

# Early Onset of Hypertension and Diabetes: Prevalence and Risk Factors among School Going Adolescents in Federal Capital Territory, North Central Nigeria

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## ABSTRACT

This study on early onset of hypertension and diabetes in adolescents was carried out to determine the prevalence of Hypertension, Prediabetes and diabetes among school-going adolescents in the Federal Capital Territory Abuja Nigeria. A questionnaire was used to assess all parameters. 717 in-school boarding and Day Students aged 10–19 years of age were assessed. Statistical analysis was carried out using Statistical Product and Service Solutions (SPSS) version 23.0. Results showed that of the 717 sampled adolescents, 488 (68.1%) and 229(31.9) were Females and Males respectively. 286 Boarders and 431 Day Students. Participants ranged between ages 13-16years (59.7%) and 17-19yrs (40.3%). Cereals (51%) were the most consumed across the adolescent diet, while Dairy (2%), Eggs (1%) and fruit (1%) were the least consumed. 22.6% of adolescents were underweight, 1.7% Overweight and 0.4% Obese. The Tri ponderal Risk assessment showed 93.6% of adolescents are at Low Risk of disease onset, 3.6% moderate risk and 2.8% High Risk. Combined Risk factors observed was Less exercise, regular consumption of processed foods and (29.5%), Family History (21.6%) 6.7% Overweight and Obesity (4.2%), Prediabetes (6.7%) Smoking (4.2%). The mean Fasting Blood Glucose (FBG) was  $4.2 \pm 1.2$  mmol/L. 9.7% and 2% males and female subjects had FBS  $>5.5$ mmol/ as either Prediabetic or Diabetic. A total prevalence of 82(11.7%) of adolescents were noted with prediabetes or Diabetes. Elevated systolic BP 17(2.4%), Elevated Diastolic BP 7(1%) and (systolic and/ or diastolic) 8(1.4%) were reported among the adolescents. The female Population had higher elevated scores in Blood Glucose Levels (7.1%) and Blood Pressure (3.2%), and the regression coefficient between BMI and other parameters was very weak ( $R < 0.2$ ) for Diabetes and Hypertension except for Systolic and Diastolic blood Pressure with statistical significance ( $p < 0.005$ ).

**Keywords:** Risk factors for Diabetes, Hypertension in African Adolescents, Adolescent Hypertension in Nigeria, Metabolic Diseases in Adolescents.

## INTRODUCTION

The Prevalence of Non-Communicable diseases such as hypertension, elevated blood glucose levels and early onset cardiovascular anomalies have gradually gained recognition among adolescents and young adults, becoming of serious public health concern as it is no longer only recorded in older age groups but also present in older Children, Adolescents and young Adults [1]. Adolescence is the second most important life stage for growth in cases of nutritional assault in childhood [2][3]. Living conditions in Low to Medium Income Countries (LMICs) may slow this process, with the ever-looming challenges of food insecurity, compensatory dietary habits and nutritional changes that foster less intake of nutritious food and a higher intake of more calorie dense meals [4]. Several Risk factors have been observed prevalent among adolescents and directly linked to susceptibility of non-communicable diseases such as Hypertension and Diabetes [5]. Globally there are reports of increasing prevalence of obesity and overweight and the association with non-communicable disease especially cardiac deaths and morbidity [6][7] Hypertension is defined as an elevated and sustained

systemic blood pressure of  $>140/90$  mmHg (CDC, 2019), where normal blood pressure is a systolic BP  $< 120$  mmHg and diastolic BP  $< 80$  mmHg [8]. As a major risk factor for heart failure, peripheral vascular disease, renal and visual impairment it is responsible for 18% of the global deaths due to Non-Communicable Diseases (NCDs) [9]. Several studies carried out across parts of Nigeria, records prevalence of obesity and hypertension as 3.5% and 5.1% for female and male adolescents [10], prevalence of systolic and diastolic pre-hypertension as 10.9% and 11.5% respectively, while the prevalence for systolic and diastolic hypertension was 14.4 and 8.6% respectively [11]. Risk factors for high blood pressure in adolescents include age, gender, obesity, physical inactivity, family history of hypertension in first degree relatives, socioeconomic status, cigarette smoking and alcohol intake [12]. Other risk factors include, birth weight, maturity during birth, heredity, and diet renal abnormalities, coarctation of the aorta, medications, neoplasm, etc. [13] According to the World Health Organization, about 1.13 billion people globally are living with hypertension, and two-thirds of this number resides in low to middle-income countries [14]. High Blood Pressure and risk factors identified in children 6-15 years have significant correlations between Childhood and Adulthood, showing a marked increase in Baseline values by age Eighteen (18). Essential hypertension, which is not necessarily linked to another medical condition, can be found among children and adolescents. With the prevalence of hypertension increasing with age, systolic hypertension becomes far more common than diastolic hypertension. [15][16]. Diabetes mellitus (DM) is a chronic metabolic disease characterized by chronic elevated blood glucose levels (hyperglycemia) above 5.5 mmol/l of Fasting Blood Glucose, due to inadequacies in insulin secretion and/or action. It is characterized by and associated with a long-term damage.

The menace of risk factors is experienced in adolescents. Overweight and/or obesity with other adolescent risk behaviors have been identified as major health risks for adolescents globally [10]. The prevalence of overweight and obesity has gradually risen overtime among adolescents globally [11], especially in Low to Medium income Countries in Africa [12][13], and other parts of the world [14] About a third of NCD risk factors have been identified in at least 50% of adolescents aged 11 to 17 years. This has increased gradually over time between 2013, 2017 and onwards [15] Physical inactivity, unhealthy diet and sedentary lifestyle presented in one third of the adolescents, in Vietnam [16] and Southern Brazil [17], Where one fourth of the adolescent population had a combination of the same risk factors in-school or out of school [17]. Also, in Southern [18] and North Central Nigeria [15] a combination of risk factors has been identified in adolescents. Observed in studies in reporting risk of disease as 2.4% - 30.9% of adolescents for hypertension and impaired fasting glucose in school going adolescents [15]. A Study reported significant relationships between body mass index (BMI) and elevated blood pressures, glucose intolerance and metabolic risks [17]. Obesity, uncontrolled elevated blood pressure and glucose levels may increase the risk of hypertension and diabetes mellitus early in life. Other observed coexisting factors e.g. Family history of hypertension and Diabetes also peaks the susceptibility of adolescents to the disease [17].

The International Society for Pediatric Adolescent Diabetes (ISPAD) defines prediabetes as FBG of 100 – 125 mg/dl and epidemiological cases of prediabetes in adolescents have been recorded across the globe. In a prevalence study of adolescent onset diabetes, 71.4% had type 1 Diabetes (T1DM), 19.5% type 2 Diabetes (T2DM) and 9.1% other forms of diabetes [19]. 36.2% had a family history of disease condition. Severe cases of diabetes in adolescents have also been identified where 34.65% were detected incidentally, with  $9.4 \pm 2.8\%$  mean HbA1c [20]. Although these studies [15][16] and more have assessed the Prevalence of cardiovascular diseases among Nigerian adolescents in the South and Western parts of Nigeria[20], there is scant information available, relating to nutritional status of adolescents, identified risk factors and prevalence of Hypertension and Diabetes within the North Central Area of Nigeria.

## MATERIALS AND METHOD

### Sample Size Determination

The minimum sample size for a statistically meaningful deduction will be calculated using the WHO Fisher method [21] [22] [23] Considering prevalence of hypertension and allowable absolute error (Precision) of 5%, ( $n=t^2(pXq)/d^2$ ) was used to determine sample size. Expected prevalence Using 8.6% corresponding to  $p=0.086$  as proportion and Prevalence of Diastolic Hypertension among adolescents [20]  $n= 120.78$ . Therefore,  $2n= 242$  (3 sampled LGAs) 726 \*after adjustment for responses,  $n=717$ . The study population comprised of 717 adolescent respondents attending selected Government public schools. A list provided by the state education

board was used to pick out Eight (8) of the most populated government secondary Schools in the FCT, representing each of the three selected local government areas.

**Data Collection.**

A Pretested semi-structured questionnaire was administered to the participants, data on Anthropometry, Age and self-reports on meal pattern. Anthropometric measurements each representing a local government area, were taken to determine nutritional status of the adolescents as consumers within the research location. Body mass index was calculated using the weight and the height as;  $Weight\ (kg)/Height^2(m^2)$  per WHO standard [16]. Stunting and underweight (Severe Thinness and Thinness) were calculated as height-for-age and weight-for-age Z-score below -2 Z-score respectively, while overweight was BMI-for-age >2 Z-score and obesity was BMI-for-age >3 Z-score (5-19 years). With the Permission of the State Education Board and National Hospital Abuja, blood Pressure parameters were assessed for prevalence of pre-hypertension and Hypertension and Prediabetes and Diabetes. This cross-sectional study was conducted in November 2023-February 2024.

**Inclusion Criteria.**

All apparently healthy adolescents aged 13 to 19 years attending a Public Secondary School located in the selected districts of the Federal Capital Territory an Presenting a signed Parental informed consent form (aged 13-19yrs).

**Statistical Analysis**

Socio demographic data is presented as descriptive statistics of percentages and frequencies using Statistical Package for Social Sciences (SPSS) software version 21.0. Variables were presented as mean ± (SD) and percentages. an independent sample t-test was used to compare two means, where appropriate at a level of significance of  $p < 0.05$  and significant correlations were made for variables linked to Body Mass Index and other parameters.

**Ethical Clearance**

Consent forms were given to parents on school visiting day and Ethical clearance was obtained from the Federal Capital Territory State Education Board (SEB) and the National Hospital Ethical Clearance Committee Abuja (NHA/EC/074/2023)

**RESULTS**

**Demographic Characteristics of Adolescents.**

The demographic characteristic of the Adolescents is shown in Table 1. There was a total of 717 school-going adolescents in the study, presently registered as students within the sampled Area. The highest participation (68.1%), was from females, showing more curiosity and eagerness to participate and ask questions. Age group 13-16years, (59.7%), had the most participation also possibly due to selection criteria of returning the consent form. Adolescents from the senior secondary school (SSS) were a total 96.2%, more than the junior secondary students due to teacher selection to suit the in vivo nature of the data collection, considering needle pricks. Participants from ‘other’ tribes made up 40% of the sampled population, which was the highest percentage of participants by tribe. This may also be due to the high migration of other tribes to the capital city.

**Participant Demographic Characteristics**

Table 1 Demographic Characteristics of School Going Adolescents Sampled Across Three (3) LGAs in the FCT

SCHOOL Variable	AMAC n(%)	BWARI n(%)	KUJE n(%)	TOTAL n(%)
Mode of Schooling				
Day	277(38.6)	70 (9.76)	84 (11.7)	431(60.1)

Boarding	97 (13.5)	103(14.3)	86 (11.9)	286 (39.9)
Sex				
M	111(15.4)	50 (6.9)	68 (9.4)	229 (31.9)
F	263(36.6)	123(17.2)	102 (14.2)	488 (68.1)
Age (Yrs)				
13-16	230 (32)	89(12.4)	109(15.2)	428(59.7)
17-19	144(20.1)	84 (11.7)	61(8.5)	289(40.3)
Class				
JSS	5 (0.69)	10(1.39)	12(1.67)	27(3.8)
SSS	369(51.4)	163(22.7)	158(22)	690(96.2)
Ethnic Group				
Ibo	65(9.06)	22 (3.06)	21(2.92)	108(15.06)
Yoruba	59 (8.2)	41 (5.71)	31(4.32)	131(18.2)
Hausa	115(16.0)	42 (5.85)	34(4.7)	191(26.6)
Other Tribes	135 (18.8)	68 (9.48)	84 (11.71)	287(40.02)
TOTAL	374 (52.2)	173 (24.1)	170 (23.7)	717(100)

\*JSS-Junior Secondary School; SSS- Senior Secondary School

### Frequency of Consumption by Food Groups in Adolescent Meals

Cereals and grains made up the bulk of meals served (51%), which is a typical staple in feeding patterns across homes and boarding schools in the sampled location. Vegetables (20%), Eggs (0%) Dairy (2%) and Fruits were the least Consumed at 1%.

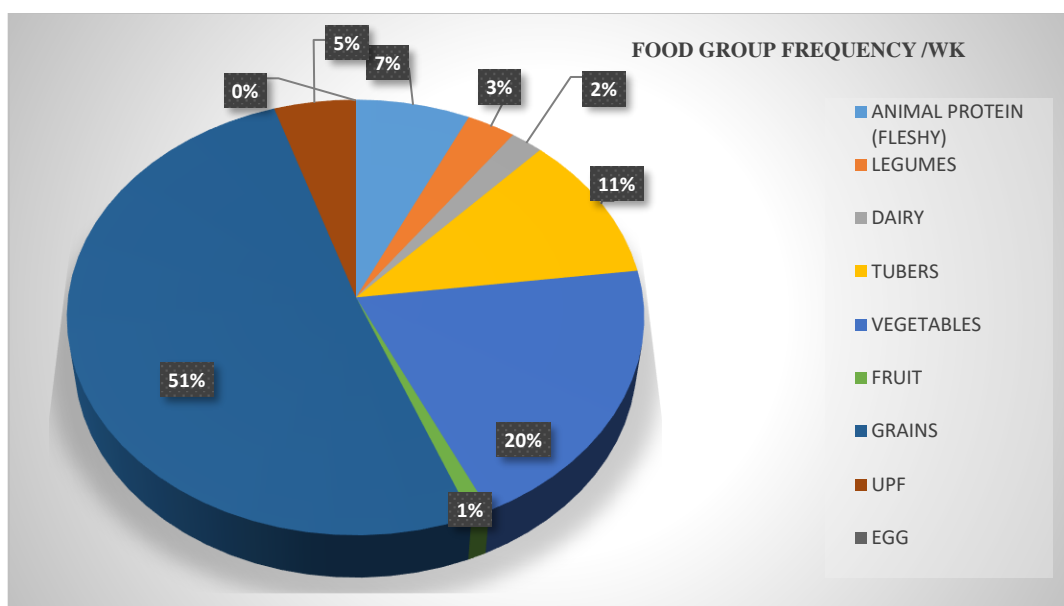


Figure 1 Frequency of Consumption by Food Groups in Meals Served

Food Groups most frequently Consumed response by Body Mass Index (Assessed via a 7day food frequency Table). Adolescents of Normal weight consumed most meals frequently

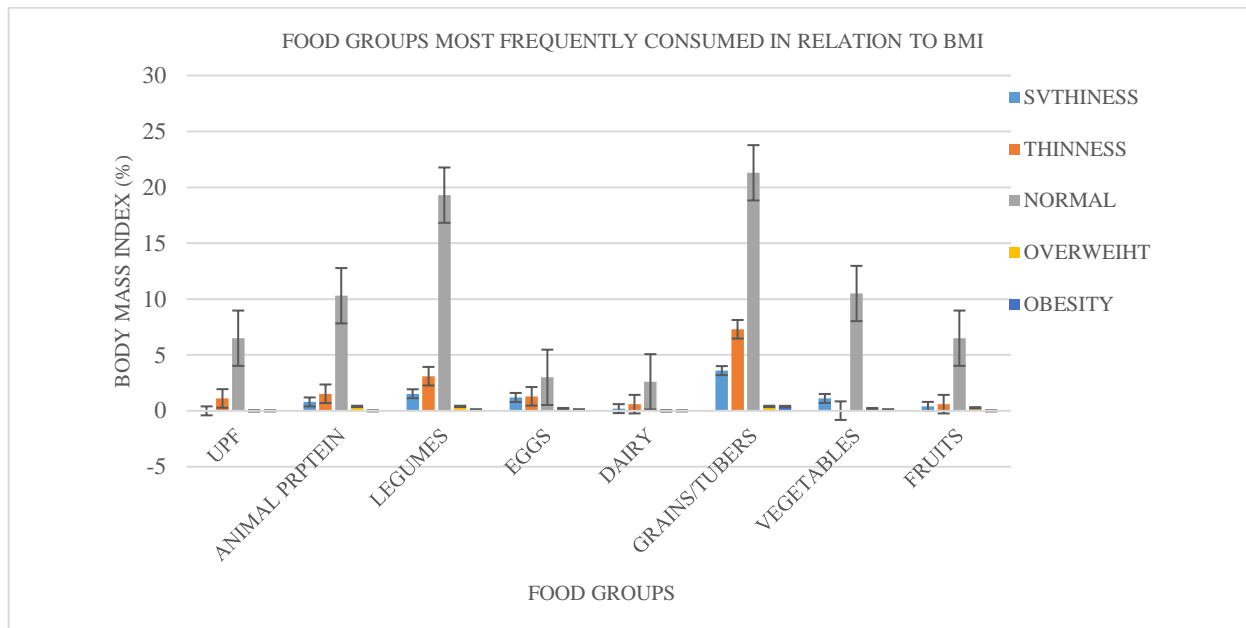


Figure 2 Frequency of Consumption by Food Groups in Meals by Nutritional Status

**Nutritional Status Body Mass Index Classification**

Table 2 Shows the Body Mass Index of the Adolescents as combined (%) underweight population (22.6%), 1.7% Overweight, 0.4% Obese and 75.3% of normal weight. Putting Malnutrition Prevalence at (24.7%)

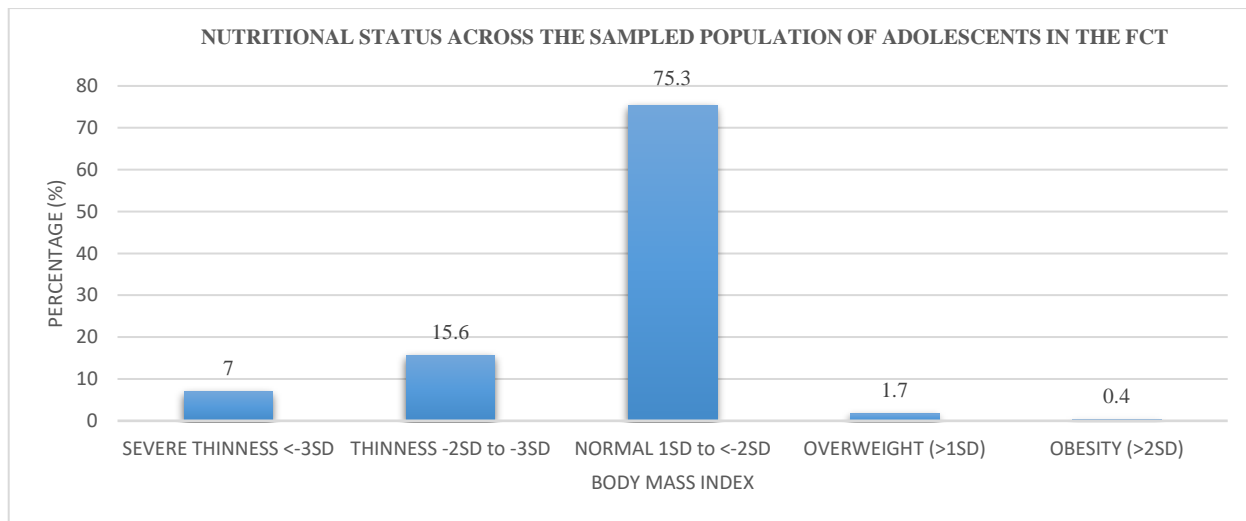


Figure 3 Nutritional Status by Body Mass Index Classification

Average Values of Variables (Mean ± SD) within the Sampled Population

Table 2 Mean Values of Variables

Average Values of	Variables (Mean ± SD)	within the Sampled Population
Variable	Mean	Std. Deviation
AGE(Yrs)	15.8	1.1
WEIGHT (kg)	51.0	9.9

BMI (kg/m <sup>2</sup> )	18.3	3.3
SYSTOLIC (mmHg)	110.6	12.4
DIASTOLIC (mmHg)	65.5	11.2
FBG (mmol/l)	4.2	1.2

### Risk Assessment and Disease Susceptibility

Risk Assessment for the Prevalence of Disease susceptibility by Triponderal Mass Index (TMI) Measured in the Sampled Population. Susceptibility to Disease in Adolescents as measured by the Triponderal Mass Index (TMI) is presented in Figure 4. Majority (83.7%) of the Sampled Adolescents were rated as Low Risk/Susceptibility and only 2% ages (13-16) and 0.8% (17-19) were rated as High Risk/Susceptibility to Disease prevalence. This is noted possibly from the low prevalence of overweight and obesity as assessed by the adolescent TMI.

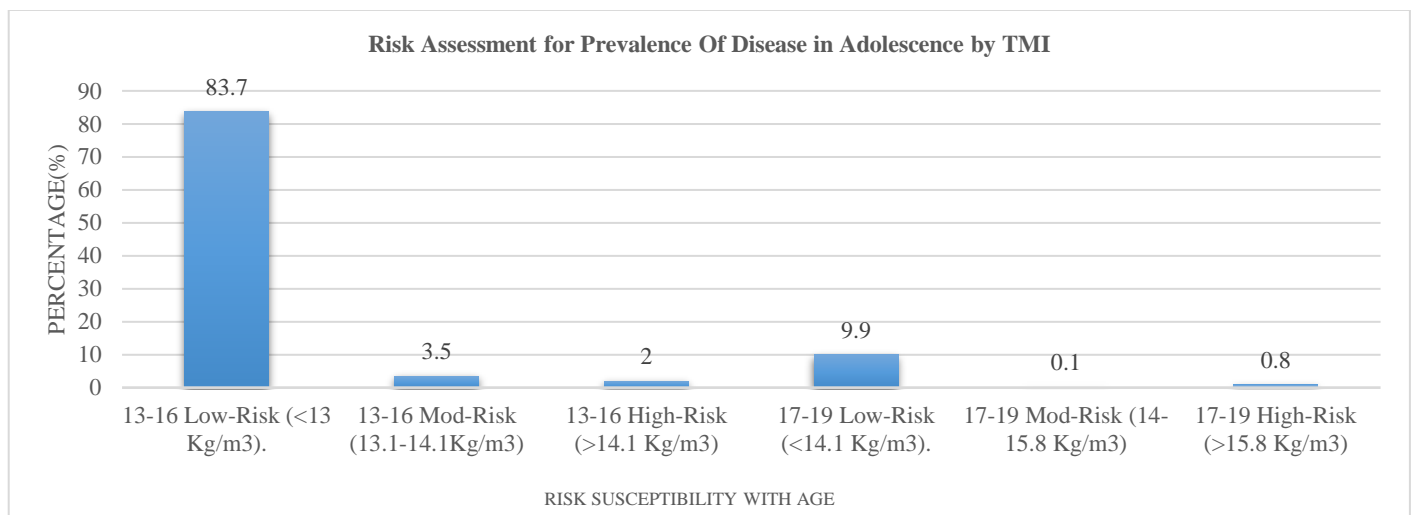
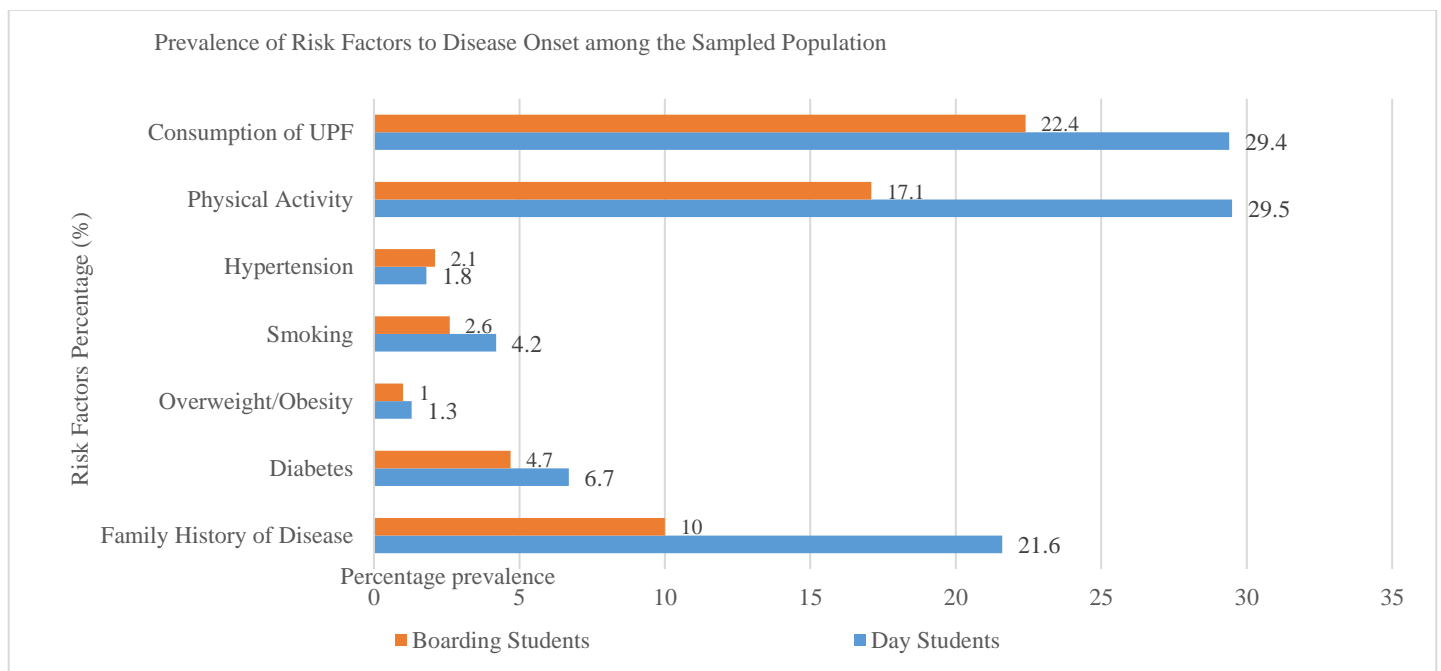


Figure 4. Risk Assessment for the Prevalence of Disease



\*UPF-Ultra Processed Food

Figure 5. Risk Factors for Disease Onset Identified in the Adolescent Population.

0.1% of the adolescents had a combination occurrence of Pre-Diabetes (Pre-Dm) and Hypertension, 0.5%, a combination of Pre-Dm and Elevated Systolic Hypertension and 1.3% had Diabetes with noted absence of Hypertension. Highest risk factor was in excess consumption of high processed foods and snacks, (51.8%). 48(6.7%) had a combined presentation of smokers within the sampled groups (Boarding and Day), 226(31.6%) Family History of Disease. The lowest occurring risk factor 2.3% being overweight or obese. This score may have been low due to the higher number of Day-Students in the sampled location. Prevalence of Pre-hypertension and Hypertension, Prediabetes and Diabetes among the Sampled Adolescent Population.

The Prevalence of Elevated Blood Pressure is shown as Elevated Systolic BP (2.4%), Elevated Diastolic BP (1%) and Elevated Systolic/Diastolic BP(1.4%)and the Majority was recorded as (94.2%) Prevalence of Pre-Diabetes (9.7%) , 2% Diabetic and normal 84.5% respectively.

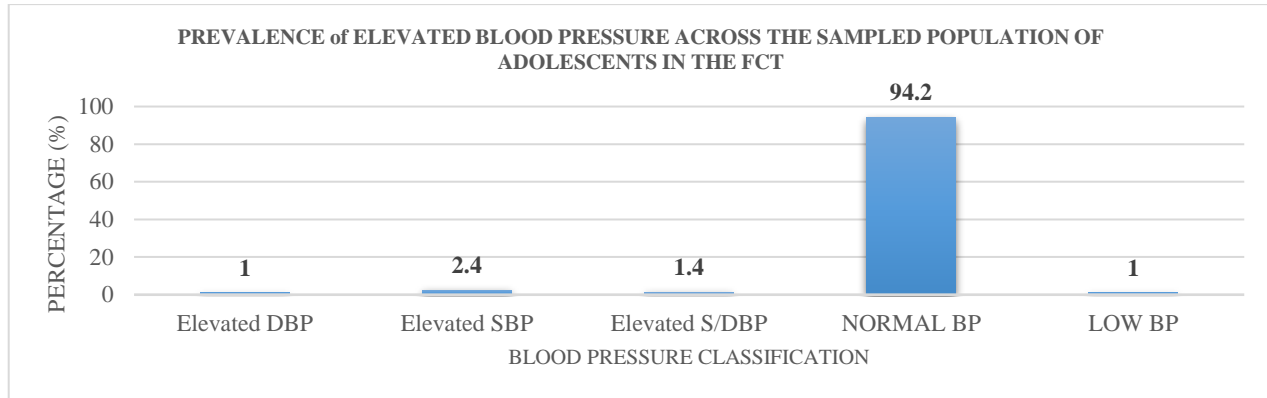


Figure 6: Showing the Percentage Prevalence of Hypertension among the Adolescents of FCT

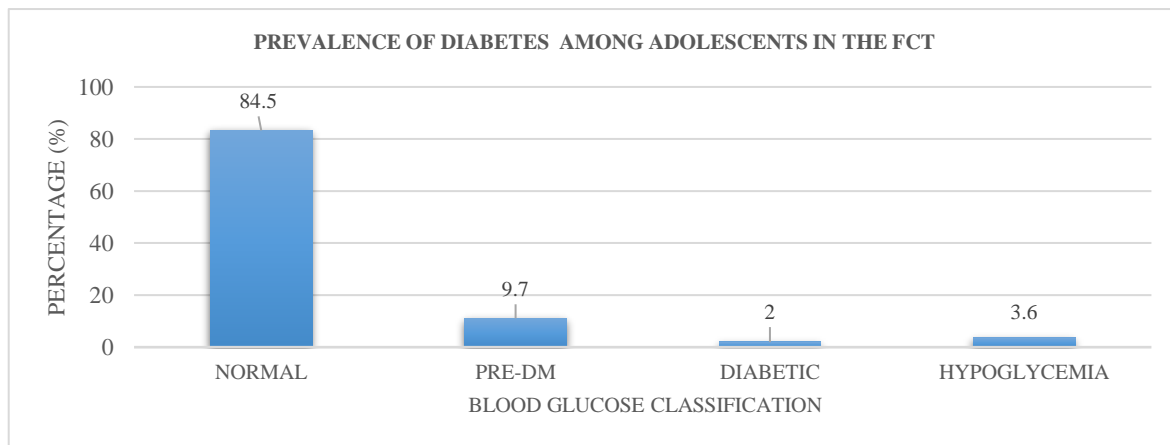


Figure 7 The Prevalence of Pre-Diabetes and Diabetes among School-going Adolescents in parts of the FCT

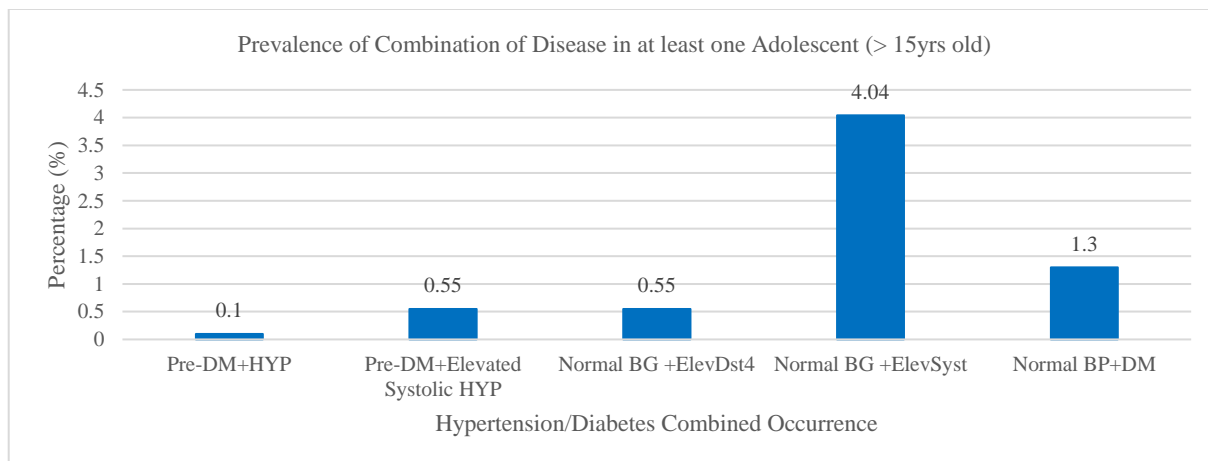


Figure 8 The Prevalence of Co-existing conditions Pre- Diabetes and Diabetes among School-going Adolescents in Parts the FCT

Table 3 Type 2 Diabetes Classification for Age, Sex >15

Normal n(%)	Blood Glucose Levels (%)	PreDM n(%)	DMII n(%)	Hypoglycemia n(%)
Male	187(26.1)	31(3.8)	4(0.55)	11(1.5)
Female	422(58.8)	43(5.9)	8(1.12)	15(2.1)
TOTAL	609(84.9)	70(9.7)	12(1.67)	26(3.62)

Table 4 Prevalence of Hypertension and Type 2 Diabetes Classification by Sex

Blood Pressure/ Blood Gluc (%)	Male n(%)	SEX Female n(%)	TOTAL n(%)
Elevated Systolic BP	3(0.41)	14(1.95)	
Elevated Diastolic BP	1(0.14)	6(0.83)	7(0.97)
HTN	5(0.69)	3(0.42)	8(1.67)
Pre-DM	31(4.32)	43(5.99)	80(11.15)
DM	4(0.55)	8(1.11)	12(1.67)
TOTAL	35(4.88)	51(7.11)	146(20.3)
*BP-Blood Pressure; HTN-Hypertension; PreDM: Pre diabetes			

**Correlation between Adolescent BMI and Blood Glucose and Hypertension Scores**

Table 5 Regression Coefficient of BMI with Blood Glucose Levels and Hypertension Prevalence

NUTRITIONALSTATUS			
Body Mass Index N)=717	R	R square	P Value
GLUCOSE SCORES	0.27	0.001	0.474
HYPERTENSION	0.10	0.01	0.007
SYSTOLIC BP	0.216	0.047	0.000
DIASTOLIC BLOOD PRESSURE	0.173	0.03	0.000

Strength of Correlation is very weak when  $R < 0.2$

**DISCUSSION**

By assessment of self-reports on the food frequency table and the in-school weekly feeding table, Grains and vegetables were highly ranked on the meal table of the students, over 50% of meal times (Fig 1). This is possibly due to the fact that grains and cereals set the bar for cheaper and easily accessible food options especially among low to medium Income families. Also frequently paired in meals with legumes and vegetables as soups, grains are a good source of Protein. Foods like Eggs, Dairy and Fruits only represented a low portion 2% and 1% of the table meals by frequency of consumption. Adolescents with Low BMI were also



seen to largely consume Grains more than other food groups. Grains and cereals can provide an easy energy boost even in cases where one-meal a day is obtained. Dairy consumption is an important aspect of adolescent meal especially for calcium and 50% of the daily consumed protein must be met from animal sources while the other half must be met from vegetative sources [24] Consumption of Ultra processed foods and snacks was recorded as high as much as more than three times /week. Foods like Meat and fish were consumed in (5%) of the meals. having access to only a few foods regularly may cause the effects of a monotonous diet, lack of interest at mealtimes and malnutrition in young ages. This is especially seen in cases where adequate consumption of dairy, poultry, and fruits meat boarding schools and low-income settings where food diversity is low.[25]

The mean age of participants was  $15.8 \pm 1.1$ , weight  $51 \pm 9.9$ kg, Height  $1.6\text{m} \pm 0.08\text{m}$ , mean BMI  $18.3 \pm 3.3$ kg/m<sup>2</sup>, mean FBG  $4 \pm 1.23$ mmol/l, mean Systolic BP  $110 \pm 12.4$  mmHg while the mean Diastolic BP was  $65.5 \pm 11.2$ mmHg. The total average BMI across the sampled population was recorded as  $18.3 \pm 3.3$ , showing a high percentage of normal BMI. The prevalence of Obesity in this location is recorded as (0.4%) which is very low, this is way lower than observed in a global project on disease prevalence [26] which also shows that there is a reduction in the prevalence of Obesity and Overweight among young ages. This may be duly attributed to several factors contributing as food insecurity and other factors of malnutrition, as also observed in other studies [27][28]. As compared with a study [20] in Southwestern Nigeria reporting Obesity as 10.2%. and similar reports of high prevalence of obesity, Obesity is reported to be lower in the northern parts than in the south, which may be linked to type of diet and genetic phenotypic representation [29]. In this population, the doubled prevalence of malnutrition (24.7%) among students attending both boarding and Day schools was similar to adolescent malnutrition in another northern part of Nigeria at 25.7% [22]. This relatively implies there are still major problems of the double burden of Malnutrition. malnutrition occurring within the adolescent population in parts of the FCT.

As shown in Figure 4, Susceptibility to disease, as a measure of risk factors for the early onset of Diabetes and hypertension, was assessed by the Tri ponderal index [30] [31]. Age group 13-16years had a higher occurrence of 'high risk' susceptibility (2%) than their counterparts 17-19 years (0.8%). This may be due to age correlation to knowledge of disease, susceptibility and management in older adolescence and older ages. [32] Secondly This may be due to population bias, as the younger age group comprised the majority of the sampled adolescent population. (0.1% - 3.5%) and (0.8% - 2%) was recorded as moderate risk to High-risk prevalence by triponderal Mass Index risk scale (TMI). The TMI is ideal for true mass Index status in adolescence.

Elevated blood glucose levels with co-risk factors such as a family history of disease, smoking, consumption of Ultra processed meals and sedentary Lifestyle, is noted as Diabetes type 2 at 15yrs of age. As shown in Figure 5, The most prevalent risk factors for onset of diabetes and hypertension in this study was observed as High consumption of Ultra processed foods and snacks more than three times a week (22-29.4%), less Physical activity, (17.1-29.5%) and a Family History of disease (10% - 21.6%). This pattern of co-risk factors in adolescents is similar to co-occurrence risk factors assessed in parts of North Central Nigeria [33]. This pattern of co-factors in adolescents was also recorded in parts of east Africa [25] mainly as unhealthy diet and sedentary lifestyle.

Diagnosis of pre-diabetes and diabetes in children and young Adults is consistent with a common chronic disorder in children, caused by absolute or relative insulin deficiency, with or without insulin resistance [34]. As shown in Tables 3 and 4, Only 9.7% of the sampled adolescents had prediabetes (FBG  $>5.5 - 6.9$  mmol/l). This value is similar to a study in Osun state, western part of Nigeria, where prediabetes among adolescents was 9.4% [34]. In this study, adolescents with Diabetes ( $>7$ mmol/l) were 2% and 84.5% Normal. 94.2% of the sampled adolescents had Normal Blood Pressure, 1.4% Elevated Systolic and Diastolic Blood Pressure (Hypertension) 2.4% Elevated Systolic BP and 1% Elevated Diastolic Blood Pressure respectively. Figure 6 and Table 4 relates with studies [15][16] showing that systolic Hypertension is often more common than diastolic hypertension.

On risk and combination of morbidities occurring in adolescents, (Figure 8) 0.1% of the participants, had a combination occurrence of Pre-Diabetes and Elevated/Systolic Hypertension, 0.5% of the adolescent population sampled, had a combination of Prediabetes and Elevated Systolic Hypertension and 1.3% had

diabetes with noted absence of Hypertension. The Low prevalence of elevated glucose scores and BMI may be due to a prolonged pathophysiology of glucose intolerance and possibly for school students who have to walk quite a distance on foot to get to school every morning, improving their required level of daily physical activity.

The regression Coefficient between Nutritional status of Adolescents and Blood Glucose scores, and Blood Pressure scores, showed a weak correlation ( $R < 0.2$ ). However, Systolic and Diastolic Blood Pressures showed a significant difference ( $p < 0.005$ ) in relationship with Body Mass Index. Body Mass Index is directly associated with Blood Pressure, increasing significantly and linearly. Despite the low prevalence of overweight and obesity, other factors such as anxiety, consumption of chemical substances and activity levels could also impact Blood Pressure. It is also important to note that although prevalence of elevated blood pressure is low, there is positive correlation between the BP and BMI of the Adolescents in the FCT, with a possible 10 of every 700 (1:70) occurrence of High Blood Pressure. This occurrence is similar to other study findings [35] showing there are adolescents with early symptoms of these non-communicable diseases.

## CONCLUSIONS

The Prevalence of Prediabetes is higher than Diabetes among this young population. This shows that adolescents are gradually and quickly being placed on the spectrum of non-communicable diseases. It is also key to note that Hypertension, the silent killer is being observed among this very young population too, however in low prevalence. Risk factors such as Smoking, high consumption of Ultra processed foods and Family history of disease occurrence are observed as the highest enablers in the disease conditions within this population. The double burden of Malnutrition cannot be overlooked in the prevalence of diseases in low to medium income communities, of which the sampled participants are also part. Low prevalence of overweight and Obesity in this location may be as a result of some school sport activities and distances students commute by foot daily to school, as the Majority of participants were 'Day students' this may have also impacted the prevalence of Elevated Blood Pressure and Diabetes seen here. Notwithstanding, a continuous effort needs to be made with respect to the prevention and management of Malnutrition and other Noncommunicable diseases. There is therefore need, to ensure that adolescents can access at least 33% of all daily Nutrient Intakes, at home or away from home. It is projected that by year 2040, more deaths would have occurred from Noncommunicable diseases than from infectious diseases. Therefore, a continuous monitoring of adolescents' dietary intake and nutrition status is key in preventing adolescents' malnutrition in the short term and non-communicable diseases in the long run.

The setbacks of this study are hereby acknowledged:

1. There was no data on lipid profile due to concerns by the local school authority on volume of blood sample to be collected. This may have given further insight into the cardiometabolic status of the adolescents.
2. There was no data collection for private secondary schools in the study location. This may have also been a good source of comparison between adolescents living under various conditions and privileges in the sampled location.

Further studies on the Lipid profile of adolescents, glycated Hemoglobin levels (HbA1c), Knowledge attitude and practice of adolescents on cardiometabolic risks needs to be carried out within this location.

## RECOMMENDATIONS

Early and regular health check programs should be carried out in Schools for early detection of Non communicable diseases and co-founding risk factors. In-school children and adolescent school feeding Programs should be well monitored to provide good nourishment. This can be achieved by regular inspection and monitoring of boarding school meals and snack shops within school premises. Adolescents should be engaged in more profitable activities like sports and cognitive development to deter them from other social vices such as smoking and alcoholism, and long hours watching Television and social media, which could be risk factors to health.

Proper Self and home care for young diabetic patients is key in management. Adolescents diagnosed as prediabetic, diabetic, prehypertensive or hypertensive should have access to prompt health care services at school or otherwise. This means better funding of the government school sickbays and other health outlets. Health Education should be improved upon in these young age groups, especially for improved self-care.

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