Diabetes Risk Diagnosis Using Obesity Markers and Glycemic Control in Indian Population

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Abstract

Statement of the Problem: It is important to note, liver and pancreas are majorly responsible for normal glucose metabolism, these organs are located centrally hence central obesity/abdominal distension will affect glycaemic control more than generalise obesity. Scientific literature highlights a strong and consistent relation between abdominal girth and diabetes risk. Haemoglobin A1c (HbA1c) is recognized as a diagnostic test for DM as well as for its monitoring.

Aim: The purpose of this study is to assess association of anthropometric markers viz. Body mass index (BMI) and abdominal girth (AG) for prediction of glycaemic control in Indian population.

Methods: This single centre observational study was carried out from Feb 2015 to Oct 2015 at Khopoli, Maharashtra. Participants of both gender, andgt;20 yrs and willing to screen for HbA1c and anthropometry were included.

Findings: Out of the 2640 participants who visited the centre, 1870 (N=860 non-DM, age median (range): 57 (48/65) and N=1010 DM, age: 60 (53/65)) were enrolled in this study. HbA1c levels were statistically significantly elevated in DM vs. non-DM group (median (range): 7.5 (6.5/8.9) vs. 5.7 (5.2/6.3); p=0.000). Interestingly, abdominal girth showed significant difference between DM and non-DM groups (median (range): 95 (88/102) vs. 93 (86/100); p=0.022). Whereas BMI did not differ across the groups (median (range): 25.5 (23.2/28.6) vs. 25.7 (23.1/28.8); p=0.486).

Conclusion and Significance: Among the anthropometric markers namely BMI and AG, AG is a better predictor of DM risk. Therefore AG should also be considered along with HbA1c for predicting DM risk.

Background

With surge in the rate of prevalence of Diabetes mellitus (DM) in India and China, Asia has become the epicentre of diabetes in the world. On the other hand, obesity has come into limelight as a major risk factor for DM and affects nearly 18% of the adult population in India.¹ The presence of both morbidities (obesity and DM) can adversely affect the health status of individuals and communities and has serious economic and social implications. Therefore, association of obesity with DM is vital in risk assessment and early diagnosis of an individual’s risk of developing diabetes.

Globally, Haemoglobin A1c (HbA1c) is recognized as a diagnostic test for DM as well as for its monitoring. Its importance and utility for prognosis, monitoring and diagnosis of DM has been a matter of research and debate. Whereas, a number of anthropometric indices, including body mass index (BMI), abdominal girth, waist-to-hip ratio (WHR), and waist-to-height ratio (WHtR), are used for obesity assessment.

The importance of abdominal girth in predicting non-communicable diseases such as cardiometabolic disorders (e.g. diabetes, cardiovascular diseases, and dyslipidemia) has been examined in many large epidemiologic studies.²⁻⁵ The clinical evidence from literature studies have shown a strong and consistent relation between abdominal girth and diabetes risk, abdominal girth can be used as a better predictor of obesity and Type 2DM (T2DM).

However, the number of prospective studies is limited, and results of remainder studies are contradictory. Thus, the evidence that the markers of obesity (waist circumference (WC) or WHR) are preferable as a first-step diagnostic tool for assessment of diabetes risk is neither convincing nor generalizable.

Considering that liver and pancreas are the two main organs which are majorly responsible for normal glucose metabolism and are located centrally. Hence central obesity will affect glycaemic control more than generalise obesity. Therefore the present observational study was aimed to find out reliable and affordable anthropometric markers. Further, we tried to assess better anthropometric marker between BMI and abdominal girth (i.e WC) for prediction of glycaemic control in Indian population.

Methods

Study design and participants

The present observational study was carried out from 1st Feb 2015 to 31st Oct 2015 in Madhavabaug hospital, Khopoli, Maharashtra.

Inclusion and exclusion criteria

Participants of both gender, above 20 years of age and who were ready to screen for HbA1c and anthropometry were included in the study. Participants who were not willing to undergo screening for HbA1c and physical examination were excluded from the study.

Anthropometric assessment was conducted for all study participants on the same day. All patients were
selected from the same centre to avoid the heterogeneity in patient population and investigators.

**Ethical considerations**

The study was conducted in accordance with the ethical principles in the Declaration of Helsinki and consistent with Good Clinical Practices. All participants provided written informed consent to participate in the study.

**Study Evaluations**

All participants were first subjected to comprehensive, relevant medical history taking, and physical examination; followed by anthropometric measurements and laboratory investigations.

**Anthropometric measurements**

Anthropometric parameters were measured using standardized techniques. Height (in centimetres) was measured using a stadiometer measure fixed at about 2 metres on a wall.

The individual was asked to stand upright without shoes with his/her back against the vertical back board, heels together and eyes directed forward. Weight (in kilograms) was measured with weighing scale machine which was kept on a firm horizontal flat surface. Body mass index (BMI) was calculated as weight / (height)² and expressed in kilograms per square meter. Abdominal girth, also known as waist circumference (in centimetres) was measured by extending a non-stretchable measuring tape around the waist by positioning the tape in a horizontal plane to the level of the measurement mark or umbilicus. To avoid any error, measurement was taken directly on skin rather than on clothes. Blood pressure was measured with mercury sphygmomanometers.

**Laboratory Investigations**

Blood investigations and related clinical procedures were performed between 8 am and 9 am in the fasting state. Participants were instructed to refrain from caffeine, nicotine, and alcohol, for at least 12 h before blood collection. Patients were asked to delay the morning dose of medicine till blood collection. Two milliliters of peripheral blood was collected from each participant in Ethylene diamine tetra acetic acid (EDTA) and plain bulb. After centrifugation, serum from plain bulb was separated and used for estimation of fasting blood sugar, while EDTA sample was used for HbA1c estimation. Postprandial blood sugar was measured at 2 h post lunch. All the measurements were done within 2 h of sample collection. All the above mentioned biochemical estimations were performed using a clinical chemistry autoanalyzer. Blood sugar was analyzed by the glucose oxidase method and HbA1c using the Agappe Diagnostics Ltd.

**Statistical Analysis**

The data was analysed for distribution and was reported as Mean ± SD or Median (Range). Non-parametric correlation was used to analyse the relationship between the study parameters. P value of <0.05 was considered significant. Statistical analysis of the results was performed using the statistical software SPSS, version 21.0 (SPSS, Chicago, IL, USA).

**Results**

In total, 2640 participants approached the cardiac centre for treatment of Coronary Heart Disease (CHD), DM and Hypertension (HTN). Post screening the study population (N=1870) was divided into two groups: 1) Patients with DM (N=1010) and 2) Non-diabetic participants (N=860).

The anthropometric and clinical profiles of the diabetic and non-diabetic participants have been reported in Table 1. It is interesting to note unlike BMI, abdominal girth showed statistically significant difference between the groups.

The HbA1c levels were found to be significantly elevated in patients with diabetes when compared to non-diabetic participants (7.9 ± 1.8 mmol/mol and 6.7 ± 1.7 mmol/mol respectively; p<0.001).

There is a strong positive correlation between abdominal girth and HbA1c in non-DM participants (r=0.083, p=0.015) vs. DM patients (r=0.019, p=0.556).

**Discussion**

The present study results highlight positive correlation between HbA1c and BMI as well as AG as long as the participants belong to non-DM group. In DM group HbA1c correlates only with abdominal girth and not BMI. However, the gender-wise distribution underlines that females show strong positive correlation between HbA1c and AG irrespective of their DM status however non-DM males alone show positive correlation between HbA1c and BMI.

A study by Qiao and Nyamdorj concluded that, BMI and waist circumference (WC) performed similarly in predicting risk of T2DM. However, in line with the results of current study, most of the cross-sectional studies suggested that WC or WHR are better predictors of diabetes risk than BMI.

Furthermore, it is important to note that the present study is conducted in a developing country like India. DM is highly prevalent in India and the economic status of majority of diseased population does not permit them the privilege of treatment. In such a patient population, monitoring the progress of disease takes a backseat. Therefore, it is immensely important to have a relative marker for diabetes monitoring which is cheap and/or readily available. Hence, the present study results highlight the importance of abdominal girth which is easily measurable marker for monitoring DM progress.

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Conflict of interest

Drs. RS and RM are employees of Vaidya Sane Ayurvedic Education and Agricultural Trust.

References


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