

Assessment of the Dietary Intake of Type-2 Diabetes Patients by using Food Frequency Questionnaire (FFQ) in Raipur city

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Abstract:

The present study was conducted to examine the dietary habits and food frequencies of type 2 diabetes patients in Raipur City, Chhattisgarh. It was an analytical study by simple and informal experimental design which was conducted in 2017-2019. A self-prepared Food Frequency Questionnaire (FFQ) in Hindi language was used to collect the data from 300 patients, 192 male and 108 female were taken in this study. The FFQ add functional food like: Fenugreek seed, flaxseed, centrathrumanthelminticum (kaalijeeri), nigella sativa (kalonji), almonds etc. These are very beneficial food to manage obesity of the type-2 diabetes patients. These functional foods are good source of fibre, magnesium, and other good micro nutrients. The selection of patients was done by means of systematic random sampling technique. The median age of the patients was 45 years. The nutritional education program become more helpful to lose weight and manage to waist hip ratio of the patient's and assessment of Knowledge, Attitudes, and Practices (KAP) test of the patients. According to nutritional education program calorie, fat were reduced and protein, fibre intake of the patients were increased. In pre-test frequency the 62 patients were found obese, and after post-test frequency 51 patients found obese. The KAP test is a crucial element of diabetes mellitus control. The KAP test was became very beneficial among diabetes patients to assessment of dietary intake by using food frequency questionnaire (FFQ). So the patients were improved healthy dietary practices due to nutritional education program, and reduced blood sugar level and weight by healthy dietary guidelines. The dietary habits of type 2 diabetics have been reported to be on income level, education level, and age, sex wise. Individualizing the nutrition interventions and encouraging to change the behaviour can help the patients in accomplishing the health goals.

Keywords: Knowledge, Attitudes, Practices, Diabetes Mellitus (DM), Food Frequency Questionnaire (FFQ)

Introduction:

Type-2 diabetes mellitus (DM) is a chronic metabolic disorder associated with high morbidity and mortality among patients^{1, 2}. Diabetics' Dietary Habits (DH) refers to food consumption based on nutrition advice given by the dietitian. It emphasizes on the intake of food that contains functional foods like: Fenugreek seed, flaxseed, centrathrumanthelminticum (kaalijeeri), nigella sativa (kalonji), almonds etc., low-fat products, omega 3 fatty acids, fruits, vegetables, a diet low in sodium and high in fiber. The ultimate goal in the management of Diabetes Mellitus (DM) is to have blood glucose levels in an acceptable range to delay or prevent the microvascular and macrovascular diabetes complications. It has also been reported that controlling the diabetics can improve weight which can help in diabetes complications. One of the important cornerstones of diabetes care is dietary management which should be based on healthy eating in context of food choices, cultural and social aspects. Healthy dietary practices are considered an integral part of treating and improving metabolic disorders and complications that can arise from Diabetes Mellitus (DM). To study the relationship between diet and health, some valid instruments are required to access the dietary intake of the subjects of the selected population. Food Frequency Questionnaire (FFQ) can be used as a successful tool used for this study. It can help us draw out the link between diabetes and health. In FFQ the study subjects are asked to report about the consumption of various foods over a specified time, the frequency of consumption can be reported as per day, per week or per month.

Objectives

1. To determine Food Frequency Questionnaire (FFQ) profile of the type-2 diabetic patients.
2. To evaluate the pre-post dietary measurement of the type-2 diabetic patients after given nutrition education to the patients.

Materials and Methods

This prospective study was conducted on 25-60 years age group 192 male and 108 female (300 patients) patients. The study design were taken survey and informal experimental design. The 150 data were collected from Paridhi Diabetes Research Centre Clinic, 100 data taken from Dr. Bandhoupadhyay Clinic, 35 data taken from the Non-communicable Disease (NCD) Clinic, and 15 patients taken from Madhumeet Diabetes Hospital, Raipur. The 300 patients were tested their Knowledge, Attitudes, Practices (KAP) test to enhance their knowledge in this educational program. The purpose of dietary survey was to measure the nutrients, foods and eating habitats of the type 2 diabetes patients. Dietary survey was done by using food frequency questionnaire (FFQ) methods of the type 2 diabetes patients. To determine the effect of education module KAP test was conducted. Assessment of knowledge, attitudes, and practices of patients was assessment by Knowledge, Attitudes, and Practices (KAP) by standard questionnaire methods. A Functional food booklet contains importance of nutrition, Low GI (Glycaemic Index) food, High GI (Glycaemic Index) food and a healthy food practice and diet chart was developed by dietitian. Importance of functional foods and herbs were suggested through these booklets. The anthropometric measurement weight, height, waist circumference, waist to hip ratio etc. done by standard methods. The effect of KAP test on type-2 diabetic patients, lifestyles, and daily routine etc. were analysed in the research work. The obtained data was analysed and the differences in the mean of various parameters were compared. The results were statistically calculated by mean, percentage, test using SPSS software version 21.

Results and Discussion

Table No. 1

Comparison of Pre Post Mean Scores on Dietary Intake of Type-2 Diabetic Patients

Variables	N	Pre Test (a)		Post Test (b)		Mean Difference (b-a)	't'
		Mean	S.D.	Mean	S.D.		
Calorie (Kcal)	300	2073.37	257.35	1706.74	166.77	- 366.62	27.59**
Protein (g)	300	55.98	6.89	72.43	8.52	+16.44	34.89**
Fat(g)	300	60.93	7.03	47.41	5.30	- 13.52	39.06
Carbohydrate (g)	300	312.98	40.53	213.78	20.67	- 99.19	47.57**
Fibre (g)	300	25.10	2.77	33.77	3.44	8.66	37.84**

t(df=299) at .05 =1.97 , t(df=299) at .01 = 2.59

A perusal of statistical figures in table 6 indicates that the pre-test mean calorie, fat and carbohydrate intake was decreased in post-test measures after administration of nutrition education program while intake of protein and fibre was increased during the pre-post test period. These results are statistically significant at .01 level of significance.

Table No. 2

Comparison of Pre Post Mean Scores on Dietary Intake of Type-2 Male Diabetic Patients

Variables	N	Pre Test (a)		Post Test (b)		Mean Difference (b-a)	't'
		Mean	S.D.	Mean	S.D.		
Calorie (Kcal)	192	2143.81	242.71	1762.36	145.70	- 381.44	22.06**
Protein (g)	192	56.86	6.68	74.72	8.41	+ 17.86	29.03**
Fat(g)	192	62.84	6.67	48.95	5.19	- 13.88	29.34**
Carbohydrate (g)	192	324.31	38.06	220.88	17.69	- 103.43	39.18**
Fibre (g)	192	25.38	2.79	34.83	3.20	+ 9.44	31.68**

t(df=191) at .05 =1.97 , t(df=191) at .01 = 2.60

The pre-post comparison of dietary intake of Type-2 male diabetic patients yielded significant results. The post-test mean calorie (M=1762.36 Kcal), fat (M=48.95g) and carbohydrate intake (M=220.88g) were significantly less as compared to pre-test mean calorie

(M=2143.81 Kcal), fat (M=62.84g) and carbohydrate intake (M=324.31g) respectively. In contrast to this, the pre-test mean scores on protein and fibre intake was 56.86g and 25.38g which were increased to 74.72g and 34.83g in post-test measurement. The result indicates a significant change in dietary intake of Type-2 male diabetic due to nutrition education at .01 level significance.

Table No. 3
Comparison of Pre Post Mean Scores on Calorie Intake of Type-2 Male Diabetic Patients with Reference to Age Group:

Age Group	N	Calorie Intake				Mean Difference (b-a)	't'
		Pre Test (a)		Post Test (b)			
		Mean	S.D.	Mean	S.D.		
25-40 yrs	82	2133.23	233.50	1790.31	153.21	- 342.91	13.53**
41-55 yrs	69	2168.59	249.56	1741.33	122.61	- 427.26	14.81**
56-70 yrs	41	2123.26	251.56	1741.85	159.64	- 381.41	9.71**

t(df=81) at .05 =1.99 , t(df=81) at .01 = 2.64

t(df=68) at .05 =2.00 , t(df=68) at .01 = 2.65

t(df=40) at .05 =2.02, t(df=40) at .01 = 2.71

As can be observed from table 3, the effect of nutrition education was observed on the calorie intake of Type-2 male diabetic patients belonging to all the three age groups namely 25-40 years, 41-55 years and 56-70 years. It shows that calorie intake of Type-2 male diabetic patients from three age groups namely 25-40 years, 41-55 years and 56-70 years saw a significant decrease in post-test mean score as compared to pre-test mean score. This can be observed from mean difference (post-test - Pre-test) of 342.91, 427.26 and 381.41 for three age groups namely 25-40 years, 41-55 years and 55-70 years at .01 level of significance.

Table No. 4
Comparison of Pre Post Mean Scores on Protein Intake of Type-2 Male Diabetic Patients with Reference to Age Group

Age Group	N	Protein Intake				Mean Difference (b-a)	't'
		Pre Test (a)		Post Test (b)			
		Mean	S.D.	Mean	S.D.		
25-40 yrs	82	57.41	7.01	75.10	10.04	+ 17.69	15.45**
41-55 yrs	69	55.51	6.67	74.48	6.00	+ 18.96	21.83**
56-70 yrs	41	58.03	5.70	74.38	8.52	+ 16.35	15.69**

t (df=81) at .05 =1.99 , t(df=81) at .01 = 2.64

t (df=68) at .05 =2.00 , t(df=68) at .01 = 2.65

t (df=40) at .05 =2.02, t(df=40) at .01 = 2.71

A perusal of pre-post data on protein intake revealed that the mean post-test protein intake was 75.10g, 74.48g and 74.38g respectively for type-2 male diabetic patients of 25-40 years, 41-55 years and 56-70 years while the mean pre-test protein intake of 57.41g, 55.51g and 58.03g for type-2 male diabetic patients of 25-40 years, 41-55 years and 56-70 years. It shows a mean increase in protein intake in every age group after nutrition education program. The calculated $t=15.45$, $p<.01$, $t=21.83$, $p<.01$ and $t=15.69$, $p<.01$ for pre-post data on protein intake confirms that nutrition education program led to change in dietary habits of type-2 diabetic patients in age groups ranging from 25 years to 70 years.

Table No. 5
Comparison of Pre Post Mean Scores on Fat Intake of Type-2 Male Diabetic Patients with Reference to Age Group

Age Group	N	Fat Intake				Mean Difference (b-a)	't'
		Pre Test (a)		Post Test (b)			
		Mean	S.D.	Mean	S.D.		
25-40 yrs	82	63.34	6.61	50.11	5.39	- 13.23	18.84**
41-55 yrs	69	63.07	6.45	48.32	3.52	- 14.75	21.37**
56-70 yrs	41	61.44	7.10	47.69	6.62	- 13.75	10.88**

$t(df=81)$ at .05 =1.99 , $t(df=81)$ at .01 = 2.64

$t(df=68)$ at .05 =2.00 , $t(df=68)$ at .01 = 2.65

$t(df=40)$ at .05 =2.02, $t(df=40)$ at .01 = 2.71

Table 5 indicates the significant impact of nutrition education on the fat intake of type-2 male diabetic patients belonging to all the three age groups namely 25-40 years, 41-55 years and 56-70 years respectively.

The post-test mean score for 25-40 years age group type-2 male diabetic patients of 50.11g was decreased by 13.23g as compared to pre-test mean fat intake of 63.34g. The calculated $t=18.84$, $p<.01$ confirm that after nutrition education program fat intake of male type-2 diabetic patients of 25-40 years was decreased as compared to initial pre-test mean scores on fat intake.

The post-test mean score for 41-55 years, age group, type-2 male diabetic patients of 48.32 g was decreased by 14.75g as compared to pre-test mean fat intake of 63.07g. The calculated $t=21.37$, $p<.01$ confirm that after nutrition education program fat intake of male type-2 diabetic patients of 41-55 years was decreased as compared to initial pre-test mean scores on fat intake.

The post-test mean score for 56-70 years age group type-2 male diabetic patients of 47.69 g was decreased by 13.75g as compared to pre-test mean fat intake of 61.44g. The calculated $t=10.88$, $p<.01$ confirm that after nutrition education program fat intake of male type-2 diabetic patients of 56-70 years was decreased as compared to initial pre-test mean scores on fat intake.

Table No. 6

Comparison of Pre Post Mean Scores on Carbohydrate Intake of Type-2 Male Diabetic Patients with Reference to Age Group

Age Group	N	Carbohydrate Intake				Mean Difference	't'
		Pre Test		Post Test			
		Mean	S.D.	Mean	S.D.		
25-40 yrs	82	322.01	37.25	224.17	18.16	97.83	25.21**
41-55 yrs	69	327.68	38.24	218.19	15.57	109.48	25.12**
55-70 yrs	41	323.26	39.85	218.83	19.37	104.43	17.08**

t(df=81) at .05 =1.99 , t(df=81) at .01 = 2.64

t(df=68) at .05 =2.00 , t(df=68) at .01 = 2.65

t(df=40) at .05 =2.02, t(df=40) at .01 = 2.71

Table 6 indicates the significant impact of nutrition education on carbohydrate intake of type-2 male diabetic patients belonging to all the three age groups namely 25-40 years, 41-55 years and 56-70 years respectively.

The post-test mean carbohydrate intake for 25-40 years age group type-2 male diabetic patients of 224.17g was decreased by 97.83g as compared to pre-test mean carbohydrate intake of 322.01g. The calculated $t=25.21$, $p<.01$ confirm that after nutrition education program, a carbohydrate intake of male type-2 diabetic patients of 25-40 years was decreased as compared to initial pre-test mean scores on carbohydrate intake.

The post-test mean carbohydrate intake for 41-55 years age group type-2 male diabetic patients of 218.19 g was decreased by 109.48 g as compared to pre-test mean carbohydrate intake of 327.68g. The calculated $t=25.12$, $p<.01$ confirm that after nutrition education program carbohydrate intake of male type-2 diabetic patients of 41-55 years was decreased as compared to initial pre-test mean scores on carbohydrate intake.

The post-test mean carbohydrate intake for 56-70 years age group type-2 male diabetic patients of 218.83g was decreased by 104.43g as compared to pre-test mean carbohydrate intake of 323.26g. The calculated $t=17.08$, $p<.01$ confirm that after nutrition education program carbohydrate intake of male type-2 diabetic patients of 56-70 years was decreased as compared to initial pre-test mean scores on carbohydrate intake.

Table No. 7

Comparison of Pre Post Mean Scores on Intake of Fibre of Type-2 Male Diabetic Patients with Reference to Age Group

Age Group	N	Intake of Fibre				Mean Difference (b-a)	't'
		Pre Test (a)		Post Test (b)			
		Mean	S.D.	Mean	S.D.		
25-40 yrs	82	25.07	2.41	35.61	3.11	+ 10.54	26.11**
41-55 yrs	69	25.79	2.48	34.33	2.75	+ 8.53	20.47**
56-70 yrs	41	25.32	3.80	34.09	3.76	+ 8.77	10.32**

$t(df=81)$ at $.05 = 1.99$, $t(df=81)$ at $.01 = 2.64$

$t(df=68)$ at $.05 = 2.00$, $t(df=68)$ at $.01 = 2.65$

$t(df=40)$ at $.05 = 2.02$, $t(df=40)$ at $.01 = 2.71$

The post-test mean fibre intake for 25-40 years age group type-2 male diabetic patients of 35.61g was increased by 10.54g as compared to pre-test mean fibre intake of 25.07g. The calculated $t=26.11$, $p<.01$ confirm that after nutrition education program, fibre intake of male type-2 diabetic patients of 25-40 years was increased as compared to initial pre-test mean scores on fibre intake.

The post-test mean fibre intake for 41-55 years age group type-2 male diabetic patients of 34.33g was increased by 8.53g as compared to pre-test mean fibre intake of 25.79g. The calculated $t=20.47$, $p<.01$ confirm that after nutrition education program fibre intake of male type-2 diabetic patients of 41-55 years was increased as compared to initial pre-test mean scores on fibre intake.

The post-test mean fibre intake for 56-70 years age group type-2 male diabetic patients of 34.09g was increased by 8.77g as compared to pre-test mean fibre intake of 25.32g. The calculated $t=10.32$, $p<.01$ confirm that after nutrition education program fibre intake of male type-2 diabetic patients of 56-70 years was increased as compared to initial pre-test mean scores on fibre intake.

Table No. 8

Comparison of Pre Post Mean Scores on Dietary Intake of Type-2 Female Diabetic Patients

Variables	N	Pre Test (a)		Post Test (b)		Mean Difference (b-a)	't'
		Mean	S.D.	Mean	S.D.		
Calorie (Kcal)	108	1948.13	234.91	1607.86	156.20	- 340.27	16.77**
Protein (g)	108	54.43	7.03	68.34	7.07	+ 13.91	21.20**
Fat(g)	108	57.55	6.39	44.67	4.31	- 12.87	27.87**
Carbohydrate (g)	108	292.82	36.94	201.17	19.61	- 91.65	27.88**
Fibre (g)	108	24.61	2.67	31.89	3.04	+ 7.28	23.33**

$t(df=107)$ at $.05 = 1.98$, $t(df=107)$ at $.01 = 2.63$

The pre-post comparison of dietary intake of Type-2 female diabetic patients yielded significant results. The post-test mean calorie ($M=1607.86$ Kcal), fat ($M=68.34g$) and carbohydrate intake ($M=201.17g$) were significantly less as compared to pre-test mean calorie ($M=1948.13$ Kcal), fat ($M=57.55g$) and carbohydrate intake ($M=292.82g$) respectively. In contrast to this, the pre-test mean scores on protein and fibre intake was 54.43g and 24.61g which were increased to 68.34g and 31.89g in post-test measurement. The results indicate a significant change in dietary intake of Type-2 female diabetic due to nutrition education at $.01$ level significance.

The data analysis on dietary intake of Type-2 female diabetic patients was further conducted on the basis of various age group. Table 33, 34, 35, 36, and 37 reports pre-post data on dietary intake of female diabetic patients based on the age group.

Table No. 9

Comparison of Pre Post Mean Scores on Calorie Intake of Type-2 Female Diabetic Patients with Reference to Age Group

Age Group	N	Calorie Intake				Mean Difference (b-a)	't'
		Pre Test (a)		Post Test (b)			
		Mean	S.D.	Mean	S.D.		
25-40 yrs	33	1893.30	161.11	1645.93	110.97	- 247.36	7.75**
41-55 yrs	40	2020.40	288.15	1608.57	164.84	- 411.82	10.56**
56-70 yrs	35	1917.25	209.64	1571.14	176.72	- 346.11	13.15**

t(df=32) at .05 =2.03 , t(df=32) at .01 = 2.72

t(df=39) at .05 =2.02 , t(df=39) at .01 = 2.71

t(df=34) at .05 =2.03, t(df=34) at .01 = 2.72

As can be observed from table 33, the effect of nutrition education was observed on the calorie intake of Type-2 female diabetic patients belonging to all the three age groups namely 25-40 years, 41-55 years and 56-70 years. It shows that calorie intake of Type-2 female diabetic patients from three age groups namely 25-40 years, 41-55 years and 56-70 years saw a significant decrease in the post-test mean score as compared to pre-test mean score. This can be observed from the mean difference (Post-test - Pre-test) of 247.36 Kcal, 411.82 Kcal and 346.11 Kcal for three age groups namely 25-40 years, 41-55 years and 56-70 years at .01 level of significance with a maximum decrease were observed in the age group 41-55 years.

Table No. 10

Comparison of Pre Post Mean Scores on Protein Intake of Type-2 Female Diabetic Patients with Reference to Age Group

Age Group	N	Protein Intake				Mean Difference (b-a)	't'
		Pre Test (a)		Post Test (b)			
		Mean	S.D.	Mean	S.D.		
25-40 yrs	33	55.09	5.89	69.93	4.74	14.84	11.23**
41-55 yrs	40	53.84	6.96	68.47	7.98	14.63	14.27**
55-70 yrs	35	54.47	8.16	66.69	7.59	12.21	11.49**

t(df=32) at .05 =2.03 , t(df=32) at .01 = 2.72

t(df=39) at .05 =2.02 , t(df=39) at .01 = 2.71

t(df=34) at .05 =2.03, t(df=34) at .01 = 2.72

A perusal of pre-post data on protein intake revealed that the mean post-test protein intake was 69.93g, 68.47g and 66.69g respectively for type-2 female diabetic patients of 25-40 years, 41-55 years and 56-70 years while the mean pre-test protein intake was 55.09g, 53.84g and 54.47g for type-2 female diabetic patients of 25-40 years, 41-55 years and 56-70 years. It shows a mean increase in protein intake in every age group after nutrition education program. The calculated $t=11.23$, $p<.01$, $t=14.27$, $p<.01$ and $t=11.49$, $p<.01$ for pre-post data on protein intake confirms that nutrition education program led to change in dietary habits of type-2 diabetic patients in age groups ranging from 25 years to 70 years.

Table No. 11
Comparison of Pre Post Mean Scores on Fat Intake of Type-2 Female Diabetic Patients with Reference to Age Group

Age Group	N	Fat Intake				Mean Difference (b-a)	't'
		Pre Test (a)		Post Test (b)			
		Mean	S.D.	Mean	S.D.		
25-40 yrs	33	57.75	3.91	45.75	3.02	- 12.00	19.56**
41-55 yrs	40	58.28	7.34	44.67	4.53	- 13.60	14.94**
56-70 yrs	35	56.53	7.10	43.66	4.91	- 12.86	16.44**

$t(df=32)$ at .05 =2.03 , $t(df=32)$ at .01 = 2.72

$t(df=39)$ at .05 =2.02 , $t(df=39)$ at .01 = 2.71

$t(df=34)$ at .05 =2.03, $t(df=34)$ at .01 = 2.72

Table 11 indicates the significant impact of nutrition education on the fat intake of type-2 female diabetic patients belonging to all the three age groups namely 25-40 years, 41-55 years and 56-70 years respectively.

The post-test mean score for 25-40 years age group type-2 female diabetic patients of 45.75g was decreased by 12g as compared to pre-test mean fat intake of 57.75g. The calculated $t=19.56$, $p<.01$ confirm that after nutrition education program fat intake of female type-2 diabetic patients of 25-40 years was decreased as compared to initial pre-test mean scores on fat intake.

The post-test mean score for 41-55 years age group type-2 female diabetic patients of 44.67g was decreased by 13.6g as compared to pre-test mean fat intake of 58.28g. The calculated $t=14.94$, $p<.01$ confirm that after nutrition education program fat intake of female type-2 diabetic patients of 41-55 years was decreased as compared to initial pre-test mean scores on fat intake.

The post-test mean score for 56-70 years age group type-2 female diabetic patients of 43.66 g was decreased by 12.86g as compared to pre-test mean fat intake of 56.53g. The calculated $t=16.44$, $p<.01$ confirm that after nutrition education program fat intake of female type-2 diabetic patients of 56-70 years was decreased as compared to initial pre-test mean scores on fat intake.

Table No. 12

Comparison of Pre Post Mean Scores on Carbohydrate Intake of Type-2 Female Diabetic Patients with Reference to Age Group

Age Group	N	Carbohydrate Intake				Mean Difference (b-a)	't'
		Pre Test (a)		Post Test (b)			
		Mean	S.D.	Mean	S.D.		
25-40 yrs	33	282.18	26.33	205.60	14.16	- 76.57	14.81**
41-55 yrs	40	305.07	44.66	200.92	20.38	- 104.15	16.25**
55-70 yrs	35	288.85	32.42	197.27	22.60	- 91.57	23.01**

t(df=32) at .05 = 2.03 , t(df=32) at .01 = 2.72

t(df=39) at .05 = 2.02 , t(df=39) at .01 = 2.71

t(df=34) at .05 = 2.03, t(df=34) at .01 = 2.72

Table 12 indicates the significant impact of nutrition education on carbohydrate intake of type-2 female diabetic patients belonging to all the three age groups namely 25-40 years, 41-55 years and 56-70 years respectively.

The post-test mean carbohydrate intake for 25-40 years age group type-2 female diabetic patients of 205.60g was decreased by 76.57g as compared to pre-test mean carbohydrate intake of 282.18g. The calculated $t=14.81$, $p<.01$ confirm that after nutrition education program, a carbohydrate intake of female type-2 diabetic patients of 25-40 years was decreased as compared to initial pre-test mean scores on carbohydrate intake.

The post-test mean carbohydrate intake for 41-55 years age group type-2 female diabetic patients of 200.92g was decreased by 104.15g as compared to pre-test mean carbohydrate intake of 305.07g. The calculated $t=16.25$, $p<.01$ confirm that after nutrition education program carbohydrate intake of female type-2 diabetic patients of 41-55 years was decreased as compared to initial pre-test mean scores on carbohydrate intake.

The post-test mean carbohydrate intake for 56-70 years age group type-2 female diabetic patients of 197.27g was decreased by 91.57g as compared to pre-test mean carbohydrate intake of 288.85g. The calculated $t=23.01$, $p<.01$ confirm that after nutrition education program carbohydrate intake of female type-2 diabetic patients of 56-70 years was decreased as compared to initial pre-test mean scores on carbohydrate intake.

The results indicate that nutrition education was equally effective in controlling carbohydrate intake of type-2 female diabetic patients ranging from 25 years of age to 70 years.

Table No. 13

Comparison of Pre Post Mean Scores on Intake of Fibre of Type-2 Female Diabetic Patients with Reference to Age Group

Age Group	N	Intake of Fibre				Mean Difference (b-a)	't'
		Pre Test (a)		Post Test (b)			
		Mean	S.D.	Mean	S.D.		
25-40 yrs	33	25.46	2.19	32.83	2.27	7.37	-14.36**
41-55 yrs	40	24.92	2.26	32.04	3.14	7.11	-13.57**
56-70 yrs	35	23.44	3.13	30.85	3.29	7.41	-12.49**

t (df=32) at .05 =2.03 , t(df=32) at .01 = 2.72

t (df=39) at .05 =2.02 , t(df=39) at .01 = 2.71

t (df=34) at .05 =2.03, t(df=34) at .01 = 2.72

The post-test mean fibre intake for 25-40 years age group type-2 female diabetic patients of 32.83g was increased by 7.37g as compared to pre-test mean fibre intake of 25.46g. The calculated $t=14.36$, $p<.01$ confirm that after nutrition education program, fibre intake of female type-2 diabetic patients of 25-40 years was increased as compared to initial pre-test mean scores on fibre intake.

The post-test mean fibre intake for 41-55 years age group type-2 female diabetic patients of 32.04g was increased by 7.11g as compared to pre-test mean fibre intake of 24.92g. The calculated $t=13.57$, $p<.01$ confirm that after nutrition education program fibre intake of female type-2 diabetic patients of 41-55 years was increased as compared to initial pre-test mean scores on fibre intake.

The post-test mean fibre intake for 56-70 years age group type-2 female diabetic patients of 30.85g was increased by 7.41 as compared to pre-test mean fibre intake of 23.44g. The calculated $t=12.49$, $p<.01$ confirm that after nutrition education program fibre intake of female type-2 diabetic patients of 56-70 years was increased as compared to initial pre-test mean scores on fibre intake.

Table 14

Analysis of Dietary Intake in Relation to RDA in Sedentary Male Type-2 Diabetic Patients

Dietary Intake	Number	RDA	Pre Test		Post Test	
			Mean	% of RDA	Mean	% of RDA
Calorie (Kcal)	67	2320	2253.6	-2.86	1780.4	-23.25%
Protein (g)	67	60	58.84	-1.93	76.03	+27.16%
Fat (g)	67	25	66.33	+165.3%	50.05	+100.2%

- A perusal of data given in table 52 shows that the sedentary male type-2 diabetic patients were consuming 2.86% less calories than the RDA before the start of the study period while they were consuming 23.25% less calories than the RDA in post-test measures.

- A perusal of data given in table 52 shows that the sedentary male type-2 diabetic patient's protein intake was 1.93% less than the suggested protein intake as per RDA while post-test measures indicate that the protein intake of sedentary male type-2 diabetic patients' protein was 27.16% more than the suggested protein intake as per RDA.
- A perusal of data given in table 52 shows that the sedentary male type-2 diabetic patients fat intake was 165.3% more than the suggested fat intake as per RDA while post-test measures indicate that the fat intake of sedentary male type-2 diabetic patients protein was 100.2% more than the suggested protein intake as per RDA.

Table 15

Analysis of Dietary Intake in Relation to RDA in Moderately Active Male Type-2 Diabetic Patients

Dietary Intake	Number	RDA	Pre Test		Post Test	
			Mean	% of RDA	Mean	% of RDA
Calorie (Kcal)	125	2730	2084.94	-23.62%	1752.6	-35.8%
Protein (g)	125	60	55.80	-7.0%	74.02	+26.6%
Fat (g)	125	30	60.97	+103.23%	48.3	+61%

- A perusal of data given in table 53 shows that the moderately active male type-2 diabetic patients were consuming 23.62% less calories than the RDA before the start of the study period while they were consuming 35.8% less calories than the RDA in post-test measures.
- A perusal of data given in table 53 shows that the moderately active male type-2 diabetic patient's protein intake was 7% less than the suggested protein intake as per RDA while post-test measures indicate that the protein intake of moderately active male type-2 diabetic patient's protein was 26.6% more than the suggested protein intake as per RDA.
- A perusal of data given in table 53 shows that the moderately active male type-2 diabetic patient's fat intake was 103.23% more than the suggested fat intake as per RDA while post-test measures indicate that the fat intake of moderately active male type-2 diabetic patients protein was 61% more than the suggested protein intake as per RDA.

Table 16

Analysis of Dietary Intake in Relation to RDA in Sedentary Female Type-2 Diabetic Patients

Dietary Intake	Number	RDA	Pre Test		Post Test	
			Mean	% of RDA	Mean	% of RDA
Calorie (Kcal)	10	1900	2391.9	+25.88%	1703.4	-10.34%
Protein (g)	10	55	61.4	+11.63	74.28	+35.05%
Fat (g)	10	20	67.1	+235.5%	47.52	+137.6%

- A perusal of data given in table 54 shows that the sedentary female type-2 diabetic patients were consuming 25.88% more calories than the RDA before the start of the study period while they were consuming 10.34% less calories than the RDA in post-test measures.
- A perusal of data given in table 54 shows that the sedentary female type-2 diabetic patient's protein intake was 11.63% more than the suggested protein intake as per RDA while post-test measures indicate that the protein intake of sedentary female type-2 diabetic patient's protein was 35.05% more than the suggested protein intake as per RDA.
- A perusal of data given in table 54 shows that the sedentary female type-2 diabetic patients fat intake was 235.5% more than the suggested fat intake as per RDA while post-test measures indicate that the fat intake of sedentary female type-2 diabetic patients protein was 137.6% more than the suggested protein intake as per RDA.

Table 17

Analysis of Dietary Intake in Relation to RDA in Moderately Active Female Type-2 Diabetic Patients

Dietary Intake	Number	RDA	Pre Test		Post Test	
			Mean	% of RDA	Mean	% of RDA
Calorie (Kcal)	98	2230	1902.8	-14.67%	1598.1	-28.33%
Protein (g)	98	55	53.71	-2.34%	67.74	23.09%
Fat (g)	98	25	56.57	+126.28%	44.38	+77.52%

- A perusal of data given in table 55 shows that the moderately active female type-2 diabetic patients were consuming 14.67% less calories than the RDA before the start of the study period while they were consuming 28.33% less calories than the RDA in post-test measures.
- A perusal of data given in table 55 shows that the moderately active female type-2 diabetic patient's protein intake was 2.34% less than the suggested protein intake as per RDA while post-test measures indicate that the protein intake of moderately active female type-2 diabetic patient's protein was 23.09% more than the suggested protein intake as per RDA.
- A perusal of data given in table 17 shows that the moderately active female type-2 diabetic patients fat intake was 126.28% more than the suggested fat intake as per RDA while post-test measures indicate that the fat intake of moderately active female type-2 diabetic patients protein was 77.52% more than the suggested protein intake as per RDA.

Table No. 18

Relationship between Socio-Demographic Variables with Gain Scores on Dietary Intake

Socio-Demographic Variables		Gain Score				
		Calorie	Carbohydrate	Fat	Protein	Fibre
Age	r	.106	-.095	-.043	-.105	-.161**
Gender	r	-.086	.157**	.081	-.233**	-.261**
Marital status	r	-.039	.051	.064	.034	-.072
Education	r	.011	-.044	-.009	.063	.108
Family Income	r	-.061	.033	.050	.044	.054

** Significant at .01 level

- No significant association was observed between age with pre-post changes in calories, carbohydrate, fat and protein intake but the changes in fiber intake saw a significant decrease in relation to advancing age at .01 level of statistical significance.
- No significant association was observed between gender and gain score on calorie and fat in a group of Type-2 diabetic patients but the association was significant and positive between gender and gain score on carbohydrate intake while significant but negative between gender and gain score on protein and fiber intake respectively.
- No significant association was observed between educations with gain score on dietary intake.
- No significant association was observed between family incomes with gain score on dietary intake.

Conclusions

The present study was to assess the dietary intake of the patients. There is strong evidence that the three months of nutritional counselling had an effect on dietary intake of type-2 diabetic patients. The pre-test mean calorie, fat and carbohydrate intake was decreased in post-test measures after administration of nutrition education program while intake of protein and fibre was increased during the pre-post test period at .01 level of statistical significance. The dietary habits of type 2 diabetics have been reported to be poor. The health care professionals can help their patients in achieving health goals by individualizing their nutrition interventions and continuing the support for changes. They should also identify the barriers that are hindering the patients from not following the recommended dietary guidelines. To achieve optimum results from self-care management, patients, doctors, and dietitians should work together. A whopping jump from 34% in the pre-test to 69% in post-test to a classification "Good" in waist-hip ratio. So naturally, the percentage of Type-2 diabetic patients is decreased in other categories of waist-hip ratio namely "Average" and "At risk". Hence the frequency distribution states the utility of managing fat percentage in Type-2 diabetic patients through nutrition education and counselling. There is strong evidence that the three months of nutritional counselling had an effect on weight measures, blood sugar level and healthy dietary practices of type-2 diabetic patients after administration of nutrition education program at .01 level of statistical significance.

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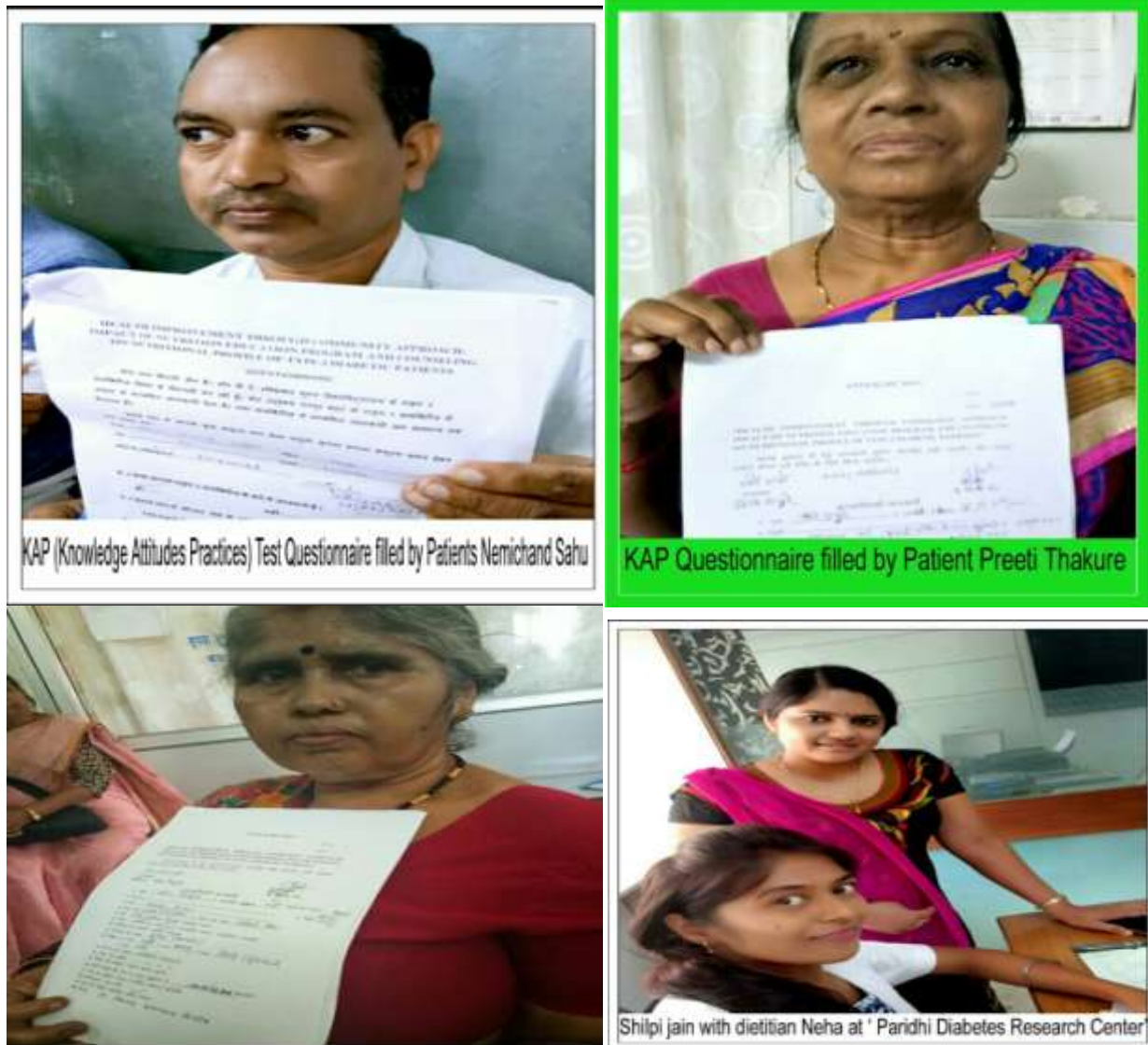


Fig: Data collection of demographic profile and KAP Test questionnaire filled by patients at 'Paridhi Diabetes Research Centre', Raipur.