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The Effect of Obesity on Cardiac Rehabilitation in Patients who have Undergone Coronary Artery Bypass Graft Surgery at the National Hospital of Sri Lanka

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ABSTRACT

Background: *Coronary artery disease (CAD) is one of the most prevalent non-communicable diseases in Sri Lanka. Coronary Artery Bypass Graft Surgery (CABG) is considered as the main revascularization procedure in patients with CAD. Cardiac rehabilitation is a multiphasic and multi-disciplinary program and is considered as a significant component of postoperative management after CABG.* ***Objective:*** *To study the effect of obesity on Cardiac Rehabilitation Program II (CRPII), a 1-month period of cardiac rehabilitation following discharge from the hospital, in patients who have undergone CABG.* ***Methods:*** *This was a prospective analytical study involving a convenient sample of 100 patients after CABG surgery. The patients (age: 40-70 years, both males and females) were selected from the cardiac rehabilitation program of the Cardiology Unit at the National Hospital of Sri Lanka. Data collection was done using 5 interviewer based questionnaires: socio-demographic characteristics using socio-demographic questionnaire, cardio-vascular endurance and fatigue levels using 6 minute-walk test (6MWT) and Borg scale (BS), anxiety and depression levels using Hospital anxiety and depression scale (HAD) and overall quality of life using quality of life questionnaire cardiac version (QOL). Data collection 1 was done on the first day of CRPII and data collection 2 was done on the final day of the program.* ***Results:*** *There were 33% obese and 67% non-obese patients in the study population. Both groups showed a statistically significant improvement ($p<0.0001$) of 6MWT, BS, HAD and QOL after CRPII. There was a significant difference ($p<0.05$) in the improvement of 6MWT in the non-obese group compared to the obese group and there was no difference in BS, HAD and QOL between obese and non-obese groups.* ***Conclusions:*** *CRPII led to an improvement in cardiovascular endurance, anxiety/depression and overall quality of life in patients who underwent CABG. Non-obese patients showed a better improvement in cardiovascular endurance compared to obese patients after CRPII.*

Keywords: Coronary artery disease, Coronary artery bypass graft surgery, Cardiac rehabilitation, Obese, Non-obese

Abbreviations: BS: Borg Scale; CABG: Coronary Artery Bypass Graft Surgery; CAD: Coronary Artery Disease, CRPI: Cardiac Rehabilitation Phase 1; CRPII: Cardiac Rehabilitation Phase 2; CRPIII: Cardiac Rehabilitation Phase 3; HAD: Hospital Anxiety Depression scale; QOL: Quality of life questionnaire Cardiac Version; 6MWT: 6-Minute Walk Test; WHO: World Health Organization

INTRODUCTION

Coronary artery disease (CAD) is considered as a noticeable non-communicable disease in the world [1]. World Health Organization has confirmed that CAD is a leading cause of deaths in the world. Further CAD accounts for 31% of all deaths worldwide. Over 3 quarters of global deaths due to CAD take place in low and middle-income countries. About 16 million of the world deaths among people under the age of 70 years occurred due to non-communicable diseases. And 82% of them are in low and middle-income countries, 37% of those deaths are caused by CAD [1].

Coronary artery disease is a leading cause of deaths in Sri Lanka [2,3]. The average mortality rate in Sri Lanka due to CAD is 524 deaths per 100,000 per year which are higher than in many high-income countries [4]. According to autopsy studies, CAD accounted for 34% of deaths in Sri Lanka [5]. In comparison, CAD accounts for only 17% of deaths in the United Kingdom and United State. The rate of hospitalization in Sri Lanka between years 2005-2010 is increased because of 3 diseases while heart diseases including CAD accounted for 29% among these 3 diseases [6]. The prevalence of CAD in Sri Lanka was 9.3% in the year 2009 whereas male were 7.2% and females were 11.3% [7].

CABG surgery is open heart surgery. CABG is considered as one of the major revascularization procedures for CAD to relieve the obstructions in the coronary arteries.

Cardiac rehabilitation is considered as a major component of postoperative management after CABG surgery. According to literature, 15% to 50% of patients participate in cardiac rehabilitation after CABG surgery with or without a referral from a physician, in the south Asian region [8]. Cardiac rehabilitation is a multiphasic program. There are 3 phases in cardiac rehabilitation: Phase 1 (CRPI), Phase 2 (CRPII) and Phase 3 (CRPIII). Phase 1 is the in-patient program which starts just after the revascularization procedure in the hospital. Phase 2 (CRPII) is an ambulatory outpatient rehabilitation program, and Phase 3 (CRPIII) is the maintenance phase.

Phase 2 (CRPII) of the cardiac rehabilitation program is an institutional based phase and the patient has to come to the outpatient department. Phase 2/CRPII in National Hospital Sri Lanka is a 1-month program where patients after 3 months from CABG surgery visits OPD twice a week for 1-month. Patients are advised to continue the same exercises at home and record the details. There were 4 main components in this phase. Those include assessment, education, exercise therapy (warm-up exercises, cardiovascular exercises and cool down and relaxation), and counseling and behavioral interventions.

Obesity has become a major modifiable risk factor for health globally. According to WHO, obesity and overweight are defined as "abnormal or excessive fat accumulation that presents a risk to health". According to a recent study, the prevalence of overweight, obesity and central obesity in Sri Lanka are 25.2%, 9.2%, and 26.2% respectively [9].

Obesity affects cardiac rehabilitation in many ways. Cardiac rehabilitation revealed a better improvement in non-obese subjects than obese subjects [10]. The dissimilar result was shown by another study as exercise capacity shows better improvement in obese than non-obese after cardiac rehabilitation [11]. The reason for contradictory data may be obese subjects who required better attention and follow up during cardiac rehabilitation than non-obese people [12]. Yet other studies revealed that there was no difference between obese and non-obese people considering the effect of cardiac rehabilitation [13]. Some studies indicated functional capacity, and lipid profiles were significantly improved in both non-obese and obese individuals and no significant difference was found between non-obese male and female in response to CRPII programs [14]. Hence obesity effect in a various manner in cardiac rehabilitation in different ethnical backgrounds.

However, no studies to analyze the effect of obesity in Sri Lanka were found up to our knowledge. Moreover, the finding of the impact of obesity in CRPII will help to design CRPII more effectively according to obesity.

MATERIALS AND METHODS

The study was conducted at the Cardiac Rehabilitation Unit, National Hospital of Sri Lanka. It was a prospective analytical study with 100 patients. Patients were selected according to the convenient sampling method.

Inclusion Criteria

Both men and women who were between 40-70 years from the patients who participate in existing CRPII in Cardiology Unit NHSL on the first day of CRPII were included in the study.

Excluded Criteria

Patients with resting blood pressure more than 200 mmHg or resting diastolic blood pressure more than 100 mm Hg at the time of examination, patients who had unstable cardiovascular system, patients who has any other cardio, respiratory, musculoskeletal, neurological disorders, patients who are diagnosed with psychiatric illnesses and patients who have any physical or psychological stress at the time of assessment were excluded from the study.

There were several data collection tool. They were measuring tape, weighing scale, socio-demographic questionnaire,

6-minute walk test (6MWT), Borg scale (BS), Anxiety and depression scale (HAD), Quality of life questionnaire cardiac version (QOL).

Methods of Data Collection

The study population was the patients who attended in the very first day of the cardiac rehabilitation program (CRPII) after 3-month of CABG surgery in NHSL. From them, a patient who fulfilled inclusion criteria were taken as the sample in this study after obtaining informed written consent. Data collection was done in two times as pre-data collection and post data collection. The pre-data collection was done on the first day of CRPII. Firstly socio-demographical data was assessed using interviewer-administered questioner. The Body mass index and waist to hip ratio was assessed using a measuring tape and weighing scale. The quality of life and psychological status were assessed using the QLI and HAD scale. Next, the physical assessment was done 10 minutes after filling the interviewer questionnaire. The physical assessment was evaluated using 6MWT (to measure cardiovascular endurance), BS (to measure fatigue level). After these procedures, data collection 1 (pre-data collection) was completed.

The patients have participated in CRPII twice a week on every Saturday and Wednesday at the Cardiac Rehabilitation Unit of National Hospital for a period of 1-month. Patients are encouraged to continue the same exercise program with warm-up exercises, cardiovascular exercises and cool down and relaxation at the home too. Data collection 2 (post data collection) were conducted on the last day of CRPII. The data was collected as the same procedure as data collection I.

Ethical Considerations

Ethical approval was obtained from the ethical committee of Kotelawala Defence University before the commencement of the study. Permission for the study was obtained from the administration of National Hospital, Sri Lanka and the Health Ministry of Sri Lanka. Written informed consent was taken from all the patients before enrolling them for the study. The procedure of the study was explained to them in their own languages and they were allowed to withdraw from the study at any time. Their names were not recorded in the data sheets. The electronic soft copies of the data sheets will be password protected. All the hard copies and the soft copies of data sheets will be stored confidentially for 5 years. The soft copies will be deleted and the hard copies will be destroyed after this period. Data collection 1 was kept totally blind from the data collection 2 to preclude the bias which can occur during the data collection.

Data Analysis

The patient was categorized in to obese or non-obese according to body mass index and waist to hip ratio. The patients were categorized into 2 groups (non-obese and obese) according to their body mass index (non-obese: body mass index <28, obese: body mass index >28). For men, more than 0.88 was considered as obese and for a woman, more than 0.81 was considered as obese [14]. The data were analyzed using Minitab version 14. The mean of the difference of (pre and post-CRPII) of findings of 6-minute walk test, Borg scale, Hospital anxiety/depression scale and quality of life index in non-obese and obese groups were compared using the paired t-test. The p-value of <0.005 was considered statistically significant.

RESULTS

Socio-Demographic Data

Age distribution: The mean age of the sample was 58.33 ± 7.45 years. Mean age of male was 58.61 ± 7.34 years and mean age of female was 58.58 ± 7.53 years.

Gender distribution: From whole population 81% were male and 9% were female. In the obese group, 60.60% were male and 39.04% were female. In the non-obese group, 91.04% were male and 8.96% were female.

Prevalence of obesity: There were 33 obese patients and 67 non-obese patients. The gender and age distribution of the study runs closely in both obese and non-obese groups. However, there were high male and less female percentages in the non-obese group (male 91.04% and female 8.96%) (Figure 1).

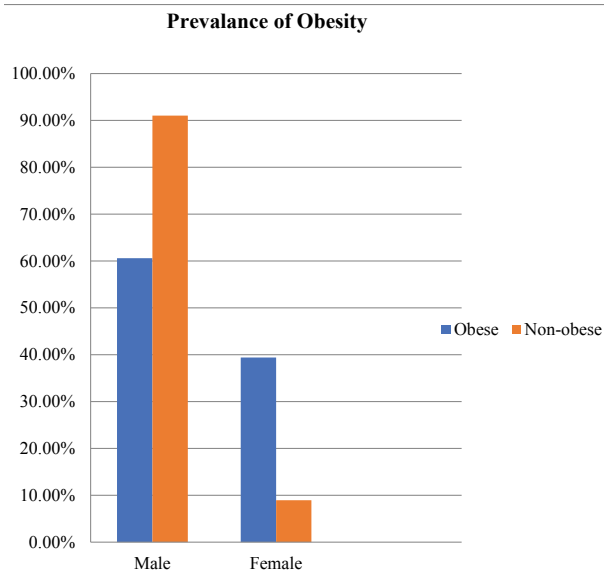

Figure 1 Demonstrates the prevalence of obesity among the population

Level of education: We categorized the educational levels into following categories, which are A (grade 5 and below), B (grade 6-10) and C (G. C.E O/L-A/L and above). When considering about the level of education, level C was the most distributed educational level (42.4% in obese and 56.7% in non-obese) and level A was the least distributed educational level in the study (21.2% in obese and 16.4% in non-obese).

Monthly income: Four monthly income levels were categorized as A (Less than Rs. 20,000.00), B (Rs >20,000.00 to Rs. 50,000.00), C (Rs >50,000.00 to Rs. 100,000.00), D (More than Rs. 100,000.00).When considering about the level of income level B was the most distributed income level (48.5% in obese and 52.2% in non-obese) and level A was the least distributed income level in both groups (18.2% in obese and 20.9% in non-obese).

Effectiveness of CRPII among Obese Group

The effectiveness of CRPII among the obese group was compared using two sample T-tests. The mean values of pre and post results of the 6-minute walk test, Borg scale, Hospital anxiety, and depression scale and quality of life index were compared. All of the above test values improved significantly after cardiac rehabilitation (Table 1).

Table 1 Effectiveness of CRPII among obese group

Variables	Pre-test (Mean ± SD)	Post-test (Mean ± SD)	p-value
Six-minute walk test	356.4 ± 58.7	437.3 ± 68.2	<0.0001
Quality of life index	18.58 ± 0.75	19.50 ± 1.0	<0.0001
Hospital anxiety and depression scale	13.46 ± 4.15	7.82 ± 3.25	<0.0001
Borg scale	7.52 ± 1.62	4.61 ± 1.30	<0.0001

Effectiveness of CRPII among Non-obese Group

The effectiveness of CRPII among the non-obese group was compared using two-sample T-test. The mean values of pre and post results of the 6-minute walk test, Borg scale, Hospital anxiety, and depression scale and quality of life index were compared. All of the above test values improved significantly after cardiac rehabilitation (Table 2).

Table 2 Effectiveness of CRPII among a non-obese group

Variables	Pre-test (Mean ± SD)	Post-test (Mean ± SD)	p-value
Six-minute walk test	373 ± 62.6	470 ± 66.3	<0.0001
Quality of life score	18.6 ± 0.86	19.6 ± 1.3	<0.0001
Hospital anxiety and depression scale	12.96 ± 4.15	7.19 ± 3.40	<0.0001
Borg scale	6.79 ± 1.83	3.58 ± 1.57	<0.0001

Comparison of Pre and Post-test Results of Obese Group with Pre and Post-test Results of Non-obese Group

The difference between pre and post-test results of the obese group with pre and post-test results of the non-obese group were compared. The improvement of 6-minute walk test, Borg scale, hospital anxiety, and depression scale and quality of life index in obese with the non-obese group were compared using paired T-test. According to Table 3 the mean values of QOL, HADS were improved in the non-obese group than the obese group, but the difference was insignificant. Yet the value of 6-minute walks test had a significant improvement in the non-obese group than the obese group [15].

Table 3 Comparison of pre and post-test results of the obese group with pre and post-test results of the non-obese group

Variables	Pre-test (Mean ± SD)	Post-test (Mean ± SD)	p-value
Six-minute walk test	80.9 ± 26.7	97.0 ± 33.4	0.02
Quality of life score	0.93 ± 0.78	1.03 ± 0.93	0.6
The hospital anxiety and depression scale	5.64 ± 2.67	5.76 ± 3.23	0.85
Borg scale	2.91 ± 1.55	3.21 ± 1.69	0.39

DISCUSSION

Distribution of Socio-Demographic Status among Study Population

The results of this study showed a comparatively similar distribution of socio-demographic status among both obese and non-obese group. Similar to the results of this study; Bjarnason-Wehrens, et al., concluded by their cohort study that there was no clear evidence on the effect of socio-economical status of patients to their cardiac rehabilitation program. Some evidence suggests poor socio-economical data (income, education, and transport) act as a barrier to cardiac rehabilitation. And people with poor socio-economical status leaves cardiac rehabilitation without proper completion. So special attention is required on them [16].

Obesity Prevalence

The prevalence of obesity in this study is 33%. Among the obese group, males accounted for 24.7% and 68.4% of females have been recorded. The result is similar compared with the recent findings in Sri Lanka [9]. That is 26.2% of all population was obese. When comparing the results of our study with the World Health Organization's recent findings, they said that 11% of men and 15% of female are obese from the whole world population. That is comparing the prevalence of obesity among male with a female of the world the percentage of the female are more than the male population. However, our study finding shows a higher value from world health statistics-2015.

Outcomes of Cardiac Rehabilitation

Cardiac rehabilitation can be considered as an important and effective component of post-operative-management of CABG. In this study, the outcomes of cardiac rehabilitation are assessed using several measures. Those are cardiovascular endurance using 6-minute walk test and Borg scale, anxiety and depression using Hospital anxiety and depression scale and quality of life using quality of life questioner cardiac version. Then the improvement of outcomes of cardiac rehabilitation between obese and non-obese people after cardiac rehabilitation program was compared. The 6-minute walk test, quality of life anxiety and depression scale and Borg scale values show high significance ($p<0.001$) in both obese and non-obese groups. According to literature, there are other contributing factors e.g. age, nutrients, history of infractions and living environment which affect improving cardiovascular endurance, anxiety/depression and overall quality of life of a patient who has undergone coronary artery bypass grafting surgery other than cardiac rehabilitation.

According to Ciftçi, et al., cardiac rehabilitation improves the overall quality of life and functional capacity of the patients after CABG in both men and women [17]. Similarly in our study cardiac rehabilitation improved the overall quality of life and functional capacity after CABG in both men and women. There was a better improvement in anxiety and depression from cardiac rehabilitation. Similarly, literature revealed that cardiac rehabilitation depressive symptoms were reduced among patients after CABG [18]. Cardiac rehabilitation shows a positive impact on anxiety/depression and panic symptoms according to Pourafkari, et al., [19]. Sharif, et al., conducted a study on the effect of cardiac rehabilitation on anxiety and depression after CABG; and concluded that cardiac rehabilitation improves

depression after CABG but not the anxiety [20]. Our results go similar to depression but were controversial with anxiety.

Comparison of Outcomes of Cardiac Rehabilitation among Obese and Non-obese Groups

Cardiovascular endurance: Similar to the results of this study; Lavie, et al., revealed that there was a significant improvement in cardiovascular endurance in non-obese group than the obese group [11]. Contrast to that, Gunstad, et al., indicated that there was less improvement in cardiovascular endurance in the obese group compared to the non-obese group [21]. Ghashghaei, et al., and Sadeghi, et al., concluded that there was a significant improvement in cardiovascular endurance in both obese and non-obese group but there was not any significant difference among the obese and non-obese group after CRP [22,23].

Quality of life: Gunstad, et al., concluded that there was less improvement in the quality of life in the obese group than non-obese [21]. But Hevey, et al., highlighted that there was not any significant difference in the improvement of quality of life among obese and non-obese [24].

Anxiety and depression: Contrast to the results of this study, Hevey, et al., suggests that there was not any significant difference improvement of anxiety and depression among obese and non-obese [24].

CONCLUSION

Cardiac rehabilitation can be considered as one of the contributing factors in a patient's recovery after CABG. CRPII helps to improve cardiovascular endurance, fatigability, anxiety, depression, and quality of life status in both obese and non-obese groups. But within these components, cardiovascular endurance shows better improvement in non-obese than the obese group. So obesity has an effect on the improvement of cardiovascular endurance in CRPII.

DECLARATIONS

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Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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