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EFFECT OF EXERCISE ON THE C- REACTIVE PROTEIN LEVEL IN OBESE INDIAN PATIENTS

Dr Sumant Kumar Singh	Asst. Professor, Dept. Of Physical Medicine And Rehabilitation, Patna Medical College & Hospital, Patna
Dr. Poonam Singh*	Junior Resident, Dept. Of Forensic Medicine, Patna Medical College & Hospital, Patna *Corresponding Author
Dr Arun Kumar	Associate Professor & HOD , Dept. Of Physical Medicine And Rehabilitation, Patna Medical College & Hospital, Patna

ABSTRACT Obesity has been recognized as an epidemic worldwide due to changes in lifestyle, unhealthy food-habit and lack of health knowledge among the population and linked to a large number of diseases. For Asians, overweight is a BMI between 23 and 29.9 kg/m^2 and obesity a BMI >30 kg/m^2. Obesity is a state of excess adipose tissue mass. Adipose tissue is an active endocrine and paracrine organ that releases a large number of cytokines and bioactive mediators, eg TNF- , IL-6, CRP etc. The study of 3 months walking-exercise interventions on 33 obese patients showed that 65% reduction of CRP were due to changes in fat mass and fat free mass. These are the most important candidate factor for reduction of CRP after 3 month of intervention. There were some other factors responsible for reduction in CRP, which might be weight and BMI and independent of other base line investigations. In addition, more studies are needed to assess the effects of different modes and intensities of exercise onCRP.

KEYWORDS : Obesity, Bmi (body Mass Index), Crp (c-reactive Protein), Exercise.

INTRODUCTION:

Obesity is a condition in which excess body fat has accumulated to such an extent that health may be negatively affected. It is commonly defined as a body mass index (BMI = weight divided by height squared) of 30 kg/m^2 or higher. Circulating plasma CRP levels are elevated in obese subjects. The reference range of CRP is 0-10mg/L. For most clinical purposes, CRP value less than 0.1 or 0.2 mg/dl can be regarded as normal value, over 1.0 as indicating clinically significant inflammation, value between 0.2 and 1.0 mg/dl may reflect minor degree of inflammation but may also reflect obesity, cigarette smoking, and diabetes mellitus. 3 months walking exercise was associated with low CRP levels independent of body fat in the healthy subjects. This study was conceptualized to get an idea regarding the effect of exercise on CRP level in Indian patients with obesity.

REVIEW OF LITERATURE

Obesity is a condition where excess body fat accumulates in the body in such a way that health may be affected negatively. It is commonly defined as a body mass index (BMI = weight divided by height squared) of 30 kg/m^2 or higher. Obesity is also defined as purely statistical grounds as a weight that is 20% or more above the average weight per height.The absolute waist circumference (>102 cm in men and >88 cm in women) or waist–hip ratio (>0.9 for men and >0.85 for women) are both used as measures of central obesity. Body fat percentage is total body fat expressed as a percentage of total body weight. Body fat % = $1.2 \times \text{BMI} + 0.23 \times \text{age} - 5.4 - 10.8 \times$ gender, where gender is 0 if female and 1 if male,). Obesity on average reduces life expectancy by 6–7 years. Severe obesity (BMIs >40) reduces life expectancy by 20 years for men and 5 years for women , Excess weight is responsible for 64% of cases of diabetes in men and 77% in women. Circulating plasma CRP levels are elevated in obese subjects. C-reactive protein--- Named for its capacity to precipitate the somatic C-polysaccharide of Streptococcus pneumoniae was the first acute-phase protein to be described and is an exquisitely sensitive systemic marker of inflammation and tissue damage. The close correlation between the degree of obesity and CRP levels in cross-sectional and prospective epidemiological studies has led us to hypothesize that adipose tissue is a potential source of CRP.

AIMS AND OBJECTIVE:

To study the effect of aerobic exercise on the **C - Reactive protein** level in obese patients.

MATERIALS AND METHODS

TYPE OF STUDY: Prospective follow-up study

STUDY POPULATION:

Consecutive obese patients (BMI >30) of either sex, aged between 18 years to 50 years.

SELECTION OF CASES:

It was decided to include a minimum of 30 obese consecutive patients (BMI>30) that was considered to be a feasible minimum sample size required for such a study.

PLACE OF STUDY: PMR department, PMCH Patna

PERIOD OF STUDY: November 2018 to October 2019.

INCLUSION CRITERIA:

1. Obese patients of both sexes.
2. Age group of 18 - 50 years.
3. Patients who understand and agree to follow the exercise program.

EXCLUSION CRITERIA:

1. Patients suffering from inflammatory conditions or diseases which may change the serum CRP level like - vasculitis and inflammatory arthritis, infection and cancer etc.
2. Patients who are on medical therapy for obesity.
3. Patients in whom exercises are contra-indicated.
4. Patients who smoke & consume alcohol.

METHODOLOGY:

The patients' demographic profile like age, sex, education, occupation and type of treatment was recorded. Then proper history and examination was performed and patients with illness and associated diseases which might affect the CRP level were excluded and assessed baseline investigations like height, weight, BMI, fat mass, fat %, fat free mass and BMR by body composition analyzer and Serum CRP was measured, Following blood examinations were done Hb,

Total / Differential blood count, ESR, SGPT, SGOT, Serum urea and creatinine and C - Reactive protein.

INTERVENTIONS:

The patients were asked to follow an aerobic walking programme in addition to the normal activity. The total time of walking suggested was 25 minutes every day, at least 5 days a week for the first month, 30 minutes each day in the second month and to 35 minutes in the third month. The patient's aerobic walking program consisted of, **warm up period**- walking slowly for 5 minutes, **target zone**- walking briskly for 15, 20 and 25 minutes in 1st, 2nd and 3rd month respectively and **cool down period**- walking slowly for 5 minutes.

STATISTICAL ANALYSIS:

This was a prospective follow up study with one follow up after baseline values. Paired t-test was used to see the significant change in baseline at the end of 3 month follow-up after intervention and to test the mean difference changes between 3 month from baseline (0 month) by using SPSS- 15 software and level of significance was fixed at p value of <0.05%.

OBSERVATION AND RESULTS:

All the 33 obese patients who had completed the study were advised for some baseline investigations like Wt., BMI, fat mass, fat free mass, fat percentage, BMR, Hb, TLC, DLC, ESR, SGOT, SGPT, serum urea, serum creatinine along with CRP, at zero month (time of first visit).

After 3 month of intervention, above investigations were done again, the results obtained were depicted in table 1. It was found that, there was significant change seen in the following parameters: CRP (p-value<0.001), weight (p-value<0.001), BMI (p-value<0.001), fat mass (p-value<0.001), fat free mass (p-value<0.001) but no significant changes were seen in others parameters like BMR (p-value=0.141), Hb (p-value=0.432), TLC (p-value=0.793), neutrophil (p-value=0.499), lymphocyte (p-value=0.839), eosinophil (p-value=0.256), ESR (p-value=0.138), SGPT (p-value=0.674), SGOT (p-value=0.188), serum urea (p-value=0.472), serum creatinine (p-value=0.171) after 3 month of walking aerobic exercise regimen.

Table1: Distribution of continuous variables (Paired t-Test):

Item	Time of assessment				
	0 month	3 month	P value	Mean difference±SD	Percentage change
	Mean±SD	Mean±SD			
CRP	10.15±15	7.49±3.12	<0.001	2.66±2.14	26.20
Weight	80.67±9.4	78.60±9.86	<0.001	2.06±1.60	2.55
BMI	33.73±3.34	32.8±3.43	<0.001	0.92±0.71	2.72
Fat mass	32.48±5.91	30.90±6.61	<0.001	1.57±1.93	4.83
FFM	46.37±8.33	46.55±7.74	<0.001	1.82±2.14	3.92
BMR	1665.1±774.2	1657.2±777.9	0.141	7.84±29.83	0.47
Hb	12.37±1.12	12.47±1.12	0.432	0.103±0.74	0.83
TLC	7660.6±1852	7722±2037.7	0.793	62.36±1352.7	0.81
Nuetrophil	67.42±7.47	68±7.17	0.499	0.66±5.59	0.97
Lymphocyte	31.36±5.86	31.18±4.41	0.839	0.182±5.10	0.58
Eosinophil	2.26±0.81	2.45±0.90	0.256	0.218±1.05	9.2
ESR	23.97±12.3	22.52±10.84	0.138	1.45±5.48	6.04
SGOT	31.30±12.30	32±12.03	0.674	0.69±9.44	2.20
SGPT	34.42±16.22	31.94±12.52	0.188	2.48±10.61	7.20
S.urea	24.55±7.54	25.34±6.85	0.472	0.78±6.18	3.17
S.creatinine	0.73±0.16	0.70±0.14	0.171	0.03±0.15	4.10

It was noticed that, there was 26.2% significant reduction in C-Reactive protein value, 2.55% reduction in weight, 2.72% reduction in BMI, 4.83% reduction in fat mass and 3.92% reduction in fat free mass after 3 month of intervention, but there was no significant changes seen in other parameters like fat percentage, BMR, Hb, TLC, DLC, ESR, SGOT, SGPT, serum urea, serum creatinine.

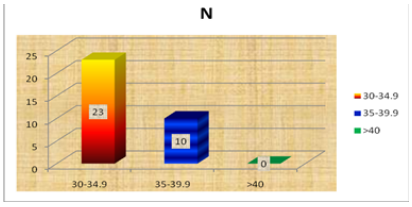
CHANGE OF CRP WITH DIFFERENT VARIABLES:

There was no significant change (p-value=0.31) in CRP among the male and female, different occupation (p-value=0.55) and among the medical ailments (P-value 0.265). We found that the changes of CRP value correlated positively with changes of weight (d CRP=0.368), fat mass (d CRP=0.528), fat free mass (d CRP=0.323). These data indicate that significant reduction in CRP values were mainly associated with reduction in weight (p-value=0.035), fat mass (p-value=0.002) and fat free mass (p-value=0.047).

But there was no correlation of changes in CRP values with changes of others variables. As per the WHO classification of obesity according to the Body Mass Index (BMI), the majority of patients belonged to class 1 obesity (BMI=30-34.9) that is 23 patients (69.7%), 10 patients (30.3%) in class 2 obesity (BMI=35-39.9) and there was no patient in class 3 obesity (BMI>40) in our study as depicted in Table 2

Table 2: The distribution of no. of patients according to BMI

BMI	Classification of obesity	No. of patients (N)	Percentage
30-34.9	Class 1	23	69.7
35-39.9	Class 2	10	30.3
>40	Class 3	0	0
Total		33	100



So the reduction of CRP values were not significantly associated with change of BMI (p-value=0.073), fat % (p-value=0.125), BMR (p-value=0.154), Hb (p-value=0.07), TLC (p-value=0.613), neutrophil (p-value=0.499), lymphocyte (p-value=0.839), eosinophil (p-value=0.256), ESR (p-value=0.90), SGOT (p-value=0.878), SGPT (p-value=0.812), serum urea (p-value=0.708), serum creatinine (p-value=0.176)

DISCUSSION:

This prospective follow-up study was designed to assess the changes in CRP levels after 3 months of walking, aerobic exercise regimen in obese patients of different age, sex, occupation and associated physical ailments.

There were no significant difference in the change of CRP

values in male and female, different ages of patients, different occupation, change of physical ailments, different grade of obesity in our study.

CHANGE OF CRP WITH OTHER VARIABLES:

All the 33 obese patients undertake baseline investigations like Wt., BMI, fat mass, fat free mass, fat percentage, BMR, Hb, TLC, DLC, ESR, SGOT, SGPT, serum urea, serum creatinine along with CRP, at 0 month and after 3 month of intervention, There were significant changes in the following parameters like- CRP (p-value<0.001), weight (p-value<0.001), BMI (p-value<0.001), fat mass (p-value<0.001), fat free mass (p-value<0.001) but no significant change seen in others parameters like BMR, Hb, TLC, neutrophil, lymphocyte, eosinophil, ESR, SGPT, SGOT, serum urea, serum creatinine after 3 month of walking aerobic exercise regimen.

In our study, the average decrease in CRP, the best overall marker of underlying chronic inflammation was (2.66mg/dl). The mean weight loss because of the exercise intervention was 2.06 kg. It was noticed that, there were 26.2% reduction in C-Reactive protein value, 2.55% reduction in weight, 2.72% reduction in BMI, 4.83% reduction in fat mass and 3.92% reduction in fat free mass after 3 month of intervention, but there were no significant changes seen in other parameters.

In a study by Laurie Barclay et al, in those patients who received exercise intervention, the overall weight loss was minimal (~1.8 kg). There were linear trends between CRP levels and 12-month changes in aerobic fitness (p_{trend} = .006), exercise adherence (p_{trend} = .004), percentage body fat (p_{trend} = .002), body weight (p_{trend} = .002), WC (p_{trend} = .02), and intra-abdominal fat (p_{trend} = .03). Unfortunately, no data are available regarding the clinical manifestations of this decline in CRP, although≈15% reduction in CRP after 1 year of statin use is associated with a lowered risk of coronary events. Although our findings indicate that exercise induced weight loss can be advocated as an effective therapy for reducing chronic inflammation, our study did not test whether this reduction is associated with an improvement in risk factors for diseases associated with inflammation. In consistent with our findings, the results of previous study, 12 wk of aerobic exercise in patients with stable congestive heart failure reduced TNF-α& CRP concentrations, and improvements in physical performance (6-minute walk) correlated with the reductions in TNF-α[iii]. The data from our study indicate that significant reduction in CRP values were mainly associated with reduction in weight (p=0.035), fat mass (p=0.002) and fat free mass (p=0.047).

But there was no correlation of change in CRP value with changes of others variables. So the reduction of CRP values were not significantly associated with change of BMI, fat %, BMR, Hb, TLC, DLC, ESR, SGOT, SGPT, serum urea and serum creatinine.

The data, calculated by stepwise multiple regression technique shown that 65% reduction of CRP were due to changes in fat mass and fat free mass.

CONCLUSIONS

The results of 3 months aerobic-exercise interventions on 33 obese patients showed weight-loss, decrease in fat mass, and reduction in the circulating concentrations of CRP. The change in CRP levels were strongly correlated with the changes in fat mass and fat free mass and partially dependent of the changes in body weight and BMI, and independent of other base line investigations.

LIMITATION OF STUDY:

The study, being conducted over a period of 3 months only may show the short term beneficial effects of aerobic exercise and lifestyle changes on the body composition and the risk factors for various life-style related diseases. Moreover the number of patients enrolled in the study was small to predict a very significant or powerful inference.

In our study, there were no control group for comparing the results with the study group. So, the extent of benefits due to the exercise and lifestyle interventions cannot be quantified. And we could not verify whether the compliance of the patients as they reported matched with that of what they really followed.

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