PREVALENCE OF DIABETES MELLITUS AMONG THE ELDERLY : AN EMPIRICAL STUDY IN CUTTACK,ODISHA.

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ABSTRACT

Ageing is a biological process and experienced by the mankind in all times. It is also a multi-dimensional process. Old age is the closing period of the life of an individual. A person's activities, attitude towards life, relationship to the family and the work, biological capacities and physical fitness are all conditioned by the position in the age structure of the particular society in which he lives. Rapid ageing trends present new challenges to government, families and the elderly themselves.

With increasing life expectancy, the numbers of older people are growing in our society. There are many illnesses that occur in association with age. Type 2 diabetes is the classical example of a disease that increases with age. Changes in lifestyle, including diet and physical activity, and the increasing numbers of elderly people are both key factors for the worldwide epidemic of diabetes. Diabetes in the elderly is emerging as one of the most important public health problems of the 21st century. Diabetes and its complications take a major toll on the quality of life of the elderly and the health care costs of the society.

Key words: Prevalence, Diabetes Mellitus, Glucose, Body mass index, Risk factors.

Introduction

Diabetes, often referred as diabetes mellitus, describes a group of metabolic diseases in which the person has high blood glucose (blood sugar), either because insulin production is inadequate, or because the body's cells do not respond properly to insulin, or both. Patients with high blood sugar will typically experience polyuria

(frequent urination), they will become increasingly thirsty (polydipsia) and hungry (polyphagia).

Diabetes Is a metabolism disorder. Metabolism refers to the way our bodies use digested food for energy and growth. Most of what we eat is broken down into glucose. Glucose is a form of sugar in the blood - it is the principal source of fuel for our bodies. When our food is digested, the glucose makes its way into our bloodstream. Our cells use the glucose for energy and growth. However, glucose cannot enter our cells without insulin being present - insulin makes it possible for our cells to take in the glucose.

A person with diabetes has a condition in which the quantity of glucose in the blood is elevated (hyperglycemia). This results in too much glucose building up in the blood. This excess blood glucose eventually passes out of the body in urine. So, even though the blood has plenty of glucose, the cells are not getting it for their essential energy and growth requirements.

There are three types of diabetes:

1) Type 1 Diabetes

The body does not produce insulin. Some people may refer to this type as insulin-dependent diabetes, juvenile diabetes, or early-onset diabetes. People usually develop type 1 diabetes before they are 40, often in early adulthood or teenage years. Type 1 diabetes is not common as type 2 diabetes. Patients with type 1 diabetes will need to take insulin injections for the rest of their life. They must also ensure proper blood-glucose levels by carrying out regular blood tests and following a special diet.

2) Type 2 Diabetes

The body does not produce enough insulin for proper function, or the cells in the body do not react to insulin (insulin resistance). Approximately 90% of all cases of diabetes worldwide are of this type.

Type 2 diabetes is typically a progressive disease - it gradually gets worse. Overweight and obese people have a much higher risk of developing type 2 diabetes compared to those with a healthy body weight.

3) Gestational Diabetes

This type affects females during pregnancy. Some women have very high levels of glucose in their blood, and their bodies are unable to produce enough insulin to transport all of the glucose into their cells, resulting in progressively rising levels of glucose. Diagnosis of gestational diabetes is made during pregnancy.

The majority of gestational diabetes patients can control their diabetes with exercise and diet. 10% to 20% of them will need to take some kind of blood-glucose-controlling medications. Undiagnosed or uncontrolled gestational diabetes can raise the risk of complications during childbirth. The baby may be bigger than he/she should be.

Diabetes type 1 lasts a lifetime, there is no known cure. Type 2 usually lasts a lifetime; however, some people are managing it through a lot of exercise, diet and excellent body weight control to get rid of their symptoms without medication. Patients with type 1 are treated with regular insulin injections, as well as a special diet and exercise. Patients with Type 2 diabetes are usually treated with tablets, exercise and a special diet, but sometimes insulin injections are also required. If diabetes is not adequately controlled the patient has a significantly higher risk of developing complications.

"Diabetes Mellitus can no longer be considered a disease of affluent nation alone, it has become a global problem, a major epidemic of the twentieth century, and one which shows no sign of abating". (King,H.:1991). Diabetes Mellitus now affects a higher proportion of persons in many developing countries than it does in Western countries where two or three percent of the population is affected. This trend has been linked with the increasing life expectancy, rural urban shifts, moves from traditional to modern life style, change in diet and physical inactivity and obesity.(Johnson,T.O.:1991). Diabetes Mellitus today affects over 50 million people in the world and about one half of them are living in the developing world. The prevalence of diabetes mellitus increases with age. In India, 20% of the elderly population has Diabetes Mellitus.(Meneilly, G.S. et.al.:1995). In addition, over 25% of older persons have impaired glucose tolerance (IGT) (Harris, MI. et.al.:1987).The majority of older individuals with diabetes have type 2 Diabetes Mellitus. At the same time, the disease and its complications cause a heavy economic burden for diabetic

patients themselves, their families and society. Both diabetes and aging increase the risk for arteriosclerosis and cardiovascular mortality. Diabetes further increases the risk of cardiovascular mortality in older people.(Johnson,T.O.:1991).

It has been well recognized that people with diabetes are in the hospital more frequently than non-diabetic age-matched individuals and stay longer in the hospital for a given admission, a similar trend noted in the elderly population in general. Elderly people who have diabetes are at double jeopardy and have a much higher rate of health care utilization. When caring for older people with diabetes, careful consideration must be given to normal age-related physiological changes, coexisting age-prevalent illnesses, and "geriatric syndromes" that may not only affect a prescribed treatment regimen, but also increase the likelihood for drug interactions, side effects, and adverse outcomes. Patients' ability to comply with a specific treatment may also be effected by diseases that occur more commonly during later life and thus increase the complexity of care. (Steven, R. et.al: 2006)

Review Of Related Studies:

Diabetes is a common non-communicable disease in India, as well as the rest of the world. The estimates of prevalence of diabetes suggested that nearly 3% of adults were diabetic in the year 2000, and this figure is projected to be nearly doubled by the year 2030. (Wild, S. er.tal :2004). Diabetes also contributes to 5% of the total mortality. (W H O:2012; Roglic, G er.tal..: 2005).

The most important demographic transition in India, as well as in the world, is due to increase in the number of aged persons, leading to an increase in the prevalence of hypertension and diabetes. Recently, India has witnessed this demographic transition, with a reduction in crude birth rate and increase in life expectancy.(Census of India:2001)

Population aging is a global demographic phenomenon. Indeed, the World Health Organization predicts that by 2025, there will be 1.2 billion people with more than 60 years of age. In particular, the very elderly (85 or over) who are the fastest growing age group, are expected to largely exceed the number of young people (World Health Organization, 2001). Moreover, the population's increased longevity is leading to a rapid growth of the older population with chronic non-communicable

diseases like diabetes (World Health Organization, 2012). Hence, there is a growing worldwide concern by public policies to enable older adults to maintain their independence and well-being as well as to respond effectively to the many challenges inherent to old age (Strine, T.W.,et.al.:2008).

The worldwide prevalence of diabetes among adults (aged 20-79 years) affected 385 million individuals in 2010 and is expected to rise 54% by 2030 (International Diabetes Federation, 2012). According to the International Diabetes Federation (2011), type 2 diabetes is accountable for at least 90% of all cases of diabetes. In particular, diabetes in older adults has become a major public health problem (Mushi et al., 2006). Half of the currently affected individuals are over 60 years of age, but the highest prevalence is found in those who are over 80 years of age, a number estimated to reach 40 million by 2050 (Gambert & Pinkstaff, 2006). In fact, Diabetes Mellitus is a chronic disease that requires several adjustments in patient's lifestyle and has been referred to as the most demanding of all chronic diseases in terms of management Because it is an incurable disease, diabetes has to be managed through a strict daily regimen of medication, use of insulin, exercise and diet. These patients are, therefore, faced with behavioural and psychological challenges that put them on an increased risk of developing several co-morbidities (Pretorious,C.,et.al.: 2009). Moreover, both old age and diabetes are independently associated with increased risk of cognitive dysfunctions (Mushi et al., 2006), as well as an increased risk of psychological distress, anxiety, depression, hypertension, mood disorders, and functional impairment, therefore, affecting negatively patients' well-being. (Mushi et al., 2006;; Strine et al., 2008).

The vast majority of cases of diabetes in the elderly are of type 2. Of the approximately 580 million elderly people (60 years and more) in the world today, around 355 million live in developing countries.(Dharmarajan,T.S.;2003).

The number of people with type 2 diabetes is increasing in the world at large and Asian Indians have the highest prevalence. The number of adults with diabetes in the world is projected to rise from 135 million in 1995 to 300 million in the year 2025. The major part of this numerical increase will occur in developing countries, especially in Asia. The countries that are projected to have the most cases of

diabetes in 2025 are India (57 million), China (38 million) and the USA (22 million). The greatest increase between 1995 and 2025 is expected to occur in India (195%). In developing countries, the majority of people with diabetes are in the age range of 45-64 years,(Rao,P.V. et.al.:1998) whereas in the developed countries the majority of people with diabetes are aged ≥ 65 years.(King, H. et.al. :2002)

In India there has been a rapid rise in the number of elderly with nearly 80 million people over 60 years which is equal to the entire population of the largest European country. By 2020, it is projected that three-quarters of all deaths in developing countries could be age-related. Non-communicable diseases such as diseases of the circulatory system, cancers and diabetes will cause the largest share of these deaths.(Ramchandran,A. et.al.:2001)

In a study conducted among asymptomatic elderly individuals in India, prevalence of diabetes mellitus was 13.0 %.(Gupta,H.L.et.al.:2002) In a study in rural South India, the age-adjusted rates for known diabetes in the middle-aged and elderly subjects were unexpectedly high, considering the poor socioeconomic circumstances, decreased health awareness and decreased access to medical facilities.(Rao,P.V. et.al.:1998). In a study conducted in Trivandrum, the capital city of Kerala State, overall prevalence of type 2 diabetes was found to be 16.3%.(Raman, K.V.et.al.:199). These data suggest that increasing life-expectancy (as in Kerala State) and changes in lifestyle and nutrition may result in substantially higher incidence of diabetes in India than currently established.

Low-socioeconomic status is associated with development of diabetes. (Ross, N.A.,et.al..:2010). Elderly persons living in urban slums are more vulnerable to various non-communicable diseases and their complications due to lack of basic amenities, poor health-seeking behavior and stress due to lack of social support.(Anand, K., et.al.:2007).

In spite of its high prevalence, and being a major cause of mortality, diabetes remains highly undiagnosed. Undiagnosed diabetes is associated with increased risk of all-cause mortality. (Wild, S.H. er.tal:.2005). Delayed diagnosis and inadequate or improper treatment result in poor disease outcomes.

Aims And Objectives

1. To study the prevalence of diabetes among elderly in an urban setup.

2. To study the associated risk factors for diabetes among the elderly.

Inclusion criteria: Elderly of 60 years and above.

Materials And Methods

One Geriatric health camp was organised at Arunodaya Nagarika Parishad building, Arunodaya nagar, cuttck-12 on 10th and 11th October 2011 organised by Rotary Club of Cuttack Mid-Town and Rotary Club of Cuttack Millennium. In ward number 41 and ward number 42, door to door campaign was arranged and pamphlets were distributed for information of aged persons as regards to the arrangement of this specific geriatric health camp. Corporators of both the wards also actively participated. The Doctor members of both the clubs were present and conducted the camp for two days. The pathological investigations were carried out by experienced technicians of M/S Satyam Diagnostics who provided the equipments (mainly auto analyser), chemicals etc at free of cost.. Free medicines were also distributed to the needy and poor patients. About 420 elderly (aged =>60 years) attended the camp.

The methodology comprised of interview, physical examination, clinical examination and laboratory investigations. General demographic, socioeconomic and family structure information was obtained through a prestructured, pretested questionnaire. Personal history regarding physical activity, diet, substance abuse (alcohol) and exercise were noted. Data were collected from all the elderly diagnosed as diabetic through the questionnaire.

Weight was recorded (to an accuracy of 1 kg) & the height of each subject (to an accuracy of 1 cm.) were measured. Blood pressure was measured in lying down position. Elderly with a pressure ≥ 140 mmHg systolic & ≥ 90 mmHg diastolic or else who were on treatment were considered hypertensive. Obesity was assessed by calculating Body Mass Index (BMI) using formula (wt in kg / ht in mt ^{2}). Elderly with BMI ≥ 25 were classified as overweight.

Diabetes was diagnosed if the fasting blood glucose was ≥126 mg/dL after an overnight fast for at least 8 hours, or if the participant was taking treatment for

diabetes. Impaired fasting blood glucose was diagnosed if fasting blood glucose was 110-125 mg/dL.

The awareness status regarding their own diabetes mellitus was defined as having diabetes diagnosed by a health professional with presence of a prescription, or anti-diabetic medicines possessed by the participant. The treatment status was defined as taking any pharmacological treatment for diabetes. Participants who were already diabetic and taking treatment were considered to have control if the fasting blood glucose was <126 mg/dL.

A normal fasting plasma glucose level is less than 110 mg per dL and normal 2hrPPG levels are less than 140 mg per dL. Blood glucose levels above the normal level but below the criterion established for diabetes mellitus indicate impaired glucose homeostasis. Persons with fasting plasma glucose levels ranging from 110 to 126 mg per dL are said to have impaired fasting glucose, while those with a 2hrPPG level between 140 mg per dL and 200 mg per dL are said to have impaired glucose tolerance. Both impaired fasting glucose and impaired glucose tolerance are associated with an increased risk of developing type 2 diabetes mellitus.

Data were analysed through SPSS package.. Tests of significance like Pearson's Chi- square test was used to find out the results. P values <0.05 were considered significant for the identified risk factors and outcome variables.

Definitions and diagnostic criteria: Diabetes was diagnosed based on drug treatment for diabetes (insulin or oral hypoglycemic agents) and/or criteria laid by the ADA in 2004 i.e. fasting plasma glucose (FPG) 126 mg/dl or 2 hr postglucose value 200 mg/dl. Impaired glucose tolerance (IGT) was diagnosed if FPG was <126 mg/dl and 2 hr post- glucose value (140 mg/dl and <200 mg/dl) .

Results
Table-1 shows the prevalence of diabetic mellitus among the study sample.

TABLE - 1:
Distribution of study subjects according to Age & Sex (n=82)

Subjects	Male	Female	Total	(%)
Total subjects	185	235	420	100
Known Diabetics	27	34	61	14.52
New Diabetics	11	10	21	5.00
Total	38	44	82	19.52

Out of 420 study elderly, 82 (19.52%) were diabetic, and among diabetes 38(46.34%) were males and 44 (53.65%) were females. %). It is also observed that 61 (14.52%) of respondents have been diagnosed to be diabetic earlier and 21(5%) of respondents were freshly diagnosed to be diabetic. The earlier diagnosed patients were found to be on medicines.

TABLE - 2:

Distribution of diabetic subjects according to Epidemiological Factors (n=82)

Epidemiological factors	M	F	Total	%
Religion				
Hindu	31	37	68	82.9
Muslim	7	7	14	17.1
Marital status				
Married	34	39	73	89.0
Widower/Widow	4	5	9	11.0
Literacy				
Illiterate	8	12	20	24.4
Literate	30	32	62	75.6
Occupation-				
Working	7	22	29	35.4
Non-Working	31	22	53	64.6
Type of family				
Nuclear	22	25	47	57.3
Joint	15	16	31	37.8
Joint Extended	1	3	4	4.9

Economic Dependency				
Dependent	10	35	45	54.9
Independent	28	9	37	45.1
*SES				
Upper	3	5	8	9.8
Upper Middle	6	3	9	11.0
Middle	17	23	15	48.8
Lower Middle	3	7	10	12.2
Lower	9	6	40	18.3
†BMI				
Under weight	6	3	9	11.0
Normal weight	23	26	49	59.7
Over weight	9	15	24	29.3
Substance Abuse				
Yes	5	1	6	7.3
No	33	43	76	92.7
Diet				
Veg.	14	13	27	32.9
Mixed/non-veg.	24	31	55	67.1
Exercise				
Routine	9	7	16	19.5
Occasional	10	11	21	25.6
No	19	26	45	54.9
Physical Activity				
Sed.	13	27	40	48.8
Mod.	17	17	34	41.5
Heavy	8	0	8	9.8

*SES- Socio-economic status,   †BMI- Body mass index

(Upper class :   Income per month: > Rs 25000.00
Upper middle: income per month: > Rs 15000.00 and < Rs 25,000.00
Middle   :   Income per month: > Rs10, 000.00 and < Rs 15,000.00

Lower middle: Income per month: > Rs5, 000.00 and < Rs 10,000.00
Lower   :   Income per month: < Rs 5, 00.00)

From Table-2, it is observed that the majority of diabetic elderly were female (53.65%), Hindu (82.9), married (81.7%), literate (75.6%), non-working occupation (64.6%), from nuclear family set up (57.3%), economically dependent (54.9%), with middle class of socioeconomic status (39.44%) and with normal BMI (59.7%).

Life style profile of diabetic elderly revealed that the majority of them were non substance abuser (92.7%), non-vegetarian (67.1%), having sedimentary life style (48.8%) and living without any physical exercise (54.9%).

TABLE - 3:

Association of risk factors with diabetes

Risk factors	Diabetic (N=82)	Non-Diabetic (n=338)	Chi-quire	P-Value
Sex				
Male	38	139	0.21	0.648
Female	44	191		
Hypertension	66	79	4.79	0.0285
Family history of diabetes	49	6	41.85	0.0128
BMI ≥ 25	24	64	1.9	0.168
Sedentary life style	40	172	1.74	0.187
Lack of exercise	45	174	0.58	0.44
Non-veg. diet	55	186	2.38	0.122
Alcohol	6	27	0.21	0.65

The most common risk factors found in our study for diabetes was positive family history 49 (59.75%), lack of exercise 45(54.87%), Non-veg./mixed diet 55 (67.07%), sedentary life style 40(48.8%).Other risk factors found for diabetes were history of hypertension 66(80.48%), overweight 24(29.26%) and alcoholic 6(7.31%).

Family history of diabetes mellitus was associated with increased risk for diabetes, which is statistically significant (p<0.001) and supports the role of heritability as long has been known for diabetes. History of hypertension is also statistically significant (p<0.05) which shows the twin epidemic of non-communicable diseases.

Discussion

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.

The so called "Asian Indian Phenotype" refers to certain unique clinical and biochemical abnormalities in Indians which include increased insulin resistance, greater abdominal adiposity *i.e.*, higher waist circumference despite lower body mass index, lower adiponectin. This phenotype makes Asian Indians more prone to diabetes and premature coronary artery disease. At least a part of this is due to genetic factors. However, the primary driver of the epidemic of diabetes is the rapid epidemiological transition associated with changes in dietary patterns and decreased physical activity as evident from the higher prevalence of diabetes in the urban population.

The present study was conducted to analyze the epidemiological factors, along with risk factors for diabetes in geriatric subjects who were suffering from type 2 diabetes. Out of 420 patients examined and investigated, the overall prevalence of diabetes was found to be 19.52 %. The prevalence of diabetes was 9.0% in males and 10.47% in females among the total study subjects and among the diabetic patients, 38(46.34%) were males and 44(53.65%) were females. Earlier studies from Assam by Medhi GK et. al. (2006) have observed prevalence of diabetes in 17.4% of elderly, an urban area study conducted by Gurav RB et. al. (2002) have reported the prevalence of diabetes in 9.41% of elderly. Similarly Ahmad,J. et. al. (2011) have reported prevalence of diabetes among elderly to be 16.66%. A study was conducted by Singh, J. et.al. in an urban slum in Nagpur during 2011. They have reported the prevalence of diabetes in 17.75% of the elderly. Puria, S. et.al. (2008)

have conducted a cross sectional study in Chandigarh and have reported prevalence of diabetes in 24.6% of the elderly. The study of Singh, A.K. et.al.(2012) in an urban slum of Delhi among the elderly estimated that the prevalence of diabetes to be 18.8%. It decreased with increasing age, and was higher among women. All these studies have supported my findings that elderly are suffering from diabetic type 2.

Prevalence of various risk factors for diabetes was observed in our study. Obesity (BMI≥25) was present in 24(29.26% of diabetics. Framingham study (1980) has reported the obesity as a risk factor in 26.5% of diabetic patients. Singh, N. P.et.al. have reported the overweight as a risk factor in 18% of diabetic patients.
Positive family history for diabetes was found in 49(69.75%). Ramachandran, A. et.al. (2006) have reported positive family history as a risk factor in 16.9% of diabetic patients and Puri, S. Has reported positive family history in 27.0% of diabetic patients.

Sedentary life style was present in 40(48.8%) of the diabetes in our study. The study of Puri, S. reports the sedimentary life style as a risk factor in 47.3 %of diabetic patients. Lack of exercise was found in 45(54.87%) patients and hypertension was found in 66(80.48%) subjects. In our study, family history of diabetes mellitus was associated with increased risk for diabetes, which is statistically significant ($p<0.001$) and supports the role of heritability as long has been known for diabetes. History of hypertension is also statistically significant ($p<0.05$) which shows the twin epidemic, as found in other studies. The other risk factors observed were not significantly associated with diabetes.

Singh J. et.al.have reported   "Stress" as the commonest risk factor (64.9%) followed by family history of diabetes (63.38%) and others. Family hisotry of diabetes and hypertension were significantly associated with diabetes ($p<0.05$) while other risk factors were not significantly associated which supports my findings. Puria, S. et.al. have reported sedimentary life style (47.3%) to be the most common risk factor for diabetes. Among the co-morbidities, 41.9% had hypertension while 28.1 % had CVD. From all these studies, it is found that hypertension is closely associated with diabetes.

Conclusion

Diabetes in the elderly population is growing into epidemic proportions throughout the world. Though there are some disease similarities in older and middle-aged people, understanding the pathophysiology, clinical features and treatment of the elderly diabetic population presents additional challenges. Tight metabolic control should be the goal of therapy, but may not be safe in all the elderly patients because of co-morbidities and risk of hypoglycemia.

Physical exercise improves muscle strength and endurance and improves insulin sensitivity. Older people, unlike the young have to perform more regular and daily exercise to improve and sustain insulin sensitivity. Lifestyle modifications to prevent weight gain, especially abdominal accumulation of fat, are important for prevention and treatment of diabetes.

The lifestyle changes are required to avoid diseases like diabetes and patients need continues motivation to continue diabetic treatment and dietary restriction. There is a need to have a holistic and multidisciplinary approach for management of elderly diabetes.

Strengthening primary health care services with special emphasis on the vulnerable population like elderly persons is needed. Non-communicable diseases are a major cause of morbidity and mortality in this age group, and deserve special attention of policy makers and programme managers.

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