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Association between Body Mass Index (BMI) and Glycemic Control in Patients with Type 2 Diabetes Mellitus Admitted in a Rural Teaching Hospital in the State of Kerala, India – A Pilot Study

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Authors' contributions

This work was carried out in collaboration between all authors. Author AVP designed the study and initially drafted the manuscript. Author AMI managed the literature search and revised the manuscript. Author AM contributed to reviewing the data. Author SKV performed the statistical analysis. All authors read and approved the final manuscript.

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ABSTRACT

Aim: To determine body mass index (BMI) of all hospitalized type 2 diabetic patients and its association with HbA_1C value
Study Design: Pilot cross-sectional study.
Place and Duration of Study: Department of Medicine, Malankara Orthodox Syrian Church Medical College and Hospital, Kolenchery, Kerala State, India. Two calendar months in 2014.
Methodology: The study covered 79 type 2 diabetic patients admitted in a tertiary care centre in a rural area of Kerala state in southern India. With a pre-set questionnaire and format, data was collected. Analysis of data was done using appropriate statistical tools.
Results: A total of 79 diabetic patients were covered in the study. Among the participantss 41.8% were overweight, 50.6% belonged to the normal BMI range and 7.6% were underweight. There was no statistically significant association between BMI and glycemic control ($p = 0.39$). There was significant association between glycemic control and age of the patient ($p = 0.029$); with increasing age there was better glycemic control. Further there was no significant association between weight, height, waist hip ratio, duration, socioeconomic score, gender, method of diabetic control, comorbidities, other regular medications and exercise with glycemic control.
Conclusion: There was no association between BMI and glycemic control of hospitalized type 2 diabetic patients. Glycemic control of diabetic patients was related to the age of the patient; with increasing age there was better glycemic control.

Keywords: Type 2 diabetes mellitus; glycemic control; body mass index; age; hospitalized patients.

1. INTRODUCTION

Diabetes Mellitus is the most common metabolic disorder affecting the world population irrespective of the geographical regions of the world. The majority of diabetes cases are type 2 diabetes mellitus (85-95%) [1]. According to the International Diabetes Federation (IDF) it is estimated that about 438 million people or 7.8% of the adult population in the world are projected to have diabetes by 2030 [2]. The 4th edition of the world diabetes atlas published by IDF at the 20th world diabetes congress in Montreal, Canada predicts that India will be the diabetic capital of world and by 2030; nearly 9% of the country's population is likely to be affected with diabetes [2].

More than 80% of diabetes deaths occur in low and middle income countries [3]. Unfortunately, there is still inadequate awareness about the real extent of this problem in the community. Inadequacies in the primary health care system result in suboptimal treatment and follow up of this chronic disease, often leading to complications and early death.

Results from various metabolic and epidemiologic studies [4,5,6,7] provide very strong evidence that obesity and body mass index (BMI) is closely related to type 2 diabetes mellitus [8,9]. Meta analysis of studies have also showed relative high risk for type 2 diabetes mellitus with increasing BMI and increasing waist circumference [10]. However there is very little information regarding the role of BMI in the glycemic control of type 2 diabetic patients especially in the Indian context. The purpose of this pilot cross sectional study was to find whether there was an association between BMI and glycemic control in type 2 diabetic patients.

2. MATERIALS AND METHODS

The study covered 79 patients with type 2 diabetes mellitus admitted to the general medicine ward during two calendar months in a tertiary care centre in Kerala state in southern India. The sample size for the study was calculated using nMaster software, version 2.0 produced by the Department of Biostatistics, Christian Medical College, Vellore, Tamil Nadu, India.

Patients with gestational diabetes mellitus and diabetes secondary to chronic pancreatitis were excluded from the study.

All study subjects were educated regarding the study. They were also educated regarding importance of life style changes and maintenance of good glycemic control. The informed consent form in local language was provided to all the participants. After the consent of the participants were obtained in the prescribed form, he/she was interviewed based

on the pre-set questionnaire and format and variables were collected. The characteristics examined included age, height, weight, waist-hip ratio, gender, socio-economic status, method of diabetes control, duration, co-morbidities, other regular medications and exercise.

The socio-economic status of the individual was measured according to the 'Updated BG Prasad Socioeconomic Classification, 2014' [11]. BMI was categorized as per the criteria set by the WHO (World Health Organization) [12]. Glycemic control was considered as adequate if the HbA1c value was less than 6.5% [13].

The collected data was entered into excel spread sheet and analyzed using Statistical Program for Social Sciences (SPSS) for Windows operating system, to look for any association between BMI and glycemic control of the participants.

Permission was obtained from the institutional ethics committee of the institution for the study.

3. RESULTS

The study sample included 79 patients (Table 1) among whom males formed a slight majority (55.7%). Nearly three quarters of the group (72.15%) were above 50 years of age. About half (53.16%) of the patients belonged to the middle socio-economic group. Only a minority were underweight (7.6%); 50.6% had a normal BMI and 41.8% were overweight. Majority of patients had good glycemic control (65.8%) and also the majority resorted to a combination of diet and oral hypoglycemic agent (OHA) to control their diabetes. 57% had other comorbidities and nearly 61% were on medications in addition to their regular oral hypoglycemic medicines. A significant proportion of patients (88.6%) did not have a regular exercise pattern.

There was no significant association between weight, height, waist-hip ratio and duration of diabetes with glycemic control (Table 2A). Neither was any association noted with gender and socio-economic status. The method of diabetes control, the presence of comorbidities, intake of medicines other than that used for diabetes and the presence or absence of a regular exercise regimen also did not have a bearing on the glycemic status of the patient (Table 2B).

In the underweight category 50% of the participants had good glycemic control and in the overweight category 39.4% had good glycemic control; But only 27.5% of participants in the normal BMI range had good glycemic control. Overall there was no significant association between BMI and glycemic control.

Age was the only factor that had an association with glycemic control ($p = 0.02$); With increasing age there was better glycemic control.

Table 1. Selected characteristics of patients with type 2 diabetes mellitus

	n	Percentage
Total no. of patients	79	100.0
Age (years)		
21-50	18	22.78
51-80	57	72.15
80+	4	5.06
Gender		
Male	44	55.7
Female	35	44.3
Socioeconomic distribution		
Class 1	14	17.72
Class 2	42	53.16
Class 3	23	29.11
BMI categories of participants		
Underweight	6	7.6
Normal	40	50.6
Overweight	33	41.8
Glycemic control		
yes	27	34.2
no	52	65.8
Method of diabetic control		
Diet, OHA, Insulin	15	18.98
Diet and Insulin	3	3.79
Diet and OHA	47	59.49
OHA	1	1.26
Diet	13	16.45
Comorbidities		
Present	45	57
Absent	34	43
Regular medications other than hypoglycemic agents		
Yes	48	60.8
No	31	39.2
Exercise pattern		
Regular exercise	9	11.4
No exercise	70	88.6

Abbreviations: BMI, Body Mass Index; OHA, Oral hypoglycemic agent

Table 2A. Association between glycaemic control and selected characteristics of patients with type 2 diabetes mellitus

	Mean	Standard deviation	Significance
Age	58.72 yrs	11.93 yrs	0.02
Weight	59.59 kg	10.43 kg	0.23
Height	162.39 cms	7.45 cms	0.94
Waist- hip ratio	0.96	0.05	0.88
Duration since detection	6.62 yrs	5.86 yrs	0.57

Table 2B. Association between glycaemic control and selected characteristics of patients with type 2 diabetes mellitus

	Glycemic control		Significance
	Yes	No	
Gender			
Male	18(40.9%)	26(59.1%)	0.15
Female	9(25.7%)	26(74.3%)	
Socioeconomic status			
Class 1	6(42.9%)	8(52.1%)	0.55
Class 2	15(35.7%)	27(64.3%)	
Class 3	6(26.1%)	17(73.9%)	
BMI			
Underweight	3(50%)	3(50%)	0.39
Normal	11(27.5%)	29(72.5%)	
Overweight	13(39.4%)	20(60.6%)	
Method of diabetic control			
Diet control	4(30.76%)	9(69.23%)	0.65
OHA	0	1(100%)	
Diet control & OHA	17(36.17%)	30(63.83%)	
Diet control & insulin therapy	0	3(100%)	
Diet control, OHA & insulin therapy	6(40%)	9(60%)	
Co morbidities			
Present	18(40%)	27(60%)	0.2
Absent	9(26.5%)	25(73.5%)	
Other regular medications			
Present	20(41.7%)	28(58.3%)	0.08
Absent	7(22.6%)	24(77.4%)	
Exercise			
Regular	4(44.4%)	5(55.6%)	0.49
No exercise	23(32.9%)	47(67.1%)	

Abbreviations: BMI, Body Mass Index; OHA, Oral hypoglycemic agent.

4. DISCUSSION

This study analyzed data from patients admitted in a rural teaching hospital in the state of Kerala in southern India. Nearly three quarters of the patients enrolled in this study were above 50 years of age. This age disparity, with prevalence more in the elderly has been reported from other centers across India [14,15]. This also seems to mirror the demographic change in diabetes where the prevalence across the world appears to be an increase in the proportion of people > 65 years of age [16].

The risk of diabetes is more evident in the low socio-economic group irrespective of whether a country falls into the high, middle or low income category [17,18]. Also outcome seems to follow a similar trend [19]. However in this study, people in the middle income group were more at risk. Another study from Kerala has concluded that people in the high socio-economic group were more at risk [20]. Data from the rest of India also shows a high risk in the high socio-economic group [21].

Nearly half of the patients in this study had a normal body mass index followed by 41.8% who

were overweight. Obesity is well established as a risk factor for diabetes [8] and adults from developing countries including asia seem to more at risk than their european counterparts [22,23].

Majority of patients (57%) in this study had comorbidities. This is in agreement with data from other parts of the world [24] and India [25].

Exercise as a routine is not a normal phenomenon in the cultural background of south asia and the finding from this study was no exception. With a strong genetic predisposition towards type 2 diabetes, efforts should be made to inculcate culturally appropriate methods to maintain a high level of physical activity and low body weight [26].

In this study there was no significant association between anthropometric indices (weight, height, waist-hip ratio), duration of diabetes, gender, socioeconomic factors, method of diabetes control, presence of comorbidities, intake of medicines other than that used for diabetes and exercise with glycemic control. No association was also noted between BMI and glycemic control.

Data from around the world regarding factors influencing glycemic control in type 2 diabetes is conflicting. In the PANORAMA study from Europe, de Pablos-Velasco P et al has reported that higher individual glycemic target, younger age, poor physician-reported patient adherence to lifestyle/medication, longer diabetes duration, increasing treatment regimen complexity and physician-reported patient's unwillingness to intensify treatment were associated with not achieving glycemic goal [27]. Also bivariate analyses in the same study found gender, socioeconomic factors, body mass index, rate of complications and hypoglycemia to be associated with not achieving adequate goal. In a study from south east asia Ahmad NS et al has reported that variables associated with good glycemic control included age and duration of diabetes mellitus; Older patients with a shorter duration of diabetes who were receiving monotherapy also showed better glycemic control [28].

In this study age was the only factor that had an association with glycemic control ($p = 0.02$); With increasing age there was better glycemic control. In asian societies, the extended family plays a very important role in the care of the elderly in the family; We hypothesize that this could be the most important determinant in glycemic control in older patients. A high level of literacy translated as better awareness about the disease could also be a contributing factor. BMI and glycemic control which was primarily evaluated in this study showed no association.

The state of Kerala in India is unique in several social and health indicators. During the last century, Kerala has witnessed a drastic reduction in mortality and a high improvement in life expectancy [29] which is comparable to the developed countries of the world. All this has been achieved at very low per capita income. A disparity in longevity has also been observed with those in the high socioeconomic status and literate people living longer [30]. However all this has come at a cost; if India is predicted to be the diabetic capital of the world [2], then Kerala is already considered to be the diabetic capital of India [31].

Also within the country there is wide disparity in the prevalence and management of diabetes [32].

4. CONCLUSION

Being a pilot study, a limiting factor of this study was the small number of patients enrolled from the community. Nevertheless, in this setting of conflicting evidence from within India and from outside the country, the factors that influence glycemic control needs to be better elucidated. Hence there is a need for larger studies to address this issue. The lack of similar studies and the conclusions drawn from this study questioning the traditionally held view regarding glycemic control in type 2 diabetes calls for more research in this field.

CONSENT

All authors declare that written informed consent was obtained from the patient (or other approved parties) for publication of this paper.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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