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Performance of American Diabetes Association Questionnaire for the risk and diagnosis of diabetes in hypertensive subjects

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ABSTRACT

Objective: The objective of the paper is to evaluate the performance of the American Diabetes Association Questionnaire for the risk/diagnosis of diabetes among subjects with systemic hypertension.

Methodology: Between January and May 2004, screening for Type 2 diabetes was conducted among people known to have systemic hypertension and who were regular attendees of Cardiology and Nephrology clinic of the Lagos University Teaching Hospital. Screening was done using the American Diabetes Association Questionnaire (ADAQ): take the test, know the risk. Oral glucose tolerance test was carried out on all the subjects as the standard for the diagnosis of diabetes. Subjects were classified based on their total score on the ADAQ into- No Risk (where score was 0-2), High Risk (where score was 5-9) and diabetes when score was ≥ 10 .

Results: A total of 207 patients were recruited of whom 131 completed the study, giving a participation rate of 63.28%. Over thirty percent (30.53%) of the 131 subjects who completed the study were at high risk for diabetes while 69.46% were classified as Diabetes (≥ 10) based on ADAQ. ADAQ yielded a sensitivity of 79.16%, a specificity of 32.71%, a positive predictive value of 20.88% a negative predictive value of 87.5% and an efficiency of 41.22%. $r=0.04$, $y=156.89+1.4$ ADAQ with p value not significant (P value >0.05)

Conclusion: The ADAQ performed poorly in our cohort of patients with systemic hypertension. Modification will need to be made to the ADAQ to enhance its performance in our study population.

Keywords: ADAQ, Diabetes Mellitus, Risk

INTRODUCTION

Hospital-based reports from many African countries increasingly show the emerging role of non-communicable diseases (NCDs) as common causes of morbidity and mortality in adults ^{1,2}. Type 2 diabetes is one of the common and serious conditions associated with considerable morbidity and reduced life expectancy. Recent estimates suggest that 246 million people throughout the world have diabetes, and this will increase to over 380 million by 2025 ³. Approximately 50% of people with diabetes are undiagnosed⁴. Type 2 diabetes may remain undetected

for several years and at the time of clinical diagnosis, many people have complications⁵.

Diabetes is a disease with a well understood natural history, recognized preclinical stages, and standardized diagnostic tests⁶ and screening for pre-diabetic hyperglycaemia is receiving considerable attention⁷. The increasing prevalence of Type 2 diabetes^{8,9} has prompted the recommendation in several countries for screening of individuals at high risk of diabetes ^{10,11}.

Systemic hypertension is one of the risk factors for Type 2 diabetes^{12,13}. In 1993, the American Diabetes Association (ADA) disseminated a questionnaire titled "Take the test, know the score", a seven-item survey that has served as a standard community-based prescreening instrument for several years¹⁴. The import of this is to promote the identification of people at increased risk of undiagnosed diabetes and simultaneously reduce costs of screening¹⁵.

The aim of this study is to assess the performance of ADAQ in a cohort of patients with systemic hypertension.

METHODS

Study design: Cross sectional study

Study location: The Department of Medicine of the Lagos University Teaching Hospital (LUTH) over a period of three months, spanning from January to March 2004.

Subjects: Clinic attendees with known history of systemic hypertension on life-style modification and/or drug(s) for the control of blood pressure. This is irrespective of blood pressure value. They were attendees of the Cardiology and Renal clinics.

Sample size: Two hundred and six persons with systemic hypertension were recruited.

Exclusion criteria included established secondary forms of hypertension, chronic renal failure and chronic liver disease.

Approval was obtained from the Ethical Committee of the Lagos University Teaching Hospital. An informed consent was obtained from the subjects before commencing the study.

Administration of ADA questionnaire

Patients attending routine medical follow up were approached and given a brief health talk on the importance of screening for diabetes among people with systemic hypertension. A questionnaire containing demographic characteristics such as name, age, gender, hospital number and ADAQ was administered to the patients. The anthropometric measurement included height in meters with measurement taken to the closest centimeter, weight in kilograms measured to the nearest milligram, and BMI calculated as the ratio of weight in kilograms to the square of height in metres. Waist

circumference was taken at umbilical level, to the nearest centimeter. Hip circumference was measured as the maximal circumference at the buttocks, to the nearest centimeter. Waist to hip ratio was calculated by finding the ratio of the waist to that of hip. The level of activity was assessed as 0, for those who do not indulge in any form of activity for at least 30min three times in a week and 1 for those that indulge in activity for at least three times in a week.

The ADAQ component scores for risk of type 2 diabetes are as follows: - 1 point each for a woman who delivered a macrosomic (>4kg) infant, one or more siblings with diabetes, one or more parents with diabetes, 5 points each for BMI >27 kg/m², age <65 years and little or no physical activity in most weeks and age 45-64 years and age ≥65 years 9 points. The results from the ADAQ was categorized into three based on the sum of the score as 0-2 (no risk), 3-9 (at risk) and ≥10 (positive for diabetes). Oral glucose tolerance test (OGTT) was also performed on all the subjects on a separate day from when the ADAQ was administered.

Performance of OGTT

At 7.30am, on the day of OGTT, fasting venous blood was taken and 75gm of anhydrous glucose dissolved in 200mls, chilled water was ingested at once by the subjects. A repeat venous sample was taken at 9.30am.

Handling of blood specimens

Blood samples were immediately centrifuged after collection to separate plasma from red cells. Plasma aliquots were frozen at -80°C until analysed. Plasma glucose was analyzed according to the method of Trinder¹⁷. Two hour post glucose venous plasma glucose estimation of ≥11.1mmol/l is considered to be diagnostic of diabetes using OGTT as a gold standard.

Data capture and analysis

Data capture and analysis

The data were entered into a Microsoft Excel database. Analysis of data was with SPSS version 11. The Means±SDs were assessed for continuous variables, and frequencies and proportions were assessed for categorical variables. Differences among groups were assessed using t- test and $p \leq 0.05$ is considered significant. Sensitivity, specificity, predictive values and efficiency were assessed from 2x2 table made between

mean 2hour plasma glucose and ADAQ. Sensitivity is the proportion of a diseased population that is identified by the screening test as positive-the true positive, specificity is the proportion of the healthy population that is identified as healthy by the screening test- the true negatives, positive predictive result is the proportion of positive results in a mixed population of sick and healthy people, negative predictive value is the proportion of negative results in a mixed population of sick and healthy people while efficiency is the percentage that the sum of the true positives and the true negatives is of the grand total population.

A plot of correlation was made using a linear regression model where r and y were estimated.

RESULTS

131 of the 207 subjects completed the study. These consisted of 87 females and 44 males. Of the 131 subjects who were administered both ADAQ and OGTT, 40(30.53%) scored 5-9 on the ADAQ while 91(69.46) had ADAQ scores of ≥ 10 . Those that had ADAQ scores of 5-9 were 23(17.56%) females and

(waist hip measurement) differed between the groups with positive score in comparison with those at risk for diabetes

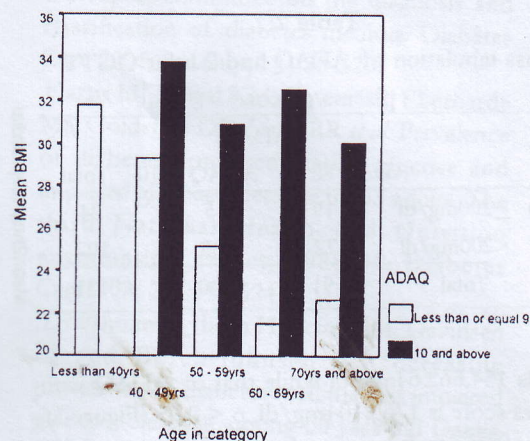


Fig 1: Shows the relationship between Body Mass Index (BMI) and age category among people with American Diabetes Association Questionnaire (ADAQ) scores

Table 1:

Showing characteristics of those that had American Diabetes Association Questionnaire screening scores

	ADAQ Score 5-9	ADAQ Score ≥ 10	P value
Age (years)	49.05 $\pm$ 10.40	54.30 $\pm$ 7.18	0.00
Family history of DM	.22 $\pm$ 0.43	0.41 $\pm$ 0.84	0.87
Activity per week	0.89 $\pm$ 0.40	0.84 $\pm$ 0.36	0.13
Height (cm)	1.65 $\pm$ 0.07	1.62 $\pm$ 0.08	0.01
Weight (kg)	74.00 $\pm$ 17.16	84.52	0.00
BMI	27.32 $\pm$ 6.50	32.87 $\pm$ 6.71	0.00
Waist circumference(cm)	91.37 $\pm$ 10.35	101.21 $\pm$ 10.94	0.00
Hip circumference(cm)	102.78 $\pm$ 12.37	110.18 $\pm$ 10.87	0.11
W/H	0.89 $\pm$ 0.59	0.92 $\pm$ 0.09	0.04
Duration of hypertension (years)	8.57 $\pm$ 8.06	9.56 $\pm$ 8.13	0.04

17(12.98%) males, while those that had ADAQ scores of ≥ 10 were 64(18.85%) females and 27(20.61%) males. No subject had an ADAQ score below 5. The mean age of the subjects was 53.11 $\pm$ 8.69years and ranged from 31 to 78yrs and median of 52.

Table 1 shows the clinical characteristics of the participating subjects. Subjects who were positive for diabetes were significantly older than those that were at risk. Family history of diabetes, waist, BMI, W/H

Figure 1 shows that BMI decreases as one advances in age in both categories of ADAQ, more remarkable among those with ADAQ score ≤ 9 . Overall, the BMI of those that had positive ADAQ scores were more than those with negative score

The plasma glucose values range from 65.5 to 702 mg/dl, mean of 169.17 $\pm$ 194mg/dl. The mean 2hrs postprandial plasma glucose for ADAQ with at risk

Table 2:

Cross tabulation of ADAQ and 2 hour OGTT plasma glucose

	ADAQ		Total
	ADAQ ≤ 9	ADAQ ≥ 10	
2hrspp $\geq 200\text{mg/dl}$	19	5	24
$< 200\text{mg/dl}$	72	35	107
Total	91	40	131

score is $154.66 \pm 64\text{mg/dl}$ while that of ADAQ with diabetes score is $176 \pm 104\text{mg/dl}$, $p < 0.05$ (Figure 3). The coefficient of variation for intra assay was 3.5% and inter assay was 9%.

Table 2 shows a cross tabulation of ADAQ screening test with the reference 2hour OGTT plasma glucose values. The efficiency of the screening test is 41.22% with a sensitivity of 79.16% and a specificity of 32.71%. The positive predictive value was 20.88% and negative predictive value was 87.5%.

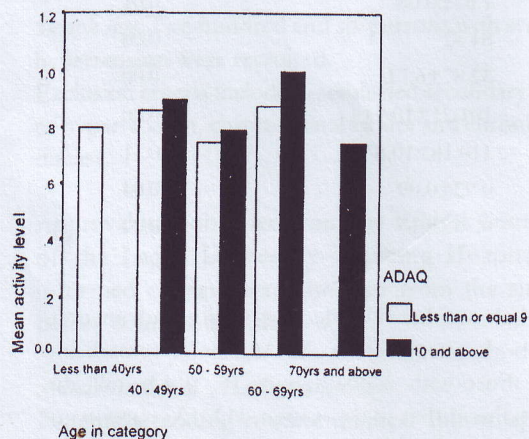
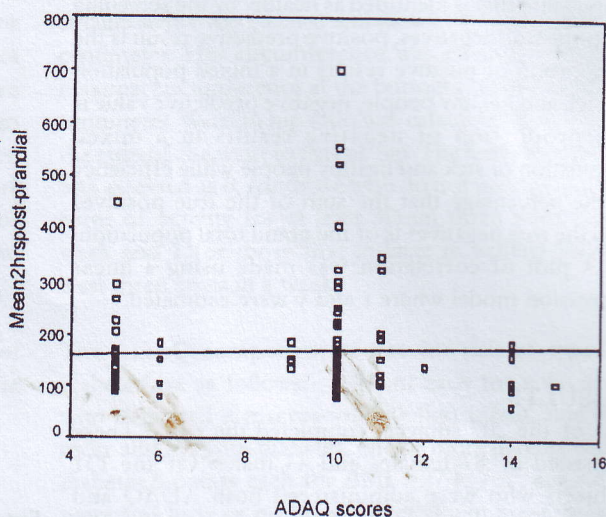


Fig 2: Shows proportion of those with mean level of activity to age category



$r = 0.04$, $y = 156.89 + 1.4\text{ADAQ}$ and $P \text{ value} > 0.05$, not significant

Fig 3 : Shows the relationship between mean 2hrs post prandial blood glucose ADAQ and scores

DISCUSSION

The use of a questionnaire to screen for diabetes will be cost-effective particularly in a developing country like Nigeria if we can demonstrate comparable efficacy with standard diagnostic techniques.

We obtained a sensitivity value of 79.16% which is similar to those of several other studies^{19, 21-23}, other sensitivity figures ranged from 59% to 81.6%. The ADAQ however, showed a low specificity of 32.7% for the exclusion of diabetes in our hypertensive cohort. Similar studies^{19, 21-23} have also reported poor specificities with a range of 47.5% to 57%. The positive predictive value, negative predictive value and efficiency of the ADAQ for the prediction of Type 2 diabetes in our cohort of hypertensive subjects were 20.88%, 87.5% and 41.22% respectively.

The ADAQ was compared with a gold standard biometric test, 2hours plasma glucose of oral glucose tolerance test. Although, it is being discourage because of time consuming and laborious nature of the procedure, but world health organization still consider it to be the standard.

The correlation in this study is 0.04 and a value of y that was not significant. This value is similar to one carried out among the Spaniards ²⁴.

The result of this study suggests that the ADAQ has a poor performance for the diagnosis of diabetes. Components of the ADAQ may need to be either modified and or scores allocated to the various components changed to enhance its performance in our study population. Indeed, the ADA has suggested that the ADAQ is not consistently valid as an effective screening tool for Type 2 diabetes and should be used in conjunction with biometric methods of testing ¹².

CONCLUSION

The ADAQ as a tool would appear to be poor predictive tool for the diagnosis of type 2 diabetes in our hypertensive population with presumed essential hypertension.

Limitations of the study

The representative sample size of this study is among people with known risk factor for type 2 diabetes, systemic hypertension and was hospital based, thus its performance may not be a true reflection in general population. Further studies may be necessary to assess its performance in our population by recruiting larger sample size.

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