

Original Research Article

# A Study to Evaluate the Effectiveness of Pulmonary Rehabilitation Program (PRP) on Physiological Parameters and Quality of Life among Patients Undergoing Coronary Artery Bypass Grafting (CABG) in Selected Hospital of Delhi

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## ABSTRACT

Objectives of the study were to: 1) Assess and evaluate the effects of Pulmonary rehabilitation program (PRP) on physiological parameters of patients after undergoing Coronary Artery Bypass Grafting (CABG) , 2) Assess and evaluate the effect of Pulmonary rehabilitation program (PRP) on quality of life of patients after undergoing Coronary Artery Bypass Grafting (CABG).

The theoretical framework adopted is based on nursing process model given by Ida Jean Orlando. Quantitative Experimental Approach and Quasi Experimental time series non equivalent control group Design was used. Consecutive sampling technique was used with sample size of 200 for experimental and control group.

Tools used were : 1) Structured Interview Schedule to collect the demographic characteristics and disease related variables, 2) Observation Schedule to observe the physiological parameters by Pulse Oximeter, Counting respiratory rate, BP Apparatus, Incentive Spirometer & Peak flow meter, 3) Structured Interview Schedule for pain assessment by Visual Numeric pain scale, 4) State trait anxiety inventory by C.D. Spielberger's – for anxiety level, 5) Structured Interview Schedule for assessment of Quality of Life by Modified WHO QOL BREF.

The significant finding of the study were : 1) On exposure to PRP experimental group had significant difference on physiological parameters with the control group subjects except the Mean Systolic as well as Diastolic Blood Pressure. 2) The patients who underwent CABG and exposed to PRP had significant difference on level of pain. 3) The anxiety level has increased from baseline to 3<sup>rd</sup> post operative day in both experimental and control group. Further it was observed that there was a gradual reduction in the anxiety level, where the reduction is more in experimental group than the control group, 4) On exposure to PRP had significant difference in the Quality Of Life as it has increased in the experimental group than in the control group subjects who were not exposed to PRP.

**Key words:** Pulmonary rehabilitation program (PRP), Coronary Artery Bypass Grafting (CABG).

## INTRODUCTION

It is estimated that by 2020 cardiovascular disease will be the cause of over 40% deaths in India as compared to 24% in 1990. With over 3 million deaths owing to cardiovascular diseases every year,

India is set to be the heart disease capital of the world in few years, said doctors on the eve of World Heart Day ( September 29, 2012).

Cardiovascular disease will be the largest cause of death and disability by 2020

in India. It has been forecasted that 2.6 Million people will die from coronary heart disease, which constitutes 54% of all cardiovascular disease deaths. Approximately half of these deaths will occur in young and middle aged individuals, making the impact to society and the economy even more significant.

**Gupta** <sup>[1]</sup> reported that in terms of absolute numbers there is 30 million CAD patients in the country. The disease occurs at a much younger age in Indians as compared to those in North America and Western Europe. Rural-urban differences reveal that risk factors like obesity, truncal obesity, hypertension, high cholesterol, low HDL cholesterol and diabetes are more in urban areas.

Kasliwal RR <sup>[2]</sup> reported that Indian patients undergoing bypass surgeries are often young (Average age of 60 years) and yet reveal a high burden of major modifiable risk factors. The prevalence of obesity, is 51%, Diabetes 48%, Hypertension 71%, smoking 40% and high LDL-C is 86%.

Cardiac rehabilitation has a beneficial effect on the prognosis and quality of life of cardiac patients, and has been found to be cost-effective. A comprehensive and low cost educational intervention designed can increase the attendance of patients to the cardiac rehabilitation programs.

## **MATERIALS AND METHODS**

Based on the theoretical framework and objectives of the study, and after extensive review of literature, to know the effectiveness of Pulmonary Rehabilitation Program, the following tools were prepared.

1. Structured interview schedule to collect the demographic characteristics and disease related variables.
2. Observation schedule to observe the physiological parameters by Pulse Oximeter, Counting respiratory rate, BP Apparatus, Incentive Spirometer & Peak flow meter

3. Structured interview schedule for pain assessment by Visual Numeric pain scale.
4. State trait anxiety inventory by C.D. Spielberger's – for anxiety level.
5. Structured interview schedule for assessment of Quality of Life by Modified WHO QOL BREF.

## **DESCRIPTION OF TOOLS**

- a) Structured Performa was prepared by the investigator for collecting Demographic profile and disease related profile regarding the patients who were undergoing the Coronary Artery Bypass Grafting (CABG). The validity and reliability was also established. The structured interview schedule developed elicit data of the sample. It consists of 14 items on demographic data which includes age, gender, religion, education, occupation, marital status, habitat, life style (active / sedentary), family type, history of smoking, alcohol, diet (vegetarian or non-vegetarian), history of illness, duration of illness, family history of CAD.
- b) Observation schedule was prepared for the measurement of physiological parameters like heart rate, respiratory rate, blood pressure, pulmonary function (IC& PEF), oxygen saturation. Heart rate was measured with Dr. Morepen's Pulse Oximeter, Respiratory rate was counted, Blood pressure measured using OMRON automatic Blood pressure monitor, Pulmonary function i.e. inspiratory capacity was measured with Incentive spirometer, Peak expiratory flow with CIPLA peak expiratory flow meter.
- c) Visual Numeric pain scale was used for pain assessment which was scored on the said pain scale marked between 1 to 10. The pain was assessed on five occasions i.e. pain on chest incision at rest, pain on chest incision during change of position, pain on chest incision on walking, pain on chest incision on deep breathing, pain on chest

incision on coughing. For each occasion the scale was categorized as Mild (1-4), moderate (5-7) and severe (8-10). Therefore score in one occasion was 10 and the total score for all occasion is 50. Each assessment was done on 3rd day, 7th day, on discharge and then on 30th, 60th and 90<sup>th</sup> day.

- d) The State trait anxiety inventory by C.D.S pielberger's were adopted to assess the anxiety level of the patient. The tool consisted of 20 items which was scored as 1,2,3 or 4 giving the range of anxiety. The scores on the anxiety scale range from 20-80. The anxiety level categorized were as : 20 denotes no anxiety, 21-35 – mild anxiety, 36-50 – moderate anxiety, 51-65 – severe anxiety and 66-80 – extreme anxiety.
- e) A Modified WHO QOL BREF instrument was used to assess Quality of life. The tool consisted of 34 items which was scored as 1, 2 or 3 which reflected the range of Quality of Life. Each items provided three response categories – Always, Sometimes and Never. The scores on QOL scale range from 34 - 102. The quality of life was categorized as: Best QOL is the score ranged between 80 – 102, Moderate QOL 57 - 79, and Poor QOL between 34 - 56.

## DESCRIPTION OF TREATMENT

The Pulmonary rehabilitation program included individualized structured instructions for patients undergoing Coronary Artery Bypass Grafting (CABG) through Information Booklet (IB), demonstration by the researcher, clarification of doubts and taking feedback. The information booklet was prepared after extensive study of literature in nursing, medicine and psychology. The investigators own experience in clinical field also helped considerably in structuring the information booklet. The opinion of the experts from the field of nursing and cardiology was also sought for validation. An information booklet (IB) was prepared which contains

complete, adequate, accurate, and relevant content for the rehabilitation of patient after coronary artery bypass grafting.

The information booklet instructions give the information on what is Coronary Artery Bypass Grafting? States the goals of the Pulmonary Rehabilitation Program. To achieve the goals of the program the complete information are abbreviated as READ so that the patients are able to memorize and recapitulate the instructions easily and remember it lifelong. READ stands for Relaxation, Exercise, Avoidance of risk And Dietary management.

**Relaxation:** Steps on how to achieve relaxation and carry out the deep breathing exercises are given in simple instructions.

**Exercise:** How to carry out the pulmonary exercises i.e. Deep breathing exercises, pursed lip breathing, breathing exercise with incentive spirometry, post expiratory pressure therapy with peak expiratory flow and diaphragmatic breathing. Ambulatory exercises include sitting and standing exercise, arm exercises and stair climbing. It also includes how to warm up for exercises and cool down. When to stop exercise and seek medical advice. It gives what are the points to be kept in mind for exercise. All points are given in step by step.

**Avoidance of Risk:** Avoiding the various risk factors like obesity, smoking, stress, sedentary life style and the life style modification after the surgery are given in simple language.

**Dietary Management:** What are the do's and don'ts which are to be observed in dietary management are given in tabular method.

The information booklet was printed in English and for a better understanding the information booklet was also translated in local language i.e. Hindi by Hindi expert and retranslated in English.

The information booklet was administered to the patient by the researcher one week before the expected operating date and demonstrations were given on deep breathing exercise, pursed lip breathing, breathing exercise with incentive

spirometer, post expiratory pressure therapy through peak expiratory flow, diaphragmatic breathing and to perform relaxation. The patients are then met twice pre-operatively to see the return demonstration on pulmonary breathing and relaxation. Along with the IB a self reporting Performa is pasted at the end of the book to get the feedback. In this self reporting Performa patients puts a tick mark if read the book and writes how many times he practiced the relaxation and pulmonary exercise each day. Clarifications of doubts are also done in these meetings.

## DATA COLLECTION PROCEDURES

For the experimental group, information booklets were distributed and demonstrations were given on pulmonary exercises. The subjects were encouraged to read the book and fill in the self reporting Performa and mention number of times they practiced the relaxation and pulmonary exercise each day. The patients were then met twice pre-operatively to observe the return demonstration on pulmonary breathing and relaxation. Clarifications of doubts are also done in these meetings.

## DATA COLLECTION TECHNIQUES

Group	Base Line Data pre test	Treatment	Post Test	Observation Days
Experimental	<ul style="list-style-type: none"> <li>Physiological parameters (Heart Rate, Respiratory rate, Blood pressure, Pulmonary function (IC &amp; PEF), Saturation of Oxygen).</li> <li>Anxiety</li> <li>Quality of Life</li> </ul>	Information booklet on Pulmonary Rehabilitation Program	<ul style="list-style-type: none"> <li>Physiological parameters (Heart Rate, Respiratory rate, Blood pressure, Pulmonary function (IC &amp; PEF), Saturation of Oxygen).</li> <li>Anxiety and Pain</li> <li>Quality of Life)</li> </ul>	3 <sup>rd</sup> , 7 <sup>th</sup> , on discharge 3 <sup>rd</sup> , 7 <sup>th</sup> , on discharge, 30 <sup>th</sup> day, 60 <sup>th</sup> day, 90 <sup>th</sup> day 3 <sup>rd</sup> , 7 <sup>th</sup> , on discharge, 30 <sup>th</sup> , 60 <sup>th</sup> , 90 <sup>th</sup> day
Control Group	Do -	---	Do -	Do -

Figure 3.2 : Schematic representation of data collection techniques

## RESULT

### SECTION I: Description of sample characteristics.

- Frequency and percentage distribution of Sample Characteristics.
  - 89 out of 200 (44.5%) patients in the age group of 55-65 years and 73 out of 200 (36.5%) patients belong to the age group of 45-55 years.
  - Majority of the patients were male patients i.e. 172 out of 200 (86%). Majority of them belonged to Hindu religion i.e. 143 out of 200 (71.5%). Most of the patients were private employees i.e. 74 out of 200 (37%).
  - Most of the patients were married i.e. 197 out of 200 (98.5%) and lived in urban environment i.e. 109 out of 200 (54.5%). Most of them belonged to nuclear family i.e. 108 out of 200 (54%).
- Frequency and percentage distribution of Disease related variables.
  - 109 patients out of 200 ( 54.5%) had no past history of medical illness , whereas

91 of them reported to have past history of medical illness. 183 patients out of 200 (91.5%) had not undergone any surgery in the past.

- Regarding the duration of illness, 67 out of 200 (33.5%) had the duration of illness between 6month – 1year and 56 out of 200 ( 28%) of them suffered with heart disease between 1-2years.
  - 115 out of 200 (57.5%) patients reported to have an active lifestyle whereas 85 out of 200 (42.5%) had a sedentary lifestyle. 106 out of 200 (53%) had the habit of smoking and most of them were non-vegetarians i.e. 133 out of 200 (66.5%). 154 out of 200 (77% ) of them reported of not having the family history of heart disease.
- Chi-square test to ascertain similarity between selected demographic variables by group wise.
    - The non significant p-value of 0.684, 0.078,0.561 for sex wise distribution , education and marital status respectively

indicates that both the groups are statistically similar in relation to sex, education level and marital status.

- The significant p-values of 0.013, 0.019, 0.050, 0.001, 0.001 for age, religion, occupation, habitat and family type respectively indicates that both the groups are statistically different and hence these were included as a covariate for the comparative analysis.
- d) Chi-square test to ascertain similarity between selected disease related variables by group wise
  - The non significant p-value of 0.320, 0.447, 0.072, 0.257, 0.881 for
  - medical history, surgical history, life style, smoking and dietary habits respectively indicates that both the groups initially were found to be similar.
  - The patients in both the groups did differ in duration of heart disease and family history of heart disease. The significant p-values of 0.001, 0.001 for duration of heart disease and family

history respectively were included as a covariate for the comparative analysis.

## SECTION II: Comparison between Experimental and Control group on Physiological Parameter and Quality of Life.

- a) Independent t-test to determine whether the experimental group and control group are similar in characteristics related to physiological variables, quality of life and anxiety at baseline.
  - The non significant p-value of 0.418, 0.275, 0.889, 0.406, for systolic blood pressure, diastolic blood pressure, SaO<sub>2</sub> and anxiety respectively indicates that both the groups are statistically similar.
  - The significant p-values of 0.041, 0.029, 0.007, 0.000, 0.001 for heart rate, respiratory rate, pulmonary function (inspiratory capacity), peak expiratory flow and quality of life respectively indicates that both the groups are statistically different.

TABLE 1: Mean and Standard Deviation of Physiological Variables, Quality Of Life and Anxiety at Baseline by Group Wise. N = 200

Variable	Experimental group		Control group		Independent t-test value	p-value
	Mean	SD	Mean	SD		
Heart Rate	85.66	6.70	83.78	6.18	2.061	0.041*
Respiratory Rate	21.30	1.87	21.96	2.34	-2.200	0.029*
Systolic blood Pressure	125.18	13.81	123.80	9.89	0.812	0.418
Diastolic blood Pressure	78.76	9.26	80.08	7.71	-1.095	0.275
Pulmonary function (inspiratory capacity)	1.05	0.15	0.9960	0.14	2.741	0.007*
Peak expiratory flow	165.00	45.22	123.00	33.65	7.451	0.000*
SaO <sub>2</sub>	97.70	0.54	97.69	0.46	0.140	0.889
Quality of life	71.94	6.918	68.85	6.15	3.336	0.001*
Anxiety	53.88	7.678	52.93	8.43	0.833	0.406

\*statistically significant at 0.05 level of significance

## SECTION III: Effectiveness of Pulmonary Rehabilitation Program (PRP).

### 1. Effectiveness of PRP on Heart rate

- i. Mean and Standard Deviation of Heart Rate of patients at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day and at discharge by group wise.
  - The patients in the experimental group are initially having the mean heart rate of 85.66 beats per minute. The patients in the experimental group are having mean heart rate

85.81, 85.87 and 84.43 beats per minute respectively on 3<sup>rd</sup> day, 7<sup>th</sup> day and at discharge. The mean heart rate for the control group patients has been 83.78, 82.99, 82.21 and 81.10 respectively at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day and at discharge

- ii. ANOVA repeated measure for Heart Rate.
  - The significant p-value for the between group comparison infers that the two groups are statistically different by heart rate wise.

- The non-significant p-value of the interaction effect “Assessment and Group” infers that the changes in the heart rate between baseline and 3<sup>rd</sup> day, from 3<sup>rd</sup> day to 7<sup>th</sup> day and 7<sup>th</sup> day to discharge has been similar for the two groups. i.e. whether the patients in the PRP group or Control group, the mean heart rate changes has equal for the two groups in all the four assessments
- iii. ANCOVA repeated measure for Heart Rate after controlling with selected covariates.
- The significant p-value of the Group comparison infers that mean heart rate are statistically different in the PRP group compared to the control group after controlling effects of the covariates.

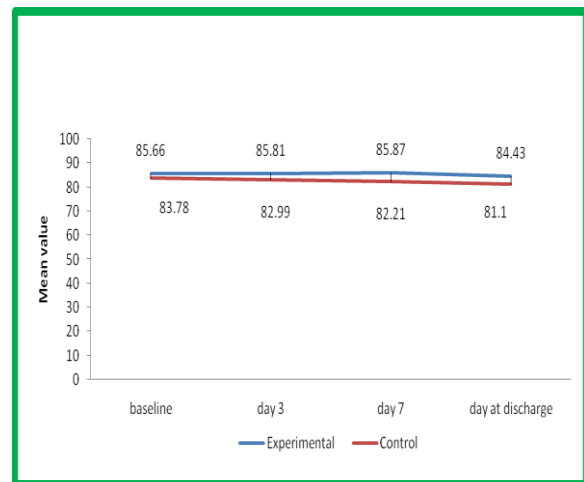


Figure 4.1 : Mean Heart rate by group wise at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day and at Discharge

TABLE 2: 2x4 ANOVA Repeated Measure Results For Heart Rate. N=200

Source	F-value	P-value	Repeated contrast test result		
			Comparison level	F-value	P-value
Between Group	14.948	<0.001*			
Within Assessment	9.806	0.002*	Baseline vs 3 <sup>rd</sup> day	0.132	0.717
			3 <sup>rd</sup> day vs 7 <sup>th</sup> day	5.974	0.015*
			7 <sup>th</sup> day vs discharge	19.237	<0.001*
Group Assessment	2.052	0.105			

\*statistically significant at 0.05 level of significance

## 2. Effectiveness of PRP on Respiratory rate

- i. Mean and Standard Deviation of Respiratory Rate of patients at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day and at discharge by group wise.
- The mean respiratory rate has been 21.30, 22.32, 21.52 and 20.88 respectively at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day and at discharge for the PRP group of patients. The mean respiratory rate has been 21.96, 22.82, 22.84 and 22.32 respectively at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day and at discharge for the control group patients.
- ii. ANOVA repeated measure for Respiratory Rate.
- The significant p-value for the between “Group” comparison infers that mean respiratory rate has been

different for the PRP group compared to the control group.

- The result infers that the changes occurs between the two groups has been similar for the comparison between baseline to 3<sup>rd</sup> day and from 7<sup>th</sup> day to discharge. The main difference occurs between the two groups has been between 3<sup>rd</sup> day to 7<sup>th</sup> day. In the PRP group, there is a reduction in the respiratory rate from 3<sup>rd</sup> day to 7<sup>th</sup> day, Where as in the control group, it remains same, without any specific change from 3<sup>rd</sup> day to 7<sup>th</sup> day. This clearly infers that PRP is effective in controlling the respiratory rate.
- iii. ANCOVA repeated measure for Respiratory Rate after controlling with selected covariates.

- The significant p-value of the “Group” comparison infers that PRP is effective in controlling the respiratory rate. The non-significant p-value of the covariates confirms that the changes occurs in the experimental group is due to the intervention.

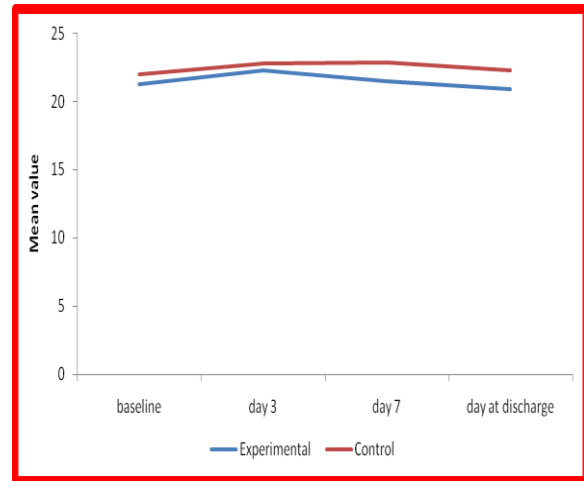


Figure 4.2 : Mean respiratory rate by group wise at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day and at discharge

TABLE 3: 2X4 ANOVA Repeated Measure Results For Respiratory Rate.

N = 200

Source	F-value	P-value	Repeated contrast test result		
			Comparison level	F-value	P-value
Between Group	15.575	.000			
Within Assessment	11.430	.001	baseline vs 3 <sup>rd</sup> day	21.896	0.000*
			3 <sup>rd</sup> day vs 7 <sup>th</sup> day	6.576	0.011*
			7 <sup>th</sup> day vs discharge	12.663	0.000*
Group Assessment	2.883	.035	baseline vs 3 <sup>rd</sup> day	0.159	0.691
			3 <sup>rd</sup> day vs 7 <sup>th</sup> day	7.268	0.008*
			7 <sup>th</sup> day vs discharge	0.136	0.713

\*statistically significant at 0.05 level of significance

### 3. Effectiveness of PRP on Systolic Blood Pressure

- Mean and Standard Deviation of Systolic Blood Pressure of patients at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day and at discharge by group wise.
  - The mean systolic blood pressure has been 125.18, 125.76, 124.50 and 122.88 respectively at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day and at discharge for the PRP group of patients. The mean systolic blood pressure has been 123.80, 124.62, 125.74 and 122.23 respectively at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day and at discharge for the control group patients.
- ANOVA repeated measure for Systolic Blood Pressure.
  - The “Between Group” comparison result infers that in general the SBP has been similar for the two groups. The mean SBP has been similar for the PRP group and control group.
  - The non-significant p-value also confirms that the changes occurs in

SBP between the two groups are statistically similar.

- “The repeated contrast” test has been applied, when the changes are statistically significant. The significant p-value of the comparison between 7<sup>th</sup> day to discharge infers that in both the experimental and control group, there has been reduction in the SBP

### 4. Effectiveness of PRP on Diastolic Blood Pressure

- Mean and Standard Deviation of Diastolic Blood Pressure of patients at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day and at discharge by group wise.
  - The mean diastolic blood pressure has been 78.76, 80.78, 80.13 and 79.26 respectively at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day and at discharge for the PRP group of patients. The mean diastolic blood pressure has been 80.08, 80.58, 80.00 and 78.68 respectively at baseline, 3<sup>rd</sup> day, 7<sup>th</sup>

day and at discharge for the control group patients.

- ii. ANOVA repeated measure for Diastolic Blood Pressure.
  - The non-significant p-value for all the comparisons (Between group comparison and within Group comparisons of Assessment and interaction effect – Group and Assessment) infers that the two groups are similar with respect to the diastolic blood pressure level and the changes between the assessments are also similar for the two groups.

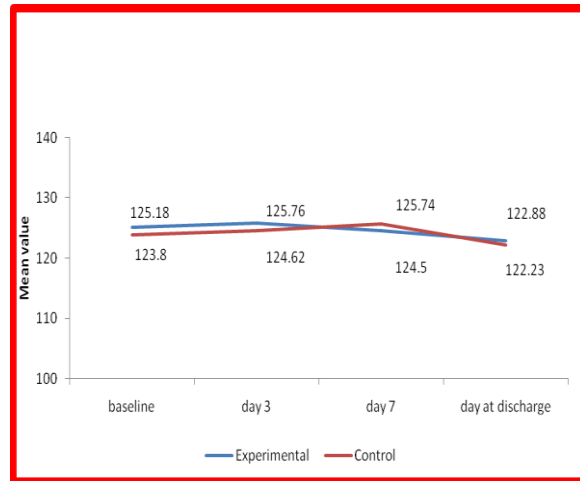


Figure 4.3 : Mean Systolic blood pressure by group wise at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day and at discharge.

TABLE 4: 2X4 ANOVA Repeated Measure Results For Systolic Blood Pressure Result.

N =200

Source	F-value	P-value	Repeated contrast test result		
			Comparison level	F-value	P-value
Between Group	0.138	0.711			
Within Assessment	5.144	0.024*	baseline vs 3 <sup>rd</sup> day	0.675	0.412
			3 <sup>rd</sup> day vs 7 <sup>th</sup> day	0.011	0.918
			7 <sup>th</sup> day vs discharge	24.783	0.000*
Group Assessment	1.199	0.309	Previous vs 3 <sup>rd</sup> day		
			3 <sup>rd</sup> day vs 7 <sup>th</sup> day		
			7 <sup>th</sup> day vs discharge		

\*statistically significant at 0.05 level of significance

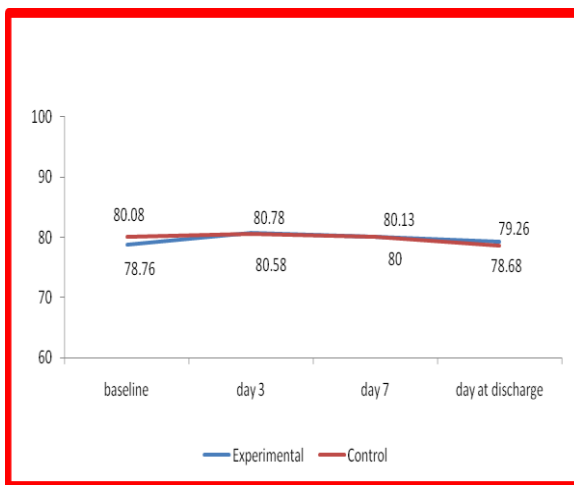


Figure 4.4 : Mean Diastolic blood pressure by group wise at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day and at discharge.

TABLE 5: 2X4 ANOVA Repeated Measure Results For Diastolic Blood Pressure N = 200

Source	F-value	P-value
Between Group	0.016	0.900
Within Assessment	2.548	0.112
Group Assessment	0.795	0.497

\*statistically significant at 0.05 level of significance

## 5. Effectiveness of PRP on Pulmonary function (Inspiratory)

- i. Mean and Standard Deviation of Pulmonary function (Inspiratory) of patients at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day and at discharge by group wise.

- The mean pulmonary function (inspiratory) has been 1.056, 0.636, 0.771 and 0.999 respectively at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day and at discharge for the PRP group of patients. The mean pulmonary function (inspiratory) has been 0.996, 0.600, 0.639 and 0.810 respectively at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day and at discharge for the control group patients.
- The mean value clearly indicates immediately after the CABG surgery, the mean pulmonary function (inspiratory) has been reduced and gradually it retains the level. Similarly, in the control group also there is a reduction in the mean pulmonary function (Inspiratory) on 3<sup>rd</sup> post operative day, afterwards there is an increase in the pulmonary function (Inspiratory).
  - i. ANOVA repeated measure for Pulmonary function.
    - The significant p-value of the comparison between 3<sup>rd</sup> post



operative and 7<sup>th</sup> post operative day infers that increase in the pulmonary function level has been different for the two groups. The mean difference (0.771-0.636=0.135) in the experimental group has been higher than the mean difference (0.039) of the control group.

- Similarly the significant p-value of the comparison between 7<sup>th</sup> post operative day and at discharge day infers that the changes are different in the two groups. The mean difference has been 0.228 and 0.171 respectively for the experimental group and control group. The above results clearly indicate that PRP is effective in improving the pulmonary function level.
- ii. ANCOVA repeated measure for Pulmonary function after controlling with selected covariates.
  - The results indicates that pulmonary function at baseline also influence the pulmonary function level at

discharge day in addition to the PRP intervention. The significance level of pulmonary function at baseline infers that it has a interaction with the PRP intervention to make an improvement in the pulmonary function after the CABG surgery.

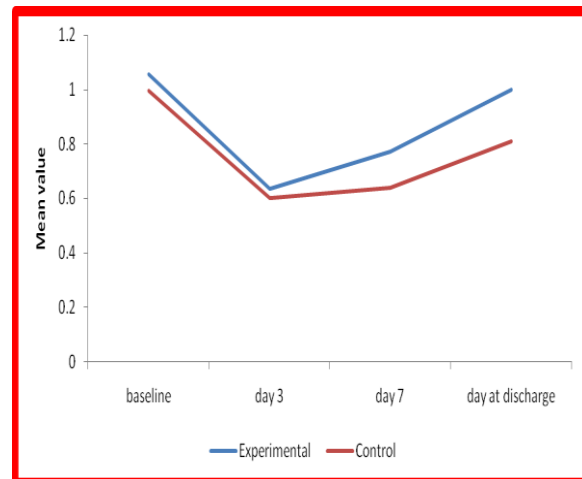


Figure 4.5 : Mean Pulmonary function (inspiratory capacity) by group wise at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day and at discharge.

TABLE 6: 2X4 ANOVA Repeated Measure Results For Pulmonary Function (Inspiratory Capacity).

N =200

Source	F-value	P-value	Repeated contrast test result		
			Comparison level	F-value	P-value
Between Group	60.228	0.000			
Within Assessment	451.423	0.000	Baseline vs 3 <sup>rd</sup> day	1148.748	0.000*
			3 <sup>rd</sup> day vs 7 <sup>th</sup> day	92.356	0.000*
			7 <sup>th</sup> day vs discharge	308.583	0.000*
Group Assessment	15.896	0.000	Baseline vs 3 <sup>rd</sup> day	0.994	0.320
			3 <sup>rd</sup> day vs 7 <sup>th</sup> day	28.113	0.000*
			7 <sup>th</sup> day vs discharge	6.298	0.013*

\*statistically significant at 0.05 level of significance

## 6. Effectiveness of PRP on Pulmonary function (Peak Expiratory Flow)

- i. Mean and Standard Deviation of Peak Expiratory Flow of patients at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day and at discharge by group wise.
  - The mean PEF value for the experimental group has been 165, 101, 114.5 and 134.5 respectively at baseline, 3<sup>rd</sup> post operative day, 7<sup>th</sup> post operative day and at discharge. For the control group the mean PEF value has been 123, 60.5, 70.5 and 87.5 respectively at baseline, 3<sup>rd</sup> post operative day, 7<sup>th</sup> post operative day

and at day of discharge from the hospital

- ii. ANOVA repeated measure for Peak Expiratory Flow.
  - The “within comparison-Group\*Assessment” result infers that the changes occurs in the two groups are same. The level of decrease at initial and gradual increase thereafter has been similar for both groups.
  - The results indicate that the PEF level has been in the higher-level in the experimental group in all the

four assessments compare to the control group.

- iii. ANCOVA repeated measure for Peak Expiratory Flow after controlling with selected covariates.
  - The significant p-value for the Group confirms that PEF level has been higher in the experimental group compared to control group after controlling the effects of all the covariates.

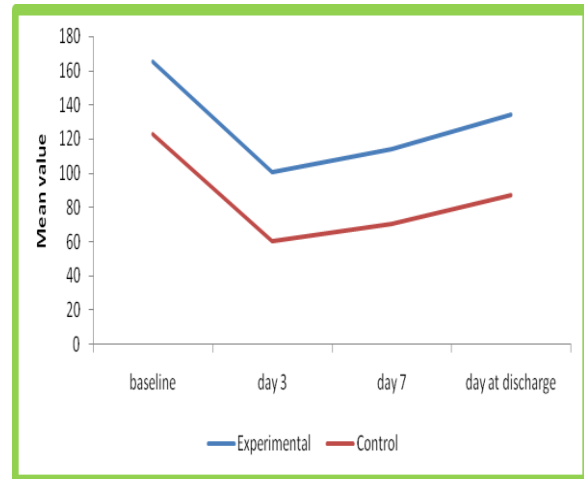


Figure 4.6 : Mean Pulmonary function (Peak expiratory flow) by group wise at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day and at discharge

TABLE 7: 2X4 ANOVA Repeated Measure Results For Pulmonary Function (Peak Expiratory Flow) N=200

Source	F-value	P-value	Repeated contrast test result		
			Comparison level	F-value	P-value
Between Group	242.725	0.000*			
Within Assessment	243.605	0.000*	Baseline vs 3 <sup>rd</sup> day	515.572	0.000*
			3 <sup>rd</sup> day vs 7 <sup>th</sup> day	57.993	0.000*
			7 <sup>th</sup> day vs discharge	79.212	0.000*
Group Assessment	0.632	0.595	Baseline vs 3 <sup>rd</sup> day		
			3 <sup>rd</sup> day vs 7 <sup>th</sup> day		
			7 <sup>th</sup> day vs discharge		

\*statistically significant at 0.05 level of significance

## 7. Effectiveness of PRP on Saturation of Oxygen (SaO<sub>2</sub>)

- i. Mean and Standard Deviation of Saturation of Oxygen (SaO<sub>2</sub>) of patients at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day and at discharge by group wise.
  - The mean SaO<sub>2</sub> level has been 97.7, 97.5, 97.7 and 97.8 respectively at baseline, 3<sup>rd</sup> post operative day, 7<sup>th</sup> post operative day and at day of discharge for the experimental group. Similarly the mean SaO<sub>2</sub> level has been 97.69, 97.3, 97.5 and 97.5 respectively at baseline, 3<sup>rd</sup> post operative day, 7<sup>th</sup> post operative day and at day of discharge.
- ii. ANOVA repeated measure for Saturation of Oxygen (SaO<sub>2</sub>).
  - The significant p-value of the “Between Group” infers that there is a significant difference between the two groups with respect to the mean SaO<sub>2</sub> level.
- iii. ANCOVA repeated measure for Saturation of Oxygen (SaO<sub>2</sub>) after controlling with selected covariates.

- The significant p-value for the “group” infers that the two groups SaO<sub>2</sub> level has been statistically different after controlling the effects of the selected covariates. Further, SaO<sub>2</sub> level in baseline also influence on the SaO<sub>2</sub> level during the day of discharge in both the groups.

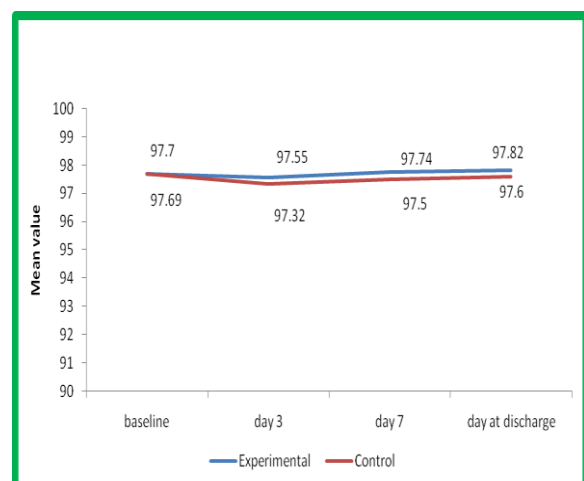


Figure 4.7 : Mean Saturation of Oxygen by group wise at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day and at discharge.

**TABLE 8: 2X4 ANOVA Repeated Measure Results For Saturation of Oxygen N = 200**

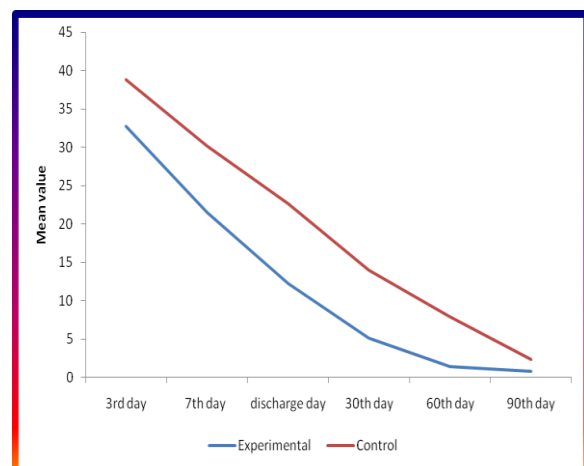
Source	F-value	P-value	Repeated contrast test result		
			Comparison level	F-value	P-value
Between Group	7.206	0.008*			
Within Assessment	22.664	0.000*	Baseline vs 3 <sup>rd</sup> day	32.622	0.000*
			3 <sup>rd</sup> day vs 7 <sup>th</sup> day	27.025	0.000*
			7 <sup>th</sup> day vs discharge	15.754	0.000*
Group Assessment	4.322	0.005*	Baseline vs 3 <sup>rd</sup> day	5.839	0.017*
			3 <sup>rd</sup> day vs 7 <sup>th</sup> day	0.020	0.888
			7 <sup>th</sup> day vs discharge	0.194	0.660

\*statistically significant at 0.05 level of significance

## 8. Effectiveness of PRP on Pain

- i. Mean and Standard Deviation of Pain of patients at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day, at discharge, 30<sup>th</sup> day, 60<sup>th</sup> day and 90<sup>th</sup> day by group wise.
  - In the experimental group the pain level has been 32.8 on 3<sup>rd</sup> post operative day and gradually it reduces to almost nil pain on 90<sup>th</sup> day after surgery. For the control group the mean pain level has been 38.8 on 3<sup>rd</sup> post operative day and reduces to very little pain on 90<sup>th</sup> day after surgery. The above mean values infers that PRP is effective in controlling the pain level of the heart disease patients undergoing CABG surgery.
- ii. ANOVA repeated measure for Pain.
  - The “Between Group” comparison result infers that the pain level has been varies in the two groups. It is observed in the experimental group the pain level has been less compares to the control group.
  - The significant p-value of the “Assessment” effect infers that the pain level from 3<sup>rd</sup> post operative day to 90<sup>th</sup> day after surgery has been different in both the groups.
  - The “Repeated contrast test” result infers that in each assessment there is a significant reduction in the pain level in both the groups. From the mean pain

- value, it is evident; the PRP intervention is effective in controlling the pain level.
- iii. ANCOVA repeated measure for Pain after controlling with selected covariates
  - The non-significant p-value of the covariates infers that other variables influence on the pain reduction is not statistically significant. The “Group” comparison p-value confirms that PRP is effective in reducing the pain level of the heart disease patients undergoing CABG surgery



**Figure 4.8: Mean Pain level by group wise at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day, at discharge, 30<sup>th</sup> day, 60<sup>th</sup> day and 90<sup>th</sup> day.**

**TABLE 9: 2X6 ANOVA Repeated Measure Results For Overall Pain Level. N=200**

Source	F-value	P-value	Repeated contrast test result		
			Comparison level	F-value	P-value
Between Group	87.431	0.000*			
Within Assessment	2400.780	0.000*	3 <sup>rd</sup> day vs 7 <sup>th</sup> day	2122.189	0.000*
			7 <sup>th</sup> day vs discharge	1215.977	0.000*
			Discharge vs 30 <sup>th</sup> day	599.530	0.000*
			30 <sup>th</sup> day vs 60 <sup>th</sup> day	358.702	0.000*
			60 <sup>th</sup> day vs 90 <sup>th</sup> day	205.881	0.000*
			Group Assessment	33.343	0.000*
			7 <sup>th</sup> day vs discharge	13.514	0.000*
			Discharge vs 30 <sup>th</sup> day	5.005	0.026*
			30 <sup>th</sup> day vs 60 <sup>th</sup> day	24.237	0.000*
			60 <sup>th</sup> day vs 90 <sup>th</sup> day	118.878	0.000*

\*statistically significant at 0.05 level of significance

### 9. Effectiveness of PRP on Anxiety

- i. Mean and Standard Deviation of Anxiety of patients at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day, at discharge, 30<sup>th</sup> day, 60<sup>th</sup> day and 90<sup>th</sup> day by group wise.
  - In the experimental group from baseline to 3<sup>rd</sup> post operative day an increase in the anxiety level has been observed afterwards a gradual reduction in the anxiety level has been observed. In the control group also a similar pattern has been observed with a slight variation in the reduction level.
- ii. ANOVA repeated measure for Anxiety.
  - The “Between Group” comparison infers that the two groups are statistically different by anxiety level.
  - The significant p-value of the interaction effect “Group \* Assessment” infers that the changes occurs between baseline and 90<sup>th</sup> day after CABG surgery has been different for the two groups. I.e. the changes occurs in the two groups are statistically different.
  - The results clearly indicate PRP is effective in reducing the anxiety level of the patients undergoing CABG surgery.

- iii. ANCOVA repeated measure for Anxiety after controlling with selected covariates
  - The significant p-value of the “Group” infers that the anxiety level has been different for the experimental group and control group after controlling the initial variations in the selected covariates.

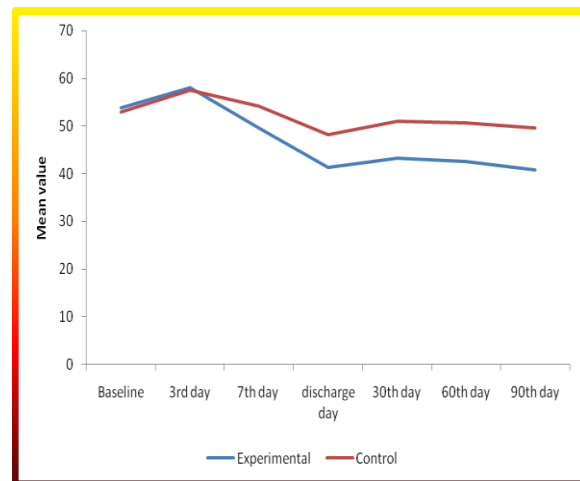


Figure 4.9: Mean anxiety level by group wise at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day, at discharge, 30<sup>th</sup> day, 60<sup>th</sup> day and 90<sup>th</sup> day.

TABLE 10: 2X7 ANOVA Repeated Measure Results For Anxiety N = 200

Source	F-value	P-value	Repeated contrast test result		
			Comparison level	F-value	P-value
Between Group	47.120	0.000*			
Within Assessment	98.870	0.000*	Baseline vs 3 <sup>rd</sup> day	56.76	0.000*
			3 <sup>rd</sup> day vs 7 <sup>th</sup> day	133.10	0.000*
			7 <sup>th</sup> day vs discharge	270.12	0.000*
			Discharge vs 30 <sup>th</sup> day	8.55	0.004*
			30 <sup>th</sup> day vs 60 <sup>th</sup> day	1.90	0.169
			60 <sup>th</sup> day vs 90 <sup>th</sup> day	11.08	0.001*
Group Assessment	17.334	0.000*	Baseline vs 3 <sup>rd</sup> day	0.116	0.734
			3 <sup>rd</sup> day vs 7 <sup>th</sup> day	25.23	0.000*
			7 <sup>th</sup> day vs discharge	6.35	0.013*
			Discharge vs 30 <sup>th</sup> day	0.38	0.536
			30 <sup>th</sup> day vs 60 <sup>th</sup> day	0.18	0.671
			60 <sup>th</sup> day vs 90 <sup>th</sup> day	1.17	0.279

\*statistically significant at 0.05 level of significance

### 10. Effectiveness of PRP on Quality of Life (QOL)

- i. Mean and Standard Deviation of Quality of Life (QOL) of patients at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day, at discharge, 30<sup>th</sup> day, 60<sup>th</sup> day and 90<sup>th</sup> day by group wise.

- In the experimental group there is a reduction in the average QOL during the post operative period and gradually it increases as day goes. In the control group also there is a reduction QOL level during the post operative period afterward it increases gradually. But the level of

- QOL in the control group is typically lesser than the experimental group
- ii. ANOVA repeated measure for Quality of Life (QOL).
    - The significant p-value of the “Between Group” comparison infers that in general, the two groups are statistically different by QOL of the heart disease patients undergone the CABG surgery.
    - The results indicate the PRP intervention is effective in the improvement of the QOL of the CABG patients.
  - iii. ANCOVA repeated measure for Quality of Life (QOL) after controlling with selected covariates
    - The significant p-value of the “Group” infers that QOL level has been varies in the two groups after

controlling the effects of the selected covariates.

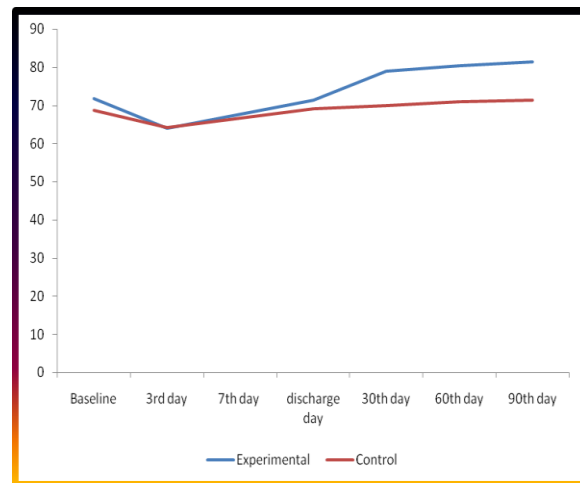


Figure 4.10: Mean Quality Of Life by group wise at baseline, 3<sup>rd</sup> day, 7<sup>th</sup> day, at discharge, 30<sup>th</sup> day, 60<sup>th</sup> day and 90<sup>th</sup> day.

TABLE 11: 2X7 ANOVA Repeated Measure Results For QOL N = 200

Source	F-value	P-value	Repeated contrast test result		
			Comparison level	F-value	P-value
Between Group	51.359	.000			
Within Assessment	109.237	0.000*	Baseline vs 3 <sup>rd</sup> day	214.32	0.000*
			3 <sup>rd</sup> day vs 7 <sup>th</sup> day	89.025	0.000*
			7 <sup>th</sup> day vs discharge	112.22	0.000*
			Discharge vs 30 <sup>th</sup> day	33.05	0.000*
			30 <sup>th</sup> day vs 60 <sup>th</sup> day	16.54	0.000*
			60 <sup>th</sup> day vs 90 <sup>th</sup> day	6.799	0.010*
Group Assessment	25.291	0.000*	Baseline vs 3 <sup>rd</sup> day	14.73	0.000*
			3 <sup>rd</sup> day vs 7 <sup>th</sup> day	2.67	0.104
			7 <sup>th</sup> day vs discharge	5.59	0.019*
			Discharge vs 30 <sup>th</sup> day	21.80	0.000*
			30 <sup>th</sup> day vs 60 <sup>th</sup> day	0.34	0.555
			60 <sup>th</sup> day vs 90 <sup>th</sup> day	1.48	0.224

\*statistically significant at 0.05 level of significance

## DISCUSSION OF THE FINDINGS

### Effect of Pulmonary Rehabilitation Program on Physiological parameters of CABG patients:

#### Effect of intervention on Respiratory rate

In the current study the result infers that the changes occur between the two groups have been similar for the comparison between baseline to 3<sup>rd</sup> day and from 7<sup>th</sup> day to discharge. The main difference occurs between the two groups has been between 3<sup>rd</sup> day to 7<sup>th</sup> day. In the PRP group, there is a reduction in the respiratory rate from 3<sup>rd</sup> day to 7<sup>th</sup> day, Where as in the control group, it remains same, without any specific change from 3<sup>rd</sup> day to 7<sup>th</sup> day. This clearly

infers that PRP is effective in controlling the respiratory rate.

The significant p-value of the “Group” comparison, infers that PRP is effective in controlling the respiratory rate. The non-significant p-value of the covariates confirms that the changes occurs in the experimental group is due to the intervention.

#### Effect of intervention on pulmonary function

In the current study also the significant p-value of the comparison between 3<sup>rd</sup> post operative and 7<sup>th</sup> post operative day infers that the increase in the pulmonary function level has been different for the two groups. The mean difference

(0.771-0.636=0.135) in the experimental group has been higher than the mean difference (0.039) of the control group. Similarly the significant p-value of the comparison between 7<sup>th</sup> post operative day and at discharge day infers that the changes are different in the two groups. The mean difference has been 0.228 and 0.171 respectively for the experimental group and control group.

The above results clearly indicate that PRP is effective in improving the pulmonary function level. Since the two groups are statistically different in this study in few variables, the analysis of covariance has been applied. The results indicates that pulmonary function at baseline also influence the pulmonary function level at discharge day in addition to the PRP intervention. The significance level of pulmonary function at baseline infers that it has a interaction with the PRP intervention to make an improvement in the pulmonary function after the CABG surgery

#### *Effect of intervention on peak expiratory flow (PEF)*

In the current study, the mean PEF value for the experimental group 165, 101, 114.5 and 134.5 is higher than the control group 123, 60.5, 70.5 and 87.5 respectively at baseline, 3<sup>rd</sup> post operative day, 7<sup>th</sup> post operative day and at day of discharge from the hospital. After the CABG surgery, in both the groups there is a reduction in the PEF level. Afterwards it is gradually increases in both the groups.

The significant p-value of the comparison between baseline PEF value and 3<sup>rd</sup> post operative mean value confirms in both the group, there is a significant reduction in the PEF value. Similarly the significant p-value of the comparison between 3<sup>rd</sup> post operative day and 7<sup>th</sup> post operative day and at day of discharge also infers that in both the groups there is an increase in the PEF level compares to their previous assessment.

The result indicates that the PEF level has been in the higher-level in the experimental group in all the four

assessments compare to the control group. The significant p-value for the Group confirms that PEF level has been higher in the experimental group compared to control group after controlling the effects of all the covariates. The significant p-value for the Baseline PEF level infers that the changes in the PEF level are not only due to PRP intervention, the initial PEF level has also plays a vital role.

From the current study it can be inferred that the effect of PRP can be seen clearly on the respiratory rate, pulmonary function and peak expiratory flow. The other physiological parameters like heart rate and saturation of oxygen (SaO<sub>2</sub>) had minimal effect of PRP whereas on the blood pressure not much influence of PRP was seen.

Thus, it was concluded that patients undergoing cardiac surgery experience reduced ventilatory capacity and respiratory muscle strength after surgery. Muscle training improved to retrieve Tidal Volume (TV) and Vital Capacity (VC) in the experimental group. Therefore findings of the present study are confirming with the studies conducted by – Matheus, [3] Moreno, [4] Barros, [5] Ferreira, [6] Romanini, [7] Weiner [8]

#### **Effects of Pulmonary rehabilitation program (PRP) on Pain and Anxiety of Patients after undergoing Coronary Artery Bypass Grafting (CABG).**

##### *Effect of intervention on pain*

In the current study the experimental group pain level has been 32.8 on 3<sup>rd</sup> post operative day and gradually it reduces to almost nil pain on 90<sup>th</sup> day after surgery. For the control group the mean pain level has been 38.8 on 3<sup>rd</sup> post operative day and reduces to very little pain on 90<sup>th</sup> day after surgery. The above mean values infer that PRP is effective in controlling the pain level of the patients undergone CABG surgery.

The “Between Group” comparison result infers that the pain level has been different in the two groups. It is observed in

the experimental group the pain level has been less compared to the control group. Therefore the PRP intervention was effective in controlling the pain level.

Since the two groups of patients differ by certain demographic variables, analysis of covariance test has been applied, to find out is any other variable influence on the pain reduction level. The non-significant p-value of the covariates infers that other variables had no influence on pain reduction.

Pain is the most common and unavoidable problem for cardiac surgical patients. It can induce many changes in physiology and affects the recovery from the surgery. With the development of non-pharmaceutical pain control, the effect of relaxation therapy in pain control was emphasized and confirmed in the recent years by – Koranyi, [9] Kaur, [10] Tore, [11] Miaofen, [12] Shuldham, [13] Hsing-Yu. [14] Therefore the present study also reveals that the PRP is effective in reducing the post operative pain in CABG patient.

#### *Effect of intervention on anxiety*

In the experimental group from baseline to 3<sup>rd</sup> post operative day an increase in the anxiety level has been observed afterwards a gradual reduction in the anxiety level has been observed. In the control group also a similar pattern has been observed with a slight variation in the reduction level

The significant p-value of the interaction effect “Group \* Assessment” infers that the changes occurs between baseline and 90<sup>th</sup> day after CABG surgery has been different for the two groups. i.e. the changes that occur in the two groups are statistically different. The above results clearly indicate PRP is effective in reducing the anxiety level of the heart disease patients undergoing CABG surgery.

Analysis of covariance test has been applied to ensure the difference is due to the PRP intervention alone or any other variable has influenced. The non-significant p-value of the covariates infers that other variables had no influence on anxiety reduction.

The result of the current study is in consistent with the below studies. Tully, [15] Dao, [16] McKenzie, [17] Phillip, [18] Fariborz, [19] Gallagher, [20] Spezzaferri, [21] Fredericks, [22] Gallagher, [23] Hartford, [24] McCrone. [25]

It is a well known fact that depression, post traumatic stress disorder, and post traumatic stress disorder are prevalent in patients undergoing coronary artery bypass grafting procedures. It also increase the risk of death by magnitudes comparable with well-established physical health risk factors after coronary artery bypass grafting surgery. The stress and anxiety in these patients are at high magnitude. It is important to access this and give psychological support pre-operatively to decrease the anxiety in the patients. The present study also reveals that through PRP the post operative anxiety was reduced showing the effectiveness of PRP.

#### **Effects of Pulmonary rehabilitation program (PRP) on quality of life of patients after undergoing Coronary Artery Bypass Grafting (CABG).**

##### *Effect of intervention on Quality of Life (QOL):*

In the current study, in the experimental group there is a reduction in the average QOL during the post operative period and gradually it increases as day goes. In the control group also there is a reduction QOL level during the post operative period afterward it increase gradually. But the level of QOL in the control group is typically lesser than the experimental group

The significant p-value of the comparison “Group \* Assessment” infers that the changes occurs in the QOL from baseline to 90<sup>th</sup> day after CABG surgery, has been different for the two groups.

The above results indicates the PRP intervention is effective in the improvement of the QOL of the patients undergone CABG. It is in consistent with the studies done for examining the effect of a multidimensional preoperative intervention

on pre surgery and post surgery outcomes. Arthur, [26] Macken, [27] Thomson, [28] Rothenhäusler, [29] Watson, [30] Dehadri. [31]

## CONCLUSION

Following conclusions are drawn from the findings:

- ❖ The patients who underwent CABG and exposed to Pulmonary Rehabilitation Program (PRP) have significant difference in heart rate with the control group subjects who are not exposed to PRP. The result reveal that the significant p-value of the Group comparison infers that mean heart rate are statistically different in the PRP group compared to the control group after controlling effects of some of the covariates.
- ❖ The results confirms that the patients who underwent CABG and exposed to Pulmonary Rehabilitation Program (PRP) have significant difference in the respiratory rate and confirms that the changes occurred in the experimental group is due to the intervention.
- ❖ The experimental group subjects exposed to PRP had shown an improvement on the pulmonary function, for the (inspiratory and peak expiratory flow) with the control group subjects who were not exposed to PRP.
- ❖ In both the group i.e. experimental and control group there is a significant reduction in mean diastolic as well as systolic blood pressure. The results were similar in both the groups.
- ❖ There is a statistical difference in experimental and control group in the saturation of oxygen, but the variations in both the groups are very minimum.
- ❖ In the experimental group the pain level experienced by the patients undergone CABG is much less than the control group patients who are not exposed to PRP. Thus it infers that PRP is effective in controlling the pain level of patients.
- ❖ In the experimental and control group anxiety level have increased from baseline to 3<sup>rd</sup> post operative day. Further

it was observed that there was a gradual reduction in the anxiety level, where the reduction is more in experimental group than the control group.

- ❖ In experimental group the quality of life had increased than in the control group subjects who were not exposed to PRP.

## LIMITATIONS

- Study was limited to two hospitals of Delhi with 200 sample that limits the generalization of the findings.
- The follow up study was done till 3 months which can be extended for further periods.

## RECOMMENDATIONS

- Similar studies may be conducted using true experimental approach.
- Comparative study can be carried out to know the effectiveness of information booklet with other strategies of teaching program.
- CD can be provided where they can observe the demonstration and follow the steps.
- Similar booklets can be prepared in various local language.
- Exploratory studies can be done to identify the learning needs of the patient undergoing CABG.
- Alternative methods for the delivery of Pulmonary rehabilitation can be performed with tele-rehabilitation or internet based program.
- Exploratory studies can be carried out in a wider geography involving for remote and rural areas.
- Longitudinal study can be conducted to evaluate the impact of Pulmonary rehabilitation program on quality of Life.
- Follow up study can be conducted to evaluate the effectiveness of PRP on physiological parameters and quality of life.
- Comparative study for cost effectiveness with implementation of PRP versus traditional methods in the post operative phase.
- Multi- centred clinical research studies can be explored to ascertain the independent contribution of PRP.

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