A Study of Correlation of Body Mass Index, Waist Hip Ratio and Lipid Profile in Type II Diabetes Mellitus Subjects

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Abstract- Diabetes Mellitus is a chronic and potentially disabling disease that represents an important public health and clinical concerned because of the economic burden it imposes on the person, family and society. The transition from a traditional to modern lifestyle consumption of diets rich in fact and calories combined with a high level of mental stress has compounded the problem further. Weight management is a key component in the treatment of over-weight or obese patients with Type 2 DM. In our study Increased BMI was observed in 23.95% of total males and, Increased BMI was present in 40.85% of total females. Increased WHR was present in 82.76% of total females. Hypertriglyceridemia was observed more in all groups followed by hypercholesterolemia, high LDL and low HDL.

Even a modest weight loss of 5% of initial body weight improves glycemic control and reduces the need for hypoglycemic medication.

Index Terms- Type 2 Diabetes Mellitus, Body Mass Index (BMI), Waist Hip Ratio (WHR), Hypertriglyceridemia.

I. INTRODUCTION

Diabetes mellitus is the most prevalent metabolic disorder worldwide. The global burden of DM is enormous with an estimated 366 million people living with DM world wide $(2011)^1$. India accounted for nearly one sixth of global diabetes burden in 2011 with about 62 million of people affected by diabetes which is projected to rise to 101 million by 2030^{1,2}. It is one of the major risk factor accounting for premature mortality and morbidity due to its complications.

Type 2 DM is the most prevalent form of DM seen in India and constitute more than 95% of the diabetes population. According to national urban diabetes survey (NUDS), the age standardized prevalence of diabetes and IGT were 12.1% and 14% respectively with no gender difference and that the prevelance of diabetes is uniformly high in all urban cities of india (Chennai 13.5%, Bangalore 12.4%, Hyderabad 16.6%, Calcutta 11.7%, Mumbai 9.3% and new Delhi 11.6%) but higher in Southern cities. It has been observed that Type 2 DM in India occurs a decade earlier than in the developed world as shown by NUDS, Daryyaganj survey, and CURE study, although the prevalence peaks at an older $age^{3,4,5}$

Insulin resistance and abnormal insulin secretion are central to the development of type 2 DM. Although the primary defect is controversial, most studies support the view that insulin resistance precedes an insulin secretory defect but that diabetes develops only when insulin secretion becomes inadequate. Type 2 DM is characterized by impaired insulin secretion, insulin resistance, excessive hepatic glucose production, and abnormal fat metabolism. Obesity, particularly visceral or central (as evidenced by the hip-waist ratio), is very common in type 2 DM (80% or more are obese Insulin resistance, the decreased ability of insulin to act effectively on target tissues (especially muscle, liver, and fat), is a prominent feature of type 2 DM and results from a combination of genetic susceptibility and obesity.

Insulin Resistance Syndromes

The insulin resistance condition comprises a spectrum of disorders, with hyperglycemia representing one of the most readily diagnosed features. The *metabolic syndrome*, the *insulin resistance syndrome*, or *syndrome X* are terms used to describe a constellation of metabolic derangements that includes insulin resistance, hypertension, dyslipidemia (decreased HDL and elevated triglycerides), central or visceral obesity, type 2 diabetes or IGT/IFG, and accelerated cardiovascular disease. This syndrome is discussed in Chap. 242. Prevention.

Type 2 DM is preceded by a period of IGT or IFG, and a number of lifestyle modifications and pharmacologic agents prevent or delay the onset of DM. The Diabetes Prevention Program (DPP) demonstrated that intensive changes in lifestyle (diet and exercise for 30 min/d five times/week) in individuals with IGT prevented or delayed the development of type 2 DM by 58% compared to placebo. This effect was seen in individuals regardless of age, sex, or ethnic group⁶.

II. MATERIAL & METHODS

Selection of patients:

The present study was conducted on 100 consecutive subjects of type 2 DM attending the outpatient department of Medicine, Kamineni Institute of Medical Sciences Hospital, Nalgonda who fulfilled the following criteria for study from October 2007 – September 2009.

Patients attending the outpatient department of medicine, KIMS, Narketpally who fulfil the following criteria for study.

Patients already known type II DM subjects, patients presenting with symptoms of polyuria, polydyspsia and polyphagia.

Patients with neuropathies like polyneuropathy, burning pain and symptoms of pins and needles.

Patients presenting with balanitis and skin infection and general weakness.

Patients detected on routine examination.

Exclusion criteria

Smokers, CRF patients, Chronic alcoholics, Patients using lipid lowering drugs, Hypothyroidism Famailial dyslipidemias.

III. METHOD OF STUDY

Anthropometric measurements to be done to calculate BMI and WHR. Waist to be measured at the midpoint between lower costal margin and superior iliac crest in the mid axillary line.

Hip circumference was measured at the level of greater trochanter of femur

FBS and PPBS to be determined by using glucose oxidase – peroxidase test.

Lipid profile to be done by enzymatic methods like Zaks method.

BMI \geq 25 for males and females to be taken to indicate generalized obesity. WHR \geq 0.90 for males and \geq 0.80 for females to be taken to indicate.

Investigations

CUE, Bl. Urea Sugar, Sr. Creatinine, Sr. Electrolytes, Lipid Profile, HbA1C, FBS, PLBs, X-Ray Chest.

BMI distribution in type II Diabetic subjects

BMI	MALES	Cumulative	Females	Cumulative
Categories	n (%)	total (%)	n (%)	total (%)
19.5 - 20.0	12		4	
	(16.90)	54 (76.05)	(13.79)	19 (65.51)
21 - 23.5	18		6	
	(25.34)		(20.68)	
23.6 - 24.9	24		9	
	(33.80)		(31.03)	
25 - 27.9	3 (4.22)		2 (6.89)	
28.0 - 29.9	5 (7.04)	17 (23.95)	2 (6.89)	10 (34.49)
<u>></u> 30	9		6	
	(12.67)		(20.68)	
<u>Total</u>	71 (100)		29 (100)	

Increased BMI was observed in 23.95% of total males and Increased BMI was observed in 34.49% of total females.

WHR DISTRIBUTION IN TYPE II DIABETIC MALES N = 71

WHR Categories	Males n(%)	Cumulative (%)	total
< 0.80	10 (14.08)		
0.81 - 0.84	14 (19.71)	42 (59.15)	
0.85 - 0.89	18 (25.35)		
0.90 - 0.94	6 (8.45)		
0.95 - 0.99	10 (14.08)	29 (40.85)	
< 1.00	13 (18.30)		

Increased WHR was present in 40.85% of total males and normal WHR was present in increased 59.15% of total males.

WHR DISTRIBUTION IN TYPE II DIABETIC FEMALES N = 71

WHR Categories	Females n (%)	Cumulative	total
		(%)	
<u><</u> 0.75	1 (3.44)	5 (17.24)	
0.76 - 0.79	1 (3.44)		
0.80 - 8.84	3 (10.34)		
0.80 - 8.84	5 (17.24)		
0.85 - 0.89	7 (24.13)	24 (82.76)	
< 1.00	13 (18.30)		
Total	29 (100)		

Increased WHR was present in 82.76% of total females and normal WHR was present in increased 17.24 % of total females.

LIPID ABNORMALITIES IN TYPE II DIABETIC SUBJECTS

Groups (n)	High triglycerides 30 – 150 mg% N (%)	High cholesterol upto 200 mg% N (%)	Low HDL (40 - 60 mg%) N (%)	High LDL 50 - 150 mg% N (%)
Generalised	20 (74.07)	14 (51.85)	07	09
Obese (27)			(25.92)	(33.33)
BMI > =				
25)				
Central	44 (83.01)	32 (60.37)	14	21
Obese (53)			(26.42)	(39.96)
(WHR > =				
0.9				
Male > =				
0.8 Female				
Non obese	13 (65.00)	9 (45.00)	3 (15.0)	6
(20) Normal				(30.00)
BMI &				
WHR				

Hypertriglyceridemia was observed more in all groups followed by hypercholesterolemia, high LDL and low HDL.

IV. DISCUSSION

Obesity has become a major worldwide epidemic affecting more than 300 million people. It is an important risk factor for diabetes mellitus, type 2, a chronic disorder of carbohydrate, fat, and protein metabolism. From the clinical perspective, visceral adipose tissue is known to generate diabetogenic substances⁷ and, as such, may be more informative than total fat for diagnostic evaluation. The standard epidemiologic translation of these important clinical facts uses anthropometric measures. Waist circumference and waist/hip ratio have been used as measures of central obesity (where visceral adipose tissue is stored), and body mass index (kg/m2) has been used as a measure of general obesity⁸. Clinical evidence suggests that the association of diabetes with central obesity is stronger than the association with general fat. Studies using computed tomography and magnetic resonance imaging have provided further evidence to support that central obesity, visceral adipose tissue, and upperbody nonvisceral fat are the major contributors to the metabolic complications^{9,10,11,12}. Central obesity has been associated with decreased glucose tolerance, alterations in glucose insulin homeostasis, reduced metabolic clearance of insulin, and decreased insulin-stimulated glucose disposal. In addition, studies that have analyzed the association of anthropometric measures and abdominal visceral fat have found waist circumference to be a better measure of central obesity because it is a better predictor of abdominal visceral fat obtained with computed tomography than is waist/hip 13 .

Lifestyle measures which combines increased physical activity and dietary modifications are an important component in the management of both type 1 and type 2 diabetes mellitus (DM). The role of exercise in the control of DM has been known since ages. Our ancient ayurvedic physicians Sushruta and Charaka stressed on the role of exercise in the treatment of DM.

V. DIETARY THERAPY

The goal of dietary therapy is to provide a nutritionally balanced diet to maintain the ideal body weight (IBW) of the patient to achieve good glycaemic control along with correction of the dyslipidaemia. Cholesterol intake should be less than 300 mg per day.

As per the choice of oils in the diet, none of the available oils are ideal, however the choice of cooking oil should be as follows:

- (a) use an oil which has moderate quantity of linoleic acid like groundnut oil, rice bran or sesame.
- (b) use an oil which has high amounts of linoleic acid like safflower oil, sunflower oil, cotton seed or corn oil along with an oil which has relatively low levels of linoleic acid like palm oil (mix equal quantities or use equal quantities separately).
- (c) use any of the above oils with alphalinoleic acid containing oil like mustard oil or soyabean oil.

Roughly the oil intake should be half a litre per person per month. The salt intake should be between 5 to 6 g per day.

Regular physical exercise is associated with changes in body composition with a reduction in body fat and increase in muscle mass, a reduction in triglycerides, increase of high density lipoprotein 2 fraction. Exercise causes a reduction in blood pressure, corrects the endothelial dysfunction and brings about improvement in the fibrinolytic activity. Exercise also induces weight loss and subsequently helps in maintenance of the weight.

To be effective, exercise should be performed regularly. An exercise schedule that is enjoyable and suits the needs of an individual should be chosen. Daily exercise of 30 to 45 minutes is preferable.

Presence of autonomic neuropathy may limit an individual's exercise capacity and increase the risk of adverse cardiovascular events.

VI. ROLE OF YOGIC PRACTICES

Several recent studies have documented the beneficial effect of yogic practices in both type 2 and type 1 DM yogic practices improve glycaemic control, reduce blood pressure, correct dyslipidaemia, reduce insulin resistance and eliminate stress leading to effective control of diabetes and prevention of its Long-term complications.

VII. SUMMARY

- Among the 100 consecutive type II diabetic subjects (71 males and 29 females) attending the outpatient department of medicine in Kamineni institute of Medical Sciences, Narketpally.
- Increased BMI was observed in 34.49% (17) of females and 23.95% (10) of males.
- Increased waist hip ratio was present more in females (82.76%) (24) than (40.85%) (29) Males.
- Lipid abnormalities are common in type II diabetics the most common being hypertriglyceridemia followed by hypercholesterolemia, high LDL and low HDL.
- Lipid abnormalities are common in type II diabetics with high BMI and high WHR.
- The most common lipid abnormality in type II diabetics was hypertriglyceridemia.
- Hypertriglyceridemia was observed in both groups; 74.07% in Generalized obese and 83.01% in Central obese (high WHR).
- Hypercholesterolemia was second most common lipid abnormality. It was observed in 51.85% of generalized obese and 60.73% of central obese subjects
- Elevated LDL was found in 33.3% of generalized obese and 39.96% of central obese
- The least common lipid abnormality in type II diabetics was low HDL which was observed in 27.35% of generalized obese and 26.42% of central obese type II diabetic subjects.

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