

Assessment of the Nutritional Status of the Non Insulin Dependent Male Diabetics

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ABSTRACT Thirty non insulin dependent diabetic females of 40 to 60 years were selected from Punjab agricultural university hospital ludhiana. After one month control period 125 gram of instant wheat meal (45 gram in breakfast, 40 gram midmorning and 40 gram in evening tea) was given daily to the selected subjects. Instant wheat meal was given to all the subjects on weekly basis for a period of two months to study the effect of supplementation on their nutritional profile. The daily diet consumed by the subjects before supplementation was inadequate in food like pulses green leafy vegetables other vegetables and fruits having protective role for diabetes whereas consumption of foods like cereals roots and tubers and fat leading to increased risk was higher as compared with the suggested intake. However after supplementation a significant increase in the intake of protective foods and decrease in the intake of cereals, roots and tubers and fat was observed. The mean daily intake of energy, carbohydrates, fat, ascorbic acid, calcium and phosphorus was higher while of protein, fibre and zinc was below the recommendations. After supplementation, the intake of protein, fibre and zinc was increased from 52 to 64 gram, 28 to 31 gram and 7.5 to 9 mg, respectively. While a significant decrease ($P < 0.01$) in energy from 1955 to 1640 kJ, 49 to 30 g in fat was found. Hence it was concluded from the study that supplementation of instant wheat meal is an effective measure to improve the nutritional status of the diabetics.

INTRODUCTION

Diabetes mellitus is a silent chronic disorder characterised by elevated blood sugar level either due to defective insulin secretion or action or both. It is associated with altered metabolism of carbohydrates, fats and protein.

India having the highest number of diabetic patients in the world, this disease is posing an enormous health problem in the country calling India the diabetic capital of the world. The international journal of diabetes in developing countries says that there is alarming rise in prevalence of diabetes which has gone beyond epidemic form to pandemic form.

Globally diabetes affects 246 million people which is about 6 per cent of the total adult population. The International Diabetes Federation estimates that the number of diabetic patients in India more than doubled from 19 million in 1995 to 40.9 million in 2007. It is projected to increase to 69.9 million by 2025 (IDF 2007).

The most prevalent is the type 2 diabetes which constitute 95 per cent of the diabetic population in the country. In this, patients are non insulin dependent and they can control the glucose in their blood by eating measured diet, taking, regular exercise and oral medication

MATERIALS AND METHODS

A group of 90 male non insulin dependent diabetic patients in the age group of 40-60 years free from serious complications of diabetes were selected from Punjab Agricultural University Hospital, Ludhiana.

An interview schedule was drafted to obtain information on various aspects such as general information, information regarding frequency of usage of various food stuffs and dietary intake of the subjects. Dietary survey was carried out to get information about dietary pattern eating behaviour, total food intake of the subjects before and after the disease. Dietary intake of the subjects was recorded for three consecutive days by 24 hour recall cum weighment method. The average daily nutrient intake of the diet was calculated by using MSU nutriguide (Song et al. 1992).

RESULTS AND DISCUSSION

The general information of the subjects is given in Table 1. Ninety subjects selected for this study were in the age 40-60 years. Twenty two per cent were between 40-50 years and 78 per cent were between 50-60 years. None of the subject was illiterate. Thirty four per cent were

Table 1: General information of the subjects

General information	Subjects (n=90)	
	Number	Percentage
<i>Age (years)</i>		
40-50	20	22
50-60	70	78
<i>Religion</i>		
Hindu	42	47
Sikh	48	53
<i>Education</i>		
High school	31	34
Graduate	27	30
Post graduate	32	36
<i>Occupation</i>		
Service	90	100
Business	-	-
<i>Activity</i>		
Sedentary	76	84
Moderate	14	16
<i>Physical Exercise</i>		
Walk	59	66
Cycling	22	24
Wa + yoga	9	10
<i>Family Type</i>		
Nuclear	56	62
Joint	34	38
<i>Family Size</i>		
Small (1-4)	54	60
Medium (5-8)	27	30
Large (>8)	9	10

educated upto high school, 30% upto graduation and rest 36% were post graduate. Eighty four per cent of the subjects were engaged in sedentary life style and 18 per cent in moderate activity. Yaznik (2004) suggested that urban life style, including poor diet, sedentary habits promotes obesity, insulin resistance and type II diabetes.

Nearly 66% of the subjects were going for walk daily, 24% were doing cycling and 10% were doing yoga and walk. Both exercises have been reported to be beneficial for maintaining body weight and increases the quality of life (Stone et al. 2001).

It was observed that 62 per cent subjects belong to nuclear family while 38 per cent belong to joint family. Sixty six per cent subjects had family members from one to four, 24% have 5-8 family member and 10 per cent have more than 8 family members.

Economic status of the diabetic subjects is given in Table 2. Seventy eight per cent subjects had income more than 10000 per month, 9 per cent between 8000 to 10000, sixty nine per cent of the subjects had per capita income more than Rs. 2500.

Frequency of Food Consumption

Frequency of consumption of various foods by

Table 2: Economic status of the subjects

Economic status	Subjects (n=90)	
	Number	Percentage
<i>Family Income /Month (Rs.)</i>		
<6000	4	4
6000-8000	8	9
8000-10000	8	9
> 10000	70	78
<i>Per capita Income/Month (Rs.)</i>		
1000-1500	3	3
1500-2000	8	9
2000-2500	17	19
>2500	62	69
<i>Family Income (Rs.)</i>		
Mean 10371		
SE $\pm$ 431.75		
<i>Per Capita Income (Rs.)</i>		
Mean 2531		
SE $\pm$ 109.41		

subjects before supplementation is presented in Table 3. Wheat and rice were the major cereals. Use of refined cereals was not common among subjects. It was observed that all the subjects consume cereal thrice a day, twenty per cent consumes refined cereal once a day, 27 per cent twice a week, 20 per cent occasionally and 10 per cent were not consuming refined cereal at all. Pulses were consumed daily by majority of the subjects. Fifty per cent subjects consume whole pulses daily and thirty three per cent consume split daily. Eighty three per cent of the subjects were consuming green leafy vegetables once a day. Thirty per cent of the subjects were consuming roots and tubers once a day, 20 per cent twice a day, 22 per cent three times a week. Forty per cent of subjects were consuming fruit daily, 26.6 per cent four times a week, 10 per cent twice a day. Percentage of subjects consuming milk and milk products twice a day was 90 while 4 per cent consume one time a day and 5.6 per cent were consuming 4 times a week. It was observed that 17 per cent of subjects were ovatarian. One egg a day was consumed by 3.4 per cent of subjects. About 28 per cent subjects were non vegetarian. 4.48 per cent of these consume twice a week and 14.56 per cent once a week and 8.9 per cent occasionally. A total of 21 per cent consume twice a day, 33 per cent once a day and 18 per cent four times a week. Fifty per cent of the subjects consume fried foods daily in the form of samosas, paranthas, pakoras. Fifteen per cent consumer these thrice a week.

Food Intake

The average daily intake of foods by the

Table 3: Frequency of food consumption by the diabetic subjects.

Food items	No. of times/day				No. of times/week				Occa- sionally	Not at all
	4	3	2	1	4	3	2	1		
Cereals										
a) Unrefined		100								
b) Refined				20	13		26.6	10	20	10
Pulses										
a) Whole			10	50	20	20				
b) Split			10	33.3	6.7	43.3	6.7			
Green leafy vegetable				83.3	6.6	10				
Roots and tubers			20	30		22.3	7.7	10		
Fruits			10	40	26.6	13.3	6.6		3.3	
Milk and Milk products			90	4.4	5.6					
Egg				3.4		5.6		7.9		
Meat and Meat Products							4.4	14.5	8.9	
Sweets			21.1	33.3	17.7	7.7	10	6.6	3.5	
Fried foods			15.5	50.0	13.3	15.5			5.5	

subjects before and after supplementation is presented in Table 4. It depicts the per cent adequacy of foods by the subjects as compared with suggested intake given Raghuram et al. (1993). Most commonly consumed cereal by subjects was wheat. Average daily consumption of cereals by subjects ranged from 200 to 375g with mean of 350 ± 22.17 g, 334 ± 33.24 g and 334.7 ± 44.6 g in group I, II and III respectively. The per cent adequacy by the subjects was 155, 148 and 135 for the suggested intake by group I, II and III respectively indicating that there was higher consumption of cereals in all the subjects. On the contrary, lower intake of cereals among NIDDM male and female were reported by Lees et al. (1998) and Vasanthamani and Savita (2001). Mostly whole pulses were consumed by the subjects. Most commonly consumed pulses were green gram dhal, rajma and lentil. Average daily consumption ranged from 25 to 65g with mean of

42.1 ± 6.21 g, 44.8 ± 6.31 g and 45.7 ± 5.21 g by subjects of group I, II and III. Per cent adequacy of pulses is .72 75 and 76 by three groups respectively which shows lower intake by the subjects. On the contrary adequate pulse intake by diabetics of coimbatore was reported by Vasanthamani and Savita (2001). Mean daily green leafy vegetable intake was 58.3 ± 3.68 g, 50.1 ± 3.01 g and 50.9 ± 5.7 g by the subjects of group I, II and III respectively. The adequacy of green leafy vegetables was 29%, 25% and 25% in group I, II and III respectively. The inadequate value of green leafy vegetables by NIDDM patients was reported by Vasanthamani and Savita 2001).

The most commonly consumed roots and tubers by the subjects ranged from 50 to 150g with mean of 134.3 ± 6.71 g, 123.8 ± 5.58 g and 115.5 ± 6.89 g. Khera (1997) reported higher intake of roots among women than men in age of 40-50 years. Average daily consumption of other

Table 4: Average daily food intake by diabetic subjects

Food group/g/day	Group I (n=30)	Group II (n=30)	Group III (n=30)	*Suggested intake	Average daily intake	Per cent adequacy	
	Average daily intake	Per cent adequacy	Average daily intake	Per cent adequacy			
Cereals	350 ± 22.17	155	334 ± 33.24	148	334.7 ± 44.6	135	225
Pulses	42.1 ± 6.21	72	44.8 ± 6.31	75	45.7 ± 5.21	76	60
Green leafy vegetables	58.3 ± 3.68	29	50.1 ± 3.01	25	50.9 ± 5.71	25	200
Other vegetables	114.3 ± 5.83	57	143.13 ± 6.75	72	108 ± 7.11	54	200
Roots and tubers	134.3 ± 6.71	-	123.8 ± 5.58	-	115.5 ± 6.89	-	NA
Fruits	73.26 ± 5.43	73	63.13 ± 4.86	63	60.5 ± 3.38	61	100
Milk and Milk products	426.4 ± 14.73	142	346.33 ± 12.38	115	272.8 ± 11.7	91	300
Eggs and meat	53.62 ± 4.31	77	58 ± 7.79	82	62.3 ± 8.83	89	70
Fat and oil	33.5 ± 4.71	223	30.2 ± 3.33	201	30.34 ± 6.10	202	15
Sugar and Jaggery	12.7 ± 2.3	-	15 ± 2.09	-	14.3 ± 1.39	-	NA

*Raghuram et al. (1993)

NA - Data not available

vegetables by the subjects ranged from 50 to 150g with average value of 114 ± 5.83 g, 143.13 ± 6.75 g, 108 ± 7.11 g with per cent adequacy of 57, 72 and 54 by group I, II and III respectively. Adequate consumption of other vegetables reported by Vasanthamani and Savita (2001). The average daily consumption of fruits by the subjects ranged from 50 to 100 g with average value of 73.26 ± 5.43 g, 63.13 ± 4.86 g, 60.5 ± 3.38 g, by group I, II and III with per cent adequacy of 73, 63. and 61 by group I, II and III respectively. Main fruit consumed by the subjects were orange, guava, mango etc.

The average daily consumption of milk and milk products by the subjects ranged from 150g to 600g with average value of 426 ± 14.73 g, 346.33 ± 12.38 g, 272.8 ± 11.70 g by the three groups which showed percent adequacy of 142, 115 and 91 by group I, II and III respectively. Milk was consumed as such or in the form of curd or tea. Inadequate consumption of milk and milk products by diabetic patients of USA was also reported by Lee et al. (1988).

Consumption of meat and egg ranged from 50 to 70g with average value of 53.62 ± 4.3 g, 58 ± 7.79 g, 62.3 ± 8.83 g with per cent adequacy of 77.82 and 89 by three groups.

The mean daily intake of fats and oil ranged from 20 to 60g with mean of 33.5 ± 4.71 g in group I, 30.2 ± 3.33 g in group II and 30.4 ± 6.10 g in group III. Per cent adequacy was 223, 20 and 202 by group I, II and III respectively. This shows that consumption of fat was much higher than required. For diabetics, mustard oil, corn oil, sunflower oil, groundnut oil, gingerly oil can be used. Gupta (2003) has suggested less than 10 per cent intake of saturated fat for diabetics and ratio of monounsaturated to PUFA should be 1: 1 in diabetic diet. Shah and Garg (1996) reported that an increase in monounsaturated fatty acid

has been suggested to improve both glycemic control and lipoprotein profile among patients with diabetes. Average daily consumption of sugar and jaggery by subjects ranged from 0 to 25g with mean of 12.7 ± 3.3 g, 15 ± 2.09 g and 14.3 ± 1.39 g in group I, II and III respectively.

Nutrient Intake

The average daily intake of energy, carbohydrates, fats, protein and fibre is given in Table 5. The average daily intake of energy ranged from 1970 to 2270 Kcals. Mean energy intake was 2209 ± 55.46 Kcals, 2108 ± 43.78 Kcal, 2014.5 ± 27.62 Kcals with per cent adequacy of 147, 140 and 134 in group I, II and III respectively. This shows that energy intake of the subjects was higher than suggested intake by Raghuram et al. (1993). The average daily consumption of carbohydrates by the subjects ranged from 150 to 370 g. Mean carbohydrate intake was 358 ± 9.38 , 337 ± 14.78 g and 314.97 ± 11.32 g with percent adequacy of 152, 143 and 133, respectively. The average daily consumption of protein by the subjects ranged from 30 to 70g.

Average daily protein intake by the subjects of group I, II and III was 65 ± 3.68 g, 65.91 ± 3.33 g of 69.18 ± 2.47 g with percent adequacy of 100, 100 and 105 in group I, II and III respectively.

The mean daily consumption of fat, saturated fat and unsaturated fat ranged from 30 to 70g. Mean value of total fat consumed by the subjects was 57.14 ± 2.35 g, 55.16 ± 1.75 g and 53.5 ± 2.53 g, respectively. The percent adequacy is 171, 165 and 160. This shows that fat consumption by the subjects was higher as compared to suggested intake. The average daily consumption of fibre by the subjects ranged from 20 to 65 g with mean value of 57 ± 0.92 g, 53.53 ± 0.86 g, 54.27 ± 0.67 g with

Table 5: Average daily intake of energy, carbohydrates, protein, fats and dietary fibres by the subjects

Nutrients	Group I (n=30) Average daily intake	Group II (n=30) Per cent adequacy	Group III (n=30) Average daily intake	*Suggested intake Per cent adequacy	Average daily intake	Per cent adequacy
Energy (Kcal)	2209.86 $\pm$ 55.56	147	2108.08 $\pm$ 43.78	140	2014.22 $\pm$ 27.62	134
Carbohydrates (g)	358 $\pm$ 9.38	152	337.0 $\pm$ 14.78	143	314.97 $\pm$ 11.32	133
Protein (g)	65.0 $\pm$ 3.68	100	65.91 $\pm$ 3.33	100	69.18 $\pm$ 2.47	105
Fat (g)	57.14 $\pm$ 2.35	171	55.16 $\pm$ 1.75	165	53.5 $\pm$ 2.53	160
Saturated (g)	32.14 $\pm$ 1.75	247	31.1 $\pm$ 1.53	207	33.2 $\pm$ 2.01	221
Unsaturated (g)	25 $\pm$ 1.37	231	24.16 $\pm$ 2.12	161	20.3 $\pm$ 3.1	135
Dietary fibre (g)	57.1 $\pm$ 0.92	152	53.53 $\pm$ 0.86	141	54.27 $\pm$ 0.67	144

*Raghuram et al. (1993)

**Ghafoorunissa (2000)

per cent adequacy of 152, 141 and 144. Madar (1995) reported that dietary fibre could contribute to control lipid metabolism disorder in NIDDM.

The dietary carbohydrates contributed about 64.9%, 63.9% and 66.2% energy in group I, II and III respectively. Raghuram et al. (1993) suggested that higher percentage of energy from dietary carbohydrates. The average contribution of dietary protein to total energy is 11.9, 12.5 and 13.7 per cent in group I, II and III respectively. Similarly average contribution of fat to total energy in group I, II and III is 23.2, 23.5 and 22 per cent. (Table 6)

The data in Table 7 shows average daily intake of vitamins by subjects and their percent adequacy. The average daily intake of thiamine ranged from 0.6 to 2.8 mg with mean value. 1.8 ± 0.13 mg, 1.24 ± 0.03 mg, 1.3 ± 0.5 mg in group I, II and III respectively and per cent adequacy is 150, 103 and 108. On contrary inadequate intake of thiamine by the diabetic subjects was reported by Varmeet (1993), Dhiman (1996), Khera (1997) and Sodhi (2000). The average daily consumption of riboflavin by subjects ranged from 0.6 to 1 mg with mean value 1.8 ± 0.70 mg, 1.3 ± 0.46 mg, 1.2 ± 0.42 mg and per cent adequacy is 128, 93 and 85 in group I, II and III respectively. Inadequate intake of

riboflavin by women was reported by Zembyanskaya et al. (1997). Daily intake of niacin by the subjects ranged from 5.2 to 12 mg with mean value of 11.75 ± 0.35 mg, 11.25 ± 0.41 mg and 10.9 ± 0.31 mg and per cent adequacy is 73, 70 and 68.1 in group I, II and III respectively. Clearly (1990) also mentioned potential benefit of niacin to insulin resistance. The average daily consumption of ascorbic acid by the subjects ranged from 30 to 150 mg. Average intake by the subjects of group I, II and III is 112.5 ± 9.97 mg, 102 ± 8.62 mg and 94 ± 11.2 mg with percent adequacy of 280, 255, 235 in group I, II and III respectively. This shows inadequate intake of vitamin B₁₂ by subjects. Similarly Sodhi (2000) also reported inadequate intake of vitamin B₁₂. This inadequacy in vitamin B₁₂ may be attributed to less consumption of non vegetarian food. The mean daily intake of folic acid by the subjects ranged from 80 to 275 mg and corresponding mean values of three groups are 175 ± 9.62 mg, 169 ± 11.2 mg, 179 ± 9.32 mg showing the percent adequacy of folic acid 175, 169 and 179 in group I, II and III, respectively.

The mean daily intake of minerals by subjects is shown in Table 7 along with percent adequacy compared with recommended dietary allowances

Table 6: Comparison of per cent energy from carbohydrates, protein and fat with different recommendations

Nutrient	Group I per cent contribution	Group II per cent contribution	Group III per cent contribution	Raghuram et al (1993)	Ghafoorunissa (2000)	Sharma (AIIMS) (2004)
Carbohydrates	64.9	63.9	66.2	60-65	55-60	60
Protein	11.9	12.5	13.7	15-20	15-20	10-20
Total fat	23.2	23.5	22.08	15-25	20-25	30
Saturated fat	13.0	13.2	13.7	-	8-10	<10
Unsaturated fat	10.1	10.3	8.3	5-8	5-8	10

Table 7: Average daily intake of vitamins and minerals by subjects

Nutrients	Group I (n=30)		Group II (n=30)		Group III (n=30)		*RDA
	Average daily intake	Per cent adequacy	Average daily intake	Per cent adequacy	Average daily intake	Per cent adequacy	
Thiamine (mg)	1.80 ± 0.13	150	1.24 ± 0.03	103	1.3 ± 0.05	108	1.2
Riboflavin (mg)	1.80 ± 0.70	128	1.30 ± 0.46	93	1.2 ± 0.42	85	1.4
Niacin (mg)	11.75 ± 0.35	73	11.25 ± 0.41	70	10.9 ± 0.31	68	16
Vit C (mg)	112.5 ± 9.97	280	102.5 ± 8.62	255	94 ± 11.2	235	40
Folic acid (mg)	175.1 ± 9.62	175	169 ± 11.2	169	179 ± 9.32	179	100
Vit B ₁₂ (mg)	0.6 ± 0.03	60	0.50 ± 0.042	50	0.82 ± 0.62	82	1
Iron (mg)	21.75 ± 0.44	77	20.3 ± 0.44	72	21.2 ± 0.32	75	28
Calcium (mg)	700 ± 23.10	175	575 ± 22.7	143	483 ± 19.8	120	400
Phosphorus (mg)	1237 ± 52.96	309	1049.4 ± 168.5	262	931 ± 48.42	232	400
Zinc (mg)	7.82 ± 0.77	50	6.82 ± 0.72	44	7 ± 0.68	46	15.5

*ICMR (1989)

as suggested by ICMR (1989). The average daily intake of iron by subjects ranged from 15 to 40 mg. Corresponding mean value of iron is 21.75 ± 0.44 mg, 20.3 ± 0.44 mg, 21.2 ± 0.32 mg and per cent adequacy is 77, 72 and 75 in groups I, II and III respectively. This shows inadequate intake of iron and this may be due to less intake of green leafy vegetables by the subjects. The average daily intake of calcium by the subjects ranged from 400 to 800 mg with mean value of 700 ± 23.10 mg, 575 ± 22.7 mg, 483 ± 19.8 mg and percent adequacy was 175, 143 and 120 by group I, II and III respectively. This higher adequacy may be attributed to high intake of milk and milk products and cereals by the subjects. Average daily intake of phosphorus by the subjects ranged from 400 to 1550 mg. Mean value of phosphorus intake by the subjects was 1237 ± 52.96 mg, 1049 ± 68.5 mg and 931 ± 48.42 mg with per cent adequacy 309, 262 and 232 in group I, II and III respectively. The intake of phosphorus by the subjects was more than ICMR recommendations. Average daily intake of zinc by the subjects ranged from 5 to 13 mg. Corresponding mean value of zinc intake by the subjects was 7.82 ± 0.77 mg, 6.82 ± 0.72 mg and 7 ± 0.68 mg with per cent adequacy of 50, 44 and 46 in group I, II and III respectively. This shows inadequate intake of zinc by subjects. On contrary adequate intake of zinc by diabetics was reported by Gross et al. (2002).

CONCLUSION

It was concluded from the study that diet consumed by male diabetic patients was adequate in cereals, milk, fats and oils and was marginally inadequate in pulses. However, intake of green leafy vegetables, fruits and other vegetables was inadequate leading to deficiency of vitamins and minerals like iron, zinc and vitamin B₁₂.

RECOMMENDATION

Nutrition counselling by the dietician plays an important note in the management of diabetes. People should be made aware about the disease and its dietary management as it is an important measure for improving the knowledge and

diabetic state of the patients and thus helps them to live full life despite diabetes.

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