# Anthropometric Characteristics of Vegetarian and Non-Vegetarian Adults in a Selected Local Government Area In Osun State, Nigeria

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**Abstract**

**Background:** Vegetarian diets have grown in popularity partly because they have been linked to numerous health benefits. They are typically high in fiber and antioxidants and low in cholesterol, potentially lowering the risk of chronic diseases. On the other hand, diets established on meat and its products play a significant role in increasing the incidence of non-communicable diseases owing to their increased calorie density and extra saturated fat.

**Methods:** A cross-sectional study was conducted among 121 adults recruited purposively from two Seventh-day Adventist churches in the Ede South Local Government area of Osun State.

**Results:** Most respondents (73.6 %) were non-vegetarian and 26.4% were vegetarian (65.6% semi-vegetarian, 25% lacto-ovo, and 9.4% vegans). Among the non-vegetarians, 4.0% were underweight, 42.0% were of normal weight, 44.0% were overweight, and 10.1 % were obese. Among Vegetarians, 56.3% and 43.7% were of normal weight and overweight, respectively.

**Conclusion:** The prevalence of obesity among non-vegetarians was high, indicating the need for nutritional education intervention on the health benefits of a vegetarian diet.

**Keywords:** Vegetarian diet, non-vegetarian diet, body mass index, waist-to-hip ratio

## Introduction

Anthropometry has long been used to determine nutritional status because of its noninvasive nature and low cost. Anthropometric measurements help to calculate Body Mass Index (BMI) and Waist-to-Hip Ratio (WHR) providing simple and useful statistics for assessing nutritional health. Anthropometry, biochemical tests, clinical examinations, and food intake assessments determine whether individuals have a 'normal' nutritional status or are at risk of malnutrition. Body mass index assessment is important because it has been shown to have an inverse relationship with the prevalence of non-communicable diseases (NCDs) such as obesity, type 2 diabetes mellitus (DM2), cardiovascular diseases (CVDs), hypertension, and some cancers (World Health Organization [WHO],



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1995). A vegetarian diet consists mostly of plant-based foods (cereals, vegetables, tubers, oilseeds, legumes, fruits, and nuts) and eliminates any meat, fish, animal products, or byproducts (Hauner, 2015). Vegetarian diets are further classified into three types: ovo-vegetarians (egg consumption), lacto-ovo-vegetarians (eggs plus dairy products consumption), and lacto-vegetarians (dairy products consumption) (Pilis et al. 2014).

The most severe vegan diet excludes all animal-derived products, including honey (Hauner, 2015). Vegans are often concerned with their food choices and environmental and animal welfare issues (Vanacore et al., 2018). Vegetarian diets have gained popularity, thanks in part to their correlation with several health advantages when compared to non-vegetarian diets (Vanacore et al., 2018). These diets often include foods high in fiber, phytoestrogens, antioxidants, phytochemicals, n-3 fatty acids, and low levels of cholesterol and saturated fat, which may reduce the risk of cardiovascular disease, diabetes, and obesity (Pilis et al., 2014; Vanacore et al., 2018). WHO reported that almost 1.2 billion people worldwide are overweight (Pilis et al., 2014).

Vegetarian diets provide nutritional benefits by lowering saturated fat, cholesterol, and animal protein while increasing minerals, vitamins, carbohydrates, antioxidants, dietary fiber, and other bioactive components. Vegans, on the other hand, may lack vitamins such as vitamin D and vitamin B-12. Their diet also lacks calcium and omega-3 fatty acids (Craig et al., 2009). The minimal intake of some nutrients does not stop these diets from being recommended since adequate scientific research shows that health advantages outweigh these risks (Sabaté, 2003a). Previous research suggests that vegetarians have a lower, and hence more ideal, BMI, WHR, and blood pressure than meat consumers (Alewaeters et al., 2005; Chiu et al., 2005).

On the other hand, diets established on meat and its products play a significant role in increasing the risk of non-communicable illnesses owing to their increased calorie density and more saturated fat (Vang *et al.,* 2008). Understanding the relationship between food groups and these features is critical for developing mechanisms that link diet and illness outcomes. This study aimed to assess the anthropometric characteristics of vegetarian and non-vegetarian adults in a selected Local Government Area in Osun State.

## Methodology

### Study Design

This was a descriptive, cross-sectional study. Cross-sectional studies are observational studies that are often used to measure the prevalence of health outcomes and describe the features of a population.

### Study Location

The study was purposely conducted in the Ede South Local Government Area because of the presence of Seventh-day

Adventist Churches (SDA). Seventh-day Adventists were chosen because they have more diverse nutritional habits than the general population.

## Sampling Technique

One hundred and twenty-one (121) respondents were recruited from two SDA churches in the Ede South Local Government Area of Osun State through purposive sampling.

## Inclusion and Exclusion Criteria

Adults of both genders, aged 18-65, who had been members of the SDA church for at least a year were eligible for the study. Individuals with chronic conditions (like hypertension, stroke, and diabetes), those under 18 or over 65, those who did not sign the informed consent form, and those who had been in the church for less than a year were not included in the study.

## Anthropometric Measurements

Prior to participants utilizing the mechanical bathroom scale, the scale was calibrated to guarantee precise body weight measurements. The participants were instructed to remove any heavy objects, such as wallets, keys, and other items, as well as any bulky clothing or accessories from their pockets. They were instructed to stand with their hands by their sides and allow the needle and digital display to stabilize before the measurements were recorded. The weight was calculated to the nearest 0.5 kilograms. The measurements for height were taken using a measuring tape, and the participants were instructed to remove their shoes beforehand. They were instructed to stand with their backs against the wall, facing forward, and the wall was in contact with the backs of their feet, calves, lower back, and head. The measurement tool was gently lowered onto the subject's head, and the height was recorded in centimeters and translated into meters.

The Body Mass Index (BMI) was calculated by dividing the weight in kilograms by the height in meters squared. The World Health Organization (WHO, 2000) categorized BMI as overweight (BMI > 25), Grade I (30.0-34.9), Grade II (35.0-39.9), or morbid obesity (BMI ≥40). Waist circumference was measured using a flexible tape rule wrapped horizontally around the waist just above the hip bones. The participants were instructed to stand upright, and the measurement was taken with an accuracy of 0.1 cm. The hip circumference was also measured using a flexible tape rule, at the largest diameter of the buttocks parallel to the floor (WHO, 2008). The Waist-to-Hip Ratio (WHR) was used to identify central obesity. The central obesity was considered as WHR >0.85 for females and >1.0 for males (WHO, 2008).

## Ethics Consideration and Informed Consent

Ethical clearance was obtained from the ethics committee of Adeleke University, Ede, Nigeria. All procedures involving human subjects for this study which were conducted in accordance with the principles outlined in the Declaration

of Helsinki. All participants provided both written and verbal informed consent.

## Results

Table 1 displays the socio-demographic characteristics of the respondents. Of the 121 respondents who participated in the study, 30.6% of the respondents were between 20-29 years, 30.6% were between 30-39 years, 19.8% were between 40-49 years, 13.2% were between 50-59 years and 5.8% were 60-69 years. More than half (54.5%) of the respondents were female, and 45.5% were male. Most of the respondents (62%) were married, 32.2% were single, and 5.8% were divorced.

**Table 1**

*Distribution of Respondents by Sociodemographic Characteristics*

| Variable | Frequency (n =121) | Percentage |
|---|---|---|
| **Age** | | |
| 20-29 years | 37 | 30.6 |
| 30-39 years | 37 | 30.6 |
| 40-49 years | 24 | 19.8 |
| 50-59 years | 16 | 13.2 |
| 60-69 years | 7 | 5.8 |
| Total | 121 | 100.0 |
| **Sex** | | |
| Male | 55 | 45.5 |
| Female | 66 | 54.5 |
| Total | 121 | 100.0 |
| **Marital Status** | | |
| Single | 39 | 32.2 |
| Married | 75 | 62.0 |
| Divorced | 7 | 5.8 |
| Total | 121 | 100.0 |
| **Occupation** | | |
| Civil Servant | 36 | 29.8 |
| Trader | 59 | 48.8 |
| Self-employed | 26 | 21.5 |
| Total | 121 | 100.0 |

Table 2 shows that most respondents (73.6%) were non-vegetarian 26.4% were vegetarian. Table 3 shows the distribution of the different types of vegetarians: 65.6% = semi-vegetarian, 25% = lacto-ovo, and 9.4% = vegans). Among the non-vegetarians, the prevalence of underweight was 4.0%, 42.0% were of normal weight, 44.0% were overweight, and the prevalence of obesity was 10.1 % using BMI. Among Vegetarians, underweight and obesity have not been reported. More than half (56.3%) of the respondents were of normal weight, while 43.4% were overweight, underweight, and obese (see Table 4).

**Table 2**

*Diet Classification of Respondents*

| Status | Frequency | Percentage |
|---|---|---|
| Vegetarian | 32 | 26.4 |
| Non-vegetarian | 89 | 73.6 |
| **Total** | **121** | **100.0** |

**Table 3**

*Classification of Vegetarian Diet*

| Types of Vegetarians | Frequency | Percent |
|---|---|---|
| Lacto (consumes milk products but not eggs) | - | - |
| Ovo (consumes eggs but not milk products) | - | - |
| Lacto-ovo (consumes milk products and eggs only) | 8 | 25 |
| Semi (consumes poultry or fish occasionally, but no red meat) | 21 | 65.6 |
| Vegan (consumes no animal products at all) | 3 | 9.4 |
| **Total Vegetarian** | **32** | **100** |

**Table 4**

*Body Mass Index Classification of Respondents by Diet Group*

| BMI Classification | Vegetarian | | Non-Vegetarian | | All | |
|---|---|---|---|---|---|---|
| | Frequency | Percentage | Frequency | Percentage | Frequency | Percentage |
| Underweight | - | - | 4 | 4.4 | 4 | 3.3 |
| Normal weight | 18 | 56.3 | 37 | 41.6 | 55 | 45.5 |
| Overweight | 14 | 43.7 | 39 | 43.8 | 53 | 43.8 |
| Obese | - | - | 9 | 10.1 | 9 | 7.4 |
| **Total** | **32** | **100** | **89** | **100** | **121** | **100** |

The prevalence of abdominal obesity among male vegetarians was 3.1%, while among male non-vegetarians, it was 13.5%. Among female vegetarians, it was 43.8%, whereas among female non-vegetarians, it was 43.8% (see Table 6).

Table 7 results show no association between BMI and consumption of meat ($p$=0.33), chicken ($p$=0.43), turkey ($p$=0.26), fish ($p$=0.26), pork ($p$=0.69), milk ($p$=0.3), cheese ($p$=0.33) and vegetable ($p$=0.15). There was an association between BMI and egg ($p$ = 0.019) and tofu ($p$ = 0.002) consumption**.** The odds of egg consumption among overweight and obese respondents were higher than those among normal-weight respondents. The odds of tofu consumption among normal-weight respondents were higher than those of overweight and obese respondents.

## Table 5

*Prevalence of Underweight, Normal Weight, Overweight, and Obesity Utilizing BMI by Different Sub-categories of Vegetarian Diet*

| Types of Vegetarians | Underweight n (%) | Normal weight n (%) | Overweight n (%) | Obese n(%) | Total |
|---|---|---|---|---|---|
| Lacto | - | - | - | - | - |
| Ovo | - | - | - | - | - |
| Lacto-ovo | - | 1 (12.5) | 7 (87.5) | - | 8 |
| Semi | - | 14 (66.7) | 7 (33.3) | - | 21 |
| Vegan | - | 3 (100) | 0 (0) | - | 3 |
| Total | - | 18 (56.25) | 14(43.75) | - | 32 |

## Table 6

*Waist-to-Hip Ratio of Respondents by Gender*

| WHR | Vegetarian N(%) | | Non-vegetarian N(%) | |
|---|---|---|---|---|
| Gender | Male | Female | Male | Female |
| High | 1(3.1) | 14(43.8) | 12(13.4) | 39(43.8) |
| Low | 15(46.8) | 2(6.2) | 27(30.3) | 11(12.4) |
| Total | 16(49.9) | 16(50) | 39(43.8) | 50(56.1) |

## Table 7

*Association between Meat Products and BMI of Respondents*

| Variable | Option | Normal weight | Overweight & Obese | Total | Chi-Squared | *P* Value |
|---|---|---|---|---|---|---|
| Meat | No | 21 | 17 | 38 | 0.94 | 0.33 |
| | Yes | 38 | 45 | 83 | | |
| | Total | 59 | 62 | 121 | | |
| Chicken | No | 5 | 8 | 13 | 0.62 | 0.43 |
| | Yes | 54 | 54 | 108 | | |
| | Total | 59 | 62 | 121 | | |
| Turkey | No | 4 | 8 | 12 | 1.27 | 0.26 |
| | Yes | 55 | 54 | 109 | | |
| | Total | 59 | 62 | 121 | | |
| Fish | No | 4 | 8 | 12 | 1.27 | 0.26 |
| | Yes | 55 | 54 | 109 | | |
| | Total | 59 | 62 | 121 | | |
| Pork | No | 21 | 20 | 41 | 0.15 | 0.69 |
| | Yes | 38 | 42 | 80 | | |
| | Total | 59 | 62 | 121 | | |
| Egg | No | 5 | 0 | 5 | 5.48 | 0.019 |
| | Yes | 54 | 62 | 116 | | |
| | Total | 59 | 62 | 121 | | |
| Milk | No | 1 | 0 | 1 | 1.06 | 0.3 |
| | Yes | 58 | 62 | 120 | | |
| | Total | 59 | 62 | 121 | | |
| Cheese | No | 0 | 1 | 1 | 0.96 | 0.33 |
| | Yes | 59 | 61 | 120 | | |
| | Total | 59 | 62 | 121 | | |
| Vegetable | No | 4 | 1 | 5 | 2.04 | 0.15 |
| | Yes | 55 | 61 | 116 | | |
| | Total | 59 | 62 | 121 | | |
| **Tofu** | No | 0 | 9 | 9 | 9.25 | **0.002** |
| | Yes | 59 | 53 | 112 | | |
| | Total | 59 | 62 | 121 | | |

## Discussion

Of the 121 respondents, 89 were non-vegetarian, 32 were vegetarian (eight were lacto-ovo-vegetarian, 21 were semi-vegetarian, and three were vegans). Diet type influences the risk of developing chronic diseases; it is believed that dietary patterns that include plenty of fruits, vegetables, whole grains, nuts, and legumes play a significant role in lowering metabolic risk factors (Melina et al., 2016). Compared to non-vegetarians who consumed animal products, the majority of vegetarian respondents were of normal weight. In this study, vegetarians were reported to have lower BMI and WHR than non-vegetarians, which is consistent with the findings of Saintila *et al.* (2020), who observed that vegetarians had lower BMI and WC than non-vegetarians.

The links between BMI, WHR, and plant-based dietary patterns have been thoroughly studied (Spencer *et al.,* 2003; Tonstad *et al.,* 2009). Although the mechanisms of action of vegetarian diet components in relation to weight and BMI reduction are not well understood, vegetarians are assumed to consume fewer calories, low saturated fat, low consumption of animal protein, and increased intake of dietary fiber, which is beneficial for controlling calorie intake and promoting satiety (Sabaté, 2003b). Obesity was not recorded among vegetarians; however, it was recorded in 10.1% of non-vegetarians. The higher BMI of non-vegetarian respondents could be attributed to their use of animal proteins. The Adventist Health Study-1(AHS-1) collected data on fatal and non-fatal occurrences from roughly 34,000 non-Hispanic Californian Adventists. This study offered valuable information, demonstrating that obesity was less common among vegetarians, which is similar to the findings of this study (Fraser, 2003).

In terms of WHR among respondents, the risk of abdominal obesity was lower among vegetarians than among non-vegetarians; however, 43.8% of female respondents in the vegetarian population had a high WHR, which could be because the majority (65.6%) were semi-vegetarians with higher consumption of animal fat compared to vegans, where animal fat is restricted with increased consumption of bioactive components (lycopene, resveratrol, among others) from vegetables (Fraser *et al.,* 2015). However, while high WHR was identified among vegetarians, it is intriguing that a higher WHR was reported among non-vegetarians, as obesity is a risk factor for high WHR, which has not been reported among vegetarians. The percentage of vegetarians with low WHR (53.1%) compared with 42.6% of non-vegetarians indicated a lower cardiovascular risk in this group.

This study found that egg and tofu consumption had a substantial effect on BMI. Egg consumption considerably increased BMI, whereas tofu consumption significantly decreased BMI. This finding is consistent with those of other studies. In a study on the effect of whole egg intake on weight and body composition in adults, a systematic review and meta-analysis of clinical trials revealed that whole egg

intake significantly increased BMI in studies in which whole eggs were not included in the diet of controls (Emrani et al., 2023). This may be because the eggs were high in cholesterol.

According to previous research, tofu consumption may aid in weight management. A 2017 study published in the Journal of Medicinal Food discovered that overweight and obese people who ingested soy protein (including tofu) as part of a calorie-restricted diet had a lower BMI and waist circumference than those who consumed dairy protein (Jenkins *et al.,* 2017). However, other studies have found no link between tofu consumption and BMI (St-Onge *et al.,* 2007). Further research is needed to fully understand the association between tofu consumption and BMI.

This study has some limitations. The findings should be cautiously generalized because the sample was chosen using non-probability procedures, in which random selection was not considered. Furthermore, because this study did not include lifestyle and physical activity characteristics, further investigations incorporating these components are advised, as they may influence anthropometric profiles.

## Conclusion

The findings of this study revealed that vegetarians have superior anthropometric indices, with lower BMI and WHR, compared with non-vegetarians. The prevalence of obesity among non-vegetarians was high, indicating the need for nutrition education intervention on the health benefits of vegetarian diets.

## Declaration of conflicting interests

The authors declare that there is no conflict of interest.

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