■ *Research Paper*

Effect of nutritional counselling on glucose level of middle aged non-insulin dependent diabetics

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■**ABSTRACT :** Diabetic patients who were suffering from type II diabetes mellitus and were only on oral hypoglycemic drugs for the treatment of the disease and registered at Govt. Sardar Patel Medical College and hospital, Bikaner (Rajasthan, India) as outdoor patients were studied to find out the effect of nutritional counselling on blood and urinary glucose level. The study was conducted on 180 middle aged diabetics from middle income group. The total sample was divided into 2 strata. Stratum I included diabetics suffering from last 5 years and stratum II included diabetics suffering from last 10 years. Further in each strata, diabetics were divided on the basis of sex and BMI into 3 categories *i.e.* obese, normal weight and underweight. A structured interview schedule was developed to collect the pertinent information from the respondents. Individual counselling method was opted to educate the diabetics about life style modifications to control the disease. Data on biochemical parameter were collected twice, first record was taken at starting of the study (prior to counselling) and the second after 3 months of nutritional counselling. Past history of the subjects in relation to diabetes like age at onset of disease, duration of disease, history of disease in the family, associated diseases and symptoms occurring on hyperglycemia were also studied. The mean fasting blood sugar level ranged between 'slightly elevated to elevated' levels for obese, normal weight and underweight groups with the overall mean noted as 166.6 and 174.9 mg/dl prior to counselling in both the strata, respectively. Further, a significant (P<0.005) reduction in FBS was noted after the counselling, with the mean values for the two strata as 113.7 and 116.8 mg/dl. Also the subjects of stratum II were having significantly (P<0.05) higher levels of blood sugar than of stratum I. Mean levels of urine sugar reduced significantly (P<0.005) after the counselling. The prior counselling mean for urine sugar was noted as 0.39 and 0.76 gm per cent for the stratum I and II, respectively. Further, stratum II subjects were having significantly (P<0.01) higher levels of urine sugar than the subjects of stratum I. Nutrition counselling have been found to be effective in reducing the level of glucose in blood and urine.

■ **KEY WORDS :** Non-insulin dependent diabetics, Nutritional counselling, Body mass index, Fasting blood glucose, Urinary glucose

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Diabetes is a disease that should be prevented and/or controlled, as it cannot be cured completely. The approach for the treatment of diabetes has been radically changed in the recent decades. Due to advanced technologies, diabetes is now one step closer to control by means of diet management, insulin/hypoglycemic drugs and exercise along with other life style changes (ADA and WHO,2000). In the past 30 years, the prevalence of diabetes type 2 has skyrocketed to such an extent that it is now viewed as an epidemic in the western world. From being a once fairly mild and rare ailment of the elderly to becoming a chronic disease, diabetes mellitus affects people of every age, race, and background, and is now a major modern cause of premature death in many countries around the world,

In fact, the success of treatment of diabetes mellitus largely depends upon effective motivation of the patients, for

which education is the best way. Education has now become an integral part of managing diabetes and has proved to improve the various outcomes. A study done by Stone (1994) on reasons of poor control of disease concluded that in most cases, due to lack of knowledge and inefficient counseling, diet therapy was not practiced effectively to have control on disease. Proper nutrition education and individual counseling help the patients to understand the disease and follow the therapy effectively. This in turn reduces the risk of complications to a greater extent and improves the quality of life (Pickup and Williams, 2003).

The role of diet management in diabetes has now been well recognized all over the world. Diet and exercise are so powerful tools that they free many of the patients from medications and insulin doses. Several long term studies have unequivocally proved the prime importance of calorie restricted well balanced diet in the treatment of disease. The diabetic diet is not complete deviation from the normal diet rather the vital aspect is routine of meals and quantity of food consumed. The programme of diet follows "divide (meals) and conquer (disease)" (Laliberte, 2003).

Bikaner is one of the 32 districts of Rajasthan (India) and occupies about 8 per cent area of the state. The number of diabetics in Bikaner city is increasing with a rapid rate for which heredity, ignorance and lack of knowledge are the main causative factors. Diet, drugs/insulin and exercise are the three main horses on which management of diabetes runs. Slight modification of diet according to the disease not only helps the patients to control diabetes but also fulfills the daily need of nutrients for the body (Mani *et al.*, 2002). Along with the balanced diet, natural hypoglycemic foods also prove very beneficial in decreasing the elevated levels of blood glucose and also have no side effects as compared to synthetic hypoglycemic drugs.

Thus, to equip the patients with skill, knowledge and attitudes, to enable them to solve their health problems and better living with diabetes, the present investigation was framed.

Objectives:
- To find out the effect of nutrition counseling on blood and urinary glucose level of the diabetics.
- To correlate the effect of nutrition counseling with the duration of disease and body mass index of the diabetics

■ RESEARCH METHODS

Methodological aspects related to present study have been described in following phases:

Phase I: Selection of the samples:
Bikaner is one of the 7 divisions of Rajasthan having 5 sub-divisions. Bikaner division was chosen as the area for study. Further, those subjects were chosen who were residing in urban area of the Bikaner city. Purposive sampling method was undertaken to select the patients. Diabetic patients who were registered at Govt. Sardar Patel Medical College and hospital, Bikaner as outdoor patients were taken under the study group. The study was conducted on 180 middle aged diabetics. All subjects belonging to the middle income group were taken for the study.

The collection of sample was based on the duration of disease. The total sample was divided into 2 strata. Stratum I included diabetics suffering from last 5 years and stratum II included diabetics suffering from last 10 years. Further each strata was divided on the basis of BMI (body mass index) into 3 categories *i.e.* obese, normal weight and underweight. Further, equal number of males and females were studied under each category.

Only those subjects were chosen for the study who were suffering from type II diabetes mellitus *i.e.* non-insulin dependant diabetes mellitus and were only on oral hypoglycemic drugs for the treatment of the disease and not on insulin. Availability and willingness of the subjects to cooperate and participate during the course of the study were considered while selecting and recording the various information required.

General information like subjects' age, sex, income, educational status, occupational status, food habits and type of life style were studied. Past history of the subjects in relation to diabetes like age at onset of disease, duration of disease, history of disease in the family, associated diseases and symptoms occurring on hyperglycemia were also studied for effective counselling of the diabetics

Phase II: Assessment of glucose level of blood and urine prior and after nutritional counseling:
The nutritional profile of the subjects was assessed using biochemical parameters specifically blood and urinary glucose level. Data on glucose level were collected twice, first record was taken at starting of the study (prior to counselling) and the second after 3 months of nutrition counselling. Extreme efforts were done to train the patients to understand the disease and to help themselves to cope up with everyday demands of diabetes and to regulate it. For the purpose, a booklet was also prepared on complete information regarding etiology of diabetes and management of the disease was discussed in detail in the booklet. The booklet was prepared after thorough study of books, discussion with experts and on the basis of work experience in hospitals. Main three principles of management of diabetes were considered namely diet, drug and exercise in the detailed in booklet. Acute and chronic complication of diabetes were explained with the help of coloured photos so that subjects can be aware of the severity of the disease if not handled carefully. Exercise part was explained to the subject so that they can do these exercises by their own at home.

Next, the individual counselling method was opted to educate about the disease, for each of the patient. Education and counselling were imparted in a friendly environment. The education programme was rigorously evaluated to determine their outcomes, cost effectiveness and to optimize the method of counselling. No education programme can be said completed without evaluation of outcomes and desirable changes. Some possible biochemical measurements, which are simple and easy to perform and at the same time giving the maximum information on nutritional status, were chosen for the present study. Variation in the intake of different nutrients present in the diet is reflected by the change in the nutrients in blood, tissues and in urine.

Estimation of blood glucose level :

The blood sugar concentration or blood glucose level is the amount of glucose (sugar) present in the blood of a human or animal. The body naturally tightly regulates blood glucose levels as a part of metabolic homeostasis. Diabetes mellitus is characterized by persistent hyperglycemia from any of several causes, and is the most prominent disease related to failure of blood sugar regulation. For glucose estimations in all the diabetic subjects venous blood samples was taken after an over night fasting. The blood samples were collected using anticoagulants. Blood glucose level was estimated using method given by Trinder (1969). Classification of UKPDS (1998) was used to find out the spectrum of glucose homeostasis and diabetes among diabetic patients.

Estimation of urine glucose level :

When sugar exceeds 180 mg/dl in blood, it appears in urine. The presence of sugar in urine signifies the severity of disease. Estimation of presence of sugar/glucose in urine is estimated by Bendicts' quantitative reagent test (Sachdeva, 1991).

■ RESEARCH FINDINGS AND DISCUSSION

The mean age at the onset of diabetes was 47.0 years and 46.2 years for the subjects of stratum I and stratum II, respectively (Table 1). Comparing the data according to the sex, the results revealed that incidence of diabetes was slightly earlier in females as compared to males, although the difference was not significant. This may be due to the fact that menopause also occurs in between the age of 45-55 years and menopausal women are at a high risk of diabetes due to hormonal changes. There is a greater incidence of higher levels of blood glucose and diabetes after menopause as compared to pre-menopausal stage. Comparing the data on BMI basis, obese and underweight subjects were having slightly earlier prediction of diabetes than normal weight group. But the difference found was not significant.

In the development of some diseases, biochemical changes can be expected to occur prior to clinical manifestations. Therefore, in the present study blood glucose and urine sugar levels were measured for each of the patients two times *i.e.* prior and after the counselling. The results interpreted as follows:

Blood glucose level:

Table 2 and 3 clearly discerns that total mean fasting blood sugar (FBS) level prior to counselling was 166.2 and 174.9 mg/dl for stratum I and II, respectively. Thus, both the strata were falling in the range of 'slightly elevated levels' of FBS. But after counselling, the level of blood glucose dropped to 113.7 and 116.8 mg/dl for the two strata, respectively.

Table 1 : Mean age (in years) of diagnosis of the diabetics									
BMI	Obese		Normal weight		Underweight		Total		Overall
	M	F	M	F	M	F	M	F	
Stratum I									
Age (yrs) ± S.E.	47.2± 2.26	45.4± 1.95	48.2± 1.72	48.3± 1.87	47.5± 1.71	45.7± 1.71	47.6± 1.13	46.4± 1.06	47.0± 0.77
Stratum II									
Age(yrs)± S.E.	46.7-± 1.96	44.5± 1.78	47.5± 1.87	49.4± 1.73	45.5± 1.71	43.7± 1.78	46.5± 1.07	45.8± 0.99	46.2± 0.73
F Value	0.24	0.534	1.042	0.981	2.10	0.699	1.67	2.08	0.194

Table 2: Mean fasting blood glucose level (mg/dl) of the stratum I diabetic subjects, prior and after counselling									
Blood glucose (mg/dl)	Obese		Normal weight		Under weight		Total		Overall
	M	F	M	F	M	F	M	F	
Prior Counselling	181.1	197.0	167.0	168.0	149.0	135.6	165.7	166.8	166.2
± S.E.	± 14.41	± 16.99	± 8.05	± 14.7	± 7.67	± 8.86	± 6.29	± 8.75	± 5.34
After Counselling	117.8	115.5	113.1	115.4	110.7	109.6	113.9	113.5	113.7
± S.E.	± 7.46	± 4.75	± 4.98	± 5.01	± 3.14	± 4.63	± 6.13	± 2.74	± 2.06
T Value	3.90***	4.63***	5.73***	3.42***	4.62***	2.80***	5.92***	5.86***	9.24***

*** indicates significance of value at P=0.05

Table 3: Mean fasting blood glucose level (mg/dl) of the stratum II diabetic subjects, prior and after counselling

Blood glucose (mg/dl)	Obese		Normal weight		Under weight		Total		Overall
	M	F	M	F	M	F	M	F	
Prior counselling	187.6	201.0	183.3	173.9	166.2	137.4	179.0	170.8	174.9
± S.E.	± 17.38	± 15.45	± 10.13	± 14.13	± 8.18	± 12.5	± 7.84	± 8.31	± 5.70
After counselling	122.0	124.2	118.9	114.1	111.8	109.9	117.6	116.1	116.8
± S.E.	± 7.36	± 5.88	± 4.75	± 4.82	± 4.74	± 4.29	± 3.24	± 4.95	± 2.21
T Value	3.47***	3.64***	3.74***	4.00***	3.09***	3.90***	6.24**	4.66***	8.52***

*** indicates significance of value at P=0.05

Comparing the data highly significant decrease (P<0.005) in FBS was noted after the counselling, in stratum I and II both.

When FBS level was compared in between the two strata (Table 4), significant difference (P<0.05) was noted prior to counselling. The level of blood sugar was noted to be slightly higher in stratum II subjects. This may be due to the reason that stratum II subjects were suffering from diabetes since longer duration (10 yrs) with uncontrolled conditions than stratum I subjects.

A study conducted by Jarrett *et al.* (1999) on 100 diabetics also concluded the elevated levels of fasting blood sugar and lipid profile was noted to be higher in the patients who were suffering from diabetes since longer duration (more than 8 years) than the subjects who had diabetes since last 2 to 3 years. Thus, the previous finding supports the present results. Further, a non-significant difference was noted in FBS level in between stratum I and II after the counseling.

Comparing the data on the basis of BMI in stratum I, the level of fasting blood sugar prior to counselling was noted to be higher in obese male and female subjects (181.1 and 197.0 mg/dl) as compared to normal weight (167.0 and 168.0 mg/dl) and underweight subjects (149.0 and 135.6 mg/dl). Similarly in stratum II also, obese male and female subjects (187.6 and 201.0 mg/dl) had higher FBS values than normal weight (183.3 and 173.9 mg/dl) and underweight (166.2 and 137.4 mg/dl) subjects.

Kadawaki *et al.* (2000) also determined in his study that risk factors like obesity worsen diabetes and is responsible for elevated levels of FBS, lipid profile and HbA_{1C} in the subjects than those with diabetes but having normal weight. Thus, according to the classification of UKPDS (1998), the mean levels of FBS prior to counselling ranged between 'slightly elevated' levels to 'elevated' levels in the three BMI groups, in both the strata.

Further, significant decrease (P<0.005) in FBS level was noted after the counselling within all the groups based on

BMI in both the strata (Fig. 1 and 2). Whereas a non-significant difference in FBS levels was noted in between the two strata in all BMI groups at both, prior and after the counselling.
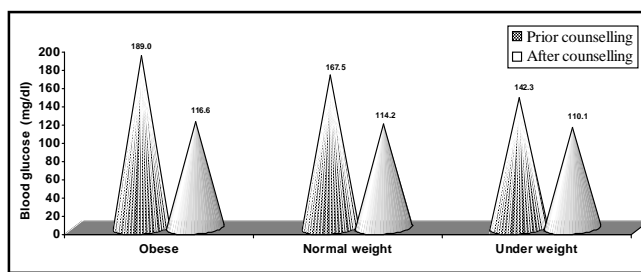

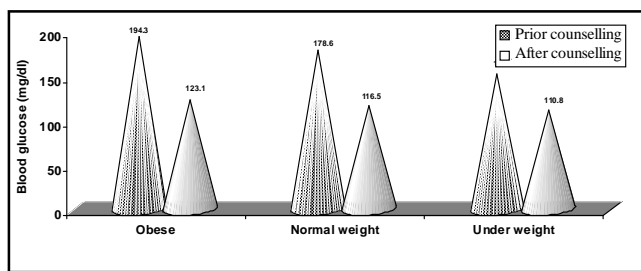Fig. 1 : Mean blood glucose level of the diabetics of stratum I

Fig. 2 : Mean blood glucose level of the diabetics of stratum II

Results discerned from Tables 5 and 6 revealed that in stratum I prior to counselling, equal distribution of subjects *i.e.* 24.45 per cent had sugar level above 126 mg/dl (diabetic level), between 150-180 mg/dl (slightly elevated level) and between 181-240 mg/dl (elevated level). Per cent of subjects falling in 'seriously elevated' levels (241-360 mg/dl) were noted to be in 8.88 per cent. Only 7.78 and 9.99 per cent subjects were having FBS less than 100 mg/dl (non diabetic level) and between 100-125 mg/dl (IGT) in stratum I, respectively.

A significant (P<0.001) decrease in per cent subjects from the elevated categories of FBS was noted as an impact of

Table 4: Stratum-wise level of significance in mean fasting blood glucose level of the diabetics prior and after counselling

Stratum wise counselling	Obese		Normal weight		Under weight		Total		Overall
	M	F	M	F	M	F	M	F	
F value for prior counselling	0.081	0.026	0.496	0.062	0.360	0.023	0.293	1.312	1.391*
F value for after counselling	0.160	1.334	0.719	0.034	0.044	0.002	0.824	0.629	1.039

* indicates significance of value at P=0..05

nutrition education and counselling. In stratum I, none of the subjects was noted for 'seriously elevated' levels of blood glucose after the counselling. Only 1.11 per cent and 5.56 per cent subjects were having 'elevated' and 'slightly elevated' levels of FBS. 21.11 per cent subjects were at 'diabetic level' with 25.55 per cent subjects at 'non-diabetic' level (Table 5). Similarly in stratum II, 28.88 per cent, 26.66 per cent and 12.23 per cent subjects had 'slightly elevated', 'elevated' and 'seriously elevated' levels of blood glucose levels. 12.23 per cent and 15.55 per cent subjects were in the category of 'IGT'

Table 5 : Per cent distribution of the diabetics according to blood glucose level, prior and after counselling (Stratum I)

Blood glucose (mg/dl)	Status	Obese M	Obese F	Normal weight M	Normal weight F	Under weight M	Under weight F	Total M	Total F	Overall
<100	Non-diabetic level									
Prior Coun.		13.33 (2)	--	--	6.67 (1)	6.67 (1)	20 (3)	6.67 (1)	8.89 (4)	7.78 (7)
After Coun.		20.00 (3)	26.67 (4)	33.33 (5)	33.33 (5)	13.33 (2)	26.67 (4)	22.22 (10)	28.89 (13)	25.55 (23)
100-125	Impaired glucose tolerance									
Prior Coun.		--	20.00 (3)	--	13.33 (2)	13.33 (2)	13.33 (2)	4.44 (2)	15.56 (7)	9.99 (9)
After Coun.		53.33 (8)	33.33 (5)	46.67 (7)	26.67 (4)	66.67 (10)	53.33 (8)	55.56 (25)	37.78 (17)	46.66 (42)
> 126	Diabetic level									
Prior Coun.		20.00 (3)	13.33 (2)	26.66 (4)	13.33 (2)	33.33 (5)	40.00 (6)	26.67 (12)	22.22 (10)	24.45 (22)
After Coun.		13.33 (2)	33.33 (5)	6.67 (1)	40.00 (6)	20.00 (3)	13.33 (2)	13.33 (6)	28.89 (13)	21.11 (19)
150 – 180	Slightly elevated level									
Prior Coun.		6.67 (1)	20.00 (3)	60.00 (9)	26.67 (4)	20.00 (3)	13.33 (2)	28.89 (13)	20.00 (9)	24.45 (22)
After Coun.		6.67 (1)	6.67 (1)	13.33 (2)	--	--	6.67 (1)	6.67 (3)	4.44 (2)	5.56 (5)
181 – 240	Elevated level									
Prior Coun.		46.67 (7)	20.00 (3)	6.67 (1)	33.33 (5)	26.67 (4)	13.34 (2)	26.67 (12)	22.22 (10)	24.45 (22)
After Coun.		6.67 (1)	--	--	--	--	--	2.22 (1)	--	1.11 (1)
241 – 360	Seriously elevated level									
Prior Coun.		13.33 (2)	26.67 (4)	6.67 (1)	6.67 (1)	--	--	6.67 (3)	11.11 (5)	8.88 (8)
After Coun.		--	--	--	--	--	--	--	--	--

Figures in parenthesis denote number of subjects   Counselling wise $\chi^2 = 67.91^{****}$ (P<0.001)

Table 6 : Per cent distribution of the diabetics according to blood glucose level, prior and after counselling (Stratum II)

Blood glucose (mg/dl)	Status	Obese M	Obese F	Normal weight M	Normal weight F	Under weight M	Under weight F	Total M	Total F	Overall
<100	Non diabetic level									
Prior Coun.		6.67 (1)	--	--	6.67 (1)	--	13.33 (2)	2.22 (1)	6.67 (3)	4.45 (4)
After Coun.		26.67 (4)	20.0 (3)	20.0 (3)	26.67 (4)	26.67 (4)	33.33 (5)	24.44 (11)	26.67 (12)	25.55 (23)
100-125	Impaired glucose tolerance									
Prior Coun.		13.33 (2)	6.67 (1)	--	13.33 (2)	20.0 (3)	20.0 (3)	11.11 (5)	13.33 (6)	12.23 (11)
After Coun.		40.0 (6)	26.67 (4)	26.67 (4)	46.67 (7)	53.33 (8)	46.67 (7)	40.0 (18)	40.0 (18)	40.00 (36)
> 126	Diabetic level									
Prior Coun.		13.33 (2)	6.67 (1)	6.67 (1)	13.33 (2)	20.0 (3)	33.34 (5)	13.33 (6)	17.78 (8)	15.55 (14)
After Coun.		13.33 (2)	33.33 (5)	46.67 (7)	20.0 (3)	13.33 (2)	13.33 (2)	24.45 (11)	22.22 (10)	23.33 (21)
150 – 180	Slightly elevated level									
Prior Coun.		20.0 (3)	40.0 (6)	53.33 (8)	13.33 (2)	26.67 (4)	20.0 (3)	33.34 (15)	24.44 (11)	28.88 (26)
After Coun.		20.0 (3)	20.0 (3)	6.66 (1)	6.66 (1)	6.67 (1)	6.67 (1)	11.11 (5)	11.11 (5)	11.12 (10)
181 – 240	Elevated level									
Prior Coun.		20.0 (3)	20.0 (3)	33.33 (5)	46.67 (7)	26.67 (4)	13.33 (2)	26.67 (12)	26.67 (12)	26.66 (24)
After Coun.		--	--	--	--	--	--	--	--	--
241 – 360	Seriously elevated level									
Prior Coun.		26.67 (4)	26.66 (4)	6.67 (1)	6.67 (1)	6.66 (1)	--	13.33 (6)	11.11 (5)	12.23 (11)
After Coun.		--	--	--	--	--	--	--	--	--

Figures in parenthesis denote number of subjects   Counselling wise $\chi^2 = 69.77^{****}$ (P<0.001)

Table 7 : Mean values of urine sugar level (gm%) of Stratum I diabetic subjects, prior and after counselling

Urine sugar (g %)	Obese		Normal weight		Under weight		Total		Overall
	M	F	M	F	M	F	M	F	
Prior counselling	1.0	1.2	0.1	0.01	0.03	0.02	0.37	0.41	0.39
± S.E.	±0.26	±0.22	±0.44	±0.25	±0.25	±0.15	±0.13	±0.13	±0.09
After counselling	--	--	--	--	--	--	--	--	--
±S.E.	--	--	--	--	--	--	--	--	--
T Value	4.07***	4.59***	2.81***	2.80***	2.80***	3.32***	3.15***	4.15***	8.88***

*** indicates significance of value at P=0.05

Table 8 : Mean values of urine sugar level (g%) of Stratum II diabetic subjects, prior and after counselling

Urine sugar (g%)	Obese		Normal weight		Under weight		Total		Overall
	M	F	M	F	M	F	M	F	
Prior Counselling	1.3	1.5	1.0	0.5	0.2	0.09	0.83	0.69	0.76
± S.E.	±0.18	±0.15	±0.23	±0.16	±0.27	±0.15	±0.12	±0.10	±0.08
After Counselling	--	--	--	--	--	--	--	--	--
±S.E.	--	--	--	--	--	--	--	--	--
T Value	3.22***	9.00***	3.91***	3.91***	2.82***	2.86***	3.33***	4.00***	5.75***
F value of Prior Couns.	2.56*	2.68*	3.42*	2.89*	3.56*	3.29*	2.04	2.36	2.64*
F value of After Couns.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

* and *** indicate significance of values at P=0.5 and 0.05, respectively

and 'diabetic' blood glucose level (Table 6).

But after 3 months of counselling, a significant (P<0.001) change in per cent subjects for different FBS categories was noted and data revealed that no subject lied in the category of 'elevated' and 'seriously elevated levels'. Only 11.12 per cent subjects had 'slightly elevated' levels of FBS. Whereas 25.55 per cent had FBS range at 'non diabetic' level and 23.33 per cent were at initial 'diabetic' level. Thus the discriminative decrease in per cent subjects within the strata from the categories of different elevated levels of FBS prior to counselling to the categories of decreased levels of FBS after the counselling was noted.
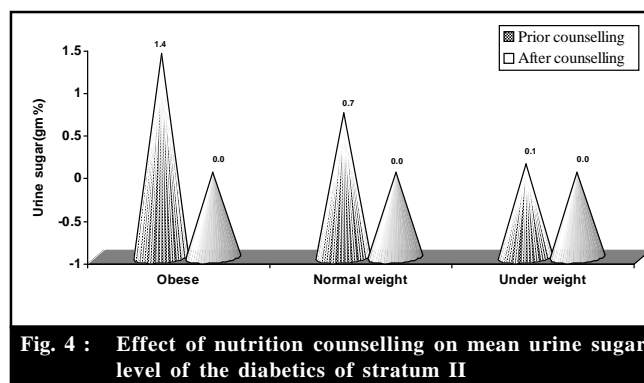
Urine sugar:

When sugar exceeds 180 mg/dl in blood, it appears in urine. The presence of sugar in urine signifies the severity of disease. The overall mean noted prior to counselling for the two strata was 0.39 and 0.76 gm per cent, respectively. Where as after the counselling due to significant reduction in blood glucose level, negligible amount of sugar in urine was noted. Thus highly significant decrease (P<0.005) in urine sugar was noted with in the same strata after the counselling. Further, significant difference (P<0.05) was noted in between the two strata at prior counselling level. The level of urine sugar was found to be higher in stratum II subjects due to the elevated levels of blood glucose than of stratum I(Table 7and 8).

Discussing the different BMI groups, obese subjects were noted to have higher level of urine sugar as compared to normal weight and underweight subjects in both the strata (Fig. 3 and 4). As obese subjects were having higher blood glucose levels, therefore the level of urine sugar was also noted to be high. Further highly significant reduction (P<0.005) in both the strata, in urine sugar level was noted after the counselling within the same group.
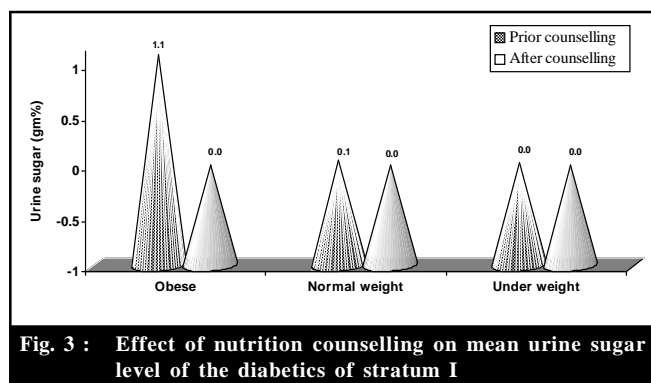
Fig. 3 : Effect of nutrition counselling on mean urine sugar level of the diabetics of stratum I

Fig. 4 : Effect of nutrition counselling on mean urine sugar level of the diabetics of stratum II

When compared in between the two strata prior to counselling, significant difference (P<0.05) was noted for all BMI groups. Subjects of stratum II were having higher levels of urine sugar than the subjects of stratum I. Whereas non significant difference was noted after the counselling in between the two strata.

Conclusion:

The mean age at the onset of diabetes ranged between 45 to 48 years. The mean levels of fasting blood sugar ranged between 'slightly elevated to elevated' levels for obese, normal weight and underweight groups. Further, a significant reduction in FBS was noted after the nutrition counseling. Mean levels of urine sugar reduced significantly after the counselling. Further, stratum II subjects were having significantly higher levels of blood and urine sugar than the subjects of stratum I. Reducing excess weight and obesity are key factors in managing diabetes more efficiently so one can improve overall health and general sense of well being. It is said, "A disease known is half cured. By adequately following the changes in dietary pattern, activity, updating yourself with all the related information and not letting useless myths to get you down, will lead to have a good control of the disease and a better quality of life".

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