



Nutritional Composition, Microbial Load of Some Pre-packaged Snacks and Safety Compliance of Informal Foodservice Operators in Oyo State

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/EJNFS/2021/v13i1030451

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/83446>

Original Research Article

Received 19 October 2021
Accepted 25 December 2021
Published 26 December 2021

ABSTRACT

Determination of the nutritional composition, microbial load, and observation of Food Health Inspector (FHI) on activities of the informal foodservice operators in some selected Local Government Areas (LGAs) in Oyo State with the view to ensure wholesome foods are sold within the study area. Proximate composition and microbial loads of some pre-packaged snacks bought from some informal foodservice operators were determined to confirm the compliance of the food with the recommended Standard Organization of Nigeria (SON) values. Questionnaire was administered to elicit information from 26 Food Health Inspectors on the activities of the Informal Foodservice Operators (IFOs) in order to ensure wholesome foods were served. The pre-packaged foods analysed in this study showed that all the pre-packaged foods contained nutrients that is above the recommended SON value. Also, the microbial load of the pre-packaged foods after three days of incubation was lower than that of the recommended SON value. The response from the food health inspectors showed that the informal foodservice operators was not conforming with the safety methods of storage and preservation of the pre-packaged food. It can be concluded that, training of the informal foodservice operator is required to reduce incidence of food poisoning and ensure that wholesome foods are served in the study area. Also, strict sanction must be put in place for the informal foodservice operators who do not comply with set rules and regulations to ensure safe pre-packaged foods are sold in Oyo State.

Keywords: Proximate composition; pre-packaged foods; Food Health inspectors; microbial load.

1. INTRODUCTION

Food is described as any substance and/or product that can be eaten or drunk by people and/or animals. It is required to maintain and increases standard of living or is used as nutrition or medical supplement [1,2]. The consumers' safety is among the primary issues to be considered in food supply chain management.

After the rapid development of many economies, quality standards, imposed on food industry, are getting much more focused on consumers' rising and persistent demand for safe food and better quality of food and beverage. Consumers' expectations and perceptions (taste, aroma, freshness, and appearance) are getting more important on a daily basis [1].

The quality of product sold is one of the most important elements for every business that offers goods and/or services. Quality concept within the foodservice system puts an importance on three key factors namely:

- i. intended purpose of product conformity;
- ii. product safety;
- iii. consumer's expectations and perceptions (Spreng and Page, 2001).

The changes in world demography have led to an estimate of about 2.5 billion people all over the world to consume food out of their homes on a daily basis, which may be because it is either assessible or convenient, [3]. This has led to increase in the consumption of pre-packaged food on a daily basis. [4] stated that 95% of working-class Nigerians in urban settings eat outside their homes and are therefore vulnerable to danger attributed to poor quality meal. Ezirigwe, [5] reported that there are over two million reported cases of food poisoning annually throughout the world with estimated deaths of two hundred thousand people in Nigeria alone which includes children.

Safe food is now recognized as one of the essential human rights due to its ability to promote good health and increase productivity for poverty reduction as the number three Sustainable Development Goal 2030 that is good health and well-being [6].

Examples of such pre-packaged food are biscuits, chin chin, doughnuts, *Akara* Ogbomosho, and *Dodo* Ikire. These type foods have been implicated in the prevalence of diet related non-communicable diseases such as chronic heart diseases, high blood pressure, diabetes that are directly associated with obesity [7,8]. Food labels have been adopted by several countries as a means of measuring and ensuring food quality and safety [9]. About 70% of deaths worldwide are attributable to non-communicable diseases (NCDS) and the cases are on the rise daily especially in developing countries like Nigeria and high consumption of prepackaged food has been implicated as part of the cause [7].

Monosodium glutamate is an excellent example of a flavour enhancer that exists naturally in proteinous meals as an amino acid called glutamate, but only as free glutamate; in salt form with sodium or potassium, it is useful in improving the flavour of foods [10]. Despite the nutritional composition of the snacks being printed on their labels, most customers are unaware of their nutritional content.

This study is aimed at determining the nutritional composition and microbial load of some selected prepackaged foods from some local government area (Oluyole, Ogbomosho, Northwest, Atiba, Kajola and Ibarapa LGA) in Oyo State, Nigeria with scores given the retailers by Food health inspectors in relation to safety of the pre-packaged.

2. MATERIALS AND METHODS

2.1 The Study Area

The study area is Oyo state, Nigeria. Oyo State is located within the southwest geopolitical zone of Nigeria alongside Ekiti, Lagos, Ogun, Ondo and Osun states. Oyo State is situated 703.6 kilometres south-west of Abuja, Nigeria's capital city, and 232.7 kilometres south of Lagos, Nigeria's commercial capital. Oyo State is the largest state by population in Nigeria's south-west geopolitical region, with a total area of 28,454 km². Kwara State borders the state on the north, Osun State on the east, Ogun State on the south, and the Republic of Benin on the west. (See Fig. 1 for the map of Oyo state) and specific local government areas to be studied are indicated in Table 1.

Table 1. Study area

| Senatorial district | LGA Urban Area | LGA Rural Area |
|---------------------|------------------|----------------|
| Oyo Central | Oluyole | Atiba |
| Oyo North | Ogbomoso south | Kajola |
| Oyo South | Ibadan northeast | Ibarapa |

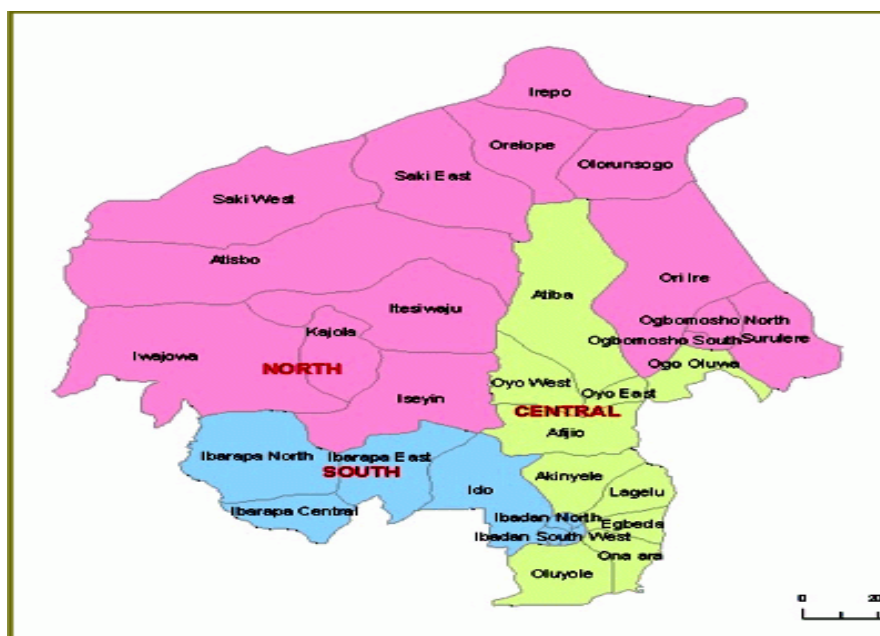


Fig. 1. Map of Oyo State

Source: <https://www.google.com/educeleb.com> assessed July, 2020

2.2 Sampling Procedures

Sample of 3 types pre-packaged foods each e.g., biscuit, coconut chips, *akara* Ogbomoso, *dodo ikire* amongst others sold by the mobile and semi-mobile foodservice operators were selected for proximate and microbial analysis from the six selected LGA in the study area as shown in Table 2. These samples were selected because they expose their product to dust, and may not exhaust the product daily and there is no form of preservation.

2.3 Sample Preparation

The pre-packaged snacks were weighed, dried in the oven (Gallenkamp Oven Model SA 9059 B) at 50°C, ground into powder and then sieved with No 72 mesh size (Griffin and George Ltd., London). The samples were stored in plastic containers with screw cap and kept in the freezer until use. Association of official analytical chemist [11] method was used to determine moisture content, total ash content, carbohydrate, crude protein, crude fats, and oil.

Table 2. Selected pre-packaged foods for proximate and microbial analysis

| LGA | Pre-packaged food |
|-------------------|--|
| Oluyole | <i>Dodo</i> Ikire Coconut chips Phocus crunchy Chin chin, |
| Ogbomoso south | <i>akara</i> Ogbomoso Meatpie <i>Dodo</i> ikire, |
| Ibadan north east | Potato chips Sausage |
| Atiba | Cracker biscuit, Coconut chips Phocus crunchy Cracker biscuits, |
| Kajola | Chin chin Potato chips Cracker biscuits, |
| Ibarapa | Phocus crunchy Coconut chips |

2.4 Proximate Analysis

Moisture, ash, crude fibre of the pre-packaged snacks was determined using AOAC, 2000. The

Kjeldhal method of AOAC [11] was used to determine the protein content of the sample. Fat content of the sample was determined using Soxhlet method. The percentage carbohydrate content was calculated by difference.

$$\text{Carbohydrate content (\%)} = 100\% - (\% \text{ moisture} + \% \text{ Ash} + \% \text{ crude protein} + \% \text{ crude fibre} + \% \text{ crude fat})$$

2.5 Energy Value

This was calculated by multiplying the values of crude protein, crude fat, and carbohydrate by factors of 4, 9 and 4, respectively. The sum of their product was expressed in kilocalories [11].

$$\text{Energy value (Kcal)} = (\text{Carbohydrate} \times 4) + (\text{Protein} \times 4) + (\text{Crude fat} \times 9)$$

2.6 Microbial Analysis

Ten grams of food sample was blended and homogenized in 90 mL sterile distilled water (10-1 dilution). Further tenfold serial dilution of the resultant homogenates was made to obtain 10^{-3} dilution respectively. From this dilution, aliquots of 0.1 mL were inoculated in replicate plates of different media using the spread plate technique (Adesetan et al., 2013). Nutrient agar (Oxoid) was inoculated for total aerobic count and Eosin Methylene Blue agar was used as a selective medium for the growth of the coliform bacteria to be incubated at 37°C for 24-72h. Colonies was counted at the end of the incubation period and expressed as Log CFU/g (Fawole, 1986).

2.7 Food Health Inspectors' Evaluation of the Informal Food Service Operators' Activities

Quantitative analysis was used to obtain information from five Food health Inspectors from each LGA on the activities of the IFOs in the study areas. The questionnaire was used to elicit information on the quality of the prepackaged food sold, safety of the pre-packaged snacks, the hygienic practices of the operators and the availability of facilities to ensure safety. Twenty - six of the questionnaire was returned. See appendix 1 for the questionnaire.

2.8 Statistical Analysis

All laboratory experiments were carried out in triplicates and results presented as mean and standard deviation of replicate analysis (N=3) of

samples collected for each food type. ANOVA was used to assess and compare result and calculations made using IBM SPSS 20.0 for windows.

3. RESULTS AND DISCUSSION

3.1 Proximate Composition of the Pre-Packaged Snacks

Table 3 shows the proximate composition results of some of the pre-packaged snack bought from the informal food service operators (IFOs) in some of the LGA in Oyo State. The crude protein values ranged between 1.4% and 15.1%. With coconut chips being the lowest and meat-pie being the highest, this may be due to addition of meat in the pre-packaged food. The protein content in *akara Ogbomosho* is 12.9% which may be due to the major ingredient in the preparation of the pre-packaged snack (*Akara Ogbomosho*). The SON standard required a less than 5% crude protein content of which most the pre-packaged food samples exceed. Although potato chips have lower crude protein content when compared with the report of (Kolawole et al., 2020) who reported an increase in protein content of Potato chips made from orange flesh sweet potato.

The crude fat content ranged from 3.6% to 29.7%. With *dodo Ikire* having the highest value and cracker biscuit having the lowest, also coconut chips and *Akara Ogbomosho* also has a significantly high crude fat content 25.6 and 23.9% respectively, the high level of crude fat in *dodo Ikire* is due the amount of palm oil used to prepare the food this similar to the report of [12] which suggested that it is a major source of cholesterol to the over ripe plantain could pose deleterious effect on susceptible person consuming foods containing high cholesterol. The fat and ash content of coconut chips reported by Manikantan [13] was higher than the value reported in this study However, according to Sajilata et al., [14] higher fat content within a certain limit makes digestibility difficult and causes rancidity in stored foods. The required standard should be between 10-25% of which *dodo Ikire* was the only product that exceed this standard.

The crude fibre content ranged between 0.3% and 6.8%, the lowest value being for *Akara Ogbomosho*, and the highest value was for cracker biscuit. The fibre content for cracker biscuit and coconut chips were significantly low

when compared with the required standard for pre-packaged foods of less than 0.5%. It is known that fibre helps eliminate waste from the gastrointestinal tract because of its ability to bind water and thus soften the stool (Capuarno, 2017).

The ash content of the pre-packaged foods was between 0.5% and 5.2% with cracker biscuit and focus crunchy being highest and *dodo Ikire* being the lowest. The two biscuits with high total ash content may be due to deliberate attempt to increase its total ash content by adding some mineral during processing which is evident in the ingredient added. The total ash content of *dodo Ikire*, coconut chips and potato chips were all significantly below the required standard of less than 2% for pre-packaged food, this is worthy of note that they are not industrially packaged food. It has been reported that total ash content in food reduces with fermentation which may be due to usage of minerals by inherent microorganisms for metabolic activities [15].

Carbohydrate content ranged from 51.0% (Akara Ogbomoso) to 75.2% for Chin chin. The carbohydrate content for Chin chin was significantly ($P < 0.05$) higher than acceptable standard for CHO in pre-packaged foods of less than 50% while all the food sample were within the standard required.

Energy value ranged between 341.8 kcal/100 g for cracker biscuit to 522.1 kcal/100 g for *dodo Ikire*. The energy value for *dodo Ikire* was significantly higher than the required range allowed of 400 – 425 kcal while the energy value for chin chin was significantly lower, this value may not be effective especially during illness such as diarrhoea. supplying adequate energy for children. According to Brown [16], an energy density of 50 Kcal per gram of food can meet the energy need of children with three to four meals a day.

Generally, the proximate composition of all the food samples bought from the IFOs and analysed have similar proximate values. This may be because they are industrially packaged product except product like *Dodo Ikire*, Akara Ogbomoso, Meat pie, Coconut chips, Chin chin and Sausage roll which are produced by IFOs who are not registered with the government. Food products like Phocus Crunchy and cracker

biscuit have been commercialized by big companies in Nigeria and they are distributed all over the country. This company utilized more technology in all aspect of the business and so have higher technological capability. The locally produced food has no information on their packaging except for the product name unlike the industrially packaged food that have name, address of manufacturer, nutritional fact, shelf life and batch number.

The producer of chin chin, *dodo Ikire*, Akara Ogbomoso are sole owner who lack capacity to invest in adequate technology need to ensure safety, this done at the detriment of the public and this fault cannot be traced to them.

3.2 Total Plate Count of the Pre-packaged Snacks

The total plate counts results of the pre-packaged snacks bought from IFOs in six LGA in Oyo State are shown in Table 3. The microbial growth after 72 h was still below the recommended standard for all the food samples. The total plate count of Coconut chips also increased with increase in days of incubation. The results were similar with highest values (4.01×10^3 , 4.20×10^3 and 4.20×10^3 cfu/g) after 72 h of incubation. The microbial growth from Chin chin were 3.30×10^3 cfu/g (Oluyole LGA), 3.50×10^3 cfu/g (Atiba LGA) and 3.35×10^3 cfu/g (Ibarapa LGA). There was slightly difference in microbial growth in Chin chin and this may be due to different handling after processing and effects of packaging material on the product.

The total plate count of Phocus crunchy was among the highest in all the food samples bought from the IFOs. The total plate count was 5.15×10^3 cfu/g (Ogbomoso LGA) and 5.30×10^3 cfu/g (Kajola LGA) after 72 h of incubation. The increase in the total plate count may be due to the fermentation process involved in the production of cracker biscuit. The total plate count of Potato chip was 1.20×10^1 cfu/g and 1.25×10^1 cfu/g (Ibadan Northeast and Kajola LGA) for the first 24 h. After 48 h of incubation, the total plate count of Potato chip increased to 2.30×10^2 cfu/g and 2.50×10^2 cfu/g. The 72h total plate count of Potato chip was 3.15×10^3 cfu/g and 3.20×10^3 cfu/g respectively.

Table 3. Proximate content of pre-packaged foods from different Informal IFO in the study area

| LGA | Moisture content w/w (%) | Crude protein w/w (%) | Crude fat w/w (%) | Ash content w/w (%) | Crude fibre w/w (%) | CHO w/w (%) | Energy (Kcal) |
|------------------------|--------------------------|-------------------------|-------------------------|------------------------|------------------------|-------------------------|---------------------------|
| SON | 6.0 max | 5.0 min | 10-25 max | 2.0 max | 0.5 max | 50 min | 400-425 min |
| Cracker biscuit | | | | | | | |
| Atiba | 7.2 ± 0.8 ^b | 11.2 ± 0.7 ^c | 3.6 ± 0.1 ^a | 4.2 ± 0.3 ^b | 5.2 ± 0.4 ^a | 68.6 ± 1.2 ^b | 351.6 ± 12 ^b |
| Kajola | 8.3 ± 0.4 ^c | 9.8 ± 0.5 ^a | 4.2 ± 0.3 ^b | 5.2 ± 0.4 ^c | 6.3 ± 0.4 ^b | 66.2 ± 1.1 ^a | 341.8 ± 11 ^a |
| Ibarapa | 5.0 ± 0.2 ^a | 10.2 ± 0.4 ^b | 4.4 ± 0.7 ^b | 3.5 ± 0.2 ^a | 6.8 ± 0.4 ^b | 70.1 ± 0.8 ^b | 358.8 ± 8.5 ^c |
| Dodo Ikire | | | | | | | |
| Oluyole | 4.9 ± 0.2 ^a | 8.2 ± 0.9 ^a | 29.7 ± 0.1 ^b | 0.6 ± 0.1 ^a | 1.1 ± 0.2 ^a | 55.5 ± 2.4 ^a | 522.1 ± 23 ^b |
| Ibadan Northeast | 4.7 ± 0.2 ^a | 8.0 ± 0.7 ^a | 27.8 ± 0.2 ^a | 0.5 ± 0.1 ^a | 1.0 ± 0.3 ^a | 58.0 ± 0.8 ^b | 515.1 ± 19 ^a |
| Coconut chips | | | | | | | |
| Oluyole | 3.3 ± 0.2 ^a | 1.4 ± 0.1 ^a | 25.6 ± 0.8 ^c | 1.1 ± 0.1 ^a | 6.2 ± 0.3 ^a | 62.5 ± 1.7 ^a | 486.0 ± 12.3 ^c |
| Atiba | 3.1 ± 0.1 ^a | 1.5 ± 0.1 ^a | 22.7 ± 0.7 ^a | 1.3 ± 0.1 ^a | 6.0 ± 0.4 ^a | 65.4 ± 1.2 ^b | 471.9 ± 11 ^a |
| Ibarapa | 3.5 ± 0.2 ^a | 1.6 ± 0.2 ^a | 23.6 ± 0.4 ^b | 1.3 ± 0.1 ^a | 6.4 ± 0.4 ^a | 63.6 ± 1.5 ^a | 473.2 ± 9.4 ^b |
| Phocus crunchy | | | | | | | |
| Oluyole | 4.5 ± 0.3 ^b | 5.2 ± 0.3 ^a | 14.1 ± 1.2 ^a | 4.9 ± 0.2 ^b | 2.1 ± 0.2 ^a | 69.3 ± 2.6 ^a | 424.9 ± 11.1 ^a |
| Atiba | 4.1 ± 0.2 ^a | 5.0 ± 0.4 ^a | 14.2 ± 0.1 ^a | 4.5 ± 0.1 ^a | 2.2 ± 0.1 ^a | 70.0 ± 1.6 ^b | 427.8 ± 9.0 ^b |
| Ibarapa | 4.6 ± 0.4 ^b | 5.5 ± 0.2 ^a | 15.2 ± 0.8 ^b | 5.1 ± 0.3 ^b | 2.0 ± 0.1 ^a | 67.6 ± 0.8 ^a | 429.2 ± 10.0 ^c |
| Chin chin | | | | | | | |
| Ogbomoso | 8.9 ± 0.9 ^a | 10.2 ± 0.8 ^a | 2.8 ± 0.4 ^a | 2.0 ± 0.1 ^a | 0.8 ± 0.5 ^a | 74.8 ± 3.4 ^a | 365.2 ± 5.5 ^a |
| Kajola | 8.7 ± 0.6 ^a | 10.4 ± 0.6 ^a | 2.6 ± 0.4 ^a | 2.2 ± 0.1 ^a | 0.9 ± 0.2 ^a | 75.2 ± 2.2 ^a | 365.8 ± 5.6 ^a |
| Potato chips | | | | | | | |
| Ibadan Northeast | 4.4 ± 0.1 ^a | 6.5 ± 0.4 ^a | 12.6 ± 0.5 ^a | 2.7 ± 0.6 ^a | 3.2 ± 0.5 ^a | 70.6 ± 1.6 ^a | 421.8 ± 6.1 ^a |
| Kajola | 4.3 ± 0.2 ^a | 6.8 ± 0.6 ^a | 12.9 ± 1.1 ^a | 2.4 ± 0.5 ^a | 3.4 ± 0.6 ^a | 70.6 ± 1.6 ^a | 425.7 ± 5.8 ^b |
| Meat pie | | | | | | | |
| Ogbomoso | 8.9 ± 0.3 ^a | 15.1 ± 0.8 ^a | 14.5 ± 0.6 ^a | 4.2 ± 0.5 ^a | 0.6 ± 0.1 ^a | 56.7 ± 0.8 ^a | 417.7 ± 4.8 ^a |
| Sausage | | | | | | | |
| Ibadan Northeast | 5.7 ± 0.2 ^a | 9.6 ± 0.5 ^a | 13.6 ± 0.7 ^a | 3.6 ± 0.6 ^a | 0.4 ± 0.1 ^a | 67.1 ± 0.9 ^a | 429.2 ± 6.3 ^a |
| Akara Ogbomoso | | | | | | | |
| Ogbomoso | 7.6 ± 0.4 ^a | 12.9 ± 0.4 ^a | 23.9 ± 0.5 ^a | 4.3 ± 0.4 ^a | 0.3 ± 0.1 ^a | 51.0 ± 0.7 ^a | 470.7 ± 9.1 ^a |

Table 4. Mean total plate count of pre-packaged foods from different IFOs in six LGA in Oyo state

| LGA | Day 0 (cfu/g) | Day 1 (cfu/g) | Day 2 (cfu/g) | Day 3 (cfu/g) |
|------------------------|---------------|----------------------|----------------------|----------------------|
| Cracker Biscuit | | | | |
| Atiba | NG | $1.45^a \times 10^1$ | $2.70^a \times 10^2$ | $3.10^a \times 10^3$ |
| Kajola | NG | $1.50^a \times 10^1$ | $2.65^a \times 10^2$ | $3.00^a \times 10^3$ |
| Ibarapa | NG | $1.45^a \times 10^1$ | $2.60^a \times 10^2$ | $3.20^a \times 10^3$ |
| Dodo Ikire | | | | |
| Oluyole | NG | $1.30^a \times 10^1$ | $1.90^b \times 10^2$ | $2.95^b \times 10^3$ |
| Ibadan Northeast | NG | $1.35^b \times 10^1$ | $1.85^a \times 10^2$ | $2.90^a \times 10^3$ |
| Coconut Chips | | | | |
| Oluyole | NG | $1.95^b \times 10^1$ | $2.50^b \times 10^2$ | $4.01^a \times 10^3$ |
| Atiba | NG | $2.00^b \times 10^1$ | $2.30^a \times 10^1$ | $4.20^a \times 10^3$ |
| Ibarapa | NG | $1.75^a \times 10^1$ | $2.80^b \times 10^2$ | $4.20^a \times 10^3$ |
| Chin chin | | | | |
| Oluyole | NG | $1.80^a \times 10^1$ | $2.05^a \times 10^2$ | $3.30^a \times 10^3$ |
| Atiba | NG | $1.90^b \times 10^4$ | $2.30^a \times 10^2$ | $3.50^b \times 10^3$ |
| Ibarapa | NG | $1.85^b \times 10^1$ | $2.20^a \times 10^2$ | $3.35^a \times 10^3$ |
| Phocus Crunchy | | | | |
| Ogbomoso | NG | $3.30^a \times 10^1$ | $4.35^a \times 10^2$ | $5.15^a \times 10^3$ |
| Kajola | NG | $3.35^a \times 10^1$ | $4.40^a \times 10^2$ | $5.30^a \times 10^3$ |
| Potato Chips | | | | |
| Ibadan Northeast | NG | $1.20^a \times 10^1$ | $2.30^a \times 10^2$ | $3.15^a \times 10^3$ |
| Kajola | NG | $1.25^b \times 10^1$ | $2.50^b \times 10^2$ | $3.20^a \times 10^3$ |
| Meat pie | | | | |
| Ogbomoso | NG | $4.40^a \times 10^1$ | $4.40^a \times 10^2$ | $4.80^a \times 10^3$ |
| Sausage roll | | | | |
| Ibadan Northeast | NG | $2.25^a \times 10^1$ | $2.55^a \times 10^3$ | $3.70^a \times 10^3$ |
| Akara Ogbomoso | | | | |
| Ogbomoso | NG | $3.75^a \times 10^1$ | $4.70^a \times 10^2$ | $5.80^a \times 10^3$ |

NG- No growth. mean \pm SD are from three different measurements. Values with different superscripts on the same row are significantly different at $p \leq 0.05$.

Table 5. Food health inspector's (FHIs) evaluation of the informal IFOs activities

| Description of Item | 1 | 2 | 3 | Mean |
|---|----------|----------|---------|------|
| Quality of meal served by the IFO | 7(26.9) | 11(42.3) | 8(30.8) | 2.0 |
| Safety of meal served | 9(34.6) | 11(42.3) | 6(23.1) | 1.9 |
| Hygienic practices | 13(50.0) | 5(19.2) | 8(30.8) | 1.8 |
| Availability of facilities to ensure safety | 5(19.2) | 13(50.0) | 8(30.8) | 2.1 |

Source: Author's survey, (2020); 1 -Not Satisfactory; 2 -Satisfactory; 3 -Highly Satisfactory

Biscuits bought from the informal food operators have total plate count of 1.45×10^1 , 2.70×10^2 , and 3.10×10^3 cfu/g, (Atiba LGA), 1.50×10^1 , 2.65×10^2 , 3.00×10^3 cfu/g (Kajola LGA) and 1.45×10^1 , 2.60×10^2 , and 3.20×10^3 cfu/g (Ibarapa LGA) for 24, 48 and 72 h of incubation. The total plate count of Biscuit was similar in the three LGA sampled. Akara Ogbomoso has total plate count of 3.75×10^1 , 4.70×10^2 and 5.80×10^3 cfu/g (Ogbomoso LGA) for 24, 48 and 72 h of incubation respectively. Meat pie has total plate count of 4.40×10^1 , 4.40×10^2 , 4.80×10^3 cfu/g (Ogbomoso LGA) for 24, 48 and 72 h of incubation. The total plate count of Meat pie was

the highest for the first 24 h when compared to the rest of the samples, and there was a slight increase in the total plate count after 72 h. Sausage roll total plate count was 2.25×10^1 , 2.55×10^2 and 3.70×10^3 cfu/g (Ibadan Northeast LGA) for 24, 48 and 72 h of incubation.

3.3 The Activities of Food Health Inspectors on the Operation of the Informal Foodservice System

The Table 4 report the activities of the food health inspector towards ensuring that wholesome food is produced by the IFO. The

frequency of visit by the health inspector to the IFO was mainly on a quarterly basis (65.3%) This may be due to lack of enough resources to increase their visit to the operation sites of the IFOs. About 23.1% of the health inspectors visited them monthly for inspection area although this is not the case for this operator who have a high attitude towards food hygiene practices this is similar to the report of Osagbemi et al., [17] that food handlers in Okene area have positive attitude towards food safety.

The food inspectors conducted workshop or training on food handling practices for the foodservice operator. About 55.5% did so quarterly, 25.9% did it yearly, while 18.5% did so monthly. This training workshop could enhance their knowledge food safety and hygienic practice in the foodservice system. About 70.4% of the food service operators had equipment such as freezer, warmers, glass, or mesh display to prevent food contamination.

About 25.9% of the health inspector's safety guides and standards for the inspection of the foodservice operators, 44.4% said they did not, while 29% were not aware of the standard. This implies that most of these inspectors did not have copies of this standard. The standard sanctions for defaulter as responded by the inspectors is permanent closure 18.5% and temporary (37%) closure of site of the food service system. About 37% impose fine while the remaining 18.5% used either of the options.

The amount of fine imposed on the foodservice operating in an unhygienic or wholesome environment vary from below N50,000 to above N100,000 showing that 51.9% was below N50,000, 22.2% was between N50,000 and N100,000 and the remaining 25.9% was above N100,000 this amount was paid into the government account of which receipt of payment was issued before the closed outlet is opened for continuation of operation.

From the Table 4 it was gathered that the mean rating for the quality of meal served by the operator was satisfactory to the health inspectors, and they also satisfied with the safety of meal served (1.9) the FHI was also satisfied with the hygienic practice of the operators within the study area. The FHI were satisfied with availability of facilities to ensure safe quality meals are prepared. In the same vein, 42.3% and 23.1% of the sampled food inspectors were

satisfied and also highly satisfied with the quality of the meal served.

In related form, trainers also need training, which is popularly refers to train the trainers program. The Table 4 report the frequency of the training received by the food health inspectors. The outcome of the analysis shows that they train the food health inspectors yearly either as a refresher course and new training programme. Which is similar to what [17] and [18] suggested that both the operators and health inspectors require to be trained frequently in order to have a wholesome food being served in the community where they operated.

4. CONCLUSION

The nutritional composition and the microbial loads of all the pre-packaged snacks use in this study do not deviate from the SON (Standard Organisation of Nigeria) given standard. This means that in influence of informal foodservice operators is not affecting the quality of the pre-packaged foods. The report from the food health inspectors in the study area shows that the informal foodservice operators are not conforming to the rules and regulation guiding the sales of some of the pre-packaged snacks. Strict punishment must be put in place for any informal foodservice operators that deviate from the laydown rules and regulations.

ACKNOWLEDGEMENT

The authors would like to acknowledge all the authors that their work was used for this manuscript. Also, Obafemi Awolowo University for the privilege to carry out this study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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APPENDIX 1. Effect of the Activities of FHIs on the operation of the Informal Foodservice System

Please rate the followings parameters as it concerns the informal foodservice operators in your LGA based on the degree of importance within your LGA on the following scale as. Not satisfactory (NS), Satisfactory (S), Highly satisfactory (HS). (Tick as many that apply)

| S/No. | Description of Item | Not Satisfactory | Satisfactory | Highly Satisfactory |
|-------|---|------------------|--------------|---------------------|
| (a) | Quality of meal served by the operator | | | |
| (b) | Safety of meal served | | | |
| (c) | Hygienic practices | | | |
| (d) | Availability of facilities to ensure safety | | | |

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