PREVALENCE OF TYPE 2 DIABETES MELLITUS AND ASSOCIATED RISK FACTORS IN VIRUDHUNAGAR DISTRICT – TAMIL NADU

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ABSTRACT:

Objective: The present study is focused to find out the prevalence of Diabetics and associated risk factors concerned with Type 2 diabetic mellitus among the study population in Virudhunagar district in Tamil Nadu. Materials and methods: A total of about 300 people above 30 years of age from urban, semi urban and rural areas in and around Virudhunagar district were the subjects for the study. All of them were screened for diabetes by checking the random blood glucose levels and blood pressure, body mass index, dietary patterns and physical activity levels were also recorded. Their knowledge about diabetes was also assessed.

Results: Among the study population, people who had RBS >=200 was 70 (male-31 and female-39) and between 140 and 200 were 47 (male-17 and female-30). People who were in pre-hypertensive stage was 123 (male-47 and femae-76) and hypertensive stage was 85 (male-35 and female-50). The co-morbidity (diabetes and hypertension) was present in among 41 (male-21 and female-20). The onset of diabetes was seen at the age of 51-55 in men and 66-70 in women. The various risk factors were lack of physical activity and family history of diabetes, common in both men and women as per this study. Nearly 37 males and 46 females were under high risk obesity grade while 32 males and 51 females were overweight. Even though this study shows a positive note that the non-diabetics were on the higher side of the total study population, a prompt treatment of the diabetic affected subjects through their life style modification and increase in levels of awareness is needed too.

KEYWORDS: Type 2 diabetic mellitus, blood glucose level, associated risk factors.

1. INTRODUCTION

India is the diabetes capital of the world with the projected 109 million individuals with diabetes by 2035. Diabetes cases up to 42 million worldwide; India ranks among top 3 countries with diabetic population. The rise in India has been from 11.9 million in 1980 to 69.1 million in 2015. Prevalence has more than doubled for men and also increased by 80% among women in India.

Diabetes Mellitus is a heterogeneous group of diseases characterized by chronic elevation of glucose in the blood. It arises because the body is unable to produce enough insulin for its own needs, either because of impaired insulin secretion, impaired insulin action or both.

Our study is dealt with Type 2 diabetes – non insulin dependent diabetes mellitus (NIDDM). Type 2 diabetes has achieved pandemic proportions and affects some 42 million people worldwide. It arises because insulin production is inadequate relative to the demands of the body, which may be increased by obesity or other factors. It is best considered a syndrome rather than a disease. The present study was undertaken to incident the prevalence of diabetes based on the age and associated risk factor among the study population.

2. MATERIALS AND METHODS

Population from urban, semi-urban, rural areas of in and around Virudhunagar district was taken as study subjects. A total of 300 adults comprising of 124 males and 176 females from the age > 30 years were surveyed. A well formulated interview schedule was used to elicit the information pertaining to socioeconomic background, lifestyle and activity pattern, anthropometrical measures, biochemical measures, dietary pattern, type of diabetes, complications involved, causes for diabetes, and practices during diabetic mellitus, treatment, dietary changes and educational needs of the study population.

All the study population were screened for diabetes, by random blood sugar (RBS), their blood pressure, body mass index (BMI), dietary patterns and physical activity levels were also recorded. Their knowledge about diabetes was also assessed by a set of questions.

Anthropometric measurements such as weight and height, waist and hip circumference were measured for all the selected type 2 diabetics by using spring flat weighing machine (Bath room scale) and height by using non-stretchable measuring tape respectively.

Body mass index (BMI) was calculated for each from the weight and height values by the following formula- BMI = (Weight in kg/height in meter^2).The waist circumference was measured in a horizontal plane, mid way between the inferior margin of the rib and superior border of the iliac crest [5].The hip circumference was measured at the level of the greater trochanters, with the legs being held close together. Waist hip ratio (WHR) is calculated by dividing the waist circumference and the hip circumference.

$$\text{Waist–hip ratio} = \frac{\text{Waist circumference (cm)}}{\text{Hip circumference (cm)}}$$

Analysis of Data:- Statistical analysis of the data was performed. The chi-square test was used for comparison of categorical variables and the significance was noted.

3. Results and Discussion

Table 1: Reveal the distribution of the study population based on Age and Gender. Of the total 300 subjects (N = 300) 124 were males and 176 were females (fig 1). Majority of them were in the age group of 61-65 years.

Table 1: Age and sex wise distribution of the study population

Age group	Male Number	(%)	Female Number	(%)
31-35	8	6.45	20	11.36
36-40	18	14.52	19	10.80
41-45	24	19.35	16	9.09
46-50	10	8.06	24	13.64
51-55	17	13.71	21	11.93
56-60	10	8.06	25	14.20
61-65	17	13.71	23	13.07
66-70	13	10.48	17	9.66
>70	7	5.65	11	6.25
Total	124	100.00	176	100.00

Fig 1 shows the percentage of male and female who turned out to be the study opulation and made the study possible. The females presence were more than the males

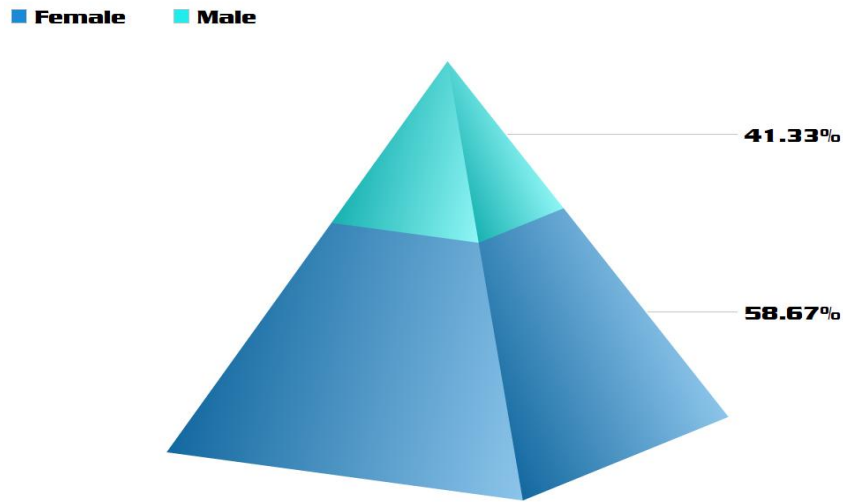Figure 1 : Segregation of study population - gender wise - (N = 300)

Table 2 : Shows the distribution of the study population based on the RBS (random blood sugar) values got when they were screened. About 17 males (13.71%) and 30 females (17.04%) are in the stage of prediabetic and 31 males (25%) and 39 females (22.16%) were diagonised as diabetic. Majority of prediabetics (RBS between 140 and 200) and diaetics (RBS > 200) werein the age group 40 − 60 years.
It is a surprise element in this study that out of the total percentage, majority of 61% were nondiabetic and only 38.99% were prediabetic and diabetic put together.

Table 2: Distribution of RBS values among the study population

Age	Sex	RBS <140		RBS 140 - 200		RBS >200		Total (%)
		N	%	N	%	N	%	
30-35	Male	6	75	0	0	2	25	8
	Female	13	65	4	20	3	15	20
36-40	Male	15	83.3	2	11.11	1	5.5	18
	Female	18	94.7	1	5.26	0	0	19
41-45	Male	10	41.6	3	12.5	11	45.8	24
	Female	12	75	2	12.5	2	12.5	16
46-50	Male	4	40	2	20	4	40	10
	Female	13	54.1	5	20.8	6	25	24
51-55	Male	10	58.8	5	29.4	2	11.76	17
	Female	13	61.9	3	14.28	5	23.8	21
56-60	Male	5	50	2	20	3	30	10
	Female	9	36	5	20	11	44	25
61-65	Male	10	58.8	2	11.76	5	29.4	17
	Female	17	73.9	4	17.39	2	8.69	23
66-70	Male	12	92.3	0	0	1	7.69	13

	Female	7	41.1	5	29.4	5	29.4	17
>70	Male	4	57.1	1	14.28	2	28.5	7
	Female	5	45.45	1	9.09	5	45.45	11
Total	Male	76	61.3	17	13.71	31	25	124
	Female	107	60.79	30	17.04	39	22.16	176
		183	61	47	15.66	70	23.33	300

Fig 2 : Nearly equinumber of adult male and female subjects were in the age group of 61 – 65 years. Majority of males affected with diabetics were in the age 36 - 45 years, in which the highest percentage lied between 41 – 45 years of age (19.35%). Majority of females are affected in the age group of 56 – 60 yrs (14.20%). While it is equally distributed from the age of 30 – 65 years. Above the age 70, only meagre percentage of both males and females are seen affected with Type 2 diabetes.
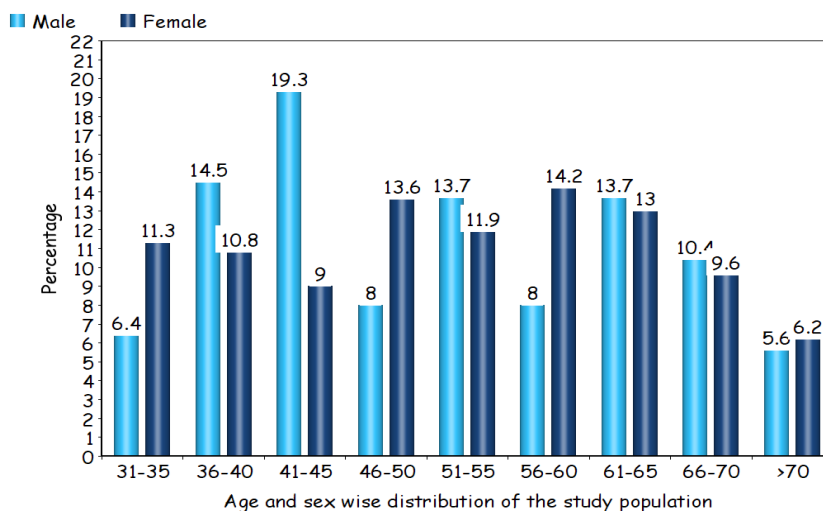

Figure 2 - Table 1

Fig 3 & 4: Almost equal percentage of male and female is Non-diabetic (61.3% and 60.7% respectively).Even though the diabetic affected female percentage is lower than male, chance is it may rise at any moment and equalize male percentage; as the pre-diabetic female percentage is higher than male which is expected to join the diabetic band if the anthropometric parameters, proper diet, exercise etc are not taken care of as an immediate measure

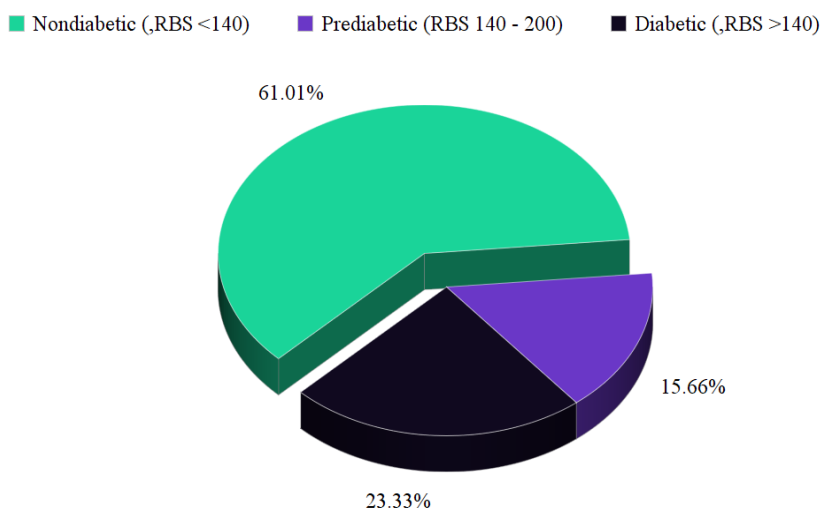Figure 3: RBS values projecting Nondiabetic ;Prediabetic and Diabetic

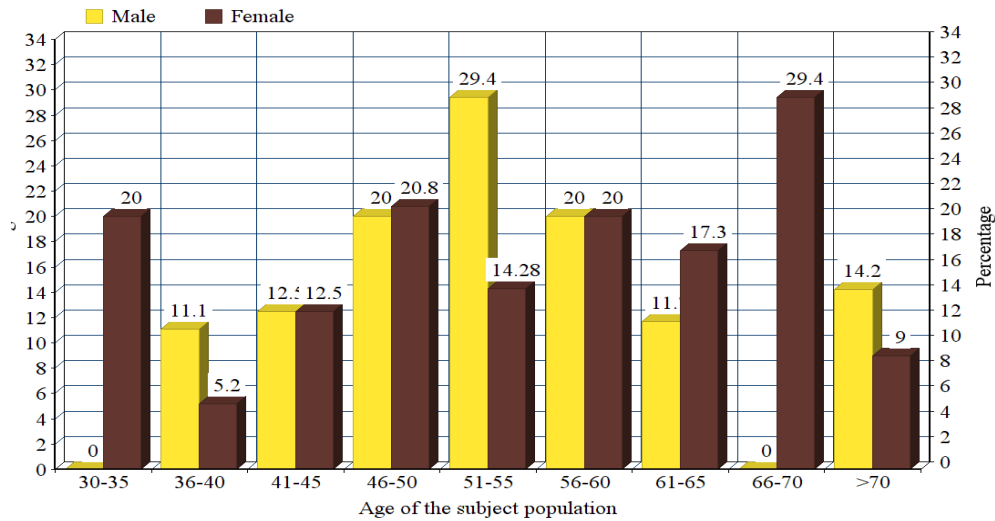Figure 4.1 Distribution of RBS 140 - 200..onset of diabetic

Table 3: Reveals the classification of hypertension among the study population.

Percentage of male and female subjects is affected with hypertension i.e.; 28.2% and 28.4%. About 37.9% males and 43.18% of females have pre-hypertension. On the whole the percentages are equally distributed among male and female subjects in the three categories considered.

Table 3: Classification of Hypertension among the study population Table 3

Age	Sex	Normal pressure N (%)	Pre-hypertension N (%)	Hypertension N (%)	Total (%)
30-35	Male	5(11.90)	2(4.26)	1(2.78)	8
	Female	13(26)	5(6.67)	2(4)	20
36-40	Male	10(23.81)	6(12.77)	2(5.56)	18
	Female	15(30)	4(5.33)	0(0)	19
41-45	Male	10(23.81)	6(12.77)	8(22.22)	24
	Female	7(14)	4(5.33)	5(10)	16
46-50	Male	3(7.14)	5(10.64)	2(5.56)	10
	Female	1(2)	19(25.33)	4(8)	24
51-55	Male	1(2.38)	11(23.40)	5(13.89)	17
	Female	2(4)	11(14.67)	8(16)	21
56-60	Male	3(7.14)	3(6.38)	4(11.11)	10
	Female	2(4)	10(13.33)	13(26)	25
61-65	Male	4(9.52)	7(14.89)	6(16.67)	17
	Female	4(8)	10(13.33)	9(18)	23
66-70	Male	3(7.14)	5(10.64)	5(13.89)	13
	Female	4(8)	5(9.33)	5(12)	17
>70	Male	3(7.14)	2(4.26)	2(5.56)	7
	Female	2(4)	5(6.67)	4(8)	11
Total	Male	42	47	35	124
	Female	50	76	50	176

FIGURE 5: CLASSIFICATION OF HYPERTENSION

■ **NORMAL PRESSURE**   ■ **PREHYPERTENSION**   ■ **HYPERTENSION**
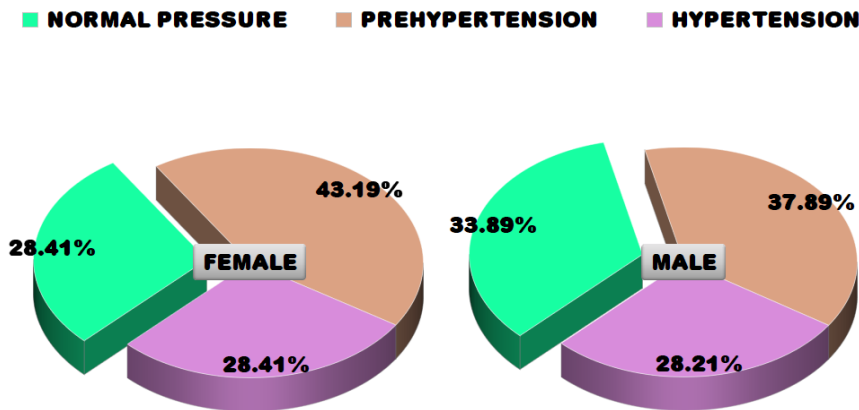
Hypertension may arise as a feature of the Type 2 diabetes syndrome. The total subjects affected with pre-hypertension and hypertension percentage wise (41% + 28.3% = 69%) are higher than the subjects with normal pressure 30.67%. The total subjects who have pre-hypertension and already affected with hypertension are high, which indicates that even though in present study the percentage of diabetic is less than the non-diabetic, the chance that it will rise to a higher percentage in future as both these diseases go hand in hand. High blood pressure makes diabetes more adverse. The convergence of two diseases (comorbidities) in a same person provides for complications which increase the morbidity, mortality and financial burden on a resource limited country like India.

Table 4: Type and frequency of exercise pattern **N = 300**

Nature of exercise	Male(n=124)					Female(n=176)				
	15 min/day		30min /day			15 min/day		30min /day		
	Once	Twice	Once	Twice	Total (%)	Once	Twice	Once	Twice	Total (%)
Walking	-	1	10	-	11(8.8)	10	6	22	13	51(28.9)
Yoga	-	2	5	7	14(11.2)	9	-	7	2	18(10.2)
Cycling	15	-	4	-	19(15.3)	6	-	5	-	11(6.25)
					44(35.5)					80(45.4)

Less than 50% of male and female subjects had a regular habit of doing exercise such as walking, yoga and cycling. Among the 300 study population adult subjects, only 35.48% male and 45.45% of female followed exercise on regular basis. Females were found to exercise regularly than males. Cycling is seen as the favorite mode of exercising among males, next favorite is walking. Whereas among females the favorite is walking and yoga comes next.

How regular exercise helps?

There are few ways that exercise lowers blood glucose:

- Insulin sensitivity is increased, so your cells are better able to use any available insulin to take up glucose during and after activity.
- When your muscles contract during activity, it stimulates another mechanism that is completely separate of insulin. This mechanism allows your cells to take up glucose and use it for energy whether insulin is available or not.

Table 5: Symptoms of diabetes among the selected type 2 diabetics **N=70**

Symptoms	Male (n=31)		Female (n=39)	
	n	%	n	%
Polyuria	20	64.5	15	38.46
Polydypsia	18	58.06	17	43.59
Polyphagia	9	29.03	19	48.7
Delayed healing	11	35.48	10	25.6
Nocturia	20	64.5	15	38.46
Loss of weight	26	83.87	18	46.15
Itching	18	58.06	9	23.07
Tiredness	11	35.48	7	17.94
Excessive sweating	17	54.84	11	28.2

The most common symptoms observed in male Type 2 diabetic subjects were loss of weight (83.87%), Nocturia & Polyuria with same percentage (64.5%), then equal percentage face Polydypsia and itching symptoms (58.06%).

In female the common symptoms with high percentage were Polyphagia (48.7%), loss of weight (46.15%), and Polydypsia (43.59%)The results indicate the common symptoms prevailed among male and female are loss of weight and Polydypsia and they are in slightly higher percentage seen in male than female.

Table 6: Risk factors for diabetes among the study population N=183

RISK FACTOR	MALE		x^2	FEMALE		x^2
	DIABETIC	NON-DIABETIC		DIABETIC	NON-DIABETIC	
BMI						
18	0	2		3	19	
18-23.9	26	67		25	89	
24.9-29.9	2	18	$P < 0.10$	4	18	$P < 0.10$
30-34.5	1	4		3	8	
>35	2	2		4	3	
Total		93			137	
Family History of diabetes						
Yes	27	14	$P < 0.001$	31	28	$P < 0.001$
No	4	81		8	109	
Dietary habit						
Vegeterian	2	6	$p < 0.1$	5	16	$P < 0.1$
Non vegetarian	29	87		34	121	
Lack of physical activity						
Yes	26	18	$p < 0.001$	33	47	$P < 0.001$
No	5	75		6	90	

It reveals that BMI (body mass index) one of the anthropometric measure and dietary habit did not had a statistically significant association in diabetics as per this survey is concerned.

Lack of physical activity and family history of diabetes were found to have significant association to diabetes for both males and females.

DEMOGRAPHIC PROFILE

The majority subjects who turned out for the study were from the urban areas and mostly from nuclear families. Surprise element here is that the percentage that turned out from rural area is 40.67%. This shows that even rural people now a day are conscious of their health and are aware of all elements concerned to it in order to look after their health in good way. This is a welcome aspect.

It is imperative that the patient is well educated about the disease, well aware of various factors contributing to the disease and the possible complications that may result.

The prevalence of diabetes in rural population is one quarter that of urban population in India. More needs to be done to address the rural-urban inequality in diabetes intervention. In India the steady migration of people from rural to urban areas, economic boon and corresponding change in life style are all affecting the level of diabetes **(Table 7**

TABLE: 7

Demographic profile		N	%
Sex	MALE	124	41.3
	FEMALE	176	58.6
EDUCATION	Graduate	101	33.6
	Matriculate	107	35.6
	Illiterate	92	30.6
OCCUPATIONAL	Sedentary	138	46
	Moderate	101	33.6
	Heavy	61	20.33
RESIDENTIAL AREA	Rural	122	40.66
	Urban	139	46.3
	Semi-Urban	39	13
TYPE OF FAMILY	Nuclear	187	62.3
	Joint	113	37.6

TABLE: 8

BMI	Obesity Grade	Male		Female	
		N	%	N	%
<18	Under Weight	15	12.09	27	15.34
18-23.9	Normal	40	32.26	52	29.54
24.9-29.9	Over weight	32	25.8	51	28.97
30-34.5	Obese	24	19.35	37	21.02
>35	Morbid Obesity	13	10.48	9	5.11
Total		124		176	

Figure 6: Distribution of total population according to BMI grade of obesity
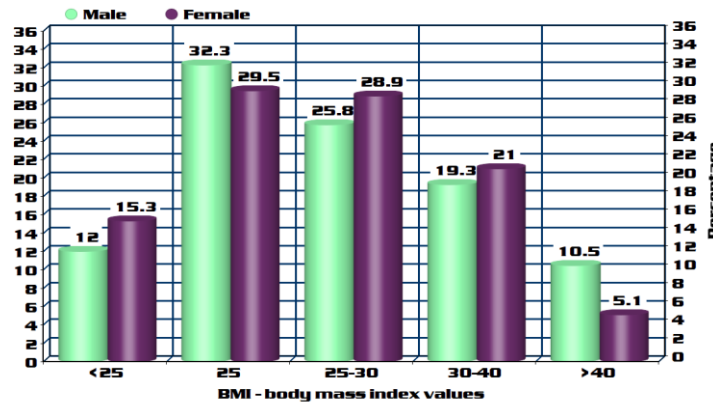
Table 8 shows that the incidence of Type 2 diabetes raises sharply in relation to obesity. An analysis of body mass index (BMI) of the subjects based on Asian Indian Classification is reported in **Fig 6.**

BMI is one of the prime anthropometric measures that have an effect on diabetes syndrome. So without an analysis on this BMI factor the study will not be a complete one.

BMI was calculated for each subject from the weight and height values by the following formula – BMI = (weight in kg / height in m^2). Majority of male (32.26%) and female (29.54%) subjects were categorized under normal BMI with value 25 kg/ m^2. This may be one of the reasons why the non-diabetic percentage was higher (61%) than the diabetic (38.9%) in this particular study. Next about 25.8% male and 28.97% of female were overweight, which comes under risk of obesity – Grade I category.

Grade II category percentage is as follows – 19.35% males and 21.02% females. The risk chance to be affected with Type 2 diabetes is still higher in this case than Grade I category.

At last the high risk category where the BMI is above 40 kg/ m^2 termed as morbid obesity is 10.48% male and 5.11% female.

When the male and female percentage was almost nearly equal in other categories, it is here that the male percentage is considerably higher than female percentage, which shows that males are more easily prone to obesity than females.

Diabetes develops at a lower BMI in Indians. And it is triggered in men at lower BMI than women.

Table 9: This shows the waist circumference under two categories Normal and High in percentages. Waist circumference is one more significant anthropometric parameter in this survey next to BMI. The waist circumference was measured in a horizontal plane, midway between the inferior region of the rib and the superior border of the iliac crest. The iliac crest is the curved superior border of the ilium, the largest of the three bones that merge to form the hip bone. When a person places his hand on his hip, it is the skin above the iliac crest that he rests his hand on.

TABLE 9

| WAIST CIRCUMFERENCE	FREQUENCY N=300	PERCENTAGE
Normal	189	63
High	111	37

About 63% i.e.; more than 50% were under normal category, this point again shows why the non-diabetic percentage was high in this study. Only 37% were under high category. This definitely will be one of the factors that have an effect over the diabetic percentage.

Table 10: Shows the prevalence of co-morbidity among the study population. In medicine, co -morbidity is the presence of one or more additional diseases or disorders co-occurring with a primary disease or disorder.

In this study the comorbidities is Type 2 diabetes and hypertension. The percentage of subjects who are affected by both - diabetes and hypertension are male – 16.94% and female – 11.36%. These people are under high risk category as the adverse effects of these comorbidities may predispose easily to heart attacks and strokes. Above the age of 40 years only females are seen to get these comorbidities (diabetes and hypertension together), whereas for males it is from age 30 itself. The higher percentage of male subjects are seen between age 51 and 55, where it is between 46 and 50 for females, and the highest percentage of females affected is almost 50% less than the highest male percentage .

Table 10: Prevalence of co-morbidity (diabetes and hypertension) among the study population

Age	Gender	Diabetes and hypertension	Percentage
30-35	Male (n=8)	1	12.5
	Female (n=20)	0	0
36-40	Male (n=18)	2	11.11
	Female (n=19)	0	0
41-45	Male (n=24)	5	20.8
	Female (n=16)	1	6.25
46-50	Male (n=10)	2	20
	Female (n=24)	5	20.83
51-55	Male (n=17)	7	41.2
	Female (n=21)	4	19.05
56-60	Male (n=10)	2	20
	Female (n=25)	4	16
61-65	Male (n=17)	0	0
	Female (n=23)	3	13.04
66-70	Male (n=13)	1	7.69
	Female (n=17)	2	11.76
>70	Male (n=7)	1	14.28
	Female (n=11)	1	9.09
Total	**Male (n=124)**	**21**	**16.94**
	Female (n=176)	**20**	**11.36**

Co-morbidity (diabetes and hypertension)
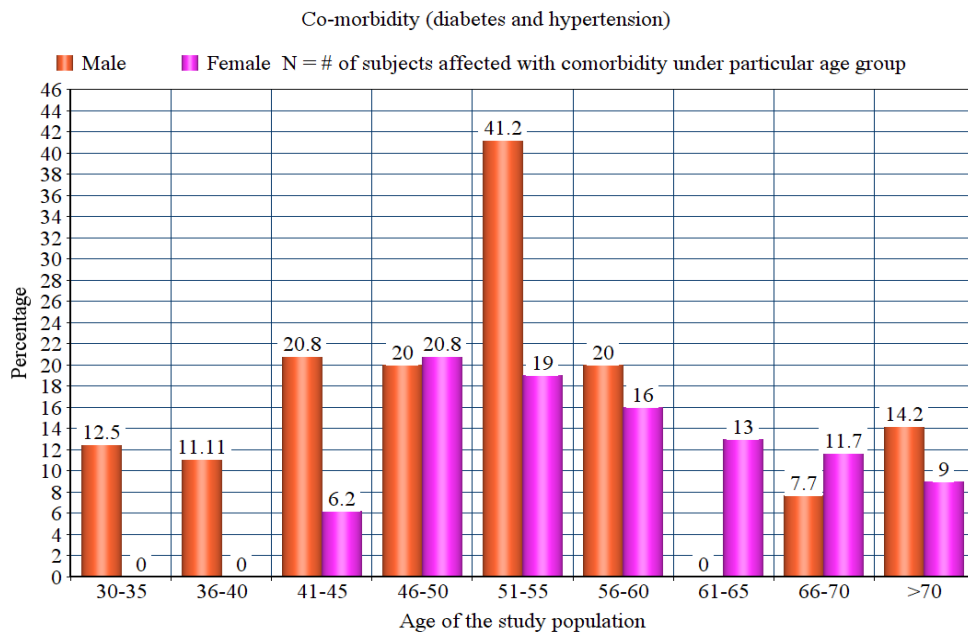
4. CONCLUSION

Chronic exposure to high blood glucose is a leading cause of renal failure, visual loss and a range of other types of tissue damage. It also predisposes to arterial disease, not least because it is often accompanied by hypertension, lipid disorders and obesity. Many cases of diabetes and almost all of its unwanted long term consequences are potentially avoidable, but this will require intervention at a societal as well as at a medical level.

The global diabetes epidemic is largely the result of three factors:

1. The aging population worldwide, specifically in mainly developing countries such as China and India.
2. The abundance of food in the developed countries and
3. The reduction in energy expenditure through physical activity as a result of automatisation and urbanization.

For aging there is no cure, but since diet and lifestyle have a profound influence in Type 2 diabetics, education about these factors is the corner stone in treatment.

Lifestyle change is the main stay of treatment, backed by a range of oral therapies, although patients frequently progress to insulin.

Glucose control has been said to reduce the impact of small vessel complications of diabetes together with cataracts and neuropathy, but has less effect upon arterial disease, the leading cause of premature death in Type 2 diabetes. Careful attention to other cardiovascular risk factors is therefore needed. There is a strong association between diabetes, reduced quality of life and depression. Adequate sleep cuts major health risks in children, teenagers. Control of energy intake and body weight is the first principle of therapy. Regular exercise is another basic element of treatment. Many classes of drug are available for the treatment. Thus it can be ended as; a good diabetes management requires an integrated effort of both patient and caregiver to handle the disease in such a way that the impact of the disease on patient's well-being is minimized.

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