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RESPONSE OF PASCHIMOTTANASANA AND KAPALABHATI ON CRP, RESISTIN AND RBS LEVEL IN OBESE INDIVIDUALS

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ABSTRACT

In India, obesity is budding as an important health problem particularly in urban areas, paradoxically co-existing with under nutrition. Almost 30-65% of adult urban Indians are either overweight or obese or have abdominal obesity. Excessive body fat is accumulated on the belly, buttocks, breasts and thighs. This may lead to diabetes, hypertension and arthritis. In simple terms, Obesity is being more than one-fifth overweight as compared to the normal weight range. Yoga postures like *Paschimottanasana* and *Kapalabhati* help to reduce weight with significant health benefits. Therefore, this work has been planned to assess their response in obese individuals on biochemical parameters like CRP, resistin and RBS. Total 60 subjects of grade-I obesity, diagnosed as per WHO criteria were registered in Department of *Kriya Sharir* BHU Varanasi. These subjects were divided into two groups by random sampling method in group I and II. Group-I individuals were advised diet restriction plan whereas subjects of group II were suggested with *Paschimottanasana* and *Kapalabhati* along with diet restriction plan. All the individuals were evaluated for biochemical parameters like CRP, resistin and RBS. Statistical analysis was done after pre and post *Yogic* intervention which showed better response in terms of reduction in CRP, resistin and RBS after performing *Paschimottanasana* and *Kapalabhati* along with diet restriction in group II. Our study concludes that regular practice of *Paschimottanasana* and *Kapalabhati* along with diet restriction is more helpful in reducing obesity and its complications.

Key words: Obesity, CRP, Resistin, RBS, *Paschimottanasana* and *Kapalabhati*.

INTRODUCTION

Obesity has reached epidemic extent in India in the 21st century, with melancholic obesity affecting 5% of the country's inhabitants.¹ Obesity is a foremost escapable cause of death worldwide, with increasing prevalence in adults and children, it is one of the most severe community health tribulations of the 21st century.² At an individual level, a combination of excessive food energy intake and a lack of physical activity is thought to explain in most cases of obesity.³ A limited number of cases are due primarily to genetics, medical reasons, or psychiatric illness.⁴ In contrast, increasing rates of obesity at a societal level are felt to be due to an easily accessible and palatable diet,⁵ increased reliance on cars, and mechanized manufacturing. Excess deposition of adipose tissue is obesity.⁶ A body weight 20% or more above desirable weight for age, sex and height is regarded as obese. World Health Organization has defined that obesity is a common chronic disorder of excessive body fat and has become a global epidemic which is present not only in the developed world but also in many developing and even in underdeveloped countries.⁷ India ranks amongst top ten obese nations⁸ and greater than 25 is considered as obesity.⁹

Complex feedback control system consisting of a central processing unit which receives afferent signals and generates appropriate efferent stimuli in response controls food intake, satiety and subsequently weight.¹⁰ Age and gender differences in food intake have been identified with an increase in adolescence, peaking in the second decade after which it declines.¹¹ Men tend to eat more than women in keeping with their higher fat free mass.¹² An age-related decrease in food

intake is associated with a slow decline in energy expenditure and in middle age the latter is faster than the former. Concomitantly the decline in sex steroid levels occurring in the perimenopause results in an increase in visceral fat and an increased risk of the development of the metabolic syndrome.¹⁰ The later is a constellation of manifestations originally described by Gerald Reaven in 1993 comprising obesity, insulin resistance and increased atherosclerotic risk with diabetes, hypertension and hyperlipidaemia.¹³

In western countries mortality rate is higher than Asian and African countries due to obesity. On average obesity reduces life expectancy by six to seven years. In individuals having BMI of 30-35 reduces life expectancy reduces by two to four years. While severe obesity having BMI >40 reduces life expectancy by 10 years.¹⁴

Health consequences of obesity are broadly categorized in two groups first the effect of increased fat mass (such as osteoarthritis, obstructive sleep, apnea, social stigmatization) and second due to the increased number of fat cells (diabetes, cancer, cardiovascular disease, non-alcoholic fatty liver disease). These co-morbidities are most commonly shown in metabolic syndrome.¹⁵

CRP is synthesized by the liver in response to factors released by macrophages and fat cells (adipocytes) and found in the blood, the levels of which rises in response to inflammation. Study by Isabelle Lemieux et al (2001) suggested that abdominal obesity is the critically correlate with elevated CRP concentrations found in men with atherogenic dyslipidemia of the insulin resistance syndrome in as much as subjects with a

high body fat mass along with an excess of visceral fat had the highest plasma CRP levels.¹⁶ Another study by John C. Chambers et al (2001) shows that CRP concentrations are higher in healthy Indian Asians than in European whites and are accounted for by greater central obesity and insulin resistance in Indian Asians. Study results suggest that inflammation or other mechanisms underlying elevated CRP values may contribute to the increased CHD risk among Indian Asians.¹⁷ Visceral obesity is associated with increased plasma hs-CRP and IL-6, so obesity is considered as a low-grade chronic inflammatory condition.¹⁸

Resistin is a member of a class of cysteine-rich proteins collectively termed resistin-like molecules. According to Holcomb et al (2000)¹⁹ human resistin is a dimeric protein containing 108 amino acids. Recently studied in murine models and suggest that obesity is associated with rise in circulating resistin (FIZZ3), a novel cysteine-rich protein secreted by adipocytes.¹⁰ In humans, the physiological role of resistin is far from clear and its role in obesity and insulin resistance and/or diabetes is controversial. In humans, as resistin is primarily produced in peripheral blood monocytes and its levels correlate with IL-6 concentrations.²⁰

The increased fat deposition might at least partially explain the central RSTN-induced insulin resistance, probably through a proinflammatory mechanism involving IL-6 and TNF. Understanding of how central RSTN circuits control fat storage and metabolism could provide another important step in unraveling the interactions between the hypothalamus, adipocytokines, and periphery.²²

Many studies have provided close relationship between obesity and glucose metabolism. One of them is De novo lipogenesis increases after overfeeding with glucose and sucrose to the same extent in lean and obese women but does not contribute greatly to total fat balance.²³ The frequent use of carbohydrate-sweetened beverages could play an important role in an increased postprandial insulin response leading to a reduction in lipolysis and fat oxidation. The combination of the frequent use of carbohydrate - sweetened beverages and an increasingly inactive lifestyle reduces the metabolic demand for fat as a fuel, considerably increases the risk of weight gain.²⁴

Yoga is an ancient restraint intended to bring steadiness and health to the physical, mental, emotional and spiritual dimensions of the individual. *Yama* (universal morals), *Niyama* (individual principles), *Asana* (physical postures), *Pranayama* (breath control), *Pratyahara* (organize of the senses), *Dharana* (concentration), *Dhyana* (meditation), and *Samadhi* (bliss)²⁵ are eight aspects of *Yoga*. *Kapalabhati* is an important part of *Shatkarma*, the *Yogic* system of body cleansing techniques.²⁶ The *Kapalabhati* practices recommended for obesity are the more dynamic forms which stimulate the metabolism and influence different hypothalamic centers which give control over thirst and the feeling of satisfaction with optimal quantities and qualities of food. Practice of *Kapalabhati* is very helpful for weight loss because it works on the abdominal muscles which reduces fat and improves body tone.²⁷ Bera et al (1993) studied, waist circumference and hip circumference decreased significantly as compared to control group. This shows that *Kapalabhati Pranayama* reduces waist circumference and hip circumference in overweight individuals.²⁸

Paschimottanasana is considered to be one of the best *Yogic* posture and most of the traditional texts emphasize its ability to improve metabolism thus helps to prevent several metabolic

disorders especially obesity.^{26, 29, 30} *Paschimottanasana* and *Kapalabhati* along with diet restriction is more helpful in reducing obesity.³¹ *Yoga* practice helps in energizing the body that has been in an inactive mode due to obesity. *Yoga* significantly helps in cleansing the body toxins and reduces fatigue. *Yogic* postures help to burn up excess fat, improve metabolism, tone up muscles and help the practitioner to enjoy a healthy life. Jerrold S. Petrofsky et al (2005) studied that the total work on the abdominal muscles during *Yogic* exercise was five times greater than the work during abdominal crunches. Because of the high muscle activity this form of exercise would be good for people who cannot easily exercise on the floor such as obese people (The journal of applied research).²⁷

Aims and Objectives

To evaluate the response of *Paschimottanasana* and *Kapalabhati* with diet restriction in obese individuals on CRP, resistin and RBS.

MATERIALS AND METHODS

Inclusion criteria

1. Obese subjects of both sex in age group 25 -55 years with grade I obesity (BMI 30-34.9) as per WHO criteria.
2. Waist hip ratio: Male >0.7, Female > 0.9.

Exclusion criteria

1. Obese individuals of age < 25 years and >55 years with any organic lesions and metabolic disorders like hypothyroidism, hypogonadism, hypercortisolism, etc.
2. Obese female with pregnancy and lactation.
3. Obese individuals with any cardiovascular complications, liver disorders, renal complications and locomotor disabilities and having any type of addiction like smoking, alcohol, tobacco chewing etc.

Design

A prospective comparative study to assess the effect of *Paschimottanasana*, *Kapalabhati* along with diet restriction and only diet restriction was conducted in urban community of Varanasi.

This study was conducted in Department of *Kriya Sharir* Faculty of *Ayurveda* IMS BHU Varanasi during September 2012 to November 2013 and approved by the ethical committee of institute of medical sciences BHU vide letter No Dean/2012-13/538 dated 21-03-2012. Obese individuals were selected and thoroughly examined for the assessment of health. Total 60 obese grade-I individuals who have satisfied the inclusion criteria were enrolled. These individuals have been divided in to two groups as follows:

1. **Group-1:** In this group, 30 obese (13 male and 17 female) individuals were selected and suggested them only diet restriction of 1600 Kcal/day.
2. **Group-2:** In this group, 30 obese (14 male and 16 female) individuals were selected and suggested them for life style modifications including specific *Yogic* techniques *Kapalabhati*, *Paschimottanasana* every day at early morning along with diet plan of 1600 Kcal/day for three months.

Procedure

Study procedure was explained to each individual according to group subjects. Group I individuals were given proforma for diet recommendation of 1600 kcal/day for 90 days whereas Group II subjects were demonstrated *Pranayama* (*Kapalabhati*),

Paschimottanasana as well as given proforma for diet recommendation of 1600 kcal/day for three months. Frequency of *Yogic* technique *Kapalabhati* 50 times/day and *Pachimottanasana* 20 times/day along with diet plan of 1600 Kcal/day as per proforma under supervision. These individuals have also performed few warm up exercises of 10 sets of upper body and 10 sets of lower body every day at early morning during the program.

Initially and after three months follow up all the parameters were assessed i.e. Weight, Body mass index (BMI), Serum glucose, C- reactive protein (CRP), Serum resistin.

Measurements of BMI

The BMI is the actual body weight divided by the height in meter squared (kg/m^2). This index provides a satisfactory measure of obesity in people who are not hypertrophied athletes. First volunteers were asked to stand in erect posture then height was measured from toe to tip of head in meter by stretch-resistant length measuring tape. Weight measured by automatic weight measuring machine then BMI was calculated by body weight divided by height in meter squared.

Collection of Venous Blood

For all the biochemical parameters of this study, 5ml. of venous blood was collected from the subjects at 9 am to 11am. Serum was separated from the blood. Separation of serum was done by centrifuging the blood sample at 3000 r.p.m. for 5-6 minutes and preserved in deep freezer at -40°C in Department of *Kriya Sharir*, Faculty of *Ayurveda*, Institute of Medical Science, Banaras Hindu University, Varanasi.

Random blood sugar estimation

Eco-pak glucose kit was used for the estimation of serum glucose, which followed end point colorimetry enzymatic test in Priest touch robonic biochemistry semi auto analyzer at 505nm. The reagent kit was intended for the direct “in vitro” quantitative determination of glucose in serum samples.

CRP estimation

Turbilyte CRP kit was used for estimation of C- reactive protein, which followed fixed point colorimetry enzymatic test in Priest touch robonic biochemistry semi auto analyzer at 546nm. The reagent kit was intended for the direct “in vitro” quantitative determination of C- reactive protein in serum or Plasma samples.

Serum resistin estimation

Koma cytokine ELISA Kit was used for the serum resistin estimation, and followed ELISA protocol which was mentioned in koma cytokine ELISA kit manual; a microtiter plate reader was read at 540 nm wavelength. The test is performed on erba elisa reader semiautomatic machine. The reagent kit was intended for the direct “in vitro” quantitative determination of resistin in serum samples.

ELISA Protocol used for serum resistin estimation

- 200 μl of washing solution was added to each well. Wells were aspirated to remove liquid and the plate was washed 3 times using 300 μl of washing solution per well. After the last wash, plate was inverted to remove residual solution and blotted on paper towel.
- 100 μl of standard or sample was added to each well in duplicate. Cover with the plate sealer. It was incubated at room temperature for at least 2 hours. Wells were aspirated to remove liquid and the plate was washed 4 times.
- 100 μl of the diluted detection antibody (0.125 $\mu\text{g}/\text{ml}$) was added per well. Cover with the plate sealer. It was incubated at room temperature for 2 hours. Wells were aspirated to remove liquid and the plate was washed 4 times.
- 100 μl of the diluted Color Development Enzyme (1:20 dilute) was added per well. Cover with the plate sealer. It was incubated for 30 minutes at room temperature.
- Wells were aspirated to remove liquid and the plate was washed 4 times.
- 100 μl of color development solution was added to each well and was incubated at room temperature for a proper color development. (15-25 minutes) To stop the color reaction 100 μl of the stop solution to each well was added.
- Using a micro titer plate reader, it was read at 450 nm wavelength.

Data analysis

The analysis of data was done by using statistical software SPSS version 16.0 to evaluate the response from initial to three months of follow up, For intra group comparison Paired sample t-test was applied' whereas for inter group comparison Independent sample t-test was applied.

Table 1: Effect of *Kapalabhati* and *Paschimottanasana* in obese individuals on weight, BMI, Random blood sugar, CRP and Resistin

Variables	Mean $\pm$ SD						Between the group 1 and 2 comparisons on difference of BT and AT Independent t- Test
	Group -1 (n=30)			Group-2 (n=30)			
	Initial	After 3 months	Within the group comparison of BT – AT Paired t-Test	Initial	After 3 months	Within the group comparison of BT – AT Paired t-Test	
Weight (kg)	84.23 $\pm$ 5.46	82.23 $\pm$ 5.49	2.17 $\pm$ 1.02 t=11.64 p<0.001	83.27 $\pm$ 6.95	78.07 $\pm$ 6.94	5.2 $\pm$ 1.49 t=19.05 p<0.01	t=9.18 p<0.001
BMI (kg/m ²)	31.54 $\pm$ 1.06	30.77 $\pm$ 0.99	0.76 $\pm$ 0.43 t=9.62 p<0.001	31.72 $\pm$ 1.32	29.74 $\pm$ 1.42	1.97 $\pm$ 0.73 t=14.91 p<0.01	t=7.8 p<0.001
RBS (mg/dl)	111.54 $\pm$ 13.73	105.52 $\pm$ 11.39	6.02 $\pm$ 3.44 t=9.59 p<0.001	110.61 $\pm$ 13.86	98.16 $\pm$ 11.24	12.45 $\pm$ 4.86 t=14.03 p<0.001	t=5.92 p<0.001
CRP (mg/dl)	4.15 $\pm$ 1.49	3.36 $\pm$ 1.41	0.78 $\pm$ 0.43 t=9.89 p<0.001	4.41 $\pm$ 1.73	2.87 $\pm$ 1.58	1.54 $\pm$ .63 t=13.5 p<0.001	t=5.4 p<0.001
RSTN (pg/ml)	1063.9 $\pm$ 197.04	946.33 $\pm$ 226.27	117.6 $\pm$ 183.27 t=3.51 p=0.001	1082.6 $\pm$ 263.26	825.03 $\pm$ 206.62	257.54 $\pm$ 83.26 t=16.94 p<0.001	t=3.80 p<0.001

BMI (Body mass index), RBS (Random blood sugar), CRP (C- reactive protein), RSTN (Resitin).

RESULTS AND DISCUSSION

All the sixty enrolled subjects completed the study. When the mean of difference of after and before *Yogic* intervention was compared between the group for all the parameters statistically highly significance change ($p > 0.001$) was observed in all parameters as showed in table.

Weight and BMI

In this study pre *Yogic* intervention weight and BMI when compared with weight and BMI after 3 months showed improvement in both the groups ($p < 0.001$) i.e. group -1 (only diet restriction) and group -2 (diet restriction, *Kapalabhati* and *Paschimottanasana*) however decrease in BMI was more in group -2. The results of this study are consistent with Manchanda et al., (2000), they had observed weight reduction after *yogic* lifestyle intervention in obese individuals.³²

Random blood sugar

As it is well known that exercise increases permeability and utilization of glucose by the body cells. In this study pre *Yogic* intervention random blood sugar when compared after 3 months showed reduction in both the groups ($p < 0.001$) i.e. group -1 (only diet restriction) and group -2 (diet restriction, *Kapalabhati* and *Paschimottanasana*) however decrease in random blood sugar was more in group -2 ($p < 0.001$) on inter group comparison as shown in table. S Singh et al (2004) studied shown that *Yoga* improved fasting level of glucose in obese persons.³³ These findings also support our result.

C- reactive protein

In this study pre *Yogic* intervention CRP when compared after 3 months showed improvement in both the groups ($p < 0.001$) however decrease in CRP was more in group -2 ($p < 0.001$) as shown in table. Koichi Okita et al. (2004) also observed reduction in CRP level after the exercise training program. After the training program, all conventional variables of cardiovascular risk were improved, and CRP levels were also significantly lowered.³⁴ These findings are also encouraging for our result.

Resistin

When Initial level of resistin in obese individuals was compared after three months of interventions, showed reduction in both the groups ($p < 0.001$) but decrease in resistin was more in group -2 as shown in table. Amir Rashidlamir et al. (2013) also found reduced levels of plasma resistin and increased adiponectin level in addition to reducing BMI, and body fat percentage in active young female³⁵ by regular aerobic training. These findings also verify our result.

CONCLUSION

All the obese individuals responded to life style modifications but this response was better in group-2. On the basis of these findings, it can be concluded that *Yogic* interventions along with diet restriction will be more helpful in the management of obesity and maintenance of health. These lifestyle modifications will be also supportive in the prevention of the complications of the obesity.

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