Effect Of Nutrition Education On Anthropometric And Blood Glucose Levels Of Niddm In Guntur City

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ARTICLE INFORMATION

ABSTRACT

Diabetic subjects in the age group of 40-60 years were selected from hospital of SHKDC, 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 Counseling improved their mean score of diabetic knowledge significantly (P<0.01). 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. Thus, nutritional counseling is an effective measure to bring about the favorable and significant change in diabetic state

Keywords
NIDDM
Prevalence
Nutrition Counseling
Over weight

1. 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 (Bezbaruah S, 2003).

This disease leads to vascular complications those results in considerable morbidity and premature mortality (Stamler et al., 1993). As much as 1.5-2% of the total population and 7.8% of people up to 40 years of age have diabetes (Amini et al., 1997). With good glycemic control, several long-term, life-threatening complications of diabetes can be prevented (A.D.A, 1997; Kathleen Mahan, 2000).

Increasing incidence is mainly due to modern lifestyle and changed diets with balance tilted 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 (Ramachandran, 1993). Diet therapy is the cornerstone of treatment in diabetes, especially for type 2 diabetic patients (Lindstorm, 2003).
Most of the people though educated are quite ignorant about the impact of diet on diabetes. 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.

2. Materials and Methods

2.1 Selection of samples

Sixty Non Insulin Dependent Diabetic subjects in the age group of 40-60 years were selected from SHKDCC Guntur hospital. 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 (Friedwald, 1972). Low Density Lipoprotein (LDL) cholesterol and Very Low Density Lipoprotein (VLDL) cholesterol values were calculated using the following formula.

\[
\text{VLDL cholesterol} = \frac{\text{Triglycerides}}{5}
\]

Where 5 is a constant factor.

\[
\text{LDL} = \text{Total cholesterol} - \text{HDL cholesterol} + \text{VLDL cholesterol}
\]

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.

3. Results and Discussion

3.1 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. 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.

3.2 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.

3.3 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.

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

<table>
<thead>
<tr>
<th>Anthropometric index</th>
<th>Over Weight group (OW)</th>
<th>Normal Weight group (NW)</th>
<th>'t' value (OW vs NW)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before NE</td>
<td>After NE</td>
<td>Mean difference</td>
</tr>
<tr>
<td>BMI</td>
<td>27.0±4.92</td>
<td>26.2±4.95</td>
<td>-0.74±0.4</td>
</tr>
<tr>
<td>WHR</td>
<td>0.89±0.07</td>
<td>0.85±0.08</td>
<td>-0.04±0.03</td>
</tr>
</tbody>
</table>

* 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

<table>
<thead>
<tr>
<th>Lipid profile</th>
<th>Desirable levels (mg/dl)</th>
<th>Over Weight group (OW)</th>
<th>Normal Weight group (NW)</th>
<th>'t' value (OW vs NW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting (mg/dl)</td>
<td>80 – 115</td>
<td>116.4 ±22.8</td>
<td>152.4 ±23.6</td>
<td>13.74</td>
</tr>
<tr>
<td>Post prandial (mg/dl)</td>
<td>120 - 180</td>
<td>242.7 ±11.6</td>
<td>212.4 ±10.8</td>
<td>7.68**</td>
</tr>
<tr>
<td>Glycosylated Hb (%)</td>
<td>&lt; 8</td>
<td>10.42 ±0.71</td>
<td>9.31 ±0.82</td>
<td>1.682**</td>
</tr>
</tbody>
</table>

NE: Nutrition Education  Significant at one per cent level

The PPBS glucose levels were non-significantly different among the two groups before the nutrition education classes while, after two months of nutrition education 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 (Lindstorm, 2003; Tuomilehto, 2001; Knowler et al. 2002). 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 (Brown et al, 2002). Results from other studies have begun to provide evidence that community-based nutrition and exercise interventions can significantly reduce risk factors for diabetic complications (King et al., 1998; Mayer-Davis et al., 2001; Harris et al, 1994). The levels of improvement found in these studies are similar to those found in our study. Studies in Finland, (Tuomilehto, 2001), New Zealand (Swinburn et al., 2001) and the US (Knowler et al, 2002) 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, (Brown et al, 2002) 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.
Table 3: Mean serum lipid profile of the diabetic subjects before and after nutrition education

<table>
<thead>
<tr>
<th>Lipid profile</th>
<th>Desirable levels (mg/dl)</th>
<th>Over Weight group (OW) Before NE</th>
<th>After NE</th>
<th>‘t’ value</th>
<th>Normal Weight group (NW) Before NE</th>
<th>After NE</th>
<th>‘t’ value</th>
<th>‘t’ value (OW vs NW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cholesterol</td>
<td>150-200</td>
<td>218±7.08</td>
<td>196±5.88</td>
<td>5.96</td>
<td>211.9±6.42</td>
<td>194.8±5.34</td>
<td>4.58</td>
<td>5.02</td>
</tr>
<tr>
<td>HDL Cholesterol</td>
<td>30-60</td>
<td>44.3±11.7</td>
<td>45.5±12.6</td>
<td>0.42 NS</td>
<td>47.20±12.9</td>
<td>49.1±12.23</td>
<td>3.31”</td>
<td>5.95”</td>
</tr>
<tr>
<td>LDL Cholesterol</td>
<td>6-178</td>
<td>176.4±43.9</td>
<td>167.3±43.1</td>
<td>4.509”</td>
<td>126.9±7.66</td>
<td>126.9±7.16</td>
<td>5.51”</td>
<td>4.10”</td>
</tr>
<tr>
<td>VLDL Cholesterol</td>
<td>6-30</td>
<td>36.5±10.7</td>
<td>35.0±10.92</td>
<td>9.633”</td>
<td>36.61±8.21</td>
<td>36.33±7.86</td>
<td>0.93 NS</td>
<td>4.42”</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>30-170</td>
<td>185.9±4.57</td>
<td>167.8±5.43</td>
<td>3.97”</td>
<td>175.5±5.73</td>
<td>175.5±5.22</td>
<td>9.94”</td>
<td>5.64”</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Nutrients</th>
<th>RDA *</th>
<th>Over Weight (OW) Before NE</th>
<th>After NE</th>
<th>“t” value</th>
<th>Normal Weight (NW) Before NE</th>
<th>After NE</th>
<th>“t” value</th>
<th>“t” Value OW vs. NW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy(K.Cal )</td>
<td>1360</td>
<td>1796±26.3</td>
<td>1474±20.1</td>
<td>2.91***</td>
<td>1687±188</td>
<td>1405±15.4</td>
<td>7.18***</td>
<td>7.14***</td>
</tr>
<tr>
<td>Carbohydrate (g)</td>
<td>212.5</td>
<td>260.46.1</td>
<td>220±31.3</td>
<td>1.96**</td>
<td>255±38.2</td>
<td>219±30.6</td>
<td>4.76***</td>
<td>4.91***</td>
</tr>
<tr>
<td>Total fat (g)</td>
<td>30.2</td>
<td>58.25±6.9</td>
<td>38.6±5.0</td>
<td>8.22***</td>
<td>49.20±7.1</td>
<td>33.87±5.3</td>
<td>10.54***</td>
<td>12.58***</td>
</tr>
<tr>
<td>Saturated fat (g)</td>
<td>33.90±6.4</td>
<td>24.4±3.7</td>
<td>27.15±5.4</td>
<td>5.68***</td>
<td>49.20±7.1</td>
<td>33.87±5.3</td>
<td>10.54***</td>
<td>12.58***</td>
</tr>
<tr>
<td>Unsaturated fat (g)</td>
<td>24.61±2.3</td>
<td>14.1±2.3</td>
<td>22.05±3.4</td>
<td>2.25**</td>
<td>13.69±3.0</td>
<td>11.11***</td>
<td>5.08***</td>
<td></td>
</tr>
<tr>
<td>Protein (g)</td>
<td>59.5</td>
<td>57.85±13.9</td>
<td>62.0±16.8</td>
<td>0.86NS</td>
<td>56.15±9.9</td>
<td>56.74±9.6</td>
<td>0.26NS</td>
<td>0.82NS</td>
</tr>
<tr>
<td>Dietary fiber(g)</td>
<td>34</td>
<td>38.47±5.6</td>
<td>45±5.4</td>
<td>2.81**</td>
<td>40.28±1.7</td>
<td>43.64±1.8</td>
<td>1.24**</td>
<td>2.24**</td>
</tr>
<tr>
<td>Thiamine (mg)</td>
<td>1.2</td>
<td>1.48±0.2</td>
<td>1.42±0.2</td>
<td>0.64NS</td>
<td>1.6±0.28</td>
<td>1.49±0.2</td>
<td>1.81*</td>
<td>1.81*</td>
</tr>
<tr>
<td>Riboflavin (mg)</td>
<td>1.4</td>
<td>1.33±0.2</td>
<td>1.31±0.2</td>
<td>0.27NS</td>
<td>1.29±0.20</td>
<td>1.27±0.13</td>
<td>0.32 NS</td>
<td>0.16NS</td>
</tr>
<tr>
<td>Niacin (mg)</td>
<td>16.0</td>
<td>14.28±2.8</td>
<td>13.1±0.2</td>
<td>0.13NS</td>
<td>12.46±2.4</td>
<td>11.0±0.1</td>
<td>2.90 ***</td>
<td>2.87***</td>
</tr>
<tr>
<td>Ascorbic acid(mg)</td>
<td>40.0</td>
<td>57.14±25.2</td>
<td>75.8±24.7</td>
<td>2.96***</td>
<td>42.33±20.0</td>
<td>103±42.1</td>
<td>8.02 ***</td>
<td>8.09***</td>
</tr>
<tr>
<td>Calcium</td>
<td>400</td>
<td>810±218</td>
<td>764±135</td>
<td>0.11NS</td>
<td>729±185</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>Phosphorous</td>
<td>400</td>
<td>1331±27.0</td>
<td>1308±22.5</td>
<td>0.22NS</td>
<td>1412±186.0</td>
<td>1342±17.5</td>
<td>1.65 NS</td>
<td>1.30 NS</td>
</tr>
<tr>
<td>Iron</td>
<td>28</td>
<td>18.80±7.9</td>
<td>21.04±4.3</td>
<td>1.11 NS</td>
<td>16.58±4.7</td>
<td>18.84±3.0</td>
<td>2.45 **</td>
<td>2.40**</td>
</tr>
<tr>
<td>Magnesium</td>
<td>350</td>
<td>371±9.1</td>
<td>373±58.5</td>
<td>0.44NS</td>
<td>436±87.5</td>
<td>371±56</td>
<td>3.76 ***</td>
<td>2.61***</td>
</tr>
<tr>
<td>Zinc</td>
<td>15.5</td>
<td>7.38±1.4</td>
<td>7.04±1.3</td>
<td>0.73NS</td>
<td>6.71±1.37</td>
<td>6.38±1.07</td>
<td>1.18 NS</td>
<td>1.34 NS</td>
</tr>
</tbody>
</table>

3.4 Lipid profile

Table 3 depicts various lipid levels of the subjects before and after nutrition education classes. The mean initial levels 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 (Raghuram et al., 1993).

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 within 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 subjects after nutrition counseling is given in Table 4. The increase in ascorbic acid was significant in subjects after nutrition 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 (Kamod, 1989). The gain and retention of knowledge related to nutrition are significantly related to age, level of education and exposure to mass media (Kukreja, 1992). Adequate basic information on diabetes enables the diabetic to comprehend and improve their psychological acceptance of disease (Raghuram et al., 1993).

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 decrease in the consumption of fruits and vegetables by the subjects. The mean intake of calcium, phosphorus and zinc decreased 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 (Raghuram et al., 1993) 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 (ICMR, 2000).

After nutrition education, reduction in intake of cereals, milk and milk products, fats and oils, 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 (Suganthi, and Saradha, 1991).

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 (ICMR, 2000) 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 (Mehta et al., 1989) showed significant difference in knowledge gain in counseled and uncoreunced 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 (Kamod, 1989). The gain and retention of knowledge related to nutrition are significantly related to age, level of education and exposure to mass media (Kukreja, 1992). Adequate basic information on diabetes enables the diabetic to comprehend and improve their psychological acceptance of disease (Raghuram et al., 1993).

4. 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.

References


