Objective. In recent times, Diabetes Mellitus (DM) has had a rapid increase in developing countries as a result of changing lifestyles among the people. This study was therefore aimed to investigate the level of awareness of DM and its associated risk factors in Afao: a rural community located in Irepodun/IfeIlodun Local Government Ekiti State, Nigeria.

Design. The study was descriptive cross-sectional in design. A multi-stage sampling technique was applied to recruit respondents who are residents in the community. Two hundred and one individuals were involved in this community-based study. Information was obtained using a modified WHO STEPs approach to chronic disease risk surveillance. The questionnaire included questions that assessed socio-demographic characteristics, diabetic risk factors and anthropometric measures of respondents.

Result. Of the 134 (66.7%) respondents aware of DM, only an average of 43.9% had knowledge of its risk factors. Respondent’s body mass index was significantly associated (P < 0.01) with knowledge of overweight/obesity as overweight (52.9%), grade 1 obese (62.5%) and morbid obese (100%) respondents had no knowledge of their status as risk factors for DM. Also, respondent’s blood pressure status showed a significant association (P = 0.099) with respondent’s knowledge of high blood pressure, 62.5% of those unaware of their blood pressure status had no knowledge of high blood pressure as a diabetes risk factor. Respondent’s age (P = 0.024) and diet; daily vegetable servings (P = 0.015) and cooking oil (P = 0.05) showed significant association with the occurrence of the disease in 14.4% respondents previously diagnosed.

Conclusion. This study shows a need to improve on the level of awareness of diabetes risk factors in Afao. Routine measurement of blood glucose levels for adults, community health education and enlightenment strategies through the ministry of health on the awareness of diabetes are highly recommended for the Afao community.
the time of conducting the study, the human population of Afao was estimated at 10,879 [6]. Afao comprises of ten settlements namely: Odo-Ode, Kajola, Oke-Uro, Temidire, Olorunfemi, Aba-Igbira, Ikefun, Aba-Fulani, Ogbon-Aarin and Oloruntedo. The community has fairly developed basic infrastructure e.g. primary schools, secondary schools, a private hospital and a Government Health centre. Afao is inhabited by the Yoruba speaking people of South-western Nigeria.

**Study Population**
Inclusion criteria: any adult (irrespective of sex and previous diagnosis of diabetes) who lives in the area was eligible to participate. Exclusion criteria: pregnant women, breast-feeding mothers, and non-consenting adults were excluded from the study.

**Study Design**
The study was descriptive cross-sectional in design.

**Sample Size**
The minimum sample size, for the study was determined using the formula [7] for a single population proportion. Z is normal deviant at the portion of 95% confidence level = 1.96, 2.3% is the prevalence of DM from a previous study in a rural community southern Nigeria [8], is margin of error acceptable = 3%. Non-response rate of 5% and a multiplication factor of 2 was further utilized to compensate for design effect. The minimum sample size obtained was 201.

**Sampling Technique**
Multi-stage sampling technique was used to recruit adults who are residents in the community. Three stages were involved: Stage one: Simple Random Sampling (SRS) was used to select four out of the ten settlements; Stage two: two streets were then selected from each of the four settlements to give eight streets by systematic sampling; Stage 3: 201 respondents (1 per household) were finally selected from households within the 8 selected streets by cluster sampling.

**Data Collection Instrument**
Data collection was done using interviewer assisted questionnaire method and physical examination. The questionnaire was a modified WHO STEP wise approach to chronic disease surveillance. Using only STEP 1 and STEP 2 for low resource countries. STEP 1 gathered information on socio-demographic features and risk factors such as smoking, alcohol use, fruit/vegetable intake, physical activity etc. STEP 2 included objective data collection by physical measurements of physiological attributes of human body such as weight and height [9]. Measurements were taken with the aid of calibrated equipment using standard techniques. Subjects were weighed in kilograms to the nearest kg. Height was measured using a stadiometer as respondents stood on barefoot with minimal/essential dressing and the results were recorded to the nearest 0.5 cm. Body mass index (BMI) was estimated as the ratio of weight in kilograms to the square of height in meters (weight (kg)/heights (m²)). Waist circumference was measured by placing a plastic tape to the nearest centimeters (cm) horizontally, at the midpoint of the lower margin of the 12th rib and the upper margin of iliac crest along the midaxillary line.

**Data Analysis**
The data collected for the study were first of all checked for errors, cleaned and then analyzed using the Statistical Package for Social Sciences (SPSS), version 23. Descriptive analysis of socio-demographic variables, respondent’s perception, risk practices and so on were presented in frequencies and percentages using tables. The Chi-square test was used to test for significance of association between the variables.

**Ethical Consideration**
Ethical clearance was obtained from the Research and Ethics committee of the Afe Babalola University Ado-Ekiti. With due respect to respondent’s privacy, oral consent was obtained from each participant before data collection. In addition, respondents were informed of their right to voluntarily participate or withdraw from the study at any stage without adverse consequences. Confidentiality was also observed as the questionnaire bore no name of respondent or any identifying information.

**Results**

**Socio-demographic Characteristics of Respondents**
A total of 201 respondents were interviewed out of which 44.3% were male while 55.7% were female, giving a male to female ratio of 0.8:1. The mean age was 36.9 ± 1.053 years, the median age was 33 years while the minimum and maximum ages were 17 and 93 years respectively. The respondents comprised largely of people in the age-group 17-40 years (70.7%). Majority of the respondents were; married (59.7%), of the Yoruba tribe (81.6%), Christians (85.6%) traders (67.2%). Also, most respondents (42.8%) had only primary education while a majority (54.7%) earned an average monthly income lesser than or equal to 15,000 Naira (39$).

**Awareness and Source of Information about Diabetes Mellitus**
Participants were asked if they knew what diabetes mellitus was and were scored on their responses about the nature of DM. Most 134 (66.7%) of the participants thought that DM was a result of partial or complete reduction in insulin secretion. Respondents who had never heard of the disease and those that felt it was through excess eating of sweet foods were scored as ‘not aware’. Majority (70.1%) of those aware of DM got to know about the disease from health care workers.
Respondents' knowledge about risk factors of diabetes mellitus (N = 134)

Of the 134 respondents who were aware of diabetes, most (53.7%) perceived poor diet as the major diabetes risk factor followed by lack of exercise and alcohol misuse (46.3%). Smoking (32.8%) was the least perceived diabetes risk factor. On the average, only 43.9% had knowledge of diabetes mellitus risk factors.
RISK PRACTICES OF DIABETES MELLITUS AMONG ALL RESPONDENTS

Smoking/Alcohol intake: Most (64.1%) of the 39 smokers had been smoking for over 5 years. Majority (58.7%) of the 46 who took alcohol drank an average of 2-5 bottles daily. Of the 31.8% respondents who used alcohol in the past, 25% had stopped drinking over 5 years earlier.

Fruits/vegetables consumption: 12.4% of the respondents did not take any kind of fruits while only 17.4% took about 5 servings daily. More than half of the study group took only 1-2 servings of vegetables daily.

Oil used for cooking: More than four-fifth (84.6%) of the participants use saturated fat (palm oil) for cooking.

Exercise/Sport (Weekly walk/Bicycle ride): While over a quarter (25.4%) of the respondents do not engage in exercise which includes at least a 30 minutes daily walk or bicycle ride 62.7% do not engage themselves in any sporting activity.

PREVIOUS MEASUREMENTS AMONG ALL RESPONDENTS

About 52.2% of the study population had gotten their blood pressure measured while 8.5% had been previously diagnosed with high blood pressure. About 60 (29.9%) respondents had gotten their blood sugar level measured while only 29 (14.4%) had been previously diagnosed with diabetes mellitus.

ANTHROPOMETRIC MEASUREMENTS AMONG ALL RESPONDENTS

With respect to body mass index of the respondents, most (40.3%) were overweight while 32 (15.9%) were obese. Furthermore, 81.1% of the total respondents had a normal waist circumference while 18.9% had an abnormal waist circumference.

KNOWLEDGE OF RISK FACTOR AND ITS ASSOCIATED RISK AMONG RESPONDENTS (N = 134)

Tab. VII looks at the association between knowledge of diabetes risk factors (Tab. III) and the risk factors/practices of respondents aware of DM. Respondent’s

| Risk practices | Frequency | Percent |
|----------------|-----------|---------|
| Currently smoke tobacco | 26 | 12.9 |
| Currently use smokeless tobacco | 13 | 6.5 |
| Total | 39 | 19.4 |
| Duration of smoking | | |
| < 1 year | 4 | 10.3 |
| 2-4 years | 10 | 25.6 |
| ≥ 5 years | 25 | 64.1 |
| Currently consumes alcohol daily | 46 | 22.9 |
| Average bottles taken per day | | |
| 1 bottle | 12 | 26.1 |
| 2-5 bottles | 27 | 58.7 |
| 6 bottles | 2 | 4.3 |
| > 6 bottles | 5 | 10.9 |
| Consumed alcohol in the past | 64 | 31.8 |
| If yes, how long did you stop? | | |
| 1 year or less | 6 | 9.4 |
| 2-4 years | 12 | 18.8 |
| 5 years | 16 | 25 |
| No response | 30 | 46.9 |
| Daily fruit servings | | |
| None | 25 | 12.4 |
| 1-2 servings | 91 | 45.3 |
| 3-4 servings | 50 | 24.9 |
| 5 servings | 35 | 17.4 |
| Daily vegetable servings | | |
| None | 8 | 4 |
| 1-2 servings | 114 | 56.7 |
| 3-4 servings | 49 | 24.4 |
| 5 servings | 30 | 14.9 |
| Oil mostly used for cooking | | |
| Palm oil | 170 | 84.6 |
| Vegetable oil | 22 | 10.9 |
| Coconut oil | 3 | 1.5 |
| Others | 6 | 3 |
| Weekly walk/bicycle ride (30 mins) | | |
| None | 51 | 25.4 |
| 2-4 days | 39 | 19.4 |
| 5-6 days | 11 | 5.5 |
| Everyday | 100 | 49.7 |
| Sports (30 mins. minimum daily) | Yes | 75 | 37.3 |

Exercise/Sport (Weekly walk/Bicycle ride): While over a quarter (25.4%) of the respondents do not engage in exercise which includes at least a 30 minutes daily walk or bicycle ride 62.7% do not engage themselves in any sporting activity.

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Tab. VII looks at the association between knowledge of diabetes risk factors (Tab. III) and the risk factors/practices of respondents aware of DM. Respondent’s

| Body mass index | Value (kg/m²) | Frequency (percent) |
|-----------------|---------------|---------------------|
| Underweight     | <18.5         | 10 (5.0)            |
| Normal          | 18.5-24.9     | 78 (38.8)           |
| Overweight      | 25.0-29.9     | 81 (40.3)           |
| Grade 1 obesity | 30-34.9       | 25 (11.4)           |
| Grade 2 obesity | 35-39.9       | 6 (3)               |
| Morbid obesity  | ≥ 40          | 3 (1.5)             |

| Waist circumference | Value (cm) | Frequency (percent) |
|---------------------|------------|---------------------|
| Normal male         | <102       | 86 (52.8)           |
| Normal female       | <88        | 77 (47.2)           |
| Total               |            | 163 (81.1)          |
| Abnormal male       | ≥102       | 3 (1.7)             |
| Abnormal female     | ≥88        | 55 (92.1)           |
| Total               |            | 58 (18.9)           |

*Guidelines on overweight and obesity [10].
blood pressure status showed a significant association (P = 0.099) with respondent’s knowledge of high blood pressure as a risk factor of DM. Most (62.5%) of the participants who did not know their blood pressure status were not aware that high blood pressure is a risk factor of diabetes. Furthermore, a significant association (P < 0.01) was observed between respondent’s body mass index and overweight/obesity as a risk factor of DM. Majority of the respondents who were overweight (52.9%), grade 1 obese (62.5%) and morbid obese (100%) were not aware of overweight/obesity as risk factors of diabetes mellitus.

**Discussion**

Evidence has shown over the years that attention be given to ensuring adequate knowledge of diabetes [11-13]. Of the 134 (66.7%) respondents aware of DM, only an average of 43.9% had knowledge of its risk factors. Lack of adequate knowledge of DM does not come as a surprise since Afao is a rural community with about 75.1% of the respondents having no formal education or a primary school education. Moreover, 70.1% of the respondents got information about the disease from community health care workers. Community health workers have shown to develop and support connections between the health care system and their own community through

Tab. VII. Knowledge of risk factor and its associated risk among respondents (n = 134).

| Risk factor               | Knowledge of risk factor | p value |
|---------------------------|--------------------------|---------|
|                           | No | Yes | Don’t know | χ²     |
| Have high blood pressure  | 53 (54.1) | 42 (42.9) | 3 (3.1) | 7.816 | 0.099* |
| Smoking                   | 75 (64.1) | 36 (30.8) | 6 (5.1) | 1.912 | 0.384 |
| Smoking                   | 8 (47.1) | 8 (47.1) | 1 (5.9) | 0.181 | 0.913 |
| Consume alcohol daily     | 3 (25) | 7 (58.3) | 2 (16.7) | 1 (4.2) | 1 (3.1) |
| Daily fruit servings      | No 52 (45.6) | 58 (50.9) | 4 (3.5) | 2.818 | 0.244 |
| Daily vegetable servings  | No 52 (45.6) | 58 (50.9) | 4 (3.5) | 2.818 | 0.244 |
| Body mass index           | Underweight | 5 (60) | 2 (40) | 0 (0) | 33.221 | < 0.01** |
| Body mass index           | Normal | 29 (50.9) | 27 (47.4) | 1 (1.8) | 1 (2.0) | 0 (0) | 1.006 | 0.605 |
| Body mass index           | Grade 1 obesity | 10 (52.5) | 6 (37.5) | 0 (0) | 48 (43.6) | 58 (52.7) | 4 (3.6) | 2.338 | 0.311 |
| Body mass index           | Grade 2 obesity | 1 (25) | 1 (25) | 2 (50) | 1 (100) | 0 (0) | 0 (0) | 33.221 | < 0.01** |
| Sport                     | No 35 (46.1) | 38 (50) | 3 (3.9) | 0.566 | 0.754 |
| Sport                     | Yes 27 (46.6) | 30 (51.7) | 1 (1.7) | 4.158 | 0.655 |
| Weekly walk               | Everyday | 34 (52.5) | 30 (46.2) | 1 (1.5) | 15 (46.4) | 14 (45) | 1 (3.6) | 4.158 | 0.655 |
| Weekly walk               | 5-6 days | 2 (28.6) | 5 (71.4) | 0 (0) | 19 (55.9) | 13 (38.2) | 2 (5.9) | 33.221 | < 0.01** |

χ²: Chi-square test; *: p value < 0.1; **: p value < 0.01
health-related awareness and education [14, 15]. Despite their merits, research has shown the need to develop diabetes competencies and evaluative tools as a way to standardize health workers diabetes trainings in local communities [16].

There is limited evidence on whether having risk factors for diabetes, ensures greater knowledge of risk factors important for motivating preventive behaviours [17]. This present study reveals that respondent’s body mass index was significantly associated with knowledge of overweight/obesity as overweight (52.9%), grade 1 obese (62.5%) and morbid obese (100%) respondents had no knowledge of their status as risk factors for DM. These findings is in congruence with previous studies that have associated obese respondents with poor awareness [17, 18]. Also, most (62.5%) of the participants who were unaware of their blood pressure status had no knowledge of high blood pressure as a risk factor of DM. Routine blood pressure monitoring is very crucial and needful for adults. This is because high blood pressure has been associated with an increased risk of diabetes [19-22].

Also, in this study, two risk factors which significantly relates with the occurrence of the disease among previously diagnosed respondents have been documented by researchers who identified age [23-25] and poor diet [26-29] as risk factors for DM.

**Conclusion**

This study concludes that one-third of the study population were unaware of diabetes, more than half of those aware of the disease had no knowledge of its risk factors while well over a tenth had been previously diagnosed with the disease. Most overweight and obese respondents had no knowledge that they were at risk of having diabetes. Respondents unaware of their blood pressure status also had no knowledge of high blood pressure as a risk factor for diabetes. The risk factors which significantly relates with the disease occurrence among previously diagnosed respondents were age and poor diet, respectively. Thus, this study shows a need to improve on the level of awareness of DM and its risk factors in Afao. Routine

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**Tab. VIII.** Association between risk factors and previous diagnosis of diabetes.

| Variable                        | DM Present n (%) | DM Absent n (%) | $\chi^2$ | $p$ value |
|---------------------------------|------------------|-----------------|----------|-----------|
| Age                             |                  |                 |          |           |
| 17-40                           | 18 (62.1)        | 124 (72.1)      | 72.875   | 0.024*    |
| 41-60                           | 9 (31)           | 52 (18.6)       |          |           |
| above 60                        | 2 (6.9)          | 16 (9.3)        |          |           |
| Currently smoke tobacco         |                  |                 |          |           |
| no                              | 27 (93.1)        | 148 (86.0)      | 1.097    | 0.295     |
| yes                             | 2 (6.9)          | 24 (14)         |          |           |
| Consume alcohol daily           |                  |                 |          |           |
| no                              | 22 (75.9)        | 155 (77.3)      | 0.03     | 0.862     |
| yes                             | 7 (24.1)         | 39 (22.7)       |          |           |
| Daily vegetables servings       |                  |                 |          |           |
| less than 5                     | 29 (100)         | 142 (82.6)      | 5.946    | 0.015*    |
| 5 and above                     | 0 (0)            | 30 (17.4)       |          |           |
| Daily fruits servings           |                  |                 |          |           |
| less than 5                     | 27 (93.1)        | 139 (80.8)      | 2.606    | 0.106     |
| 5 and above                     | 2 (6.9)          | 33 (19.2)       |          |           |
| Oil mostly used for cooking     |                  |                 |          |           |
| unsaturated fat                 | 8 (27.6)         | 23 (13.4)       | 3.844    | 0.05*     |
| saturated fat                   | 21 (72.4)        | 149 (86.6)      |          |           |
| Weekly walk/bicycle ride        |                  |                 |          |           |
| Everyday                        | 20 (69)          | 80 (46.5)       | 6.255    | 0.1       |
| 2-4 days                        | 2 (6.9)          | 37 (21.5)       |          |           |
| 5-6 days                        | 2 (6.9)          | 9 (5.2)         |          |           |
| None                            | 5 (17.2)         | 46 (26.7)       |          |           |
| Body mass index                 |                  |                 |          |           |
| underweight                     | 1 (3.4)          | 9 (5.2)         | 0.792    | 0.978     |
| normal                          | 12 (41.4)        | 66 (38.4)       |          |           |
| overweight                      | 12 (41.4)        | 69 (40.1)       |          |           |
| grade 1 obesity                 | 3 (10.3)         | 20 (11.6)       |          |           |
| grade 2 obesity                 | 1 (3.4)          | 5 (2.9)         |          |           |
| morbid obesity                  | 0 (0)            | 3 (1.7)         |          |           |

$\chi^2$: Chi-square test; *: $p$ value < 0.05
measurement of blood glucose levels for adults, community health education and enlightenment strategies through the Ministry of Health on the awareness of DM are highly recommended for the Afao community.

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Conflict of interest statement

The authors declare no conflict of interest.

Authors’ contributions

ARD and AIOE contributed in the study design, training and supervision of data collectors. ARD designed the questionnaire. AIOE analyzed the data with the contribution of AEO. AIOE drafted the manuscript with the contribution of AEO, ARD and IOA. All authors reviewed and approved the final version of the manuscript.

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