

Assessment of weight reduction in overweight adult people with combination treatment of electronic devices, diet and physical exercise

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■ **ABSTRACT** : Obesity is a public health problem that has raised concern worldwide. According to the World Health Organization (WHO), there will be about 2.3 billion overweight people aged 15 years and above, and over 700 million obese people worldwide in 2015. This study was conducted assess weight reduction in overweight adult people with combination treatment of electronic devices, diet and physical exercise. All available subjects attending a commercial weight reduction clinic were selected. The sample comprised one hundred eighty adult (180) peoples (90 male and 90 female) in the age group of 30-40 year. We aimed to examine the effectiveness of combined nutrition and complete lifestyle modification package (NCLMP) for overweight adult people. In NCLMP we combined electronic Devices, diet and physical exercise programmes with at least 6 months of follow-up, conducted in overweight and obese adults (body mass index ≥ 25). Results revealed that in Pre-intervention phase majority of the subjects (75 %) were found to be in the category of high risk while minority of the respondents (25 %) had normal WHR (< 0.8). The mean WHR was 0.83 ± 0.0 . and the fat values exceed the normal range of fat, diet of subjects in comparison to the balanced diet was substantially inadequate in food groups, representing the excess fat deposition in the subjects owing to obesity. Intervention phase results revealed effect of electronic devices, physical exercise and nutritionally balanced weight loss diet on body composition of males were showed body fat (%) before intervention was 31.10 ± 3.2 and after intervention 29.26 ± 4 and decrease after intervention -1.84 . Effect of electronic devices, physical exercise and nutritionally balanced weight loss diet intervention on body composition of females were found body fat (%) before intervention was 33.83 ± 4.6 and after intervention 32.2 ± 4.5 and decrease after intervention -1.59 . Weight loss is similar in the short-term for diet-only but with combined longer-term programme weight loss is increased when electronic devices, diet and physical activity are combined.

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Overweight and obesity is increasing worldwide at an alarming rate. Health is a dynamic life process, which begins at birth is governed by genetic and environmental factors throughout life. Now a day, due to sedentary life style and industrialization several health problems have cropt into people's life among which obesity is predominant (Vijyalakshmi *et al.*, 2005).

Obesity has reached and epidemic proportion globally with approximately 106 billion adults and attend 20 million children under the age of five being overweight (Flegal *et al.*, 2004).

Obesity is a public health problem that has become epidemic worldwide. Substantial literature has emerged to show that overweight and obesity are major causes of co-morbidities, including type II diabetes, cardiovascular diseases, various cancers and other health problems, which can lead to further morbidity and mortality. The related health care costs are also substantial. Therefore, a public health approach to develop population-based strategies for the prevention of excess weight gain is of great importance. However, public health intervention programmes have had limited success in tackling the rising prevalence of obesity.

A recent report of year 2008 by center of disease control and prevention (CDC), Only one state, colorado had prevalence of obesity equal to or greater then 30 per cent and were located in the mid south-east region.

The World Health Organization (WHO) defines obesity as 'global epidemic'. It was estimated that around 400 million people were suffering from obesity. Developed nations are not only recognized obesity as a major public health problem; even developing countries consider obesity as an important health problem. Studies from different states of India suggested that the prevalence of obesity ranged from 10-50 per cent. The pace of developmental transitions - urbanization, modernization, globalization marked in recent years has led to the double burden of 'under nutrition' and 'obesity' in developing countries. There are various factors that can cause obesity among adults and unhealthy lifestyle is on the top in the list.

Physical inactivity has become a public health problem all over the world. The current high level of physical inactivity is believed to be partly due to insufficient participation in physical activity during leisure time and an increase in sedentary behaviour during

occupational and domestic activities (WHO, 2013).

Obesity is one of the biggest health problems today, which affect a person not only physically but psychologically as well. In developing countries, obesity is more common in middle-aged men and women, people of higher socio-economic status and those living in urban communities.

Obesity is usually determined using body mass index (BMI), calculated as the weight in kilograms divided by the square of the height in meters (kg/m^2). A BMI over $25\text{kg}/\text{m}^2$ is defined as overweight, and a BMI of over $30\text{kg}/\text{m}^2$ as obese. These markers provide common bench marks for assessment, but the risk of disease in all population can increase progressively from lower BMI levels.

The prevalence of obesity is increasing in most parts of the world, not sparing any age and sex group. Globally there are more than one billion overweight adults and at least 300 billion of them obese (WHO, 2000).

India is passing through a transitional phase of socio-economic development while the country has still to overcome problems arising from under development and poverty. India 14 per cent populations is suffering from obesity (12% males and 16% females) while a third of India's population stills falls below the poverty line (NFHS, 2007).

Convenience foods are becoming very popular with urbanites become of tremendous increase in the numbers of working women, busy life schedules, changing life style etc. These convenience foods are usually rich in trans fatty acids, cholesterol, saturated fats, sugar's energy contribute to rise in the incidence of obesity.

Diet management coupled with exercise is one of the ways to provide a positive solution for the problem of obesity. The word diet is often used to describe an eating plan intended to aid weight loss. However, diet really refers to the foods persons eats in the course of a day or week. These are many different types of diet, low fat diet, low CHO diet, very low calorie diet, crash diet, balanced weight loss diet etc.

In recent years nutrition and fitness has assumed an increased importance in the management of chronic condition and minimizing risk factors. For this purpose the requirement is to work quita a way to help the population to improve personal and family nutrition in face of economic hand grip.

The success rate of conventional weight reduction

programmers is extremely low therefore non-conventional methods are subject to worldwide speculation. The present study is an endeavor to determine weight reduction by using diet, active exercise and electronic exercise. Looking to this need development of Nutrition and Complete Lifestyle Modification Package on weight reduction by using electronic Devices, diet and physical exercise treatment would be of great help.

■ RESEARCH METHODS

The study was conducted within the municipal limits of Udaipur City, Rajasthan. An overweight adult person with equal representation from both the sexes in the age range of 30-40 years was selected.

For the assessment of overweight and nutritional status of adult people, an interview schedule was developed to collect the information about respondent's age, religion, caste, type and size of family, education, family occupation, marital status. Basic anthropometric measurements such as height, waist and hip circumference measurements were taken using standard methods given by Jelliffe (1966). The derived anthropometric measurements *viz.*, body mass index and waist and hip ratio were calculated. The Body Mass Index or Quetelet's Index, a measurement of body weight adjusted for height was used as measure of adiposity in the subject (Garrow, 1987).

The BMI indicates both fat and lean tissues. The index was calculated by dividing the absolute weight (kg) with absolute, height (meter) square. These figures then matched with the classification given by James *et al.* (1988).

BMI weight / Height (kg/m ²)	
BMI class	Type of malnutrition
<16	Chronic energy deficiency III
16-17	Chronic energy deficiency II
17-18.5	Chronic energy deficiency I
18.5-20	Low weight normal
20-25	Normal
25-30	Obese grade I
>30	Obese grade II

Weight and Body composition of the subjects was determined using bioelectrical impedance using Body composition analyzer. In body composition parameters *viz.* fat mass, muscle mass, bone mass, lean body mass, total body water and visceral fat rating were determined.

In intervention phase subject were divided into 2 group male (90) and female (90). On the basis of energy requirement of the subject for weight loss diet plan was prepared for one week and then given to the subject. Furthermore individual Counselling was also given to the subject so solve their queries. During intervention phase anthropometry measurement (WT, BMI, WHR) were recorded weekly. Along this electronic muscle exerciser is used to exercise the muscle by passing an impulse through the muscle, which stimulates the muscle (motor nerves control muscle activity). For active exercise walk and yoga methods was used. Walking is the simplest and most effective from of activity for fitness and health way or living. Yoga has been practiced for thousands of year in the east and embodied many different system.

In post intervention phase All the nutritional, biochemical and atherogenic factors, that were assured prior to the intervention period were assessed again and recorded in the-“Nutrition and complete lifestyle modification package”, used in the pre experiment phase, after 3 months.

■ RESEARCH FINDINGS AND DISCUSSION

One hundred eighty subjects both male and female attending the weight reduction clinic was selected for the present study. The general information of the survey group obtained through a structured questionnaire. Study was conduct in pre-intervention, intervention and post-intervention phases so as to accomplish the objectives of the study. The results obtained are presented in Table 1 to 4 and Fig. 1 to 6.

Pre-Intervention phase :

Results pertaining to anthropometric measurements as obtained in present study are given below:

Weight :

The mean weight of the male subjects was 85.6±9.6 kg, which was more than the weight of a reference Indian male (60kg) and the mean weight of the female subjects was 72.8±11.1 kg, which was more than the weight of a reference Indian female (55kg).

Height:

The mean height of the male subjects was recorded to be 173.2±6.8 cm and the mean height of the female subjects was 161.7±6.7.

Table 1 : Anthropometric measurements of the subjects

Sr. No.	Body measurements	Mean ± SE	
		Male	Female
1.	Weight (kg)	85.6 ± 9.6	72.83 ± 11.1
2.	Height (cm)	173.2 ± 6.8	161.72 ± 6.7
3.	BMI (kg/m ²)	28.3 ± 1.9	28.06 ± 1.9
4.	WHR	0.96 ± 0.12	0.86 ± 0.05
5.	Body composition		
	Fat (%)	33.8 ± 0.6	39.4 ± 0.6
	Body fat mass (kg)	30.1 ± 0.8	27.9 ± 0.9
	Total body water (kg)	29.9 ± 0.9	27.9 ± 0.9
	Fat free mass (kg)	50.5 ± 0.6	40.6 ± 0.6

Body mass index (BMI) :

The average BMI of subjects was found to be 28.3 ± 1.9 kg/m².

Waist - hip ratio (WHR) :

Waist hip ratio of females reveals that majority of them (75 %) had WHR between 0.8 to 0.9 and hence they were classified under high risk category followed by those falling under the normal category (25 %). The mean waist to hip ratio of the male subjects was 0.96 ± 0.1 and a female subject was 0.86 ± 0.0, which placed them in the category of high risk.

Body composition:

Body composition data forms the basis for a wide variety of therapeutic health and fitness prescriptions.

Body fat per cent:

In the present study, the mean value of body fat in the male subjects was evolved out to be 33.8 ± 0.6 per cent and 39.4 ± 0.6.

Body fat mass:

Mean total fat mass at initial level of the study population emerged from Table 1 and revealed that males had 30.1 ± 0.8 kg fat mass and females had 27.9 ± 0.9 kg fat mass

Total body water (TBW):

The overall mean value of total body water among all the male subjects was observed to be 29.9 ± 0.6 kg and female subjects was 27.9 ± 0.9 kg.

Fat free mass (FFM):

Fat free mass includes muscles, bones, body water and organs. The mean fat free mass of the study population of male subject was 50.5 ± 0.6 kg and a female subject was 40.6 ± 0.6.

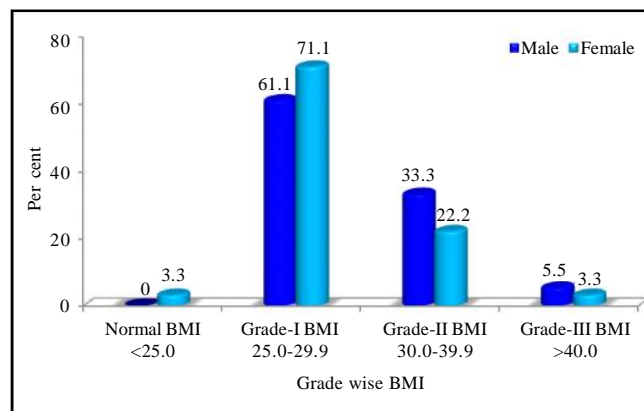


Fig. 1 : Distribution of subjects with respect to grade wise BMI

Dietary intake:

The nutritional status of any individual is directly

Table 2 : Distribution of subjects with respect to grade wise BMI

Sr. No.	Male (90)	Female (90)	Percentage (n=180)
Normal BMI <25.0	(00)	3.3(03)	1.66(03)
Grade 1 BMI 25.0-29.9	61.1 (55)	71.1(64)	66.1(119)
Grade 11 BMI 30.0-39.9	33.3(30)	22.2(20)	27.7(50)
Grade 111 BMI >40.0	5.5 (05)	3.3(03)	3.8(07)

Table 3 : Mean ± SE values of food intake of females

Sr. No.	Food groups	Balanced diet	Mean±SE	% to BD*
1.	Cereals (g)	270	170.2±4.6	63
2.	Pulses (g)	60	28.3±1.7	47.1
3.	Leafy vegetables (g)	100	36.2±5.6	36.2
4.	Roots and tubers (g)	100	125±6.9	125
5.	Other vegetables (g)	100	89.7±8.5	89.7
6.	Fruits (g)	100	72.5±9.9	72.5
7.	Milk and its products (ml)	400	151.2±6.8	50.4
8.	Sugars (g)	20	51.2±0.7	256
9.	Fat and oils (g)	20	91±1.5	455

*BD- Balanced Diet

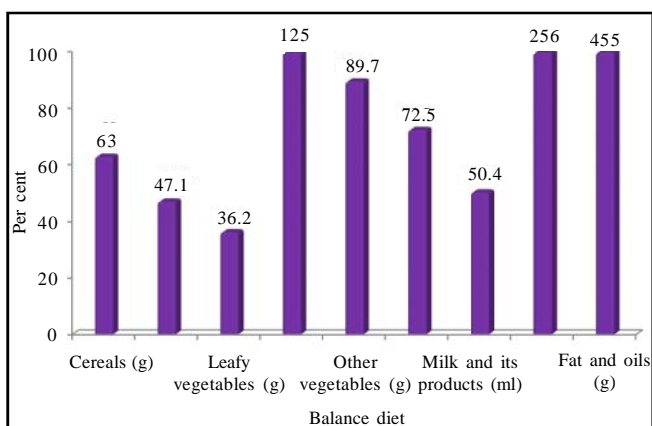


Fig. 2 : Mean ± SE values of food intake of females

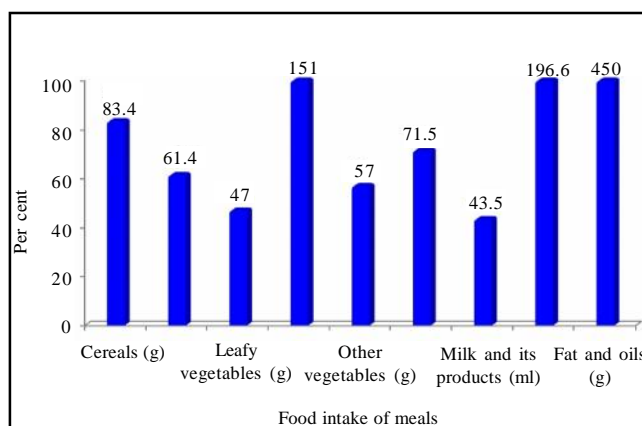


Fig. 3 : Mean ± SE values of food intake of males

affected by his/her food intake. The components of the diet should be chosen judiciously so that it provides all the nutrients in adequate amount and in proper proportion (ICMR, 2010).

Food intake:

In the present investigation food intake of subjects was studied by “24 hour recall method”.

Nutrient intake :

Life cannot be sustained without adequate nourishment. Man needs sufficient food for growth, development and to lead an active and healthy life (ICMR, 2010).

Table 5 and 6 indicates that diet of male and female obese subjects was higher in energy, fat and carbohydrates, as compared to respective recommended

Table 4 : Mean ± SE values of food intake of males

Sr. No.	Food groups	Balanced diet	Mean±SE	% to BD*
1.	Cereals (g)	350	290±2.8	83.4
2.	Pulses (g)	70	40.8±3.5	61.4
3.	Leafy vegetables (g)	100	46.2±1.1	47
4.	Roots and tubers (g)	100	145±6.9	151
5.	Other vegetables (g)	100	48.2±9.0	57
6.	Fruits (g)	100	70.2±8.9	71.5
7.	Milk and its products (ml)	600	229.7±32.5	43.5
8.	Sugars (g)	30	50.2±9.8	196.6
9.	Fat and oils (g)	35	90.5±1.0	450

*BD- Balanced Diet

Table 5 : Mean daily intake of nutrients by male subjects

Sr. No.	Nutrient intake	RDA	Mean ± SE	% to RDA
1.	Energy (Kcal)*	1900	2053.4 ±291.5	108.0
2.	Protein (g)*	55	39.5 ±0.6	9.6
3.	Fat (g)*	20	105.6 ±2.6	291
4.	Carbohydrates (g)*	400	252.1 ±3.9	102.6
5.	Fibre (g)	20	7.2±0.1	36.4
6.	Calcium (mg)	600	268.4±50.5	44.66
7.	Iron (mg)	31	10.69±3.75	34.1
8.	Thiamin (mg)*	1.0	0.44 ±0.17	44.0
9.	Riboflavin (mg)*	1.1	0.52 ±0.17	47.2
10.	Niacin (mg)*	10.8	8.31±2.7	78.8
11.	Vitamin C (mg)	40	20.58±7.8	51.2

RDA- Recommended Dietary Allowance suggested by ICMR (2010)

*Khanna *et al.* (2003)

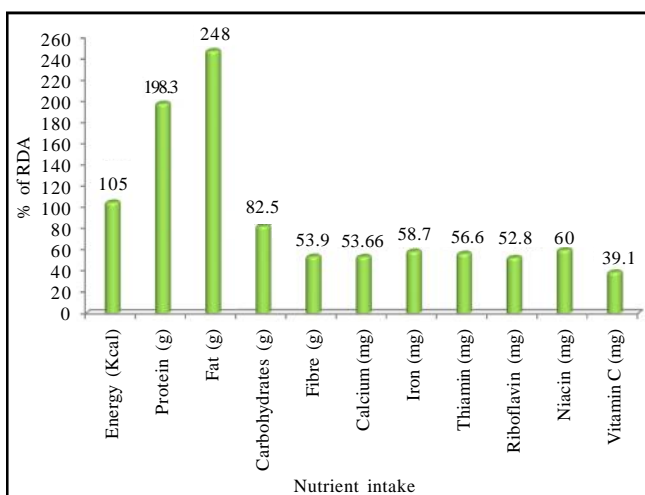


Fig. 4 : Mean daily intake of nutrients by male subjects

values, slightly inadequate in calcium, iron, riboflavin and niacin whereas extremely low in fibre and protein. It

indicates that fruits, green leafy vegetables, pulses need to be increased in the diet of subjects under study.

Physical activity:

Physical activity is a key determinant of energy expenditure and thus is fundamental to energy balance and weight control. Therefore, approximate time spent on various physical activities by the subjects was also studied to have an idea about the general lifestyle pattern of the subjects.

Intervention and post intervention phase:

This phase was fundamentally the execution phase in which the nutritionally balanced weight loss diet (personalized plan) were given to the subjects. It provides enough energy to meet the person’s metabolic needs and activity level. It includes a balanced variety of foods, but limits of carbohydrates and fat. A Nutritionally balanced

Table 6 : Mean daily intake of nutrients by female subjects

Sr. No.	Nutrient intake	RDA	Mean ± SE	% to RDA
1.	Energy (Kcal)*	2320	2438 ±398.1	105.0
2.	Protein (g)*	60	119.1±22.4	198.3
3.	Fat (g)*	25	62.07±62.6	248
4.	Carbohydrates (g)*	400	330.12±52	82.5
5.	Fibre (g)	20	10.78±4.2	53.9
6.	Calcium (mg)	600	322.5±64.8	53.66
7.	Iron (mg)	17	9.99±2.23	58.7
8.	Thiamin (mg)*	1.2	0.68 ±0.15	56.6
9.	Riboflavin (mg)*	1.4	0.74 ±0.21	52.8
10.	Niacin (mg)*	16	9.61±2.79	60.0
11.	Vitamin C (mg)	40	15.66 ±4.3	39.1

RDA- Recommended Dietary Allowance suggested by ICMR (2010)

*Khanna *et al.* (2003)

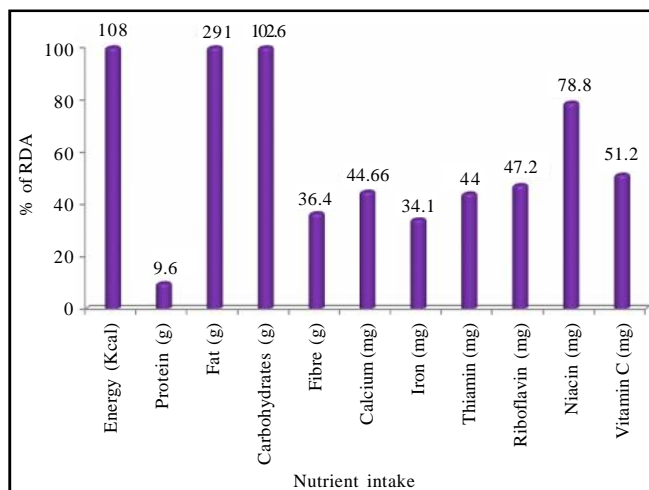


Fig. 5 : Mean daily intake of nutrients by female subjects

weight loss diet helps to reduce half to one kg weight per week. In the present study, diet plans were prepared for one week according to the energy requirement of the subjects for weight loss and then given to the subjects.

During intervention phase, each subject was counselled and monitored weekly. Results revealed that greater per cent of the subjects (70 %) lost half kg weight in the first week, so similar diet plan was given for next week whereas 30 per cent subjects did not lose weight, in this case energy was further reduced by 100 kcal. Those subjects who did not reduce the weight during the

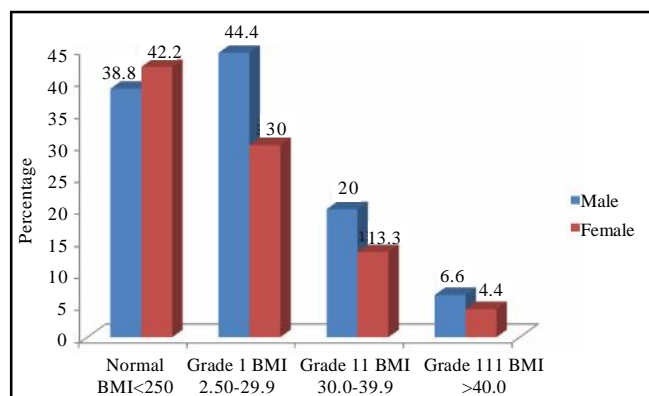


Fig. 6 : Distribution of subjects after treatment with respect to grade wise BMI

prior week, all of them began to lose in the second week. Only one female was found to be started losing weight by third week of intervention. Diet plan was given to the subjects till reduction in BMI unit was similar with the observation recorded in case of individuals on crash diet.

The impact of diet was assessed every week and was statistically analyzed. Declining trend of observations clearly suggests a positive role of diet on weight and BMI. Hassapidou *et al.* (2011) also found significant reduction in body weight (4.3 kg) and BMI (1.5 kg/m²) in a group of obese subjects after following diet programme for 3 months.

Table 7 presents the grades of obesity in male and female subjects after treatment. It was observed that the number of male subjects with normal BMI increased 38.8 per cent and female subjects with normal BMI increased to 42.2 per cent as compared to 3.3 per cent before treatment. Similarly subjects in Grade 1 were 37.7 per cent as compared to 66.1 per cent before treatment. On the other hand per cent of subjects suffering from Grade 11 obesity fell from 27.7 per cent to 16.6 per cent after treatment, also in Grade 111 from 3.8 per cent to 5.5 per cent.

Electronic muscle exerciser was also used to exercise the muscle by passing an impulse through the muscle, which stimulates the muscle (motor nerves control muscle activity). Results pertaining to effect of nutrition complete life style modification programme as obtained in present study are given in Table 8 and 9.

Table's exhibits that fat free mass of the male subjects increased from 39.9±1.1 at pre intervention to 41.1±1.0 kg and female subjects increased from 37.9±1.1 at pre intervention to 39.1±1.1 at the end of the study. Thus, in the present investigation, there was an increase in the fat free mass with the subsequent decline in the body fat, as a beneficial impact of electronic muscles exercise and nutritional balanced weight loss diet.

Results of fat mass of the male subjects decreased from 24.5±1.5 at pre intervention to 21.5 ±1.4 kg and fat mass of the female subjects decreased from 27.4±1.5 at pre intervention to 24.5±1.4kg.

Table 7 : Distribution of subjects after treatment with respect to grade wise BMI

Sr. No.	Male (90)	Female (90)	Percentage (n=180)
Normal BMI<25.0	38.8(25)	42.2(38)	40.5(73)
Grade 1 BMI 25.0-29.9	44.4(40)	30(27)	37.7(67)
Grade 11 BMI 30.0-39.9	20(18)	13.3(12)	16.6(30)
Grade 111 BMI >40.0	6.6(06)	4.4(04)	5.5(10)

Table 8 : Effect of nutrition and complete lifestyle modification package on body composition of males

Body composition	Mean \pm SE			Paired 't' value
	Before intervention	After intervention	Increase/decrease after intervention	
Body fat (%)	31.10 \pm 3.2	29.26 \pm 4.1	- 1.84	2.36**
Fat mass (kg)	24.4 \pm 1.5	21.5 \pm 1.4	- 2.9	6.51**
Total body water (kg)	30.9 \pm 0.6	31.2 \pm 0.6	+ 0.3	1.18NS
Fat free mass (kg)	39.9 \pm 1.1	41.1 \pm 1.1	+ 1.2	5.90**

NS=Non-Significant ** indicates significance of value at P=0.01

Table 9 : Effect of nutrition and complete lifestyle modification package on body composition of females

Body composition	Mean \pm SE			Paired 't' value
	Before intervention	After intervention	Increase/decrease after intervention	
Body fat (%)	33.83 \pm 4.6	32.2 \pm 4.5	- 1.63	3.73
Fat mass (kg)	27.4 \pm 1.5	24.5 \pm 1.4	- 2.9	7.51**
Total body water (kg)	30.9 \pm 0.6	31.2 \pm 0.6	+ 0.3	1.18NS
Fat free mass (kg)	37.9 \pm 1.1	39.1 \pm 1.1	+ 1.2	4.78**

NS=Non-significant ** indicates significance of value at P=0.01

Table 10 : Gender wise comparative effect of diets on body composition of males and females subjects

Body composition	Group	Pre-intervention	Post-intervention	% change
Fat per cent	I	31.10 \pm 3.2	29.2 \pm 4.1	- 1.84
	Male			
Fat mass (kg)	II	33.83 \pm 4.6	32.2 \pm 4.5	-1.59
	Female			
Fat free mass (kg)	I	24.4 \pm 1.5	21.5 \pm 1.4	- 3.0
	Male			
Fat free mass (kg)	II	27.4 \pm 1.5	24.5 \pm 1.4	-2.9
	Female			
Total body water (kg)	I	39.9 \pm 1.1	41.1 \pm 1.1	+1.2
	Male			
Total body water (kg)	II	37.9 \pm 1.1	39.1 \pm 1.1	+1.2
	Female			
Total body water (kg)	I	30.9 \pm 0.6	31.2 \pm 0.6	+0.3
	Male			
Total body water (kg)	II	30.9 \pm 0.6	31.2 \pm 0.6	+0.3
	Female			

Results of TBW of the subjects calculated before and after the intervention showed slightly higher value in both subjects 31.2 \pm 0.6 kg were found at the end of the intervention.

Globally, men and women face markedly different risks of obesity. In all but of handful of countries, obesity is much more prevalent among women than men. Globally, men and women face different risks of obesity. Table 10 shows gender wise comparative effect of diets on body composition its shows that the average reduction in fat per cent was significantly greater in the male group than female group. With regard to fat loss, also there was a trend towards greater loss of fat mass in the male group than female. Table also exhibits that the Male and

female group obtained same increments in fat free mass (+ 1.2 %) and total body water (+ 0.3 %) but the significance difference between the groups was observed in fat mass, body fat per cent and fat free mass.

Conclusion :

The findings of this study demonstrate that combination of diet, active and electronic exercise has a positive effect on body weight in people with overweight and obesity. Although exercise alone improved weight loss only marginally, when combined with nutrition and complete lifestyle modification programme the amount of weight loss achieved with exercise increased substantially.

Our results are consistent with previous studies by Kumar *et al.* (2004); Goyal *et al.* (2010) and Brahmbhatt and Oza (2012). The prevalence of overweight/obesity (17.5%) of our study was much higher compared to another study carried out among school children of rural and urban areas of Mysore (Saraswathi *et al.*, 2011) who reported the prevalence of overweight/obesity was 8.75 per cent in urban areas and 0.8 per cent in rural area. Compared to other studies in different states of India, the prevalence of overweight and obesity our study was within the range.

In other studies the prevalence of obesity was higher among boys than girls (Marwaha *et al.*, 2006; Kaur *et al.*, 2008 and Goyal *et al.*, 2010). However, this result signify that gender differences was effect modifier and this difference could be explained by various lifestyle factor like physical activities, dietary pattern, time spent on television viewing, video games and socio-economic status.

In the present study it was found that the weight loss was enhanced with inclusion of diet and exercise along with electronic devices which are in agreement with the results from a meta –analysis. This indicates superiority of the use of diet on diet exercise in reducing obesity during the period of treatment. The diet and exercise programme produce a 3-5 fold greater change in body composition than exercise programme with lower body weight among women. There is almost no treatment for obesity that results in long term maintenance of weight loss, except surgery and almost all conventional weight loss programme are followed by weight regain. It can be thus concluded that weight loss can be brought about by exercise and diet. For sustained weight loss along with exercise and diet behaviour modification is required.

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■ REFERENCES

Brahmbhatt, Krutarth and Oza, Umesh (2012). Obesity among

adolescents of Ahmedabad city, Gujarat, India – A community based cross-sectional study. *Internat. J. Biol. & Med. Res.*, **3** (2): 1554-1557.

Flegal, K., Gail, M. and Williamson, D. (2004). Both obesity and underweight linked to excess deaths. *American J. Med. Association*, **20**: 741-748.

Garrow, J.S. and James, W.P.T. (1996). *Human nutrition and dietetics*. WHO, Geneva, 521-533 pp.

Gopalan, C. and Kaur, H. (1993). Towards better nutrition, problems and policies. Nutrition Foundations of India: 131-135.

Goyal, Ramesh K., Shah, Vitthaldas N., Saboo, Banshi, D., Phatak, Sanjiv R., Shah, Navneet N, Gohel, Mukesh C., Raval, Prashad B. and Patel, Snehal S. (2010). Prevalence of overweight and obesity in Indian adolescent school going children: its relationship with socioeconomic status and associated life style factors. *J. Association Physicians India*, **58** : 151-158.

Hassapidou, M., Konstantina, P., Athanasiadou, N., Tokmakidou, V., Ioannis, P., George, V. and Fotini, T. (2011). Changes in body weight, body composition and cardiovascular risk factors after long-term nutritional intervention in patients with severe mental illness: an observational study. *Bio Med. Center Psychiatry*, **11**: 31.

ICMR (2010). Nutrient requirement and recommended dietary allowances for Indians. A report of expert group of the Indian Council of Medical Research, NIN, Hyderabad (A.P.) INDIA.

Jelliffe, D.B. (1966). The assessment of nutritional status of the community. WHO Monograph series. No.53 WHO Geneva pp.13-18.

Kaur, Supreet, Sachdev, H.P.S., Dwivedi, S.N., Lakshmy, R. and Kapil, Umesh (2008). Prevalence of overweight and obesity amongst school children in Delhi, India. *Asia Pac. J. Clin. Nutr.*, **17** (4): 592-596.

Khanna, K., Gupta, S., Passi, S.J., Seth, R. and Mahna, R. (2003). *Text book of nutrition and dietetics*. Phoenix Publishing House Pvt. Ltd., New Delhi.187.

Kumar, Mohan, N., Aslam, N., Rangbulla, A., Kumbkarni, S., Sood, N.K. and Wander, G.S. (2004). Prevalence of sustained hypertension and obesity in urban and rural school going children in Ludhiana. *Indian Heart J.*, **56** (4) : 310-314.

Marwaha, Raman K., Tandon, Nikhil, Singh, Yashpal, Aggarwal, Rashmi, Grewal, Khushi and Mani, Kalaivani (2006). A study of growth parameters and prevalence of overweight and obesity in school children from Delhi. *Indian Pediatric.*, **43** : 943-952.

Vijayalakshmi, P., Parimala, R. and Padmapriya, D. (2005).

Effect of naturopathic treatment in reducing weight among obese volunteers. *Indian J. Nutri. & Dietetics*, **40** : 1-8.

WHO Expert Committee Report (2000). Obesity preventing and managing the global epidemic, WHO technical report series. 894. Report of WHO consultation, Geneva: 6-7, 23, 25.

World Health Organization (2010). Obesity-preventing and managing the global endemic. WHO technical report series no 894. WHO, Geneva, Switzerland.

■WEBLIOGRAPHY

Centers for Disease Control and Prevention (2008). *cdcinfo@cdc.gov*.

James, W. and Anderson, C. : \Documents and Settings\Windows XP\Desktop\new reserch review\Long-term weight-loss maintenance a meta-analysis of US studies.htm - aff-1#aff-1, Elizabeth C KonzC:\Documents and

Settings\Windows XP\Desktop\new reserch review\Long-term weight-loss maintenance a meta-analysis of US studies.htm - aff-1#aff-1, Robert C FrederichC:\Documents and Settings\Windows XP\Desktop\new reserch review\Long-term weight-loss maintenance a meta-analysis of US studies.htm - aff-1#aff-1, and Constance L Wood. (2001). Long-term weight-loss maintenance: a meta-analysis of US studies. *American Society for Clinical Nutrition*.

National Family Health Survey-3. Mumbai: International Institute for Population Sciences. 2007. http://en.wikipedia.org/wiki/Obesity_in_India.

NIN (2010). *Dietary guidelines for Indians –A Manual*. National Institute of Nutrition, ICMR, Hyderabad. 2010.

WHO (2013). Obesity and overweight. WHO Fact Sheet. World Health Organization. Geneva, Switzerland. Available at: <http://www.who.int/mediacentre/factsheet/>

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