

**International Journal of Biomedical and Advance Research**

ISSN: 2229-3809 (Online); 2455-0558 (Print)

Journal DOI: [10.7439/ijbar](https://doi.org/10.7439/ijbar)

CODEN: IJBABN

**Original Research Article**

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**Analytical study of associated risk factors of type 2 diabetes mellitus among rural population aged 40 years and above**

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E-mail: [drfarooqblde@gmail.com](mailto:drfarooqblde@gmail.com)**Abstract**

Diabetes is now one of the most common non-communicable diseases globally and is emerging fast as one of the most serious health problems of our time. The present study was carried out in the village Hebbal, which is a designated rural field practice area of Community Medicine Department, M R Medical College, Gulbarga for duration of one year from 2008 to 2009 with aim to out to determine the prevalence of diabetes and its associated factors for causation of Diabetes Mellitus II. The present study found positive association between stress, sedentary lifestyle, family history of diabetes, hypertension and alcohol consumption with abnormal glucose tolerance. It was also found that type of family and type of diet were not significantly associated with abnormal glucose tolerance.

**Keywords:** diabetes mellitus, non-communicable diseases, abnormal glucose tolerance**1.Introduction**

Diabetes is now one of the most common non-communicable diseases globally and is emerging fast as one of the most serious health problems of our time. It is a global epidemic with devastating humanitarian, social and economic consequences. The disease claims as many lives per year as HIV/AIDS and places a severe burden on healthcare systems and economies everywhere, with the heaviest burden falling on low and middle income countries.

It is estimated that 246 million people worldwide will live with the disease in 2007, representing 5.9% of the adult population (20-79 age group). The number is expected to reach some 380 million by 2025, representing 7.1% of the adult population. It is estimated that almost 80% of the 246 million people with diabetes today live in developing countries. Each year, some 3.8 million adults die from diabetes-related causes. Almost 80% of diabetes deaths occur in low and middle – income countries.[1]

India leads the world with largest number of diabetic subjects earning the dubious distinction of being termed the diabetes capital of the world. According to the diabetes Atlas 2006 published by the International Diabetes Federation, the number of people with diabetes in India currently around 40.9 million is expected to rise to 69.9 million by 2025 unless urgent preventive steps are taken.[2]

It would be important and worthwhile to determine the role of various risk factors in the causation of type II diabetes in local epidemiological setup. The present study was aimed to determine the associated risk factors. It would be important and worthwhile to determine the role of various risk factors in the causation of type II diabetes in local epidemiological setup. So using WHO diagnostic criteria for diagnosis of diabetes, a community based cross – sectional study was carried out to determine the prevalence of diabetes and its associated factors in village Hebbal which is rural field practicing area of M.R. Medical college, Gulbarga.

## 2. Materials and methods

The present study was carried out in the village Hebbal, which is a designated rural field practice area of Community Medicine Department, M R Medical College, Gulbarga for duration of one year from 2008 to 2009. It has a total population of 4178. The study population included all subjects who were aged 40 years and above. This population serves as denominator to know the prevalence of diabetes. The present study was a population based cross – sectional study. Values of diagnosis of diabetes using glucometer (WHO 1999 criteria)[3]

### Glucose concentration in mg/dl

Capillary whole blood (mg/dl)	
<b>Diabetes mellitus</b>	
Fasting	≥ 110
2hrs – post glucose	≥ 200
<b>Impaired glucose tolerance</b>	
Fasting	< 110
2hrs post-glucose	≥140 - <200

The percentage of Population aged 40 years and above of age is 24.80%.[4] The sample size in our study area with a total population of 4178 was estimated as 1036. In the present study a total of 1000 People were screened for diabetes, as on repeated visits the remaining 36 people could not be contacted. The data was collected by house to house visit, those person who were aged 40 years and above were interviewed using pre-designed and pre-tested Proforma. This was followed by a detailed clinical

examination, anthropometric measurements and investigations.

## 3. Results

It was found that number of hours spent in watching TV is significantly associated with the abnormal glucose tolerance. ( P<0.001) (Table 1) Prevalence of IGT among hypertensives and normotensives was 12.38% and 3.01% respectively. It was found that blood pressure is significantly associated with abnormal glucose tolerance. (P<0.001) (Table 2) Table 3 shows that 115 cases (11.5%) among study population had positive family history of diabetes. Family history of diabetes was significantly associated with abnormal glucose tolerance (P<0.001). Table 4 shows that there was trend of increasing prevalence of diabetes with decrease in physical activity. Also physical activity was significantly associated with abnormal glucose tolerance.(P<0.001) Prevalence of diabetes and IGT increased with increase in BMI. There was also significant association between BMI and abnormal glucose tolerance (P<0.001)(Table 5). Type of diet was not positively associated with abnormal glucose tolerance. (P<0.05)(Table 6) It was found that stress was significantly associated with abnormal glucose tolerance. (P<0.001)(Table 7) There was no association of smoking with abnormal glucose tolerance (Table 8). Table 9 shows association between alcohol use and abnormal glucose tolerance. (P=0.02).

**Table no 1: Association between numbers of hours spent in watching TV and abnormal glucose tolerance.**

Number of hours in watching TV	Abnormal glucose tolerances						Total
	NGT	%	IGT	%	DM	%	
< 2 hrs	668	93.82	28	3.93	16	2.25	712(71.2%)
2-5 hrs	238	84.70	21	7.47	22	7.83	281(28.1%)
>5 hrs	7	100.00	0	0.00	0	0.00	7(7%)
Total	913	913	49	4.9	38	3.8	1000(100%)
Inference	Number of hours in watching the TV is significantly associated with the Abnormal glucose tolerances with $\chi^2=24.184$ ; df=4 :P<0.001						

**Table no 2: Association between blood pressure and abnormal glucose tolerance**

Blood pressure	Abnormal glucose tolerances						Total
	NGT	%	IGT	%	DM	%	
Normotensive	749	93.86	24	3.01	25	3.13	798(79.8%)
Hypertensive	164	81.19	25	12.38	13	6.43	202(20.2%)
Total	913	913	49	4.9	38	3.8	1000(100%)
Inference	Blood pressure is significantly associated with the Abnormal glucose tolerances with $\chi^2=36.007$ ; df=2; P<0.001						

**Table no 3: Association between family history of diabetes and abnormal glucose tolerance**

Family history of diabetes	Abnormal glucose tolerances						Total
	NGT	%	IGT	%	DM	%	
Positive	74	64.35	21	18.26	20	17.39	115 (11.5%)
Negative	839	94.80	28	3.17	18	2.03	885 (88.5%)
Total	913	913	49	4.9	38	3.8	1000 (100%)
Inference	Family history of DM is significantly associated with the Abnormal glucose tolerances with $\chi^2=120.846$ ; df=2; P<0.001						

**Table no 4: Association between physical activity and abnormal glucose tolerance**

Physical activity	Abnormal glucose tolerances						Total
	NGT	%	IGT	%	DM	%	
Sedentary	109	72.67	21	14.00	20	13.33	150(15%)
Mild	139	86.34	12	7.45	10	6.21	161(16.1%)
Moderate	379	95.71	12	3.03	5	1.26	396(39.6%)
Vigorous/ Heavy	286	97.61	4	1.37	3	1.02	293(29.3%)
Total	913	91.3	49	4.9	38	3.8	1000(100%)
Inference	Physical activity is significantly associated with the Abnormal glucose tolerances with $\chi^2=97.039$ ; df=6, P<0.001						

**Table no 5: Association between body mass index and abnormal glucose tolerance**

BMI	Abnormal glucose tolerances						Total
	NGT	%	IGT	%	DM	%	
Normal (18 – 24.99)	660	92.70	34	4.78	18	2.53	712 (71.2%)
Over weight (25-29.99)	212	90.99	9	3.86	12	5.15	233 (23.3%)
Obese (30)	41	74.55	6	10.91	8	14.55	55 (5.5%)
Total	913	91.3	49	4.9	38	3.8	1000 (100%)
Inference	BMI is significantly associated with Abnormal glucose tolerances with $\chi^2=27.294$ ; df=4; P<0.001						

**Table no 6: Association between type of diet and abnormal glucose tolerance**

Type of diet	Abnormal glucose tolerances						Total
	NGT	%	IGT	%	DM	%	
Vegetarian	649	92.19	30	4.26	25	3.55	704(70.4%)
Mixed	264	89.19	19	6.42	13	4.39	296(29.6%)
Total	913	91.3	49	4.9	38	3.8	1000(100%)
Inference	Type of diet is not statistically associated with Abnormal glucose tolerances with $\chi^2=2.572$ ; df=2; P=0.276						

**Table no 7: Association between stress and abnormal glucose tolerance**

Stress	Abnormal glucose tolerances						Total
	NGT	%	IGT	%	DM	%	
Present	203	79.0	25	9.7	29	11.3	257 (25.7%)
Absent	710	95.6	24	3.2	09	1.2	743 (74.3%)
Total	913	91.3	49	4.9	38	3.8	1000 (100%)
Inference	Presence of stress is significantly associated with the Abnormal glucose tolerances with $\chi^2=73.178$ ; df=2; P<0.001						

**Table no 8: Distribution of study population based on smoking habits**

Smoking tobacco	Abnormal glucose tolerances						Total
	NGT	%	IGT	%	DM	%	
Current smoker	161	95.27	3	1.78	5	2.96	169(16.9%)
Ex-smoker	14	100.00	0	0.00	0	0.00	14(1.4%)
Non-smoker	738	90.33	46	5.63	33	4.04	817(81.7%)
Total	913	91.3	49	4.9	38	3.8	1000(100%)
Inference	Smoking tobacco is not statistically associated with Abnormal glucose tolerances with $\chi^2=6.404$ ; df=4; P=0.171						

**Table no 9: Distribution of study subjects based on alcohol consumption**

Alcohol use	Abnormal glucose tolerances						Total
	NGT	%	IGT	%	DM	%	
Current user	108	89.26	6	4.96	7	5.79	121 (12.1%)
Ex-user	24	100.00	0	0.00	0	0.00	24 (2.4%)
Non-user	781	91.35	43	5.03	31	3.63	855 (85.5%)
Total	913	91.3	49	4.9	38	3.8	1000 (100%)
Inference	Alcohol use is statistically associated with Abnormal glucose tolerances with $\chi^2=11.67$ ; P=0.02						

## 4. Discussion

### 4.1 Abnormal glucose tolerance and number of hours spent in watching TV per day

Present study found that prevalence of diabetes was 2.25% in <2 hours watching TV groups, and it was 7.83% in group who watched TV for 2-5 hours. The prevalence of IGT in <2 hours watching group was 3.93% and in 2-5 hours watching group prevalence was 7.47%. Number of hours spent in watching TV was found to be significantly associated with abnormal glucose tolerance. ( $P < 0.001$ ). (Table no 1) Similar observation was made by Hu FB et al[5] that average time spent in watching television was significantly associated with diabetes ( $p < 0.001$ ) Dunstan et al[6] in his study also observed deleterious relationship between television viewing and abnormal glucose tolerance.

Television watching is a sedentary behavior and results in lower metabolic rate which in turn results in obesity. Watching of TV 2hrs/ day is associated with 23% increased risk of obesity and 14% increase in risk of diabetes.

### 4.2 Abnormal glucose tolerance in relation to blood pressure

In the present study hypertension prevalence in rural subjects aged 40 years and above was 20.2%. Prevalence of diabetes and IGT in hypertensive population was 6.43% and 12.38% respectively. It was found that there was significant association between blood pressure and abnormal glucose tolerance. ( $P < 0.001$ ). (Table no 2) Similar observation was also made by Hamit Acemoglu et al[7] that Type 2 DM was more frequent among people with hypertension than with normotension and also was significantly associated (11.5% vs. 3.38%,  $p = 0.0001$ ). According to regression analysis, DM was 2 times higher in hypertensives than in normotensives.

### 4.3 Abnormal glucose tolerance in relation to family history

Among 38 diabetics, 20 (52.63%) had family history of diabetes. Prevalence of diabetes and IGT among positive history subjects was 17.39% and 18.26%. Family history of diabetes was significantly associated with abnormal glucose tolerance. ( $P < 0.001$ ). (Table no 3) In a study done by Kokiwar et al[8] high prevalence was in individuals having family history of diabetes (46.93%) as compared to those with those with no such history. (11.31%). ( $p < 0.001$ )

### 4.4 Abnormal Glucose Tolerance and Physical Activity

In present study we found that higher prevalence of diabetes (13.33%) and IGT (14%) was

in sedentary life style subjects. Prevalence of diabetes (1.02%) and IGT (1.37%) was lowest in persons with vigorous physical activity. Physical activity was significantly associated with the abnormal glucose tolerance. ( $P < 0.001$ ). (Table no 4) Similarly observations were done by Kokiwar et al[8], it was found that prevalence of diabetes was significantly greater amongst people doing sedentary physical activity (33.84%) as compared to people involved in heavy physical activity (11.53%).

The protective effect of physical activity against diabetes mellitus is possibly due to increased insulin sensitivity which can be accentuated by weight loss achieved through physical activity.

### 4.5 Abnormal Glucose Intolerance and BMI

The present study showed prevalence of diabetes among overweight and obese persons was 5.15% and 14.55% respectively. And prevalence of IGT was 3.86% and 10.91% among overweight and obese subjects. BMI was significantly associated with abnormal glucose tolerance ( $P < 0.001$ ). (Table no 5) Similarly in a study done by Kokiwar et al[8] it was observed that abnormal glucose tolerance was significantly higher in those with  $BMI \geq 25 \text{ kg/m}^2$  (27.47%) as compared to those having  $BMI < 25 \text{ kg/m}^2$  (9.7%) ( $p < 0.001$ ). Dhadwal D et al[9] also found obesity was significantly associated with diabetes ( $p < 0.05$ ). Prevalence of diabetes was 4.15% in  $< 25$  BMI subjects and it was 6.7% in the individuals with  $BMI > 25$ . ( $p < 0.05$ ).

Obesity causes stress in endoplasmic reticulum, this stress results in suppression of signals of insulin receptors leading to insulin resistance.

### 4.6 Abnormal Glucose Tolerance and Type of Diet

In our study we found that prevalence of diabetes was 3.55% among vegetarians and 4.39% among mixed diet consuming persons. Prevalence of IGT was 4.26% among vegetarians and 6.42% within mixed diet consuming population. It was found that type of diet is not statistically associated with abnormal glucose tolerance. ( $p > 0.05$ ). (Table no 6)

### 4.7 Abnormal Glucose Tolerance and Stress

Among 38 diabetics, 29 (76.3%) had history of stress. Prevalence of diabetes was 11.3% in subjects with stress and 1.2% among subjects without stress. Prevalence of IGT was 9.7% and 3.2% among subjects with stress and without stress respectively. Presence of stress was found to be significantly associated with abnormal glucose tolerance ( $P < 0.001$ ) (Table no 7). Similar observation were made by Dutt et al[10] that stress was important risk factor for diabetes (OR 4.3, LL CI 10.9,  $p < 0.0001$ ).

The effects of stress on glucose metabolism are mediated by variety of "counter regulatory"

hormones that are released in response to stress and those results in elevated blood glucose levels and decreased insulin action.

#### 4.8 Abnormal Glucose Intolerance and Smoking

In present study 16.9% of study population had a habit of smoking. Prevalence of diabetes and IGT within current smokers was 2.96% and 1.78% respectively. Among non-users prevalence of diabetes and IGT was 4.04% and 5.63% respectively. It was found that smoking tobacco was not statistically associated with abnormal glucose tolerance. (Table no 8) Similar were results of Amos Benjamin et al[11] that smoking was not significantly associated with diabetes. ( $p=0.0359$ ) Similarly Hamit Acemoglu[7] found that smoking had no effect on diabetes. Type 2 DM was 4.86% in non-smokers, 5.23% in ex-smokers, and 2.67 % in daily smokers ( $p=0.057$ ).

Also in our study it was found that number of cigarettes/ beedis smoked per week and duration of smoking was not statistically associated with abnormal glucose tolerance.

#### 4.9 Abnormal Glucose Tolerance and Alcohol Consumption

In our present study, 12.1% of subjects were current users of alcohol and prevalence of diabetes and IGT among them was 5.79% and 4.96% respectively. And prevalence of diabetes and IGT among non user was 3.63% and 5.03% respectively. It was found that, alcohol use was significantly associated with abnormal glucose tolerance. ( $P<0.05$ ). (Table No 9) Similarly Dutt et al[10] in his study identified that alcohol consumption is a risk factor for diabetes (OR 2.9, LL CI 10-9  $P<0.001$ ). Kokiwar et al[8] also found that the Prevalence of diabetes was high in those consuming alcohol (22.29%) as compared to non alcoholics (11.46%).( $p<0.001$ )

### 5. Conclusion

The present study found positive association between stress, sedentary lifestyle, family history of diabetes, hypertension and alcohol consumption with abnormal glucose tolerance. It was also found that type of family and type of diet were not significantly associated with abnormal glucose tolerance.

Primary prevention is possible by modifying the environmental factors influencing diabetogenesis such as obesity, diet and physical activity. Long term studies have shown that beneficial effects of life style

modifications on reducing the risk of diabetes. India is going to face big challenge posed by the prevalence of diabetes and its complications unless steps are taken to implement the primary and secondary prevention of diabetes. It's necessary to identify the risk factors for diabetes and also for vascular complications.

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