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Full Length Research Paper

Effect of Nutrition Education on Anthropometric and Blood Glucose Levels of Niddm in Guntur City

Jalaja Kumari. D

E-mail: jalaja9krishna@yahoo.com, **Phone no:** 9849178420

Faculty, Department of Foods & Nutritional sciences, Acharya Nagarjuna University (A.N.U), Guntur.

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Sixty Non Insulin Dependent Diabetic subjects in the age group of 40-60 years were selected from hospital of Sri hari Krishna diabetic care centre, Guntur and were surveyed for their nutrient adequacy using "24 hour recall method" for three consecutive days. Nutrition education was imparted to the subjects after assessing their basic knowledge regarding the diet and disease. Nutrition Counselling improved their mean score of diabetic knowledge significantly (P<0.01). The height, weight, body mass index and waist to hip ratio of the subjects were measured before and after nutritional education. A significant decrease in weight (66.45 to 61.20 kg), body mass index (27 to 26.2 kg/m2) and waist to hip ratio (0.89 to 0.85) and fasting blood concentrations of glucose (FBS), HbA1c, total cholesterol, and triglyceride. However, no such improvements were observed in control group. was observed. Significant decrease in the consumption of cereals, milk and milk products, fats and oils, sugar and jaggery whereas increase in the consumption of pulses, green leafy vegetables, root vegetables was found among diabetics after nutrition counseling. The percentage of calories from carbohydrates 59 to 61%, protein 13 to 16% increased and from fat it was decreased to 27 to 22% in the subjects after nutrition counseling. The intake of fiber (39 to 44%) increased while of vitamins and minerals except iron, zinc and niacin were adequate in the subjects after nutrition counseling as compared to ICMR's recommendations. Therefore it can be concluded that nutrition counselling is an important measure for improving the knowledge and bringing about favourable and significant changes in anthropometry of diabetics.

Keywords: NIDDM, Prevalence, Nutrition Counseling and Over weight.

INTRODUCTION

Diabetes is fast becoming a leading cause of morbidity, mortality and disability across the world. The incidence of diabetes mellitus is increasing day by day affecting 150 million people across the world. Out of which 33 million are Indians and India has been declared as the Diabetic Capital of world [1].

This disease leads to vascular complications those results in considerable morbidity and premature mortality [2]. As much as 1.5-2% of the total population and 7.8% of people up to 40 years of age have diabetes [3]. With good glycemic control, several long-term, life-threatening complications of diabetes can be prevented [4],[5].

Increasing incidence is mainly due to modern life style and changed diets with balance titled towards refined foods especially sugar and fat. Both these factors have led to substantial increase in the prevalence of obesity. In people with strong genetic factor, environmental factors such as excessive intake of food, obesity, lack of exercise and infection act as precipitating factor. In other words, heredity loads the gun and environmental factors trigger finally resulting in diabetes [6]. Diet therapy is the cornerstone of treatment in diabetes, especially for type 2 diabetic patients [7].

Patient education including nutrition education is now accepted as an essential component of diabetic management. Numerous studies with DM patients have shown the association of nutrition education with improving dietary behavior [8], nutritional knowledge and improving clinical outcomes. Even though western studies have clearly indicated the beneficial aspects of

intensive diabetic education, the studies in India are scanty. Taking into consideration the beneficial effects of education in preventing diabetes, the present study has been planned.

METHODOLOGY

Selection of samples

To recruit the subjects, an announcement on diabetic nutrition class was made at a DM clinic center in SRI HARI KRISHNA DIABETIC CARE CENTRE, GUNTUR. The program was open to all type 2 DM patients who had gone through the baseline tests including Food frequency questionnaire at the clinic, and 60 DM patients in the age group of 40-60 years were voluntarily participated in the program. The background information, lifestyle and dietary pattern were recorded using the interview schedule for all the 60 selected diabetics. Anthropometric indices namely Body Mass Index (BMI) and Waist – Hip Ratio (WHR) and biochemical parameters namely fasting, post prandial blood glucose by GOD-PAP method and Glycosylated Haemoglobin by chromatographic spectrometric ion exchange method were determined for all the subjects.

Estimation of total cholesterol, High Density Lipoprotein (HDL) cholesterol and triglycerides were estimated by using enzymatic method [9]. LDL-cholesterol was calculated [10]. Very Low Density Lipoprotein (VLDL) cholesterol values were calculated using the following formula.

LDL-cholesterol = Total cholesterol − HDL cholesterol − (Triglyceride/5)

$$\text{VLDL cholesterol} = \frac{\text{Triglycerides}}{5}$$

Where 5 is a constant factor.

General characteristics and dietary behaviors and nutrient intakes

An interview using a questionnaire was performed to get general characteristics and health behavior data. Dietary behavior and food exchange knowledge were assessed by the questionnaire developed for this study. Food intake was recorded by “24 hour recall method” for three consecutive days and average daily intake of nutrients was calculated using standard food composition tables [10]. The dietary behavior questionnaire was developed based on questionnaire [11], Nutrient intakes were measured by trained nutrition graduate students using 114-item FFQ.

To calculate their blood glucose, lipid profile, food intake and nutrient, selected subjects were divided in to two categories according to their grades of obesity i.e. overweight and normal weight subjects.

Contents and procedure of nutrition education

Diet planning

- Energy requirement was prescribed by physicians for each subject based on the subject’s height, weight, and activity level according to the guidelines of ICMR (RDA).
- Energy distribution was set in accordance with Korean Dietetic Association recommendation (protein 15-20%, fat 20-25%, carbohydrate 55-60%).
- Individualized diet planning using food exchange system was given considering food preference and dietary behavior shown in the results of FFQ and dietary behavior questionnaire. Also, diabetic complications were taken into account, if any.

Curriculum of nutrition education

The curriculum of nutrition education was structured to provide an understanding of meal planning and dietary recommendation (Fig. 1). The purpose of this program was to encourage and support self-management leading to long-term adherence to diet recommendation. Food model was used to help subjects understand the food exchange system.

Procedures of nutrition education

The nutrition education program consisted of one session for 1 to 2 hours long according to individualized diet prescription and was performed in a small group of 4~5 patients. The control group subjects were given written results of the FFQ after baseline examination and had no further contact for following 3 months.

Statistical analysis

Statistical analyses were conducted using SPSS program (version 12.0). All data were expressed as mean and standard error (continuous variables) or number and percentage (categorical variables).

RESULTS AND DISCUSSION

Background information

out of 24 males and 36 females, 43 had normal weight (67.6 kg NCHS standards) and 17 were found to be over weight 38 were involved in sedentary activity, 16 in moderate activity and only six of them were involved in heavy activity .

The duration of diabetes among the subjects ranged from 1 to 13 years, Forty one subjects showed familial incidence of diabetes. Polyurea, hyperglycemia, infection, poor wound healing and tiredness were the predominant symptoms expressed by 37 subjects.

Table 1: Mean Anthropometric indices of the Diabetics Before and after the nutrition education

Anthropometric index	Over Weight group (OW)				Normal Weight group (NW)				't' value (OW vs NW)
	Before NE	After NE	Mean difference	't' value	Before NE	After NE	Mean difference	't' value	
BMI	27.0±4.92	26.2±4.95	-0.74±0.4	9.174**	22.4±3.8	22.9±4.33	0.54±1.99	1.478NS	2.93**
WHR	0.89±0.07	0.85±0.08	-0.04±0.03	6.610**	0.85±0.07	0.86±0.07	0.01±0.02	0.821NS	6.32**

** Significant at one per cent level NS: Not Significant OW: Over Weight group NW: Normal Weight group

Table 2: Mean Blood Glucose and Glycosylated Haemoglobin levels of the Diabetics Before and after the nutrition education

Lipid profile	Desirable levels (mg/dl)	Over Weight group (OW)			Normal Weight group (NW)			't' value (OW vs NW)
		Before NE	After NE	't' value	Before NE	After NE	't' value	
Fasting (mg/dl)	80 – 115	166.4±22.8	152.4±23.6	13.74**	149.7±12.3	127.8±14.5	1.603**	9.75**
Post prandial (mg/dl)	120- 180	242.7±11.6	212.4±10.8	7.68**	228.7±15.9	183.7±13.4	7.57**	14.01**
Glycosylated Hb (%)	< 8	10.42±0.71	9.31±0.82	1.682**	10.28±0.87	8.63±1.07	14.88**	13.34**

NE: Nutrition Education ** Significant at one per cent level

Twelve subjects were betal leaves chewers, 18 were smokers and 13 were taking alcohol for a period of 1-10 years.

With regard to exercise pattern 38 of the subjects were in the practice of doing exercise regularly mainly in the form of walking. (light intensity exercise), 16 were doing moderate intensity exercise and heavy intensity exercise was done by only six subjects.

Anthropometric indices

Table 1 shows the anthropometric indices of the selected subjects.

The data clearly indicates that the BMI of the diabetic subjects before nutrition education was 27 which were reduced to 26.26 after nutrition education with a statistical significance at one per cent level. The mean BMI of the normal weight group was 22.41 initially and it was increased to 22.95 (with a mean difference of 0.54) at the end of the study period with no statistical significance.

The mean initial WHR was 0.89 and it decreased to 0.85 after treatment in the over weight group with a mean difference of 0.04. The difference between these two values was found to be statistically significant at one per cent level. The WHR of the normal weight group was 0.85 before the study and it slightly increased to 0.86 after the study period with a mean difference of 0.01. This difference was not found to be statistically significant. The difference in the anthropometric measurements between the over weight and normal weight group were found to be significant at one per cent level.

Biochemical changes

Table 2 presents the mean fasting and post prandial blood glucose and glycosylated hemoglobin levels of the subjects before and after nutrition education.

The mean initial fasting blood glucose levels of 166.4 and 169.7 mg/dl decreased significantly ($p<0.01$) to 152.4 and 167.8 mg/dl in diabetic over weight (OW) and diabetic normal weight (NW) subjects respectively at the end of the nutrition education. The mean fasting glucose levels were higher initially and also after the nutrition education in two groups, when compared to the normal range (80-115 mg/dl).

The mean Post Prandial Blood Glucose level (PPBS) was 242.7 and 238.7 mg/dl before the nutrition classes and the levels decreased to 212.4 and 193.7 mg/dl in OW and NW group diabetics respectively after the study. The PPBS glucose levels were non-significantly different among the two groups before the nutrition education classes while, after two months of nutrition education

Table 3: Mean serum lipid profile of the diabetic subjects before and after nutrition education.

Lipid profile	Desirable levels (mg/dl)	Over Weight group (OW)			Normal Weight group (NW)			't' value (OW vs NW)
		Before NE	After NE	't' value	Before NE	After NE	't' value	
Total Cholesterol	150-200	218±7.08	196±5.88	5.96**	211.9±6.42	194.8±5.34	4.58**	5.02**
HDL Cholesterol	30-60	44.3±11.7	45.5±12.6	0.42NS	47.20±12.9	49.1±12.23	3.31**	5.95**
LDL Cholesterol	66-178	176.4±43.9	167.3±43.1	4.509**	126.9±7.66	126.9±7.16	5.51**	4.10**
VLDL Cholesterol	6-30	36.57±10.7	35.0±10.92	9.633**	36.61±8.21	36.33±7.86	0.93NS	4.42**
Triglycerides	30-170	185.9±4.57	167.8±5.43	3.97**	175.5±5.73	175.5±5.22	9.94**	5.64**

NE: Nutrition Education ** Significant at one per cent level NS: Not Significant

classes the values were significantly ($p<0.01$) different among the OW and NW diabetic subjects.

The mean difference in glycosylated hemoglobin levels of the over weight and normal weight diabetic subjects were 1.11 and 1.65 per cent respectively were found to be statistically significant ($p<0.01$). Several recent randomized controlled trials have been successful in decreasing the rate of progression from glucose intolerance to type 2 diabetes through the provision of nutrition training in diverse communities [7],[9],[13]. An uncontrolled nutrition intervention conducted in EIG Uarco, Costa Rica, showed promising results, achieving a reduction in fasting blood glucose, glycosylated hemoglobin and triglyceride levels [11]. Results from other studies have begun to provide evidence that community-based nutrition and exercise interventions can significantly reduce risk factors for diabetic complications. [12],[13],[14] The levels of improvement found in these studies are similar to those found in our study. Studies in Finland, [1121] New Zealand [18] and the US [13] provide evidence that changes in lifestyle, including dietary intake, can be effective in preventing diabetes. A randomized controlled study of type 2 diabetic subjects was carried out in the Mexican-American population in Texas, [12] in which a 1.5% reduction in mean glycosylated hemoglobin levels of the intervention group was demonstrated at the 6-month measurement point compared with the control group.

Lipid profile:

Table 3 depicts various lipid levels of the subjects before and after nutrition education classes. The mean initial levers of serum total cholesterol before the sessions were 218 ± 7.08 and 211.9 ± 6.42 mg/dl in OW and NW diabetic groups respectively. It was observed that the mean values of serum total cholesterol were on higher side in three groups than the desirable values (<200 mg/dl) during the study period [19].

The mean initial and final serum HDL-C values were 44.37± 11.75, 47.20±12.9 in OW and 45.57± 12.68, 49.1± 12.23mg/dl in NW before and after nutrition education classes respectively. It was observed that there was a non-significant increase in two groups. Further, the levels of HDL-C were with in the normal range of 30-60mg/dl.

The mean difference of LDL-Cholesterol and VLDL-Cholesterol were found to be 9.13 and 1.54 mg/dl respectively. The mean triglyceride levels were 185.9±4.57 and 182.97±5.73mg/dl in OW and NW diabetic groups respectively, which were reduced to 167.8±5.43 and 175.5±5.22mg/dl after nutrition education sessions and the difference, was found to be significant.

The mean daily intake of energy, carbohydrates, fat, protein and fibre, thiamine, riboflavin, niacin, ascorbic acid, calcium, phosphorus, iron, magnesium and zinc before and after nutrition counseling is given in Table 4. The average energy intake by overweight and normal weight subject was 1796 and 1687 Kcal respectively before nutrition counseling. The high energy value of diets of overweight as compared to normal weight subject was mainly due to high intake of fats and oils, sugar and jaggery, milk and milk products. The intake of carbohydrates, fats and fibre was found to be adequate when comparable with that of other study. [18] The intake of protein was adequate in overweight subjects as compared to normal weight subjects when compared with suggested values. [16] The percentage of calories from carbohydrates 59 to 61 percent, protein 13 to 16 percent increased that of fat decreased 27 to 22 in subjects after nutrition counseling. Percentages of energy from carbohydrates, protein and fat [19],[20] found in these studies are similar to those found in our study for the diabetics (Table 4).

The average daily intake of thiamine, riboflavin and niacin was decreased whereas intake of ascorbic acid was increased in both overweight and normal weight subjects after nutrition counseling. The increase in ascorbic acid was mainly due to increase in the consumption of fruits and vegetables by the subjects. The mean intake of calcium, phosphorus and zinc decreased

Table 4: Mean intake of nutrients by the Diabetic subjects before and after nutrition education

Nutrients	RDA *	Over Weight (OW)			Normal Weight (NW)			"t" Value OW vs. NW
		Before NE	After NE	"t" value	Before NE	After NE	"t" value	
Energy(K.Cal)	1360	1796±263	1474±201	2.91***	1687±188	1405±154	7.18***	7.14***
Carbohydrates (g)	212.5	260±46.15	220±31.3	1.96**	255±38.2	219±30.6	4.76***	4.91***
Total fat (g)	30.2	58.25±6.9	38.6±5.0	8.22***	49.20±7.1	33.87±5.3	10.54***	12.58***
Saturated fat (g)	NA	33.90±6.4	24.4±3.7	5.68***	27.15±5.4	20.17±3.6	6.52***	7.63***
Unsaturated fat (g)	NA	24.61±2.3	14.1±2.3	2.25**	22.05±3.4	13.69±3.0	11.11***	5.08***
Protein (g)	59.5	57.85±13.9	62.0±16.8	0.86NS	56.15±9.9	56.74±9.6	0.26NS	0.82NS
Dietary fiber(g)	34	38.47±5.6	45±5.4	2.81**	40.28±1.7	43.64±1.8	1.24**	2.24**
Thiamine (mg)	1.2	1.48±0.29	1.42±0.21	0.64NS	1.6±0.28	1.49±0.20	1.81*	1.81*
Riboflavin (mg)	1.4	1.33±0.28	1.31±0.26	0.27NS	1.29±0.20	1.27±0.13	0.32 NS	0.16NS
Niacin (mg)	16.0	14.28±2.8	13.1±0.22	1.34NS	12.46±2.4	11.0±0.18	2.90 ***	2.87***
Ascorbic acid(mg)	40.0	57.14±25.2	75.8±24.7	2.96***	42.33±20.0	103±42.1	8.02 ***	8.09***
Calcium	400	810±218	764±135	0.11NS	729±185	-------	--------	------
Phosphorous	400	1331±270	1308±225	0.22 NS	1412±186.0	1342±175	1.65 NS	1.30 NS
Iron	28	18.80±7.9	21.04±4.3	1.11 NS	16.58±4.7	18.84±3.0	2.45 **	2.40**
Magnesium	350	371±91.1	373±58.5	0.44 NS	436±87.5	371±56	3.76 ***	2.61***
Zinc	15.5	7.38±1.4	7.04±1.3	0.73 NS	6.71±1.37	6.38±1.07	1.18 NS	1.34 NS

whereas increase in the intake of iron and magnesium was observed in overweight and normal weight subjects.

In the present investigation food and nutrients intake values are compared with the other study [16] and not with values given by ICMR because ICMR values are for normal persons. The suggested energy intake of the subjects was calculated on the basis of their body weight i.e. 20 Kcal per kg of body weight for obese person and 30 Kcal per kg of body weight for normal person. Majority of the subjects were overweight. The average weight of all the subjects was 68 kg and was multiplied with 20 Kcal and their energy requirement is calculated as 1360. Out of this total energy requirement, 60-65% i.e. 62.5% should be derived from carbohydrates and 15-20% i.e. 17.5% from protein and 15-25% i.e. 20% from fats. The data for suggested values for vitamins and minerals for diabetic patient is not available and these values were compared with the values given by ICMR [21].

After nutrition education, reduction in intake of cereals, milk and milk products, fats andoils, sugar and jaggery was found in overweight as well as normal weight subjects. Similar findings reported decrease in cereals, pulses, fats and oils in obese diabetic patients after diet counseling for 6 weeks [22].

Decrease in the consumption of thiamine and niacin was mainly due to decrease in the consumption of cereals after nutrition education. Intake of riboflavin was less than RDA because of less consumption of green leafy vegetables. Riboflavin consumption could be improved by substituting mustard/rape leaves with other green leaves such as spinach, amaranths, raddish, carrot or fenugreek which are good source of riboflavin. The intake of calcium and phosphorus was more than the RDA (400 mg/day) given by ICMR, before and after nutrition education because of the consumption of more amount of milk by the subjects.

The mean iron intake increased in both the groups after nutrition counseling. As compared to ICMR [21] recommendations of 28 mg for sedentary man, the intake of both the groups was inadequate initially and increased after nutrition counseling but less than RDA. In accordance with the present findings [23] showed significant difference in knowledge gain in counseled and uncounseled diabetics after 6 weeks of diet counseling. Intensive diabetic education through 20 minutes teaching session everyday for 10 days about diabetes, its

importance and weight reducing diets, controlled diabetes in all 100 NIDDM patients [24]. The gain and retention of knowledge related to nutrition are significantly related to age, level of education and exposure to mass media [25]. Adequate basic information on diabetes enables the diabetic to comprehend and improve their psychological acceptance of disease [19].

CONCLUSION

In conclusion, the past decades have witnessed a rapid rise in the prevalence of diabetes, especially in the urban areas. The fact that there is a shift in age of onset to younger age groups is alarming as this could have adverse effects on the nation's economy. Hence, the early identification of at risk individuals and appropriate intervention in the form of weight reduction, changes in dietary habits and increased physical activity could greatly help to prevent, or at least delay the onset of diabetes and thus reduce the burden due to non communicable diseases in India. Nutrition education related to diet improved diabetic state and reduced the risk of secondary complication in the NIDDM patients. In particular, BMI and glycemic levels decreased. The decreased glycosylated hemoglobin should translate into a reduced risk of micro vascular complications. Thus, nutrition counseling is an effective measure to bring about favorable and significant changes in diabetic state.

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