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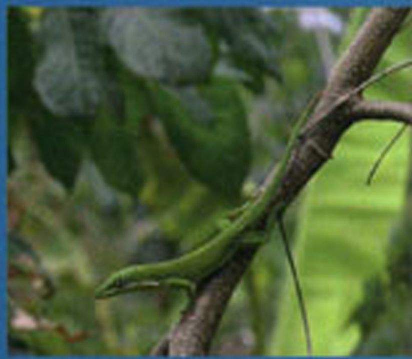

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Full Length Research Article

IMPACT OF STRESS AND DIET IN ACHIEVING WEIGHT LOSS

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ABSTRACT

Objective: To study the effect of pre- intervention stress scores and self-reported habitual dietary intake with the success in achieving weight reduction measured as change in anthropometric indices and body composition variables in women on a comprehensive weight reduction program.
Methods: Women in the age group of 20-30 years, visiting a nutrition consultation clinic in Jaipur city with the aim of weight loss and willing to participate in the study were included. Fifty six women enrolled in the study. Each participant was assessed for anthropometric indices and dietary intake. Dietary counselling was imparted to each participant. At the end of 60 days participants were reassessed for various parameters. Responders and non-responders were classified according to NHLBI (National Heart Lung and Blood Institute) guidelines which states that adequate weight reduction is about 1 to 2 pounds per week (about 0.450 kg – 0.900/ week) (5). As per the recommendation this amount sums up to 3.6kg -7.2 kg in 2 months.
Results: Stress scores negatively affected weight reduction ($r = -0.275$, $p < 0.05$). Stress was responsible for 8.52% variability in weight reduction. Among responders, milk and milk product consumption was responsible for 31.33% variability in weight reduction, whereas fat consumption was responsible for 8.75% variation in weight loss.
Conclusions: Stress negatively affects weight reduction quantified as amount of weight loss or change in BMI. Mean intake of pulses and legumes, milk and milk products, nuts and oilseeds, leafy vegetables were higher in responders as compared to non-responders

INTRODUCTION

By 2030, the number of overweight and obese adults has been projected to be 1.35 billion and 573 million individuals respectively without adjusting for secular trends. If recent secular trends continue unabated, the absolute numbers were projected to total 2.16 billion overweight and 1.12 billion obese individuals (Kelly *et al*., 2008). WHO has set a target to promote multi-sectorial and multi-stakeholder engagement in order to reverse, stop and decrease the rising trends of obesity in child, youth and adult populations, respectively, by 2020 (W.H.O., 2013). The treatment of obesity continues to present major challenges, including poor adherence to diet, inadequate and unsatisfactory weight loss, weight regain, and high rates of attrition (Colombo, 2014). As obesity becomes an ever greater public health problem, additional interventions with long-term efficacy are needed to reduce body weight and maintain weight loss (Apovian, 2013). An understanding of factors affecting changes in anthropometric indices (weight, WC, WHR, BMI) and body composition (body fat%, body lean%, visceral fat) will help in checking the epidemic of obesity. Present paper investigates the effect of pre- intervention stress scores and self-reported habitual dietary intake with the success in achieving weight reduction measured as change in anthropometric indices and body composition variables in women on a comprehensive weight reduction program.

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MATERIALS AND METHODS

Women in the age group of 20-30 years, visiting a nutrition consultation clinic in Jaipur city with the aim of weight loss and willing to participate in the study were included. Fifty six women enrolled in the study. Each participant was assessed for anthropometric indices – height was recorded using a stadio-meter, weight was recorded with the help of digital weighing scale. Waist and hip circumference were measured by a non-stretchable measuring tape. Twenty four hour dietary recall was recorded for three days of which two days were working days and third day was a holiday. Each participant was counselled for dietary and lifestyle modifications.

Table 1. Mean Values of Different Variables

Variable	Total (N=56)	Responders (n = 11)	Non-responders (n = 45)
Age (Years)	25.11 ± 2.97	25.73 ± 3.36	24.96 ± 2.85
BMR (Kcal)	1552.72 ± 230.63	1571.33 ± 215.04	1548.17 ± 234.06
Body Fat%	35.52 ± 4.78	35.20 ± 5.74	35.60 ± 4.50
Body Lean%	22.63 ± 1.75	22.03 ± 2.92	22.78 ± 1.27
Visceral Fat	11.23 ± 4.75	12.27 ± 5.97	10.98 ± 4.36
WC (cms)	88.45 ± 8.98	91.59 ± 4.65	87.68 ± 9.59
HC (cms)	107.42 ± 9.74	110.91 ± 11.99	106.57 ± 8.90
Waist hip ratio	0.83 ± 0.11	0.84 ± 0.12	0.83 ± 0.11
Body Mass Index	30.67 ± 4.75	30.95 ± 4.04	30.60 ± 4.90
Weight (kgs)	76.46 ± 13.85	80.24 ± 12.16	75.54 ± 14.08
Height (m)	1.58 ± 0.06	1.61 ± 0.02	1.57 ± 0.06

Table 2. Pre and Post Intervention Mean Scores of Anthropometric Measurements of Participants

	Responders			Non-responders		
Variable	Pre	Post	t	Pre	Post	t
Fat%	35.20 ± 5.74	27.42 ± 9.12	3.20*	35.60 ± 4.50	34.56± 4.56	5.80**
Lean%	22.03 ± 2.92	22.89 ± 2.32	2.62*	22.78 ± 1.27	23.00 ± 1.41	2.03*
Visceral Fat	12.27 ± 5.97	10.00 ± 4.37	3.64*	10.98 ± 4.36	9.60 ± 4.08	8.06**
WC	91.59 ± 4.65	85.00 ± 5.81	3.99**	87.68 ± 9.59	85.46 ± 10.03	5.43**
WHR	0.84 ± 0.12	0.80 ± 0.12	2.34*	0.83 ± 0.11	0.82 ± 0.11	3.59**
BMI	30.95 ± 4.04	28.22 ± 3.61	11.23**	30.60 ± 4.90	30.08 ± 4.98	7.23**
Weight (Kg)#	80.24 ± 12.16	73.15 ± 10.85	10.66**	75.54 ±14.08	74.25 ±14.17	7.33**
% Weight Loss	8.77 ± 2.08			1.76 ± 1.69		9.93**

Responders – 3.6 -7.2 kg in 2 months, Non-responders < 3.6kg in 2 months
*Significant at p< 0.05 ** Significant at p < 0.001

A 1200 kcal/day diet was planned for each participant which provided 55% kcal from carbohydrate, 20% kcal from protein and 25% kcal from fat (visible fat was limited to 15% of total energy). At the end of 60 days participants were reassessed for various parameters. Responders and non-responders were classified according to NHLBI (National Heart Lung and Blood Institute) guidelines which states that adequate weight reduction is about 1 to 2 pounds per week (about 0.450 kg – 0.900/ week) (5). As per the recommendation this amount sums up to 3.6kg -7.2 kg in 2 months. This research work was given ethical clearance by 'Sanjeevani Ethics Committee'.

RESULTS

All the participants were women in the age group of 20-30 years. Mean anthropometric indices of the participants are reported in Table 1. Figure 1 presents per cent distribution of participants on basis of various cut-off values for obesity – body fat per cent, waist circumference, waist-to-hip ratio and grades of obesity based on body mass index. Highest proportion of women i.e. 87.5% had central adiposity based on WC. Fifty per cent of participants had body fat more than 35%. Obesity since childhood was reported by 17.86% participants and 14.29% of the women had family history of obesity. Successful weight reduction, defined by NHLBI guidelines was achieved by 19.64% participants (i.e. 11 participants). Table 2 represents pre and post intervention mean scores of anthropometric measurements of participants (responders and non-reponders). Highly significant reduction in body fat per cent, visceral fat, waist –to-hip ratio body mass index and body weight was observed. Conservation of lean mass was also statistically significant at 5% significance level. Mean weight loss was 7.78kg in responders and 1.29kg in non-responders, which were found to highly significant (p<0.05). Per cent weight change in responders was 8.77 ± 2.08 as compared to 1.76 ± 1.69 for non-responders.

Table III represents mean intake on basis of food groups by the responders and non-responders. Mean intake of pulses and legumes, milk and milk products, nuts and oilseeds, leafy vegetables were higher in responders as compared to non-responders.

Table 3. Mean Intake by the Participants on Basis of Food Groups

Food Group	Responders	Non-responders
Cereal Grains and Products (gms/d)	138.62 ± 41.51	137.48 ± 56.77
Pulses and legumes (gms/d)	31.55 ± 26.22	25.82 ± 19.48
Milk and Milk products (gms/d)	308.64 ± 136.54	273.64 ± 148.03
Nuts and oilseeds (gms/d)	4.64 ± 6.91	1.84 ± 5.08
Leafy vegetable (gms/d)	104.09 ± 92.12	71.85 ± 72.84
Roots and Tubers (gms/d)	40 ± 45.78	38.22 ± 48.95
Other Vegetables (gms/d)	87.64 ± 43.20	70.2 ± 53.46
Fruits (gms/d)	62.09 ± 45.07	74.04 ± 70.25
Fats and oils (gms/d)	44.09 ± 12.58	39.54 ± 10.73
Sugars (gms/d)	7.73 ± 7.79	9.44 ± 9.30

Factors affecting changes in different anthropometric indices

Changes in body weight (Δ Wt.): When computed for all the participants, weak but statistically significant correlations were computed for total dietary fibre (gm/d) and insoluble dietary fibre intakes (gm/d) (r = 0.256 and r = 0.283, respectively; p< 0.05). Stress scores negatively affected weight reduction (r =-0.275, p< 0.05). Stress was responsible for 8.52% variability in weight reduction. For the respondents, amount of weight reduction had a statistically significant association with intake of milk and milk products (r = 0.477), nuts and oilseeds (r = 0.281), fruits (r = 0.271), meat and poultry (r = 0.481), calcium (r =0.263), vitamin B12 (r = 0.781) and vitamin D (0.500). Weight reduction was retarded carbohydrate intake (r = -0.409), sugars (r = -0.274), junk food and trans fats (r = -0.406). Milk and milk product consumption was responsible for 31.33% variability in weight reduction, whereas fat consumption was responsible for 8.75% variation in weight loss.

Body Mass Index (ΔBMI): Stress score had a weak negative correlation with changes in BMI. Insoluble dietary fibre (r = -0.272) and total dietary fibre (r = 0.246) supported a reduction in BMI at 5% significance level. Responders had a strong positive association with intake of milk and milk products (r=0.446), nuts and oilseeds (r =0.254) and fruits (r =0.270). At nutrient level β – carotene (r = 0.381), linoleic acid (r =0.693), vitamin B12 (r =0.763) and vitamin D (r =0.490) accelerated reduction in BMI. Higher intakes of carbohydrate (r = -0.459), trans fat (r = -0.419), cereal grains (r =-0.341), sugars (r = -0.337) resulted in lower degree of change in BMI. Intake of cereal grains caused 14.42% of change in BMI and 32.46% variability was caused by milk and milk products.

Reduction in Waist Circumference (ΔWC): In the pre-intervention phase approximately 30% of the participants had WC ≥ 80 cms which reduced to 25% of participants in the post –intervention phase. Reduction in waist circumference was positively associated only with folic acid (r = 0.308) intake for all the participants. For the respondents statistically significant positive associations were observed with consumption of alpha linolenic acid (ALA) (r=0.396), folic acid (r =0.592). Stress did not exert any effect on change in WC. We could not find any study reporting similar results.

Reduction in waist-to-hip ratio (ΔWHR): Twenty five per cent of the women had WHR ≥ 0.85 in the pre – intervention phase which reduced to twenty one per cent after 60 days. Overall change in WHR was 2.41% which was less than Δ WHR in respondents (3.75%), whereas, for the non – responders this change was 1.20%. Reduction in WHR increased with higher folic acid intake (r =0.318 {overall} and r = 0.512 {respondents}. No association was observed with stress scores and other dietary and nutrient factors with ΔWHR.

Factors affecting changes in various body composition parameters

Reduction in Body Fat Per cent (Δ Fat %): More than 35% body fat was recorded for 51.79% of the women in pre-intervention phase which reduced to 42.86% post-intervention. Overall, there was 6.64% reduction in body fat%; for responders this reduction was 22.10% whereas, this value was only 2.92% for non-responders. Reduction in fat tends to decrease with higher levels of stress scores (r = -0.272, $p< 0.05$). For the responders, Δ Fat % was strongly correlated with consumption of pulses and legumes (r =0.292), fruits (r = 0.516) and MUFA (r = 0.404), at 5% significance level.

Reduction in visceral fat (ΔVF): Visceral fat loss has shown statistically significant positive association with intakes cereal grains and products (r =0.330) and leafy vegetables (r =0.301). At nutrient level, consumption of magnesium (r = 0.286), niacin (r = 0.360), thiamine (r = 0.303) and zinc (r = 0.305) had weak to moderate association with reduction in visceral fat, at 5% significance level.

For the responders, ΔVF was enhanced by intake of nuts and oilseeds (r =0.380), leafy vegetables (r = 0.427), dietary fibre (r = 0.633), iron (r =0.421), niacin (r = 0.500), thiamine (r = 0.472), vitamin C (r = 0.509) and vitamin D (r =0.463).

Conservation of lean mass (Δ Lean %): Conservation of lean mass did not show any association with any variable when observed for all the participants. When computed for respondents strong positive association with consumption of pulses and legumes (r =0.702), milk and milk products (0.402), nuts and oilseeds (r =0.271), protein (r =0.459) and MUFA (r =0.337). Stress score negatively affected conservation of lean mass (r = -0.596)

DISCUSSION

Weight reduction is affected by numerous factors. Recent scientific literature provides evidence that stress affects change in weight is reported to be higher with lower stress at entry level predicted success in weight reduction (Elder *et al*., 2012). Logistic regression analyses demonstrated that stress was associated with greater risk of weight gain (OR, 1.27, 95% CI, 1.12 to 1.44, p = 0.001) and weight loss (1.33, 1.10 to 1.61, p = 0.003), but associations were stronger among women (Serlachius *et al*., 2007). Diet and nutrition are in itself a complex issue related to weight reduction. In the present paper macronutrient and micronutrient aspects of diet have been evaluated in terms of their impact on various anthropometric indicators and body composition as a measure of obesity. Data suggests that increases from ~400 to 1200 mg of dietary calcium/d increase weight and fat loss by 26% and 28%, respectively. The use of dairy foods in place of calcium supplements has led to respective increases in weight and fat loss of 70% and 64% (Zemel *et al*., 2004). A high prevalence of micronutrient deficiencies in obese subjects has been reported in a recent research. Deficiencies were found in 9.5% participants for vitamin B_{12}, 25.2% for folic acid, 67.8% for copper, and 73.9% for zinc (De Luis *et al*., 2013). Recently, thiamine has been reported to prevent obesity and obesity-associated metabolic disorders in OLETF (Otsuka Long-Evans Tokushima Fatty) rats (Tanaka *et al*., 2010).

Pulses have a unique nutritional profile consistent with several dietary composition factors thought to assist with weight control (McCrory *et al*., 2010). Clifton *et al* reported a conservation of lean body mass with a diet rich in monounsaturated fatty acids (Clifton *et al*., 2004). Another study suggested that total fiber was inversely associated with subsequent weight and waist circumference change. For a 10-g/d higher total fiber intake, the pooled estimate was −39 g/y (95% CI: −71, −7 g/y) for weight change and −0.08 cm/y (95% CI: −0.11, −0.05 cm/y) for waist circumference change. A 10-g/d higher fiber intake from cereals was associated with −77 g/y (95% CI: −127, −26 g/y) weight change and −0.10 cm/y (95% CI: −0.18, −0.02 cm/y) waist circumference change. Fruit and vegetable fiber was not associated with weight change but had a similar association with waist circumference change when compared with intake of total dietary fibre and cereal fibre. A single study investigating impact of different dietary factors on various indices of obesity could not be found (Du *et al*., 2010).

Conclusion

Stress negatively affects weight reduction quantified as amount of weight loss or change in BMI. Factors related to diet and nutrition are complex in itself. Literature does not provide evidence of complex interactions between various nutrients which modifies their physiological impact. Studies reveal associations between individual food groups or macronutrient composition of diet or individual micronutrient with weight reduction. Further research is required in direction of understanding the effect of nutrients in isolation as well as in group, on various anthropometric indices and body composition to help in developing better understanding of prediction of success or failure in achieving targeted weight loss.

Conflict of Interest

There is no conflict of interest for the submitted piece of research work.

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