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Full Length Original Research Paper

"Study of dietary patterns and risk profile among the patients of Diabetes Mellitus in Bhubaneswar"-an Original Research article

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Abstract:

Background: The prevalence of Diabetes Mellitus is 2.4% among adults in rural areas and 4-11.6 % in urban dwellers. In recent years increasingly sedentary life styles and poor eating habits have contributed to the simultaneous escalation of diabetes and obesity worldwide[1,2]. **Objectives:** (a) To assess the dietary patterns of diabetic patients of urban areas. (b) To study the effect of the diet and lifestyle on their glycemic control. **Methods:** This was a cross sectional study of diabetic patients attending diabetic outpatient clinic at Kalinga Institute of medical Sciences, Bhubaneswar. **Result:** Out of the total 50 patients, only 4% of the respondents had ≥ 30 BMI. 80% of the respondents had BMI ≥18.5-24.99. Only 4% of the respondents had a waist hip ratio (WHR) of ≥0.85. The percentage of energy from the protein, fat and carbohydrate (PFC) showed that 59.5% of the respondents had ≥ 15% protein, 87.5% had ≥ 25% fat and 17% had ≥ 60% carbohydrate. **Discussion:** A waist hip ratio of ≥ 0.85 among females and ≥ 1.0 in males reflects central obesity. Central obesity with of respondents carrying excess body fat positive glycosuria cases pose a higher risk towards diabetes. **Conclusion:** Dietary transition coupled with inactivity, taking junk food and carbonated drinks appear to have contributed to the high prevalence rate of obesity of the urban population

Keywords: Diabetes, Diet, Obesity, BMI, Glycemic

Background:

Diabetes mellitus is not a single disease entity but rather a group of metabolic disorders sharing the common underlying feature of hyperglycemia. Hyperglycemia in diabetes results from defects in insulin secretion, insulin action, or, most commonly, both. The chronic hyperglycemia and attendant metabolic dysregulation may be associated with secondary damage in multiple organ systems, especially the kidneys, eyes, nerves, and blood vessels The prevalence of diabetes is increasingly sharply in the developing world as people adopt more sedentary life styles, with India and China being the largest contributors to the world's diabetic load.

SIGNIFICANCE OF THE PROBLEM (THE DISEASE BURDEN):

The prevalence of Diabetes Mellitus is 2.4% among adults in rural areas and 4-11.6 % in urban dwellers. In recent years increasingly sedentary life styles and poor eating habits have contributed to the simultaneous escalation of diabetes and obesity worldwide[1,2,3], which some have termed as the *diabesity epidemic*. Sadly, obesity and diabetes have now percolated even to children exposed to "junk" food and lacking adequate exercise. The term metabolic syndrome (previously called "Syndrome X") has been applied to an increasingly common condition wherein abdominal obesity and insulin resistance are accompanied by a constellation of risk factors for cardiovascular disease like abnormal lipid profiles. As the incidence of communicable diseases has declined and expected life span has increased, diabetes has become a major public health

problem, and it continues to be one of the top 10 "killers"[4]. There is hope, however, since the role of primary prevention of type 2 diabetes by life-style and dietary alterations, and secondary prevention of diabetic complications by strict glycemic control, has become increasingly recognized.

AIMS AND OBJECTIVE OF THE STUDY

a. To assess the dietary patterns of diabetic patients of urban areas
b. To study the effect of the diet and lifestyle on their glycemic control.

SCOPE OF THE STUDY

This study will help in understanding the relationship between diet, lifestyle and treatment response and outcome in diabetic patients. The dietary practices and lifestyle factors responsible for failure to achieve glycemic control in diabetic patients will be identified. The above findings will help to provide a better dietic plan and lifestyle modification advice to the patients

DISCUSSION:

Diabetes is a chronic metabolic disorder in which a person has hyperglycemia (high blood sugar) either because the body does not produce enough insulin or because cells do not respond to the insulin, a hormone produced by the β cells of the Islets of Langerhans of the pancreas. (figure 1 & 2)

Figure 1: Normal anatomy of pancreas of human being

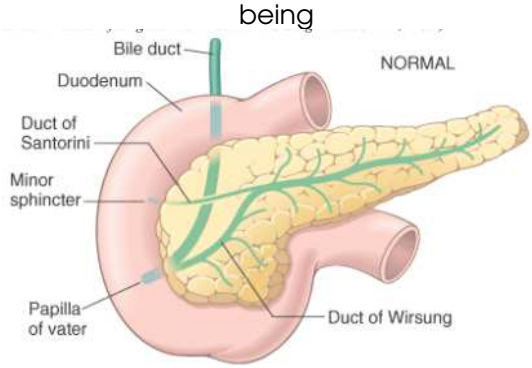
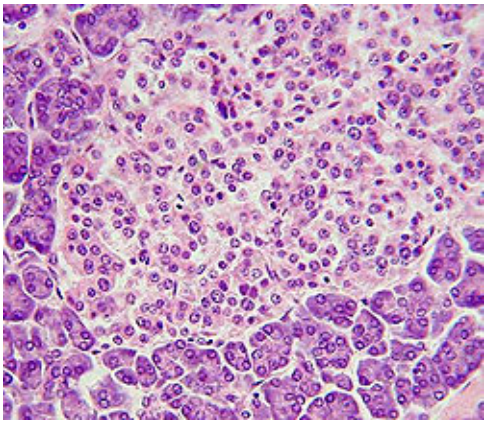


Figure 2: Histology of normal Islets of Langerhans of pancreas



DIAGNOSIS OF DIABETES MELLITUS:

Blood glucose values are normally maintained in a very narrow range, usually 70 to 120 mg/dL. The diagnosis of diabetes is established by noting elevation of blood glucose by any one of three criteria:

1. A random glucose concentration greater than 200 mg/dL, with classical signs and symptoms (discussed below)
2. A fasting glucose concentration greater than 126 mg/dL on more than one occasion.
3. An abnormal oral glucose tolerance test (OGTT), in which the glucose concentration is greater than 200 mg/dL 2 hours after a standard carbohydrate load.

However, those with fasting glucose concentrations greater than 100 mg/dL but less than 126 mg/dL, or OGTT values greater than 140 mg/dL but less than 200 mg/dL, are considered to have impaired glucose tolerance, also known as "pre-diabetes."

CLASSIFICATION:

The vast majority of cases of diabetes fall into one of two broad classes:

Type 1 diabetes: is an autoimmune disease characterized by pancreatic β-cell destruction and an absolute deficiency of insulin. It accounts for approximately 5% to 10% of all cases, and is

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Int. J. Drug Dev. & Res., October-December 2014, 6 (4): 124-132

the most common subtype diagnosed in patients younger than 20 years of age.

Type 2 diabetes: is caused by a combination of peripheral resistance to insulin action and an inadequate secretory response by the pancreatic β cells[5] ("relative insulin deficiency").

PATHOGENESIS OF TYPE 2 DIABETES MELLITUS:

Type 2 diabetes is a multifactorial complex disease. Environmental factors, such as a sedentary life style and dietary habits and genetic factors are involved in the pathogenesis.[5-7]

The two metabolic defects that characterize type 2 diabetes are Insulin resistance & β-Cell dysfunction.

CLINICAL FEATURES OF DIABETES

The clinical features of Diabetes are polyuria (frequent urination), polydipsia (increased thirst), polyphagia (increased appetite), and, when severe, ketoacidosis, all resulting from metabolic derangements. [9]

Diabetic ketoacidosis is a serious complication of type 1 diabetes but may also occur in type 2 diabetes. There is severe hyperglycemia (the plasma glucose levels are usually in the range of 500 to 700 mg/dL), marked dehydration and ketonuria.

Hyperosmolar nonketotic coma due to severe dehydration resulting from sustained osmotic diuresis (particularly in patients who do not drink enough water to compensate for urinary losses from chronic hyperglycemia)..

In both types it is the long-term effects of diabetes, more than the acute metabolic complications, that are responsible for the overwhelming majority of the morbidity and mortality.[10] In most instances these complications appear approximately 15 to 20 years after the onset of hyperglycemia.

LONG TERM COMPLICATIONS OF DIABETES MELLITUS

- Myocardial infarction,
- Renal vascular insufficiency
- Cerebrovascular accidents
- Hypertension
- Dyslipidemia,
- Diabetic nephropathy
- Diabetic retinopathy
- Glaucoma and cataract formation,
- Diabetic neuropathy

Enhanced susceptibility to infections of the skin and to tuberculosis, pneumonia, and pyelonephritis.

DIETETIC MANAGEMENT OF DIABETES MELLITUS:

The mainstay of treatment of Diabetes Mellitus type 2 is oral hypoglycemic drugs, lifestyle modification and strict dietary control. The dietetic treatment aims at bringing the blood sugar level to normal along with proper health of the patient. Intake of calories is an important yardstick in bringing the normal blood sugar level. Body weight has to be watched carefully. Also urine examination is a must. The calorie content of the diet must be calculated to the ideal weight. If the actual weight is more; calories must be reduced to bring down the body weight by breaking the body fat.[11]

RESULTS:

PATIENT PROFILES

A total of 50 patients were studied.

Table 1: Sex distribution of patients

Sex	Total no. of patients	% age
Male	37	74
Female	13	26

ANTHROPOMETRY& IMPEDANCE:

Anthropometric and impedance measurements are shown in Table 1 & 2. Detailed categorization showed that only 4% of the respondents had ≥ 30

BMI. 80% of the respondents had BMI ≥18.5-24.99. Only 4% of the respondents had a WHR of ≥0.85. This above data indicate that the prevalence of obesity in this study group was 4% only. The glycosuria test resulted in 40 % of positive cases.

Table 2: Body Mass index

CLASSIFICATION	BMI (weight(Kg) / height²(m))	Risk of co-morbidities	% of patients
Underweight	<18.50	Low	3
Normal range	18.5-24.99	Average	80
Overweight	≥25		
Pre-obese	25-29.99	Increased	10
Obese class I	30-34.99	Moderate	4
Obese class II	35-39.99	Severe	0
Obese class III	≥40	Very severe	0

Table 3: Waist hip ratio (WHR) of the patients

	WHR	%age of patients
Females	<0.85	24
	≥0.85	2
Males	<1.0	72
	≥1.0	2

24 HOUR DIETARY RECALL

Table 4 shows the mean nutritional intake of the 3 day-24 h dietary recall. The percentage of energy from the protein, fat and carbohydrate (PFC) showed that 59.5% of the respondents had ≥ 15% protein, 87.5% had ≥ 25% fat and 17% had ≥ 60% carbohydrate. The percentage contribution of energy from PFC were 16, 33 and 51%, respectively, compared to the South Pacific recommended daily allowance (RDA) of 15, 25 and 60%, respectively.[5] Dietary anti-oxidants. The dietary anti-oxidant intake (Table 3) of vitamin C, vitamin E and β-carotene levels show that β-carotene (5434 mg) and vitamin E (8.7 mg) were below their RDA and there was a high intake of vitamin C (160 mg). About 30.5 and 82.5% of respondents had not been meeting the iron and zinc daily requirements, respectively, although, their mean intake was moderate.

Other important food components are cholesterol and fiber. The consumption pattern showed that 38.5% had ≥ 300 mg (RDA) of cholesterol, while dietary fiber consumption showed 97.5% had < 40 mg (RDA). Rice, roti, White bread and sugar were the two most frequently consumed sources of carbohydrate, rice being the most dominantly consumed staple food.

Table 4: Caloric and nutrient intake of patients

Nutrient	Mean ± SD intake	South Pacific RDA	Cut-off points	Subject (%)
Total energy (kcal)	2256 ± 574	2200	< 2200	47.5
	≥ 2200	52.5		
Protein (%)	15.7 ± 4.0	15	< 15	40.5
	≥ 15	59.5		
Fat (%)	32.7 ± 7.0	25	< 25	12.5
	≥ 25	87.5		
Carbohydrate (%)	51.5 ± 8.7	60	< 60	83
	≥ 60	17		
Dietary fibre (g)	23.3 ± 69	40*	< 40	97.5
	≥ 40	2.5		
Cholesterol (mg)	293 ± 193	300*	< 300	61.5
	≥ 300	38.5		
β-Carotene (mg)	5434 ± 3593	25000	< 25000	100
	≥ 25000	0		
T/A Eq (mg)	1320 ± 1805	750	< 750	22
	≥ 750	78		
Vitamin C (mg)	160 ± 86	30	< 30	2
	≥ 30	98		
Vitamin E (mg)	8.7 ± 5.4	10	< 10	72
	≥ 10	28		
Fe (mg)	15.2 ± 6.2	12	< 12	30.5
	≥ 12	69.5		
Zn (mg)	11.3 ± 41	12	< 12	82.5
	≥ 12	17.5		

FOOD FREQUENCY

The most frequently consumed carbohydrate foods were rice (94%) and wheat (81%) of the respondents consumed them. The daily intake was about 250 g of rice and 90 g of wheat per meal. Sweet tea was the most frequent

beverage and drunk two-three times a day, which contained about 18 g of sucrose per cup of tea (200 ml/cup). Likewise, daily consumption of jam spread on bread accounted for the modal sugar intake of 20 g per meal. However the use of jam was limited to only 5 % of the respondents. An additional source of sugar that was eaten frequently in large quantities was sweets and sharbats. The most frequently consumed protein foods were eggs, fish and meat, whereby 53.5% of respondents had fish and 49.5% consumed meat at least twice a week. The most frequently consumed meat was mutton and chicken. The main sources of fat intake were observed to be butter, cooking oil, coconut cream, whole-cream milk. Milk was commonly taken with tea. Whole-cream milk was more frequently taken compared to low-fat and skim milk, and about 95% of respondents had milk in their tea. Butter was more popular than margarine. The frequent use of cooking oil to fry increased the calorie intake. The main sources of dietary anti-oxidants were vitamin C and β-carotene and are found in fruits and vegetables. How-ever, fruits were consumed only once a week by 56.5% of the respondents, with the modal intake of vegetables was 110 g per meal. Although vegetables were consumed everyday 2–3 times with the modal intake of 150 g in a meal

PHYSICAL ACTIVITY

The level of lifestyle activities in this study (Table 4) shows that a majority of the respondents had low levels of activity, that is, more sitting and sleeping/lying than standing. More than 46% of the respondents had a 7–10 h sitting period and 54.5% had 8–10 h sleeping/lying within a 24-h period. About 61.5% walked ≤ 3 h. Organized exercise or sports was rarely practiced.

Table 5: Lifestyle activities in patients

Activity	Hour categories	Subject percentage	Mean ± SD No. of hours
Standing	< 5	49	
	5–8	44	5.0 ± 2
	≥ 9	7	
Sitting	< 7	42	
	7–10	46	7.2 ± 3
	≥ 11	12	
Walking	≤ 3	61.5	
	4–6	32	3.3 ± 2
	≥ 7	6.5	
Sleeping/lying	< 8	34	
	8–10	54.5	8.3 ± 2
	≥ 11	11.5	
Brisk walk	No	91.5	0.1 ± 0.3
	Yes	8.5	
Sports/aerobics	No	93.5	0.1 ± 0.2
	Yes	6.5	

CEREMONIAL DIETARY CUSTOMS

This study shows that 90% of the respondents attended communal functions which involved food consumption, of which 43% attended ceremonies four times a month and 26.5% attended twice a month. The most frequently consumed protein foods during ceremonies were meat, chicken and fish. About 61% of the respondents consumed more than 200 g of meat and 39.5% had more than 200 g of fish in a ceremonial meal. The most common cooking method used for meat and fish was frying and then re-cooking in mustard oil. The main carbohydrate foods eaten were rice; about 79.5% of the respondents ate more than 150 g in a ceremonial meal. The main method of preparation was traditional boiling. It seems that only during ceremonial feasting are prestigious staples, such as mushrooms, are consumed. Fresh fruits were rarely included in a ceremonial feast. About 48.5% of the respondents ate more than 100 g of vegetables, which was usually cooked in mustard oil or refined oil. The most frequently consumed desserts during ceremonies were ice cream (48.3%) and khiri (rice cooked in milk and sugar) (34.5%).

LABORATORY PARAMETERS

Glycemic control:

The blood glucose levels of 86 % of the patients were in higher than normal. The HbA1c values of

90 % of the patients were high. (table 5) (figure 1 & figure 2)

Table 6: Levels of blood glucose and HbA1c

	Blood glucose levels	HbA1c
Within normal range (% of patients)	14	10
High (% of patients)	66	44
Very high(% of patients)	20	46

Figure 7: chart showing the values of HbA1c in the patients

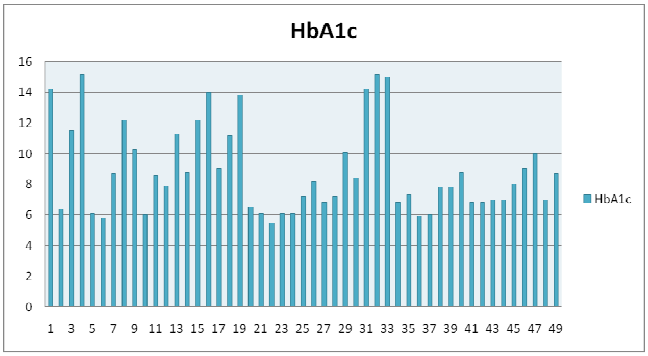
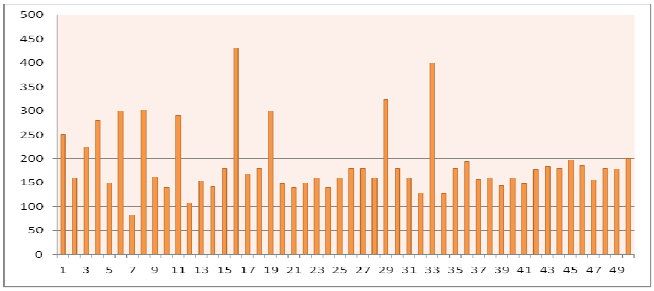


Figure 8: Chart showing the blood glucose levels in the patients



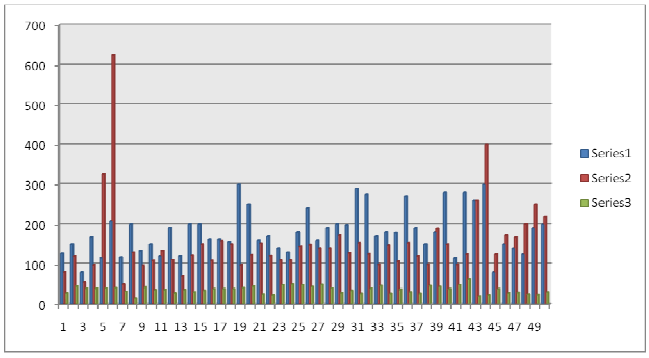
Lipid profile

70-90 % of the patients had normal levels of serum cholesterol, LDL, VLDL, triglycerides and HDL. (Table 6) & (figure 3)

Table 7: Lipid profile of the patients

Parameter studied	Normal range	Mean value in patients	% age of patients having normal values	%age of patients having abnormal values
Cholesterol	<200 mg/dl	183	72	28
Triglyceride	<150 mg/dl	139	78	22
HDL	>35 mg/dl	35.7	84	16
LDL	<30 mg/dl	28	65	35
VLDL	<130 mg/dl	127	90	10

Figure 9: Chart showing the levels of Serum cholesterol (series 1), Triglyceride (series 2) and HDL (series 3)



Dietetic advice and blood glucose monitoring

Only 7 out of 50 patients visited dieticians on a regular basis. Only 2 patients used a self testing device to monitor blood glucose. 15% patients came for regular blood glucose testing in the laboratory.

Discussion:

Diabetes is a significant health problem in the urban society. Obesity is a strong contributor for the development of diabetes Mellitus. The method used to assess obesity in this study was Waist Hip ratio (WHR). The WHR circumference is an important predictor of potential health hazards.[12]A ratio of ≥ 0.85 among females and ≥ 1.0 in males reflects central obesity.[13]Central obesity with of respondents carrying excess body fat positive, glycosuria cases pose a higher risk towards diabetes. It is likely that in the next 10 years, a significant number of these respondents will start to develop complications of obesity if they do not improve their eating patterns and lifestyle activities. Excess fat in the abdominal area with apple-shaped obesity carry a greater risk of chronic diseases, especially

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diabetes mellitus type 2. Too much body fat also may promote insulin resistance.[14]

The 24 h dietary recall reveals a high contribution of total energy from carbohydrates with a moderate contribution of fat. High energy intake of fat in diet, especially saturated fat, has been widely documented to be associated with the risk of non-communicable diseases.[15-17] Consumption of refined cereals and cereal products require the frequent use of butter and cooking oil, hence exacerbating the intake of fat. A high consumption of dietary anti-oxidants has been documented to be protective against free radical formation which results in less tissue and cell damage.[18]Vitamin C, vitamin E and β-carotene are considered to be important in maintaining health and disease prevention and acting as radical-scavenging defense system.[19] Eating varieties of different kinds of food in a meal to obtain optimum levels of nutrients and anti-oxidants would be an advantage in protecting our body from tissue damage. In this study, β-carotene and vitamin E intake was much lower than their RDA, which leads to concern of the higher risk of tissue damage from free radicals and thus a higher risk of developing diseases. Micronutrients are important for the normal body functions but are only required in a certain quantity. Too much or too little may be deleterious to health. Proportions of iron and zinc are important because excess amount promote autoxidation and Fenton reaction. [20] A deficiency contributes to the development of anemia and other related disorders, respectively. The low intake of fiber indicates that few people were consuming complex carbohydrates such as root crops, which are high in fiber. However, more people were consuming refined carbohydrates. This could be evidence of a dietary transition and deviation from the traditional eating pattern to a more western style. The food frequency shows that the major sources of fat were cooking oil, milk and fat in meat.

This study reveals a low prevalence of overweight and obesity among patients of diabetes Mellitus in the population studied. The finding correlates very well with low prevalence of hypercholesterolemia and hyperlipedimia in the study population. Obesity is usually associated with hyperlipedimia and hypercholesterolemia and both are a major contributor for the development of Diabetes Mellitus. However detailed analysis of the food pattern in the study group revealed that the traditional way of cooking food and dietary practices did not significantly lead to inappropriately increase intake of cholesterol and fat. Most of the people in this study group took fast food and junk food only occasionally. Hence it can be concluded that obesity and hyperlipedimea were not a significant problem in this study group and the traditional diet need not be changed.

However a high percentage of people had poor glycemic control as evidence by their blood glucose levels. The possible reasons behind this are

- High content of simple carbohydrates in the diet
- Low content of fiber.
- Most of the patients did not follow a strict diabetic diet. Only 7 out of 50 patients visited dieticians on a regular basis.
- Ceremonial eating and eating of sweets and deserts in functions.
- Poor compliance to medications

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- Lack of regular blood glucose testing to monitor glycemic control.

CONCLUSION:

Diabetes mellitus has emerged as a significant health problem in developing countries like India. Obesity is a key factor contributing to the development of Diabetes. Dietary transition coupled with inactivity, taking junk food and carbonated drinks appear to have contributed to the high prevalence rate of obesity of the urban population. However, it seems to be of less significance in our population where people still follow the traditional ways of dietary habits. But ignorance of nutritional concepts and food combinations seem prominent. Lack of proper dietary advice, ignorance of the utility of regular blood glucose testing and inability to follow the doctor's advice have resulted in poor glycemic control in these patients. Perhaps, effective nutrition educational programs would help in the rapid and widespread improvement of the diabetic patients. For a concrete action to be implemented, the role of a dietician is of paramount importance.

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