

Nutrient Adequacy of Non Insulin Dependent Male Diabetics Influenced by Nutrition Counseling

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ABSTRACT Sixty non insulin dependent male diabetic subjects in the age group of 40-60 years were selected from hospital of Punjab Agricultural University, Ludhiana 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 ($P \leq 0.01$) from 7.31 to 19.26. 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 favourable and significant change in diabetic state.

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, 2003). Increasing incidence is mainly due to modern life style 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).

It is imperative to fight this menace through education, research and integrated efforts. NIDDM is an endocrinological disorder in which nutrition education plays an important role (Srivastava, 1988). 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.

MATERIAL AND METHODS

Selection of the Subjects: Sixty non insulin dependent male diabetic subjects in the age group of 40-60 years were selected from PAU Ludhiana Hospital. To calculate their food and nutrient intake, selected subjects were divided into two categories according to their grades of obesity i.e. overweight and normal weight subjects.

Dietary Survey: A dietary survey was conducted to assess the existing dietary pattern of the subjects for three consecutive days by '24 hour recall-cum-weighment method' twice before and after nutrition education. The food intake of the subjects were recorded in household measures which was then converted into exact measures by the investigator using their own set of utensils on a volume by volume basis. The size of chapaties (unleavened bread) was measured with the help of paper disc. The number of chappaties prepared from known volume of wheat flour using standardized measures was noted and this enabled calculations for the amount of wheat flour used for one chappati and made allowances for their

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thickness. Amount of raw food items consumed by each subject was calculated with the help of standardized vessels for cooked foods. Variations in consistency especially for cooked legumes and some vegetables were taken into consideration while converting cooked food into raw foods. This was made possible from observation of raw and cooked volumes of household utensils which were compared with standardized utensils.

Nutrient Intake Calculations: The average daily nutrient intake of the subjects was calculated from the actual amount of each food consumed daily by MSU Nutriguide (Song et al., 1992). The average nutrient intake were compared with recommended dietary allowances given for different calorie diet for diabetic patients by Raghuram (1993) and with RDA given by ICMR (1990).

Nutrition Counselling: A multiple choice questionnaire to test the basic knowledge about the disease and diet was drafted. After assessing the basic knowledge of the subjects related to disease and diet, the subjects were imparted nutrition education regarding the disease, its symptoms, causes, complications, dietary modifications, food exchanges, different calorie diet. Nutrition education was imparted to the subjects through lectures, discussions, charts after every 15 days for 3 months. The subjects knowledge was assessed again by using the same knowledge testing questionnaire after 3 months and difference in knowledge score was calculated.

Statistical Analysis: The data on nutrient intake were obtained and analysed statistically. The mean, standard error, analysis of variance, t-value and their test of significant was calculated using a Computer Package Programme – CPC SI and CS II of Cheema and Singh (1990).

RESULTS AND DISCUSSION

Table 1 presents the data about the food intake by the subjects before and after nutrition counseling. Consumption of cereals, milk and milk products, fats and oils was higher than the suggested values given by Raghuram (1993). After nutrition counseling, there was significant ($P < 0.01$) 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, other vegetables, fruits was found among the

diabetics. However, percent inadequacy in the consumption of green leafy vegetables, other vegetables and fruit was found after nutrition counseling (Table 2).

The mean daily intake of energy, carbohydrates, fat, protein and fibre before and after nutrition counseling is given in Table 3. 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. A significant decrease in energy intake (1688 to 1429 Kcal) was observed in all the subjects after nutrition counseling. The intake of carbohydrates, fats and fibre was found to be adequate when compared with the values given by Raghuram. The intake of protein was adequate in overweight subjects as compared to normal weight subjects when compared with suggested values given by Raghuram (1993). 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 (Table 4).

Similar percentage of energy from carbohydrates, protein and fat have been recommended by Raghuram (1993) and Ghafoorunisa (1994) for the diabetics (Table 5).

The mean intake of vitamins and minerals by the subjects before and after nutrition counseling is presented in Table 6. 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 whereas increase in the intake of iron and magnesium was observed in overweight and normal weight subjects.

Table 7 presents the percent adequacy of nutrients before and after nutrition education. Energy, fat, fibre, thiamine, ascorbic acid and calcium were found to be adequate whereas intake of riboflavin, niacin and iron was found to be deficient when compared with ICMR Recommendations (1999). Mean score of knowledge about diet and disease was also

Table 1: Average food intake by the subjects before and after nutrition counseling.

Food groups(g/day)	Overweight (n=21)			Normal weight (n=39)			All subjects (n=60)		Suggested intake	Range
	Before NC	After NC	t-value	Before NC	After NC	t-value	Before NC	After NC		
Cereals	226 ± 57.4	195 ± 40.4	1.96**	239 ± 54.2	196 ± 42.6	3.86***	235 ± 55.6	196 ± 41.9	170	150-225
Pulses	46 ± 9.23	56 ± 6.8	3.73***	48 ± 5.69	58 ± 4.8	7.92***	48 ± 7.21	58 ± 5.6	60	60
Green leafy vegetables	16 ± 33.8	48 ± 8.3	4.10***	13 ± 25.7	45 ± 11.2	7.21***	14 ± 28.8	46 ± 10.4	200	200
Other vegetables	79 ± 32.4	129 ± 18.6	5.94***	67 ± 26.1	121 ± 15.2	13.13***	65 ± 30.0	124 ± 16.9	200	200
Root vegetables	35 ± 41.0	69 ± 22.5	3.56***	62 ± 10.1	90 ± 8.7	13.00***	52 ± 28.2	83 ± 18.0	NA	NA
Fruits	48 ± 5.69	58 ± 4.8	7.92***	46 ± 9.23	56 ± 6.8	3.73***	48 ± 7.21	58 ± 5.6	100	100
Milk and milk products	416 ± 131.3	364 ± 95.4	1.46 ^{NS}	399 ± 124.9	322 ± 65.5	3.37***	405 ± 127.5	337 ± 79.8	300	300
Fats and oils	39 ± 2.10	17 ± 3.5	17.03***	30 ± 3.38	14 ± 4.0	19.11***	33 ± 5.1	15 ± 4.2	11	10-15
Sugar and jaggery	53 ± 2.93	13 ± 2.98	8.06***	40.0 ± 6.79	10 ± 4.2	10.80***	44 ± 8.32	11 ± 4.0	NA	NA

NC – Nutrition Counseling

Values represent mean ±S.E.

*** significant at 1%

** significant at 5%

* Raghuram 1993

Table 2: Percent adequacy of foods.

Food Groups	Over weight (n=21)		Normal subjects (n=39)		All subjects (n=60)	
	Before NC	After NC	Before NC	After NC	Before NC	After NC
Cereals	132.94	114.70	140.58	115.29	138.23	115.29
Pulses	76.66	93.33	81.66	96.66	80.00	96.66
Green leafy vegetables	8.0	24.00	65.00	75.00	7.00	23.33
Other vegetables	39.5	64.5	33.5	60.5	32.5	62.00
Fruits	48.00	58.00	46.00	56.00	48.00	58.00
Milk and milk products	138.66	121.33	133.00	107.00	135.00	112.33
Fats and oils	354.54	154.54	272.72	127.27	300.00	136.36
Sugar and jaggery	NA	NA	NA	NA	NA	NA

NC – Nutrition Counseling

Table 3: Average daily intake of energy, fats, protein and dietary fiber by the subjects before and after nutrition counseling.

Nutrients	RDA*	Over weight(n=21)		Normal weight (n=39)		All subjects (n=60)										
		Before NC	After NC	t-value	Before NC	After NC	t-value	Before NC	After NC	t-value						
Energy, Kcal	1360	1796	± 263.0	1474	± 201	2.91***	1687	±188	1405	±154	7.18***	1688	± 217	1429.0	±175	7.14***
Carbohydrates, g	212.5	260	± 46.15	220	± 31.3	1.96**	255	± 38.2	219	± 30.6	4.76***	251	± 41.6	219.0	± 30.9	4.91***
Total fat, g	30.2	58.25	± 6.90	38.61	± 5.0	8.22***	49.20	± 7.1	33.87	± 5.3	10.54***	51.00	± 7.5	35.53	± 5.7	12.58***
Saturated fat, g	NA	33.90	± 6.4	24.47	± 3.7	5.68***	27.15	± 5.4	20.17	± 3.6	6.52***	29.51	± 6.6	21.68	± 4.2	7.63***
Unsaturated fat, g	NA	24.61	± 2.3	14.14	± 2.3	2.25**	22.05	± 3.4	13.69	± 3.0	11.11***	21.55	± 1.4	13.85	± 2.8	5.08***
Protein, g	59.5	57.85	± 13.96	62.04	± 16.8	0.86 NS	56.15	± 9.9	56.74	± 9.6	0.26 NS	56.75	± 11.54	58.6	± 12.9	0.82 NS
Dietary fiber, g	34	38.47	± 5.6	45	± 5.4	2.81**	40.28	± 1.7	43.64	± 1.8	1.24**	39.37	± 2.6	44.31	± 2.4	2.24**

NC – Nutrition Counseling

Values represent ± S.E.

* Raghuram (1993), ADA (1998)

** Significant at 5%

*** Significant at 1%

NS Non significant

NA Not available

Table 4: Contribution of carbohydrate, fat and protein to percent energy intake by the subjects before and after nutrition counseling.

Nutrients	Over weight (n=21)		Normal subjects (n=39)		All subjects (n=60)	
	Before NC	After NC	Before NC	After NC	Before NC	After NC
Total calories	1796	1474	1687	1405	1688	1429
Carbohydrates	57.90	59.70	60.46	62.34	59.47	61.30
Total fat	29.18	23.57	26.24	21.69	27.19	22.37
a) Saturated fat	16.98	14.94	14.48	12.92	15.73	13.65
b) Unsaturated fat	12.33	8.63	11.76	8.76	11.48	8.72
Protein	12.88	16.83	13.31	16.15	13.44	16.40

NC – Nutrition Counseling

Table 5: Comparison of percent energy from carbohydrates, protein and fat with various recommendations for diabetics.

Nutrients	All subjects		AIIMS 1986	Viswanathan, 1996	Beet <i>et al.</i> , 1991	Reghuram, 1993	Ghafoorunissa, 1994
	Before NC	After NC					
Carbohydrates	59.47	61.27	50-60	65	50-55	60-65	55-60
Protein	13.44	16.39	15-20	15	15-20	15-20	15-20
Total fat	27.19	22.37	20-25	25-30	30	15-25	20-25
Saturated fat	15.73	13.65	NA	10	NA	NA	8-10
Unsaturated fat	11.48	8.72	NA	15-20	NA	NA	5-8

NA – Data not available.

NC – Nutrition Counseling

Table 6: Mean intake of vitamins and minerals by the subjects before and after nutrition counseling.

Nutrients (mg/day)	RDA *	Over weight(n=21)		Normal weight (n=39)		All subjects (n=60)	
		Before NC	After NC	Before NC	After NC	Before NC	After NC
Thiamine	1.2	1.48 ± 0.29	1.42 ± 0.21	1.6 ± 0.28	1.49 ± 0.20	1.55 ± 0.29	1.47 ± 0.21
Riboflavin	1.4	1.33 ± 0.28	1.31 ± 0.26	1.29 ± 0.20	1.27 ± 0.13	1.30 ± 0.24	1.20 ± 0.19
Niacin	16.0	14.28 ± 2.8	13.19 ± 0.22	12.46 ± 2.4	11.0 ± 0.18	13.1 ± 2.7	11.7 ± 2.2
Ascorbic acid	40.0	57.14 ± 25.2	75.80 ± 24.7	42.33 ± 20.0	103.35 ± 42.15	130.85 ± 24.0	94.39 ± 39.3
Calcium	400	810 ± 218	764 ± 135	729 ± 185.0	695 ± 106	758 ± 198	719 ± 122
Phosphorus	400	1331 ± 270	1308 ± 254	1412 ± 186.0	1342 ± 175	1384 ± 228	1330 ± 206
Iron	28	18.80 ± 7.9	21.04 ± 4.3	16.58 ± 4.7	18.84 ± 3.0	17.36 ± 6.1	19.61 ± 3.71
Magnesium	350	371 ± 91.1	373 ± 58.5	436 ± 87.5	371 ± 56	413 ± 95	372 ± 57
Zinc	15.5	7.38 ± 1.4	7.04 ± 1.3	6.71 ± 1.37	6.38 ± 1.07	6.95 ± 1.4	6.61 ± 1.2

NC Nutrition counseling

Values represent ± S.E.

* ICMR (2000)

** Significant at 5%

*** Significant at 1%

Table 7: Nutrient intake of the subjects before and after nutrition counseling as percent RDA.

Nutrients	Over weight (n=21)		Normal subjects (n=39)		All subjects(n=60)	
	Before NC	After NC	Before NC	After NC	Before NC	After NC
Energy	132.05	108.38	124.04	103.30	124.11	105.07
Protein	97.22	104.26	94.36	95.36	95.37	98.48
Fat	192.88	127.84	162.91	112.15	168.87	117.64
Fibre	113.14	132.35	118.47	128.35	115.79	130.32
Thiamine	123.33	118.33	133.33	124.16	129.16	122.5
Riboflavin	95.0	93.57	92.14	90.71	92.85	92.85
Niacin	89.25	82.43	77.87	68.75	81.87	73.12
Ascorbic acid	142.85	189.5	105.82	258.37	327.12	235.0
Calcium	202.5	191.0	182.85	173.75	189.5	179.75
Iron	67.14	75.14	59.21	67.28	62.0	70.03

NC- Nutrition Counseling

Table 8: Diabetic knowledge test score before and after nutrition education.

Knowledge test score	Before nutrition education	After nutrition education
Subjects getting zero score	16(26.66)	None
Subjects getting above 80%	None	28(46.66)***
Mean knowledge test score	7.31	19.26

Figure in parenthesis indicate percentages.

*** Significant at 1%

improved after nutrition counseling from 7.31 to 19.26 (Table 8).

The food was consumed mainly in three meals i.e. breakfast, lunch and dinner. All the subjects were taking a cereal preparation i.e. *parantha* with butter/curd and milk/tea in the breakfast. Chapatti/rice with *dal* and or vegetable and salad with or without curd was consumed in lunch and dinner. It was observed that frequency of consumption of fried products and biscuits in between the meals was more by overweight subjects while normal weight subjects consumed three heavy meals. The mean difference in food consumption between two groups was the quantity of food consumed, generous use of oil in cooking and intake of soft drinks, shurbats etc. being higher by overweight subjects.

In the present investigation food and nutrients intake values are compared with the suggested values given by Raghuram (1993) and not with values given by ICMR (1999) because ICMR values are for normal persons. Different amounts of food and nutrients are given by Raghuram for diabetic patients. 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 (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. Similarly, Suganthi and Saradha (1991) also reported decrease in cereals, pulses, fats and oils in obese diabetic patients after diet counseling for 6 weeks.

Based on recommendations given by Raghuram, the overweight subjects with mean ideal body weight 74 kg consumed more energy (1796 Kcal) i.e. 24 Kcal/kg of body wt/day before nutrition counseling as compared to recommended 1480 Kcal/day but after nutrition counseling it was almost near to the desired values of 1480 Kcal but the normal weight subjects with mean IBW 64 kg were consuming less calories both before and after intervention (1687 and 1405 Kcal/day as compared to recommended 1920 Kcal/day). Percent of energy from protein taken by overweight and normal weight subjects showed an increase from 13.70 to 16.83 percent and 13.31 to 16.15 percent

respectively after nutrition education. Over-weight subjects consumed 23.57 percent of their calories as fat, 14.93 percent being saturated, 8.63 percent unsaturated fat with corresponding values of 21.69 percent and 12.92 percent and 8.76 percent by normal weight subjects respectively. Similar percentage of energy 15.25 percent from fat have been recommended by Raghuram et al. (1993) and Ghafoorunissa (1994). According to recommendation of 25gram/ 1000 Kcal by American Diabetic Association (ADA, 1998), the fibre intake was adequate in both the groups.

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, 2000 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 (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 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 (Kamod, 1989). Kukreja (1992) also reported that gain and retention of knowledge related to nutrition are significantly related to age, level of education and exposure to mass media. According to Raghuram et al (1993) adequate basic information on diabetes enables

the diabetic to comprehend and improve their psychological acceptance of disease.

CONCLUSION

Nutrition education related to diet improved diabetic state and reduced the risk of secondary complication in the NIDDM patients. Thus, nutrition counseling is an effective measure to bring about favourable and significant changes in diabetic state.

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