Association of Body Mass Index and Estimated Glomerular Filtration Rate in a Population of Kerala

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ABSTRACT

BACKGROUND

Chronic Kidney disease is a major health problem. E-GFR is the best index for assessing kidney function. Few studies have examined the relation of BMI and e-GFR in a population of Kerala. We wanted to find the association between BMI and e-GFR in a population of Kerala.

METHODS

A total of 519 subjects was screened. After measuring height and weight, body mass index was calculated. Blood pressure, diabetes, mellitus, proteinuria, serum creatinine were checked. Estimated GFR (e GFR) was assessed using modification of diet in renal disease (MDRD formula).

RESULTS

30.7% of the studied population were obese and 18.1% were overweight. Increased BMI is strongly associated decreased e-GFR.

CONCLUSIONS

Increased BMI is associated with a decrease in e-GFR. Awareness and lifestyle modifications have to be given priority to prevent chronic diseases.

KEYWORDS

e-GFR, MDRD Formula, Body Mass Index (BMI)

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BACKGROUND

The increasing prevalence of chronic kidney disease is a major health problem. CKD is defined as kidney damage or glomerular filtration rate (GFR) <60 mL/min/1.73 m^2 for 3 months or more, irrespective of cause.[1] Identifying risk factors for CKD is crucial for imparting effective preventive measures. CKD is increasing mortality and cardiovascular complications. Obesity increases the risk of cardiovascular disease, diabetes and hypertension. Obesity is a nutritional disorder due to imbalance between energy intake and energy expenditure. It will lead to increase in adipose tissue and overweight. The global epidemic of overweight and obesity is becoming a major health problem. It is affecting quality of life, money expenditure on health and life expectancy. The effect of overweight and kidney function is a topic of increased concern. There are studies which proves increased BMI leading to decreased renal function. Obese patients are at a risk of focal segmental glomerulosclerosis and glomerulomegaly. In western countries many patients have an estimated GFR less than 60 mL/min/1.73 m^2 or a BMI of 30 Kg/m^2 or more. But the association between BMI and e-GFR is not well studied in a population of Kerala. Identifying the risk factors, having a knowledge on it and taking preventive measures will contribute to the wellbeing of the population. Such an attempt is made in this study.

METHODS

An institutional ethical committee clearance was obtained for the study. A community awareness and detection medical camp was organized at two different panchayats with the help of nephrology department. People of different age groups attended the camp. Total of 519 subjects attended the camp. Giving a proforma, information's regarding age, sex, history of kidney disease, diabetes mellitus, and hypertension was collected. A cross sectional study design was adopted. All the attendants were selected as respondents.

Blood pressures of all subjects of different age groups who attended the camp were measured in sitting position on right arm using sphygmomanometer. Informed consent was taken. 5 ml of blood was drawn under aseptic precaution and sent to biochemical laboratory. Serum creatinine, blood glucose and urine protein analysis were done. Serum creatinine was assessed using Jaffe's method. GFR was assessed using MDRD formula-

GFR=186 x (S. Creatinine)-1.154 x (Age)-0.203 x (0.742 if female) x (1.210 if black).

National kidney foundation recommends estimating GFR by MDRD formula.[2,3,4,5] Height was measured using measuring tape with a sensitivity of 0.5 cm, with patient standing straight with occiput, buttocks and heel touching the wall. Weight was measured using portable weighing machine by instructing subjects to stand erect without footwear. Body mass index of all the subjects were calculated after taking their consent. Body mass index is a simple index of weight for height and classify individuals into underweight, normal, overweight and obese group.

Obesity classification is a ranking of obesity, where. The World Health Organization (WHO) classifies obesity by body mass index (BMI), which is closely related to both percentage body fat and total body fat.[6] Body mass index or BMI is a simple and widely used method for estimating body fat mass. BMI was developed in the 19th century by the Belgian statistician and anthropometrist Adolphe Quetelet.[7] BMI is an accurate reflection of body fat percentage in the majority of the adult population.

BMI is calculated by dividing the subject's mass by the square of his or her height, and is expressed as-

BMI= Kilograms/ $Metre^2$

The most commonly used definitions, established by the World Health Organization (WHO) in 1997 and published in 2000, provide the values listed in the table.

BMI	Classification[8]
<18.5	underweight
18.5–24.9	normal weight
25.0–29.9	overweight
30.0–34.9	class I obesity
35.0–39.9	class II obesity
≥ 40.0	class III obesity

Statistical Analysis

Collected data entered in Microsoft excel and was analysed using statistical software SPSS version 11.0. Continuous variables were expressed as mean and standard deviation while categorical variables as percentage. Association with BMI and GFR was found using multiple regression analysis.

RESULTS

	BMI	No. of Subjects	% Distribution
Under weight	<18.5	53	10.2
Normal	18.5-24.9	213	49
Overweight	25-29.9	94	18.1
Obese	>30	159	30.7

Table 1. Distribution of Subjects According to Their BMI

	BMI	Mean GFR (ml/min)
Under weight	<18.5	64.48 ± 15
Normal	18.5-24.9	62.61 ± 14
Overweight	25-29.9	60.74 ± 17
Obese	>30	57.18 ± 12

Table 2. Relation between BMI and GFR

Table 1 shows that majority of the population have a BMI in the normal range, while 30.7% is obese and 18.1% is overweight. Table 2 shows decreased e-GFR as BMI increases. There is a significant negative correlation.

DISCUSSION

Obesity is a global health problem affecting all ages. Obesity is turning into a global epidemic and is worsening in most parts of the world. It has implications in both physical health

and economic health.[9] High BMI is associated with high mortality and morbidity. Prevalence of obesity was found to be 44.7% among women and 33% among men in a study done in rural Kerala[10] Obesity was found to be more among females (33%) than males (17%) in the study by Sugathan et al.,[11] in Kerala. The problem of obesity is on increase in Kerala may be due to the lifestyle changes or high living standards. Obese persons are healthier and live longer now than in previous decades because of better care and risk-factor management. The mix of increased prevalence and decreased mortality leads to more years spent with obesity and more time for the damaging coexisting illnesses, such as type 2 diabetes and chronic kidney disease, to develop. 30.7% of the people was found to be obese and 18.1% were overweight in our study which is comparable with the above studies.

In the present study effort was made to correlate the kidney function and body mass index. Estimation of e-GFR gives the approximate number of functioning nephrons. Yuanyuan et al[12] conducted a study at Beijing and investigated the association between BMI and e-GFR among 1447 Chinese people. It indicated that BMI is an independent predictive factor for kidney function. It was a prospective study of 48 years duration and they assessed e-GFR. In another study done by Ishizaka et al it was found increased BMI was associated with low GFR.[13] Sankar and colleagues in Singapore also found similar result.[14] In a community based cross sectional study in Japan it was found increased BMI is associated with CKD independently of blood pressure, serum lipid and glucose levels in general population.[15] Epidemological studies show CKD is not only a risk for ESRD, but also of Cardiovascular disease[16,17,18,19,20] which is a leading cause of death in developed countries. So, a definite approach is necessary to prevent the development of CKD. The mechanisms by which CKD develops has to be understood. Age, hypertension, dyslipidemia, smoking, obesity are all factors associated with CKD.[21-28] The mechanism that lead to renal dysfunction in overweight and obese is not completely understood. Obese people are at a high risk of developing focal segmental glomerulosclerosis and glomerulomegaly. BMI is a risk factor CKD even after adjustment for smoking status, blood pressure, lipids and FBG. Renal blood flow and GFR increases in obesity may be followed by microalbuminuria. It leads to development of overt proteinuria and progressive CKD. Microalbuminuria is followed by a progressive fall in GFR.[29,30] In our study also e-GFR showed a steady decrease. It decreased to 60.74 ml/min in overweight to 57.14 ml/min in obese as shown in table 2.

Lifestyle is the main factor contributing to obesity which ultimately contributes to CKD occurrence. Awareness and early preventive measures can reduce the incidence.

Limitation of the study is that it is a cross sectional study design and the association with other risk factors remain to be explored. The distribution of the population under study is not uniform as the data was obtained from a medical camp.

CONCLUSIONS

The problem of obesity is on the increase in Keralite population. 30.7% of the studied population were obese and 18.1% were overweight. Increased BMI is strongly associated with decreased e-GFR. Prevention of obesity has to be given adequate importance. Awareness and lifestyle modifications has to be given priority to prevent chronic diseases including chronic kidney disease.

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