

SUMMARY AND CONCLUSION

Obesity is a leading preventable cause of death worldwide, with increasing prevalence in adults and children, and authorities view it as one of the most serious public health problems of the 21st century. Obesity increases the likelihood of various diseases, particularly heart disease, Type 2 diabetes, obstructive sleep apnea, certain types of cancer, and osteoarthritis. Obesity is most commonly caused by a combination of excessive food energy intake, lack of physical activity, and genetic susceptibility, although few cases are caused primarily by genes, endocrine disorders, medications or psychiatric illness. However, one can lower the risk of obesity by modifying as many as the controllable risk factors as far as possible.

Indians now report more frequently with overweight, obesity, and their consequences. India is the second most populous country in the world that comprises approximately 17 per cent of the world's population and contributes to 16 per cent of the world's deaths. Furthermore, under nutrition and overweight/obesity are both higher for women than men. This dual disease pattern in women may have an endocrine basis, but more probably has its roots in societal and cultural mores, which prevent women from leading a healthy lifestyle.

As the number of people with obesity rises, it is essential to create awareness related to the role of nutrition, counseling to prevent and treat this condition and to promote the health status. It is highlighted that diets higher in complex carbohydrates, dietary fiber and relatively low fat diets benefits obese individuals. Studies have proved that a low carbohydrate and high fiber diet help to control obesity and to bring the blood glucose level and lipid profile nearer to the desirable level.

The main treatment for obesity consists of dieting and physical exercise. Diet programs may produce weight loss over the short term, but maintaining this weight

loss is frequently difficult and often requires making exercise and a lower food energy diet as a permanent part of a person's lifestyle. Studies all over the world indicate that certain dietary components can play a significant role in weight reduction and reduce the risk of complications. Dietary modification, weight control and regular exercise are the main approaches towards the management of obesity and its risk factors. Diet being the sheet anchor the challenge currently is to identify the anti obesogenic diet supplement to control obesity.

Although obesity is the starting scene in India compared to western country, nevertheless it needs to be tackled aggressively before it assumes serious epidemic proportions. In India, because of migration and industrialization, urbanization is increasing at significant rate. There is much scope of urbanization and concentration of population in bigger cities. Globalization is also playing an important role for modernization and sedentary life. So in near future obesity would emerge as a challenging problem for India. There exists a considerable gap between the diet and lifestyle pattern in the community. Therefore, care should be taken for the future, as prevention is better than cure. The present study was thus designed with the following objectives.

- Elicit information on demographic profile, dietary pattern and lifestyle pattern of the selected obese subjects
- Assess the nutritional status of the obese subjects
- Impart knowledge through health and nutrition education campaign
- Create awareness on the need for lifestyle modification
- Dietary intervention and lifestyle modification for obese women
- Evaluate the impact of interventions through various parameters

For the present study 1000 subjects in the age group of 40- 60 years whose BMI ≥ 30 and total cholesterol level ≥ 200 mg/dl from both sexes based on their willingness and written consent to participate for the intervention study were

selected for screening. The selected subjects were given orientation regarding the conduct of the study and also briefed on the modalities and purpose of the study.

The background information pertaining to the present study including the education and occupation status of the selected subjects, income, family type along with the dietary and activity pattern followed by them and information related to the family and personal history of the subjects were collected using a pretested questionnaire specially designed for the purpose.

Among the selected 1000 obese subjects, 240 were chosen based on their age, sex, BMI, WHR, blood glucose level and lipid profile for the intervention study. The chosen subjects were divided into four groups of 60 subjects each, experimental (N-30) with corresponding control group (N-30). The first three experimental groups namely obese group (OB Group), obese subjects with diabetes (OBD Group) and obese subjects with hyperlipidemia (OBHL Group) were selected for dietary intervention with their corresponding control groups. The fourth experimental group namely OBY (N-30) group was selected for dietary and lifestyle intervention which has its own similar control group. The control group did not receive any type of intervention during the study period of 120 days. Ethical clearance was obtained from the Human Ethical Committee of Avinashilingam University (HEC.2011.29) to conduct the present study.

Supplements were tried out using whole wheat, green gram, wheat bran and oat bran in the ratio of 3:3:2:2. The selected foods were cleaned, dried, roasted and powdered. The subjects in the experimental groups were supplemented with 100g of the breakfast mix, the mix was neatly packed in air tight packets of 100g each and distributed in person. The subjects were instructed that the contents of each packet to be cooked daily and consumed for their breakfast in the form of roti/chappathi/adai / dosa with no or less oil as per their desire.

The fasting blood glucose levels, post prandial blood glucose levels, glycosylated haemoglobin levels and total lipid profile were recorded for the experimental and control groups before and after the intervention of 120 days.

The salient findings arising out of the research study are summarized as follows:

- ④ Among the 1000 obese subjects surveyed 429 were male and 571 were female. The present study data revealed that the onset of obesity was high after the age of 40 years in both the sexes.
- ④ Educational status revealed that majority of male and female subjects were educated up to the higher secondary level i.e., 30.1 per cent and 37.7 per cent respectively. Among the selected obese subjects it was observed that 1.2 per cent of male were educated only up to primary school level. The percentage of higher education was more in female when compared to male.
- ④ With regard to the occupational status, majority of male were either doing business or were placed in the Government jobs. Equal proportion of the females was observed to be housewives and also Government employees.
- ④ In the present study the data gathered from 1000 subjects revealed that majority belonged to nuclear family system. On an average 74 per cent were in the nuclear family and 26 per cent were in the joint family system.
- ④ Among the selected subjects 59.6 per cent of them were in the high income group 28.2 per cent were in the middle income and only 12.2 per cent of them were in the low income group.
- ④ With regard to the flesh food intake, percentage of subjects consuming non vegetarian items were higher when compared to vegetarian and ova vegetarians. People are interested to consume non-vegetarian foods than vegetarian items.
- ④ The type of meals consumed by the selected obese subjects revealed that 54.8 per cent of male subjects consume 3 meals a day with healthy snacks, whereas 46.1 per cent of female subjects followed 3 meal pattern without snacks. On an average 37.7 per cent of the selected obese subjects took 3 meals a day without snacks.

- ④ With regard to the consumption of dairy products majority consumed low and medium and high fat foods such as cheese and paneer were consumed occasionally when they have family get together, business meeting or family functions.
- ④ With regard to the quantity of fats and oils consumed, most of the subjects used less than 25 ml per day, whereas only minimum per cent of subjects used more than 25 ml per day.
- ④ A total of 67 per cent of male subjects knew about the importance of dietary fiber in human nutrition. With regard to the female group, 74 per cent of the subjects had some knowledge about dietary fiber. Around 26.4 per cent of female were not aware of dietary fiber.
- ④ The activity pattern revealed that 43.8 per cent were doing moderate activity, 37.8 per cent were doing sedentary activity and 18.4 per cent were doing heavy work.
- ④ The data regarding the physical activity pattern revealed that 50.8 per cent of the selected obese subjects were health conscious and strictly adopted exercise for more than half an hour a day as they are more health conscious and had an urge to reduce weight and wanted to be free from other complications, but only 39.8 per cent of the selected subjects were following regular exercise for less than half an hour daily, the reasons were due to lack of time and they were not able to adopt heavy physical activities but they are satisfied with light intensity exercise pattern.
- ④ Though alcohol consumption was not good for health majority (68.43 per cent) of male had the habit of consuming alcohol. With regard to the frequency of consumption, in the order of 6.8 per cent and 33.33 per cent were consuming alcohol daily and twice a week respectively. Around 44 per cent consume alcohol once a week and 15.99 per cent were consuming alcohol occasionally. It was happy to note that none of them consume more than 250 ml of alcohol daily.

- ④ Smoking beedi was common among the low income group. Occasionally cigarette was smoked by 6.98 per cent of the subjects only when they have get- together with friends or during stress.
- ④ Tea and coffee were consumed by majority of the subjects once daily. With regard to health drink consumption 36.8 per cent of male and 25.1 per cent of female consume other health drinks daily.
- ④ The data gathered for the present study reveals that obesity is long lasting and age was one of the attributing factors for the onset of obesity.
- ④ The personal history of the subjects includes various health problems such as asthma, angina, blood pressure, high cholesterol, epilepsy, arthritis, thyroidism, diabetes, etc in addition to obesity. Diabetes said to be the major health problem among obese individuals was observed among 22.4 per cent of male and 19.4 per cent of female. From the data gathered it was observed that high blood cholesterol was more prevalent among the selected subjects.
- ④ Among the various types of treatment for obesity and its health risks, 59.7 per cent of male and 56.2 per cent of females preferred allopathic treatment for maintaining their body weight. It was surprised to note that none of them followed unani and naturopathy.
- ④ Fifteen per cent of male and 17.2 per cent of female suffered from backache and 15.6 per cent of male and 23.1 per cent of female suffered from shortness of breath respectively.
- ④ From familial tendency of the subjects it was concluded that heredity is playing a vital role for the precipitation of obesity in the younger generation.
- ④ The selected supplement for dietary intervention contains 6.71 g of sugars and 19.53 g of dietary fiber and 3.24 per cent of fat per 100g. The anitnutritional factos such as Zinc, Tin, Lead, mecury arsenic and phenols are present in meagre amount within the acceptable range.

- ④ The results of the mean height for the selected 1000 subjects revealed that 18.2 per cent of male and 15.6 per cent of female had their height measurements in comparison with the NCHS standards and majority were below the standard level.
- ④ With regard to the weight measurements all the 1000 selected subjects were obese had their weight above the normal level recommended by ICMR 2012.
- ④ Around 55.5 per cent and 55.9 per cent of male and female subjects respectively were under the mild obese class I category and only 1.9 per cent of male and female respectively were in the pre obese category which is considered as “At risk of obesity’. A worrying scenario in the study happened to be the fact that 2.6 per cent of male and 3.3 per cent of female respectively were in the obese class II group whose BMI is ≥ 40 .
- ④ In the present study, the WHR for all the 1000 subjects were computed which revealed that only 1.6 per cent of male were normal and 98.4 per cent were obese with $WHR \geq 0.95$, In the case of female only 0.88 per cent were normal and 99.12 per cent of women were in the obese grade with $WHR \geq 0.85$.
- ④ Regarding the mean lipid profile namely total cholesterol, low density lipoprotein cholesterol, very low density lipoprotein cholesterol and triglycerides of the selected female obese subjects were comparatively higher than the desirable level and high density lipoprotein cholesterol level was lower than the standard values.
- ④ Subjects who received both the dietary and lifestyle interventions recorded the best result especially in lowering the body weight in which the OBY group with yoga practice stood first with a reduction of 3.9 kg when compared to other groups. The next in the order is the OBHL group with a reduction of 3.7 kg and a similar trend was observed in the OB and OBD group with a reduction of 3.3 kg.

- ④ The present study revealed that the high fibre mix supplemented to different experimental groups namely OB, OBD, OBHL and OBY (yoga and relaxation therapy), OBY group recorded the best result in lowering their BMI grades.
- ④ With regard to the WHR recorded for female subjects, WHR values were reduced in the case of three dietary intervention groups. Thus the supplementation of high fiber breakfast mix helps to reduce adiposity significantly.
- ④ With regard to the food intake of the selected subjects in the experimental group it was recorded that intake of cereals was deficit by 7.4 per cent, for roots and tubers 62.5 per cent deficit was noticed, 50 per cent and 10 per cent deficit respectively recorded for other vegetables and milk and milk products before the intervention. After the intervention period the actual intake of food was recorded as 11.1 per cent deficit for cereals, 60 per cent deficit for roots and tubers, 20 per cent deficit for green leafy vegetables, other vegetables by 37.5 per cent, fruits by 35 per cent, and milk and milk products by 25 per cent deficit.
- ④ Daily food intake of the control group before the intervention revealed that the intake of cereals, green leafy vegetables roots and tubers, other vegetables, and milk and milk products were deficit by 14.8 per cent, 70 per cent, 25 per cent 45 per cent and 3.3 per cent respectively, whereas the intake of fruits, and sugar and jaggery was excess by 60 per cent and 50 per cent respectively. The intake of fats and oils was similar to that of the experimental group. The selected subjects consume pulses as recommended by RDA. After the intervention period the intake of all the food groups were deficit except pulses, fats and oils and sugar and jaggery which was excess by 3.3 per cent, 60 per cent and 25 per cent respectively.
- ④ Mean nutrient intake of the female subjects in the experimental group revealed that all the nutrients recorded were excess except iron, beta carotene and fiber which was deficit by 28.6 per cent, 23.9 per cent and 55 per cent respectively before the intervention. The nutrient intake after the

intervention period showed that the consumption of energy, calcium, iron, beta carotene and fiber were deficit by 0.5 per cent, 15 per cent, 19 per cent, 17.7 per cent and 5 per cent respectively. And all the other nutrients were in excess, except riboflavin which is on par with RDA.

- ④ Nutrient intake of the female subjects in the control group showed that all the nutrients calculated were excess except, calcium, iron, beta carotene and fiber by 16.2 per cent, 23.8 per cent, 8.9 per cent and 50 per cent respectively at the start of the intervention. After the intervention period the nutrient intake of protein was deficit by 1.8 per cent, calcium by 1.7 per cent, iron by 9.5 per cent, beta carotene by 25.8 per cent and fiber by 45 per cent.
- ④ Supplementation with high fiber breakfast mix for the OB group showed a significant reduction in the fasting, post prandial blood glucose level and glycosylated haemoglobin level when compared to the control group. However when both the experimental and control group were compared it showed one per cent ($P < 0.01$) level of significance statistically between the groups.
- ④ With regard to the lipid profile of the OB group, after intervention there was a significant reduction in total cholesterol, LDL- cholesterol, triglycerides, VLDL- cholesterol and TC / HDL ratio, whereas the HDL increased significantly after intervention by 1.6 mg/dl.
- ④ Results of the OBD group reveals that supplementation with high fiber breakfast mix a reduction of 14.1 mg/dl, 15.3 mg/dl and 1.3 per cent was recorded respectively for fasting, post prandial blood glucose level and glycosylated haemoglobin levels respectively which was significant at one per cent level. The non supplemented group did not reveal significant difference.
- ④ The results of the mean lipid profile of the OBD group showed a marked reduction in total cholesterol and LDL cholesterol with 36.6 mg/dl and 34.1 mg/dl respectively. The triglycerides, and VLDL level also reduced. However the HDL-cholesterol level had mildly increased after intervention.

- ④ Supplementation with high fiber breakfast mix for the obese hyperlipidemic subjects brought about a striking difference in the fasting and post prandial blood glucose with a mean difference of 10.4 mg/dl and 12.7 mg/dl respectively and glycosylated haemoglobin level with a mean difference of 0.5 percent. They were significant at one per cent level. A one per cent level of significance was observed for the reductions of all the lipid fractions. There was a notable increase in the HDL cholesterol level with a mean difference of 4.5 mg/dl before and after the intervention.

- ④ The lifestyle modification of yoga and exercise along with dietary intervention helps to decrease the fasting, post prandial blood glucose and glycosylated haemoglobin levels and also there found to be significant reduction in total cholesterol, triglycerides, LDL-cholesterol and VLDL-cholesterol at one per cent level and recordable improvement was observed in HDL – cholesterol level by 2.5 mg/dl.

- ④ When the correlation coefficient was compared for all the groups OBY group showed a positive correlation between the body weight and blood glucose such as fasting, post prandial glucose and glycosylated haemoglobin and HDL cholesterol levels and OBD group showed a positive relationship between the body weight and total cholesterol level.

- ④ The mean differences of all the intervention groups were compared and the results revealed that the difference in blood glucose level and total lipid profile levels were highly significant.

CONCLUSION

The prevalence of obesity is increasing rapidly in most urbanized and industrialized countries like India. Obesity has a great number of negative health, social and economic consequences. Mortality and morbidity rates are higher among overweight and obese individuals than lean people. Increased BMI is linked with a greater risk of CHD, hypertension, hyperlipidemia, NIDDM and certain cancers. The most important reason is the economic and cultural differences between the countries and individual in particular.

Therefore management of obesity through developing novel approaches, assessing current interventions and proposing measures needed to transform the "obesogenic" environment are the needs for urgent attention in India and throughout the world. In this context, diet incorporated with underexploited bran and exercise plays a vital role in the management of the lifestyle disorders. Diet is the most crucial part in the individual's life as it is emphasized on exceptionally high fiber foods such as bran along with lifestyle modifications.

From the present study it was concluded that supplementation of high fiber breakfast mix is highly helpful to control and manage blood sugar level among obese, obese diabetic and obese hyperlipidemic subjects. Wheat bran and oat bran can be considered as functional foods because of its hypoglycemic and hypolipidemic effect. The supplementation given is low cost, locally available and can be incorporated in acceptable form which was highly effective in the management of weight reduction, diabetes mellitus and hypercholesterolemia without any side effects.

RECOMMENDATION

The findings of the study recommend the following thrust areas:

- ④ Create awareness among the public regarding nutritional significance of fiber rich foods which are available at our door steps.
- ④ More research works can be carried out to find out the acceptability, digestibility coefficient of cereal fibers incorporated recipes for regular consumption.
- ④ Elaborate studies are needed to analyse the nutritional essentials of fiber that are necessary for the prevention of non communicable diseases.
- ④ Educate the public about lifestyle modification and adopt appropriate exercise with healthy food habits for physical fitness.
- ④ Create awareness to the public on the importance of high fiber foods available in our door steps which help in better management of obesity and avoid further complications.