



RESEARCH ARTICLE

FACTORS ASSOCIATED WITH WEIGHT LOSS AND CHANGES IN BODY COMPOSITION IN A COMMERCIAL WEIGHT REDUCTION PROGRAM

*¹Richa Chaturvedi and ²Nimali Singh

¹Department of Home Science, Kanoria PG Mahila Mahavidyalaya, Jaipur (Rajasthan), India

²Department of Home Science, University of Rajasthan, Jaipur (Rajasthan), India

ARTICLE INFO

Article History:

Received 21st May, 2016
Received in revised form
18th June, 2016
Accepted 20th July, 2016
Published online 20th August, 2016

Key words:

Weight reduction,
Factors,
Food habits,
Body composition.

ABSTRACT

Introduction: Obesity is a multi-factorial disease arising from a complex interaction between genetic and environmental factors. Why some people succeed at adopting and sustaining behaviours associated with weight control while others, undergoing similar treatment programs, do not, remains largely unknown.

Objective: To identify factors associated with weight loss and changes in body composition in a commercial weight reduction program.

Methodology: Purposive sampling technique was used to enrol subjects in the age group of 20-60 years visiting a commercial weight reduction centre with the purpose of weight loss. Baseline data included 624 subjects (310 males and 314 females) with the BMI ≥ 25 kg/m². Total 200 subjects participated in the study with 102 visiting a commercial weight reduction centre and 98 visited a Gymnasium. In the comprehensive study the nutritional status of the subjects was assessed at both pre and post intervention stages, including parameters such as - anthropometric indicators, body composition and diet recall.

Results: Factors such as food habits, skipping of breakfast, marital status, stress, change in physical activity, cardio-respiratory fitness had an impact on weight loss, change in body composition and fitness levels. Significant associations were found between different variables. The macronutrient, stress and physical activity level model had a strong association with weight loss ($r = 0.649$) and was responsible for 42.13% variability.

Copyright©2016, Richa Chaturvedi and Nimali Singh. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Citation: Richa Chaturvedi and Nimali Singh, 2016. "Factors associated with weight loss and changes in body composition in a commercial weight reduction program", *International Journal of Current Research*, 8, (08), 35698-35701.

INTRODUCTION

Obesity is a multi-component disease arising from a complex interaction between genetic and environmental factors. However, the dramatic increase in obesity prevalence observed in the last decade seems attributable mainly to environmental changes promoting the intake of energy dense foods and/or reduced physical activity due to high number of sedentary jobs, different transportation systems and increasing urbanization. A 'running society' with a high level of stress develops compensatory and gratifying behaviours, where eating has a primary role (Grave *et al.*, 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 *et al.*, 2014). Why some people succeed at adopting and sustaining

behaviours associated with weight control while others, undergoing similar treatment programs, do not, remains largely unknown (Wing, 2003). Findings of a recent research also stated that health behaviour changes such as eating more fruits and vegetables, increasing physical activity and reducing stress were all predictive of clinically significant weight loss (Carpenter *et al.*, 2014).

Objective

To identify factors associated with weight loss and changes in body composition in a commercial weight reduction program.

Methodology

The study was conducted in Jaipur city of India. Purposive sampling technique was used to enrol women in the age group of 20-60 years visiting a commercial weight reduction centre (CWRC) with the purpose of weight loss. Baseline data included 624 subjects (310 males and 314 females) with the

*Corresponding author: Richa Chaturvedi,

Department of Home Science, Kanoria PG Mahila Mahavidyalaya, Jaipur (Rajasthan), India.

(Body Mass Index) BMI $\geq 25\text{kg/m}^2$. Success rate of any commercial weight reduction programme have been predicted to be 20%. Therefore, a sample size of 176 (44 in each group) women was computed, at 5% confidence interval and 10% confidence limit; for the comprehensive study on the basis of willingness to participate in the study. Total 200 subjects participated in the study with 102 visiting a commercial weight reduction centre and 98 visited a Gymnasium. In the comprehensive study these subjects were assessed at both pre and post intervention stages for various parameters such as nutritional status – anthropometric indicators, body composition and diet recall. Anthropometric indicators such as height, weight, waist circumference (WC) and hip circumference (HC) were measured using standard W.H.O. protocols. Body composition was assessed by OMRON HBF-362 body composition analyzer based on biological impedance. Diet and nutrient intake was assessed by 24 hour food recall. Written consent was acquired from all participants and ethical clearance for the study was obtained by Sanjeevani Ethical Committee in Jaipur.

RESULTS AND DISCUSSION

Classification of responders and non-responders

After the post-treatment assessment participants were classified as responders and non-responders on the basis of “Key Recommendations *Clinical Guidelines on the Identification, Evaluation and Treatment of Overweight and Obesity in Adults: Evidence Report, 1998*” which states that adequate weight reduction is about 1 to 2 pounds per week (about 0.450 kg – 0.900 kg/ week). This quantity sums up to 1.8 – 3.6 kg /month (3.6 -7.2 kg/ 2 months) (NHLBI, 1998). Subjects were assessed for their total weight reduction during the 60 days period. Subjects who were able to reduce ≥ 3.6 kg were considered as respondents (R) and those who reduced < 3.6 kg were considered as non-respondents (NR). Mean weight loss for females was higher than that for males but the difference was not statistically significant. When analyzed for subjects attending different Centres mean weight loss for CWRC (3.58 ± 2.82 kg) subjects was higher as compared to weight loss of subjects attending Gym (1.95 ± 2.84 kg) and the difference was statistically significant at 5% significance level ($t=3.62$). This rejected our null hypothesis that there will be no difference in the weight loss of subjects attending different combination program (Table 1).

Table 1. Mean Weight Loss (kg) of Subjects

Variable	Weight (kg)	t-Test
CWRC		3.62**
Males (n=50)	3.26 \pm 2.50	0.722 ^{NS}
Females (n=52)	3.75 \pm 2.96	
Total (n=102)	3.58 \pm 2.82	
Gym		0.361 ^{NS}
Males (n=50)	1.84 \pm 2.32	
Females (n=48)	2.03 \pm 3.15	
Total (n=98)	1.95 \pm 2.84	

*Significant at 5% **Significant at 1% level NS – Not significant

Overall, 30% subjects were successful in achieving the target. Response rate was low among subjects attending Gym (17%) as compared to those attending CWRC (45%).

Association of various parameters with weight loss, anthropometric indices and changes in body composition Personal and Family Profile

Gender was not found to have any effect on weight reduction. Professionally engaged women had 5.09 (odds ratio) times greater chance of success in weight reduction as compared to homemakers. Type of family was found to have no effect on obesity grades and weight loss. For females menstrual cycle regularity had significant relationship with obesity grades and weight loss. Presence of co-morbidities affected weight loss and obesity grade significantly (Table 2).

Table 2. Association between Personal and Family Profile with Weight Loss

Variables	df	Chi-square
Marital status and weight loss response	1	8.54**
Gender and weight loss	1	0.995 ^{NS}
Occupation and weight loss (Females)	1	10.09**
Type of family and obesity	1	0.00 ^{NS}
Type of family and weight loss	1	1.02 ^{NS}
Menstrual history and obesity grade (Females)	2	8.73**
Menstrual history and weight loss (Females)	1	8.83**
Co-morbidities and weight loss	1	5.82**
Co-morbidities and obesity grade	1	3.35*

*Significant at 5% level **Significant at 1% level NS –Not significant

Strong association was observed for marital status and weight loss but not for obesity grades. Married subjects had an odds ratio of 2.77 lesser chance to reduce weight as compared to unmarried or divorced subjects. An analysis of the marital status and body weight of 9043 adults in the US National Health and Nutrition Epidemiological Follow-up Survey (NHEFS), a longitudinal national study that interviewed and measured adults in a baseline assessment and reassessed them again in a follow-up approximately 10 years later. Weight of men and women were differently associated with marital changes. Women who were unmarried at baseline and married at follow-up had greater weight change than those who were married at both times. Analysis of weight loss and weight gain separately revealed that socio-demographic variables, including marital change, were more predictive of variation in weight loss than weight gain. Unmarried women who married gained more weight than women married at both times. Men who remained divorced/ separated and men who became widowed lost more weight than men married at both baseline and follow-up (Sobal *et al.*, 2003).

Food Habits

Table 3 presents association between food habits and weight reduction.

Table 3. Association of Food Habits with Response and Non-Response in Subjects

Variables	Chi-square value	df	P value
Veg. /Non-veg with Response / Non-response	3.89*	1	0.005
Skipping meals with Response/Non-response	10.67**	1	0.001
Smoking and response /Non-response (Males)	5.71**	1	0.001
Alcohol and response/ non-response (Males)	29.67**	1	0.001

*Significant at 5% level **Significant at 1% level

Vegetarianism has been found to have strong association with weight loss response. Similar findings were reported in recent research in which twelve randomized controlled trials were included, involving a total of 1151 subjects who received the intervention over a median duration of 18 weeks. Overall, individuals assigned to the vegetarian diet groups lost significantly more weight than those assigned to the non-vegetarian diet groups (weighted mean difference, -2.02 kg; 95 % confidence interval [CI]: -2.80 to -1.23) (Huang *et al.*, 2016). Skipping of meals also had a strong association with response to non-response. Subjects who were not skipping meals had 2.1 times more odds of losing weight. A National Health and Nutrition Examination Survey (2001-2008) found that regular breakfast consumers had lower body mass indexes and waist circumferences than breakfast skippers (O'Neil *et al.*, 2014).

Physical Activity Level

Physical activity level (PAL) and rate of change of PAL (Δ PAL) has been associated with various parameters among both males and females attending CWRC and Gym (Table 4).

Table 4. Correlation Values of PAL and Δ PAL With Various Parameters

	CWRC (n=102)		Gym (n=98)	
	Male (n=50)	Female (n=52)	Male (n=50)	Female (n=48)
PAL				
Age	-0.290*	-0.288*	-0.367*	-0.413*
Initial Weight	-0.412*	-0.294*	-0.308*	-0.279*
BMI	-0.461*	-0.294*	-0.264*	-0.274*
WC	-0.442*	-0.134 ^{NS}	-0.267*	-0.139 ^{NS}
WHR	-0.349*	-0.275*	-0.280*	-0.264*
Body Fat %	-0.302*	-0.304*	-0.314*	-0.359*
Lean %	0.146*	0.260**	0.157*	0.155*
Visceral fat	-0.148*	-0.176*	-0.186**	-0.187**
Δ PAL				
Weight Loss	0.587**	0.492**	0.708**	0.749**

*Significant at 5% **Significant at 1% level NS – Not significant

Initial physical activity level was found to be negatively correlated with age for all the groups, with strongest inverse association among females attending Gym ($r = -0.413$). Initial body weight and Body Mass Index (BMI) were also inversely related with initial physical activity level. WC had an inverse relation with PAL in males but the same relation was not observed in females. Higher PAL resulted in lower WHR among all the groups. Physical activity was also found to reduce total body fat percent, visceral fat and conserve lean body mass. Change in PAL (Δ PAL) had a strong positive relation with Δ (change in) weight i.e. the greater the change (increase) in PAL greater will be the change in weight.

A meta-analysis of 45 studies of adults ($n = 218,166$) and nine studies of children and adolescents ($n = 19,268$) showed that physically active adults had a 33% lower odds of obesity ($p = 2 \times 10^{-13}$), 19% lower odds of overweight ($p = 7 \times 10^{-9}$), 0.79 kg/m² lower BMI

($p = 3 \times 10^{-15}$), 2.44 cm smaller waist circumference ($p = 1 \times 10^{-20}$) and 1.30% lower body fat percentage ($p = 2 \times 10^{-15}$) than inactive adults (Kilpeläinen, *et al.*, 2011).

Cardio- Respiratory Fitness Parameters

Table 5 shows significant associations of cardiovascular fitness with other parameters. Resting heart rate (RHR) was found to have a significant association with age, whereas a strong association with body fat per cent and visceral fat. Recovery heart rate (ReHR) was found to be associated with body fat per cent.

Table 5. Association of Cardio Respiratory Fitness Parameters with Other Variables

S. No.	Variables	CWRC (n=102)		Gym (n=98)	
		Males (n=50)	Females (n=52)	Males (n=50)	Females (n=48)
1	RHR and Body Fat%	0.253**	0.348**	0.290**	0.252**
2	RHR and Visceral fat	0.146*	0.383**	0.139*	0.323**
3	ReHR and Body Fat%	0.181*	0.308**	0.288**	0.142*

*Significant at 5% **Significant at 1% level NS – Not significant

A recent study on young medical students ($n=132$), in India reported that resting heart rate had higher values and significantly positive correlation with obesity indices among obese group compared to non-obese individuals ($p < 0.05$). A significantly higher RHR points towards an altered autonomic balance in obese young adults (Itagi *et al.*, 2014). Another study on 60 young adult subjects in the age group of 18-20 years, established a significant correlation between obesity indices like BMI and RHR, with the obese group exhibiting significantly faster RHR (Shekokar *et al.*, 2013).

Stress Score

High stress scores were found to be related to high total cholesterol levels and low levels of high density lipoprotein levels in subjects. Also there was a negative association of stress with physical activity level and weight loss in both the genders of both the centres.

Table 6. Association of Stress Score with Weight Loss

Variable	CWRC (n=102)		Gym (n=98)	
	Male (n=50)	Female (n=52)	Male (n=50)	Female (n=48)
Weight Loss	-0.254**	-0.293**	-0.201**	-0.382**

Similar results have been found in a recent study which evaluated job related stress and lifestyle variables in 91,593 workers undergoing periodic check-ups. In the bivariate analysis, job stress was significantly associated with previous dyslipidaemia diagnosis ($p < 0.001$), lipid-lowering therapy ($p < 0.001$) and altered total-cholesterol ($p = 0.001$), HDL-cholesterol ($p < 0.001$) and LDL-cholesterol levels ($p = 0.025$). After adjusting for potential confounding variables, job stress was still associated with current dyslipidaemia diagnosis (OR = 1.10; 95% CI, 1.04–1.17), high LDL-cholesterol (OR = 1.14; 95% CI, 1.05–1.23), low HDL-cholesterol (OR 1.08; 95% CI, 1.01–1.15), high total cholesterol/HDL-cholesterol ratio (OR 1.13; 95% CI, 1.05–1.23) and high LDL-cholesterol/HDL-cholesterol ratio (OR 1.11; 95% CI, 1.04–1.19) (Catalina-Romero *et al.*, 2013).

Also, physical activity level and stress scores were found to be inversely related to each other and the relation was stronger in males than females. A recent study used baseline and follow-up self-report survey data comprising a cohort of 1382 women aged 18 to 46 years, in Victoria, Australia. The study revealed cross-sectional and longitudinal associations between stress and both less leisure-time physical activity and more frequent fast food consumption. Longitudinal associations were also found between stress and increased television viewing time (Mouchacca *et al.*, 2013). Initial stress scores were found to have an adverse effect on weight reduction for males and females attending either CWRC or Gym. Similar results were observed in a two phase randomized control trial, the LIFE study, which provided an intensive behavioural weight loss intervention to 472 obese (BMI -30-50kg/m²) adults. Using logistic regression, lower stress at entry level predicted success in weight loss program (p=0.024) and also weight loss was significantly correlated to decline in stress (p =0.048) (Elder *et al.*, 2012).

Nutrient, stress, physical activity

Multiple regression analysis revealed that post intervention nutrient intake had a strong impact on weight reduction (p=0.001). Macronutrient composition of diet (model comprising of protein, energy, carbohydrate and fat), significantly affected weight reduction. On adding stress and physical activity level to this model the effectiveness of the intervention increased. The macronutrient model was positively correlated to weight loss (r = 0.497) and resulted in 24.66% variability in weight loss. The macronutrient, stress and physical activity level model had a strong association with weight loss (r =0.649) and was responsible for 42.13% variability.

Conclusion

Multiple variables affect weight reduction and a pre-assessment of an individual can help in prediction of response or non-response in weight reduction. Focal point during a comprehensive weight reduction program should not be weight loss on scale alone but also on favourable changes in body composition, fitness levels and improved nutritional status. To achieve this; well-planned nutritionally adequate diet combined with physical activity and stress relieving techniques are a pre-requisite.

REFERENCES

Carpenter, K.M., Lovejoy, J.C., Lange, J.M., Hapgood, J.E., Zbikowski, S.M., 2014. Outcomes and utilization of a low intensity workplace weight loss program. *J. Obes.* 2014, 1–7. doi:10.1155/2014/414987

- Catalina-Romero, C., Calvo, E., Sánchez-Chaparro, M., Valdivielso, P., Sainz, J., Cabrera, M., González-Quintela, A., Román, J., 2013. The relationship between job stress and dyslipidemia. *Scand. J. Public Health* 41, 142–149.
- Colombo, O., Ferretti, V.V., Ferraris, C., Trentani, C., Vinai, P., Villani, S., Tagliabue, A., 2014. Is drop-out from obesity treatment a predictable and preventable event? *Nutr. J.* 13, 13. doi:10.1186/1475-2891-13-13
- Elder, C., Gullion, C., Funk, K., DeBar, L., Lindberg, N., Stevens, V., 2012. Impact of sleep, screen time, depression and stress on weight change in the intensive weight loss phase of the LIFE study. *Int. J. Obes. Lond.* 36, 86–92.
- Grave, R.D., Centis, E., Marzocchi, R., Ghoch, M.E., Marchesini, G., 2013. Major factors for facilitating change in behavioral strategies to reduce obesity. *Psychol. Res. Behav. Manag.* 6, 101–110.
- Huang, R.-Y., Huang, C.-C., Hu, F., Chavarro, J., 2016. Vegetarian Diets and Weight Reduction: a Meta-Analysis of Randomized Controlled Trials. *J. Gen. Intern. Med.* 31, 109–116.
- Kilpeläinen, T., Qi, L., Brage, S., Sharp, S., Sonestedt, E., Demerath, E., Ahmad, T., Mora, S., 2011. Physical Activity Attenuates the Influence of FTO Variants on Obesity Risk: A Meta-Analysis of 218,166 Adults and 19,268 Children. *PLOS Med.* 8, e1001116.
- Mouchacca, J., Abbott, G., Ball, K., 2013. Associations between psychological stress, eating, physical activity, sedentary behaviours and body weight among women: a longitudinal study. *BMC Public Health*, 13, 828. doi:10.1186/1471-2458-13-828
- NHLBI, 1998. Clinical Guidelines on the Identification, Evaluation and Treatment of Overweight and Obesity in Adults. (Evidence Report No. 98-4083). National Institutes of Health.
- O'Neil, C., Nicklas, T., Fulgoni, I., 2014. Nutrient Intake, Diet Quality, and Weight/Adiposity Parameters in Breakfast Patterns Compared with No Breakfast in Adults: National Health and Nutrition Examination Survey 2001-2008. *J. Acad. Nutr. Diet.*, 114, S27–S43.
- Shekokar, P., Raut, M., Warkar, A., 2013. Effect of Obesity On Resting Heart Rate Among Medical Students. *Int. J. Biomed. Med. Res.*, 4, 3593–3596.
- Sobal, J., Rauschenbach, B., Fronquillo, E., 2003. Marital status changes and body weight changes: a US longitudinal analysis. *Soc. Sci. Med.*, 56, 1543–1555.
- Wing, R.R., 2003. Behavioural interventions for obesity: recognizing our progress and future challenges. *Obes. Res.*, 11, 3S–6S.
