risk factors for future health outcome, but it is unclear whether these effects are related to one another or independent risk factors [19].

Boyce et al. in 1997 found in a cross-over design trial that

four months of exercise training by using stationary cycling in sixteen non-dialysis Chronic Kidney Disease subjects decreased blood pressure and increased peak oxygen consumption [20]. In another non-randomized trial, Clyne et al. found that exercise coaching for three months via bicycle ergometry in ten pre-dialytic Chronic Kidney Disease patients accrued highest exercise capability, increased thigh muscular [21]. A study by Ross E revealed that a program of diet plus lifestyle activity may propose similar health benefits and is an appropriate substitute to diet plus a structured aerobic exercise for obese women [22]. Another study by Gorden M et al. concluded that fat mass does not have any effect on VO₂max. Obesity does not necessarily denote a reduced ability to consume oxygen for activities [23]. Another study shows similar results regarding the functional level of cardiac rehabilitation patients, i.e., functional fitness declines in obese patients because of the inert load created by excess bodyfat [24]. P Ekkekakis in 2006 reports that, as the intensity increases, overweight adults tend to experience more skeletal, muscular aches, and pains than normal weight adults [25].

Recent studies have also indicated significant effects of cardiac rehabilitation on reducing subsequent hospitalization costs following major Chronic Heart Disease events [26] and pooled data from several randomized studies indicate significant reductions in subsequent primary Chronic Heart Disease [27-29]. Therefore, it is required to evaluate the independent roles of body fat in exercise conditioning in evaluating improvements that were observed in peak aerobic capacity following cardiac rehabilitation. The purpose of the study is to identify the effects of aerobic capacity on BMI changes in obese and non-obese phase II cardiac rehab patients and at the same time to evaluate the peak METs activity of obese and non-obese cardiac rehabilitation phase II patients. This study is going to be endorsing factors for effective weight reduction strategies to enhance the benefits of cardiac rehabilitation for a large number of obese post CABG patients.

METHODOLOGY

Post CABG 30 patients were enrolled in the Out Patient Department (OPD) phase II cardiac rehabilitation of a tertiary care hospital. The initial assessment comprised of height, weight, blood pressure, MET activity, heart rate, Oxygen saturation, baseline exercise test and ECG (through telemetry). The patients were divided into two groups of 15 patients each. One group having non-obese (normal & overweight) while the other consisted of obese patients. Both the groups received 18 exercise sessions/month, diet plan and 12 education classes. Each exercise session consisted of 10 minutes of warm-up, 20 minutes of treadmill combined with 20 minutes of bicycling, 10 minutes of cool down exercise followed by stretchings. The intensity of exercise varies among individual, and it ranges from 70 to 75% of the maximal heart rate obtained by exercise testing. Also, patients were encouraged to exercise four to five times per week (equivalent to 18 exercise sessions/month) in the outpatient department under the supervision of a

cardiac rehabilitation specialist.

Each exercise prescription was adjusted periodically to ensure a gradual increase in exercise performance. The dietary instruction was individualized, and monthly return visits with the dietitian were routine, particularly for obese patients and those who were less compliant with the diet. All patients were frequently encouraged by physicians, dietitians, exercise physiologists, and nurses to comply with both the dietary and exercise portions of the program. The recommended treatment was delivered in 54 sessions. At the end of 54 sessions, weight height, peak MET activity with heart rate and ECG were repeated to determine the changes in the obese and non-obese patient. The complete study has been completed in 3 months of duration. Informed consent has been taken before the administration of the questionnaire from every participant. The objectives of the study explained and rationale was given for conducting this survey to proceed with the survey. Data was analyzed on SPSS version 20. Frequencies and percentages were taken out for categorical variables. A paired sample t-test was conducted to determine whether BMI is significantly different before or after the intervention of both the groups. Independent sample tests were conducted to compare the differences of the group. A value of $P < 0.05$ was used as an indicator of statistical significance.

Inclusion Criteria: Post CABG, Phase II cardiac rehab patients, BMI 18.5-39.9 kg/m², male and female ages between 40-62 years were selected for the study with their consent to be the part of the research.

Exclusion Criteria: Patients having: BMI greater or equal to 40kg/m², Myocardial Infarction, Ventricular Septal defect repair and patient on lipid-lowering drugs were excluded from the study. Patients who did not meet the criteria of phase II cardiac rehab program were also excluded.

Aerobic Exercise Training Protocol

The participants of the studies, who are assigned to the exercise group, have received instruction for walking properly and appropriate selection of shoe. An introductory session was completed to educate the patient on developing a walking program, thus familiarizing him/her with the lab and to operate and utilize treadmill. Each exercise training session included: 10 minutes of warm-up, 40 min aerobic activity, 10 minutes cool-down and stretchings. Each training program was individualized and based on the results of the baseline exercise tests. Patients were not allowed to exercise at a heart rate beyond that achieved on the maximal exercise test.

RESULTS

The 30 patients participated in this study that was divided into two equal groups of $N = 15$ each, while they become part of study based on BMI. Only those Participants were enrolled in the study whose BMI lies between 18.5kg/m² to 39.9kg/m². Participants having BMI between 18.5kg/m² to 29.9kg/m² were allocated in group A, and BMI of 30-39.9kg/m² was placed in group B. All participants of group B completed 12 weeks of cardiac rehabilitation program

phase II without any dropouts while two patients of group A were dropped out due to health hazards.

Demographics	Numbers	Mean	SD
Gender			
Male	21	15	8.485
Female	9		
Age			
< 60	9		
60-70	20	10	6.74
>70	1		
Comorbidities			
No	3		
Yes			
DM	22		
HTN	27	13.75	9.47

Table 1: Demographic details

The Pre and post MET activity mean \pm SD scores of group A (3.0767 \pm 5.29), (4.6923 \pm 4.8038) and pre and post MET activity scores of group B (2.0714 \pm 6.0302), (4.6667 \pm 0.65134). Also, both groups have a significant impact on aerobic capacity, but the group b obese patients $n = (15)$ shows more improvement in met activities as compared to the comparative group. At the same time, post-Cardiac Rehabilitation programs assessment shows a reduction in BMI which was (21.9793 \pm 1.36) in group A as well as in group B (28.9167 \pm 2.70169) as shown in table 2 which shows the significant result in both group A and B. perception of fatigue and shortness of breath were shown in table 3.

SL.NO	OUTCOMES	Group A		Group B	
1	Initial BMI	23.0727	P=0.05	30.893	P=0.05
2	Post BMI	21.9793		28.916	
3	Initial MET	3.0767	P=0.05	2.0714	P=0.05
4	Post MET	4.6923		4.6667	

Table 2: Outcomes before and after exercises in both groups

SL.NO	FATIGUE AND S.O.B PERCENTAGE OF PERCEPTION	GROUP A	GROUP B
1	Felt fatigue	80	86.7
2	No fatigue	20	13.3
3	Zero level of fatigue	57.1	23.1
4	Severe level of fatigue	42.9	76.9
5	Felt shortness of breath (SOB)	60	53.3
6	No shortness of breath (SOB)	40	46.7
7	Zero level of SOB	80	42
8	Severe level of SOB	20	58

Table 3: Data regarding perception of exhaustion in both groups.

On a question regarding the type of aerobic activity performed in the past two weeks by obese and non-obese cardiac rehab phase II patients. All obese patients performed walking as an aerobic activity while 92.3% of non-obese patients performed walking as an aerobic activity. On a question regarding using a stationary bike as an aerobic exercise, 83.3% of non-obese patients use stationary bikes for 1-3hrs/week while 40.0% of obese patients use a stationary bike as aerobic exercise. On a question regarding aquatic

exercises 9.1% of non-obese patients perform the aquatic exercise for 30-60mins/week while no obese patient performs aquatic exercises while 30.8% of obese patients perform aquatic exercises for 1-3 hrs./week and no non-obese patient perform aquatic exercises for 1-3 hrs per week.

DISCUSSION

Regular aerobic physical activity increases exercise capacity and plays a role in both primary and secondary prevention of cardiovascular disease. Inactivity is a risk factor for coronary artery disease. Exercise training increases cardiovascular functional capacity and decreases myocardial oxygen demand at any level of physical activity in a healthy population as well as in most patients with cardiovascular disease. The potential risk of cardiovascular disease can be reduced by physical activity. Joint flexibility strength and endurance exercise are an important part of a comprehensive exercise program. Use of lightweight seems beneficial in cardiac rehabilitation patients. This investigation demonstrates that body fat contributes to the "observed" improvement in METs activity by following exercise conditioning programs and cardiac rehabilitation. To our knowledge, there are few studies on the effects of exercise training, but this study has examined the comparative analysis of obese and non-obese post CABG phase II patients.

The key finding of this study is that, a program of 3 months of the aerobic exercise training program in post CABG obese patients shows marked increase in peak Mets activity in obese (4.6667 ± 4.8038) as compared to non-obese (4.6923 ± 0.65134) patients. A study by Goran M et al. in the year 2000 revealed similar results that, absolute VO_2 max was significantly higher in the obese (1.24 ± 0.27 v/s 1.56 ± 0.40), and VO_2 max relative to body weight was significantly lower (44.2 ± 3.2 v/s 32.0 ± 4.1) [30]. It seems that excess fat is increasing the challenge by the obese individual. Based on recent work concerning fitness vs. fatness, it's time to re-examine the nature of the relationship between aerobic fitness and total body fatness in humans [31-37]. Previous analysis of this relationship by Toth et al. demonstrates that Fat-Free Mass acts as the covariate, rather than dividing VO_2 max by body weight or Fat-Free Mass, but this is still unclear that whether Fat Mass (FM) has any additional independent effects on VO_2 max [38]. In comparison with the obese patients, the non-obese patients had a significantly higher reduction in body weight that is (28.9167 ± 2.70169), (21.9685 ± 1.41287).

The result from this study suggests that change in body weight should be considered as an essential clinical outcome in cardiac rehabilitation programs and substantial efforts should be directed towards maximizing weight reduction for overweight patients with chronic heart disease. These should include maximization of exercise-related energy expenditure in cardiac rehabilitation and adoption of hypocaloric diet using behavioral education. To date, several studies have provided evidence that high body weight, BMI, and adiposity are associated with a lower level of physical activity participation and lower adherence to activity programs [39-42].

Overweight individuals seem less voluntarily than normal-weight ones to participate in and adhere to physical activity remain largely unknown despite the obvious practical importance of this question.

Patients who experience weight loss during CR have an improved prognosis as compared to those who did not lose weight. There is emerging evidence to indicate meaningful weight loss is possible through individualized Cardiac Rehabilitation program directed toward higher caloric expenditure and a negative caloric balance.

This is good news for people who understand the role of physical activity in weight control but dislike vigorous physical activity or believe that they lack time to exercise. For an overweight patient with a sedentary lifestyle, a diet combined with a lifestyle program of gradual and moderate-intensity physical activity helps to reduce weight and enhances weight management while improving Cardiovascular Disease risk profile.

On a question regarding swimming as an aerobic exercise, only 9.1% of non-obese perform swimming 30-60 mins/week as aerobic exercises. A study in 1981 by Sheldon Magder concluded that in a patient with reduced exercise capacity swimming require near maximal efforts comparative healthy individual and individual who are not good at swimming achieve the same peak Vo_2 during swimming consume in cycling [43]. According to an estimate of cardiac death rate per 100, 00 hour of exercise ranges from 0-2.0/100,000 in general population and from 0.13/100, 00 to 0.61/100, 00 in cardiac rehabilitation programs. Falls and musculoskeletal injuries are additional risks associated with physical activity, but most of them do not require medical treatment. The incidence of such complications is comparatively low in patients with low-intensity activities.

CONCLUSION

The result of the present study in conjunction with previous findings highlights the importance of aerobic activity for both obese as well as non-obese (normal and overweight) patients. There is some considerable evidence that aerobic exercises including stationary bike and walking in addition to diet plan and education classes in a cardiac rehabilitation program improve weight maintenance. This study is going to help reduce the expense of obesity-related problems as it is going to be a treatment regimen for cardiac as well as non-cardiac patients.

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