

1           **Nutritional composition, microbial load of some pre-packaged snacks and safety**  
2           **compliance of informal foodservice operators in Oyo State**

3  
4   **Abstract**

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

23  
24   **Keywords:** *Proximate composition, pre-packaged foods, Food Health inspectors, microbial*  
25   *load*

26  
27   **1.0 Introduction**

28   Food is described as any substance and/or product that can be eaten or drunk by people  
29   and/or animals. It is required to maintain and increases standard of living or is used as  
30   nutrition or medical supplement (Savov and Kouzmanov, 2009; Hardy, *et al.*, 2022). The  
31   consumers' safety is among the primary issues to be considered in food supply chain  
32   management.

33 After the rapid development of many economies, quality standards, imposed on food  
34 industry, are getting much more focused on consumers' rising and persistent demand for safe  
35 food and better quality of food and beverage. Consumers' expectations and perceptions (taste,  
36 aroma, freshness, and appearance) are getting more important on a daily basis (Savov and  
37 Kouzmanov, 2009).

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

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

44 The changes in world demography have led to an estimate of about 2.5 billion people all over  
45 the world to consume food out of their homes on a daily basis, which may be because it is  
46 either assessable or convenient, (Fellows and Hilmi, 2018). This has led to increase in the  
47 consumption of pre-packaged food on a daily basis. (Akanji *et al.*, 2016) stated that 95% of  
48 working-class Nigerians in urban settings eat outside their homes and are therefore vulnerable  
49 to danger attributed to poor quality meal. Ezirigwe, (2018) reported that there are over two  
50 million reported cases of food poisoning annually throughout the world with estimated deaths  
51 of two hundred thousand people in Nigeria alone which includes children.

52 Safe food is now recognized as one of the essential human rights due to its ability to promote  
53 good health and increase productivity for poverty reduction as the number three Sustainable  
54 Development Goal 2030 that is good health and well-being (De Neve and Sachs, 2020).

55 Examples of such pre-packaged food are biscuits, chin chin, doughnuts, *Akara* Ogbomoshu,  
56 and *Dodo* Ikire. These type foods have been implicated in the prevalence of diet related non-  
57 communicable diseases such as chronic heart diseases, high blood pressure, diabetes that are  
58 directly associated with obesity (Olatona *et al.*, 2019; Taiwo *et al.*, 2002). Food labels have  
59 been adopted by several countries as a means of measuring and ensuring food quality and  
60 safety (Kasapila and Shawa, 2011). About 70% of deaths worldwide are attributable to non-  
61 communicable diseases (NCDS) and the cases are on the rise daily especially in developing

62 countries like Nigeria and high consumption of prepackaged food has been implicated as part  
63 of the cause (Olatona *et al.*, 2019).

64 Monosodium glutamate is an excellent example of a flavour enhancer that exists naturally in  
65 proteinous meals as an amino acid called glutamate, but only as free glutamate; in salt form  
66 with sodium or potassium, it is useful in improving the flavour of foods (Otemuyiwa and  
67 Adewusi, 2014). Despite the nutritional composition of the snacks being printed on their  
68 labels, most customers are unaware of their nutritional content.

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

## 73 **2.0 Materials and Methods**

### 74 **2.1 The study area**

75 The study area is Oyo state, Nigeria. Oyo State is located within the southwest geopolitical  
76 zone of Nigeria alongside Ekiti, Lagos, Ogun, Ondo and Osun states. Oyo State is situated  
77 703.6 kilometres south-west of Abuja, Nigeria's capital city, and 232.7 kilometres south of  
78 Lagos, Nigeria's commercial capital. Oyo State is the largest state by population in Nigeria's  
79 south-west geopolitical region, with a total area of 28,454 km<sup>2</sup>. Kwara State borders the state  
80 on the north, Osun State on the east, Ogun State on the south, and the Republic of Benin on  
81 the west. (See Fig 1 below for the map of Oyo state) and specific local government areas to  
82 be studied are indicated in Table 1.

83

84 **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

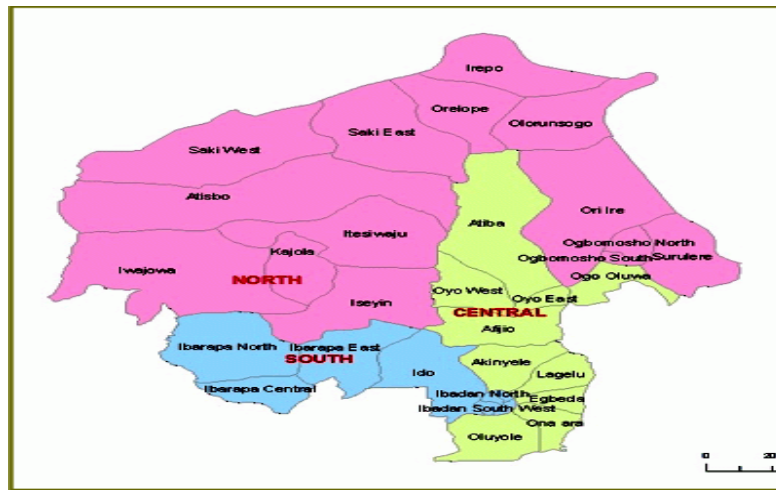
85

86

87

88

89



**Figure. 3.2** 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 2.2. 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.

**Table 2 Selected Pre-packaged Foods for Proximate and Microbial Analysis**

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

	Potato chips	107
Ibarapa	Cracker biscuits, Phocus crunchy	108
	Coconut chips	109

110

111

112

### 113 **2.3 Sample preparation**

114 The pre-packaged snacks were weighed, dried in the oven (Gallenkamp Oven Model SA  
115 9059 B) at 50°C, ground into powder and then sieved with No 72 mesh size (Griffin and  
116 George Ltd., London). The samples were stored in plastic containers with screw cap and kept  
117 in the freezer until use. Association of official analytical chemist (AOAC,2000) method was  
118 used to determine moisture content, total ash content, carbohydrate, crude protein, crude fats,  
119 and oil

120

### 121 **2.4 Proximate analysis**

122 Moisture, ash, crude fibre of the pre-packaged snacks was determined using AOAC, 2000.  
123 The Kjeldhal method of AOAC (2000) was used to determine the protein content of the  
124 sample. Fat content of the sample was determined using Soxhlet method. The percentage  
125 carbohydrate content was calculated by difference.

126 Carbohydrate content (%) = 100% - (% moisture + % Ash + % crude protein + % crude fibre +  
127 % crude fat)

128

### 129 **2.5 Energy value**

130 This was calculated by multiplying the values of crude protein, crude fat, and carbohydrate  
131 by factors of 4, 9 and 4, respectively. The sum of their product was expressed in kilocalories  
132 (AOAC, 2000).

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

133

### 134 **2.6 Microbial analysis**

135 Ten grams of food sample was blended and homogenized in 90 mL sterile distilled water (10-  
136 1 dilution). Further tenfold serial dilution of the resultant homogenates was made to obtain  
137 10<sup>-3</sup> dilution respectively. From this dilution, aliquots of 0.1 mL were inoculated in replicate  
138 plates of different media using the spread plate technique (Adesetan *et al.*,2013). Nutrient  
139 agar (Oxoid) was inoculated for total aerobic count and Eosin Methylene Blue agar was used

140 as a selective medium for the growth of the coliform bacteria to be incubated at 37°C for 24-  
141 72h. Colonies was counted at the end of the incubation period and expressed as Log CFU/g  
142 (Fawole, 1986).

143

## 144 **2.7 Food health inspectors' evaluation of the informal food service operators'** 145 **activities**

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

## 151 **2.8 Statistical analysis**

152 All laboratory experiments were carried out in triplicates and results presented as mean and  
153 standard deviation of replicate analysis (N=3) of samples collected for each food type.  
154 ANOVA was used to assess and compare result and calculations made using IBM SPSS 20.0  
155 for windows

## 156 **3.0 Results and discussions**

### 157 **3.1 Proximate composition of the pre-packaged snacks**

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

168 The crude fat content ranged from 3.6% to 29.7 %. With *dodo Ikire* having the highest value  
169 and cracker biscuit having the lowest, also coco nut chips and *Akara Ogbomosho* also has a  
170 significantly high crude fat content 25.6 and 23.9 % respectively, the high level of crude fat  
171 in *dodo Ikire* is due the amount of palm oil used to prepare the food this similar to the report  
172 of (Kayode *et al.*, 2013) which suggested that it is a major source of cholesterol to the over

173 ripe plantain could pose deleterious effect on susceptible person consuming foods containing  
174 high cholesterol. The fat and ash content of coconut chips reported by Manikantan (2016)  
175 was higher than the value reported in this study However, according to Sajilata *et al.*, (2002)  
176 higher fat content within a certain limit makes digestibility difficult and causes rancidity in  
177 stored foods. The required standard should be between 10-25% of which *dodo Ikire* was the  
178 only product that exceed this standard.

179 The crude fibre content ranged between 0.3% and 6.8%, the lowest value being for *Akara*  
180 *Ogbomosho*, and the highest value was for cracker biscuit. The fibre content for cracker  
181 biscuit and coconut chips were significantly low when compared with the required standard  
182 for pre-packaged foods of less than 0.5%. It is known that fibre helps eliminate waste from  
183 the gastrointestinal tract because of its ability to bind water and thus soften the stool  
184 (Capuarno, 2017).

185 The ash content of the pre-packaged foods was between 0.5% and 5.2% with cracker biscuit  
186 and focus crunchy being highest and *dodo Ikire* being the lowest. The two biscuits with high  
187 total ash content may be due to deliberate attempt to increase its total ash content by adding  
188 some mineral during processing which is evident in the ingredient added. The total ash  
189 content of *dodo Ikire*, coconut chips and potato chips were all significantly below the  
190 required standard of less than 2% for pre-packaged food, this is worthy of note that they are  
191 not industrially packaged food. It has been reported that total ash content in food reduces with  
192 fermentation which may be due to usage of minerals by inherent microorganisms for  
193 metabolic activities (Osundahunsi and Aworh, 2003).

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

198 Energy value ranged between 341.8 kcal/100g for cracker biscuit to 522.1 kcal/100g for *dodo*  
199 *Ikire*. The energy value for *dodo Ikire* was significantly higher than the required range  
200 allowed of 400 – 425kcal while the energy value for chin chin was significantly lower, this  
201 value may not be effective especially during illness such as diarrhoea. supplying adequate  
202 energy for children. According to Brown (1991), an energy density of 50 Kcal per gram of  
203 food can meet the energy need of children with three to four meals a day.

204 Generally, the proximate composition of all the food samples bought from the IFOs and  
205 analysed have similar proximate values. This may be because they are industrially packaged  
206 product except product like Dodo Ikire, Akara Ogbomosho, Meat pie, Coconut chips, Chin  
207 chin and Sausage roll which are produced by IFOs who are not registered with the  
208 government. Food products like Phocus Crunchy and cracker biscuit have been  
209 commercialized by big companies in Nigeria and they are distributed all over the country.  
210 This company utilized more technology in all aspect of the business and so have higher  
211 technological capability. The locally produced food has no information on their packaging  
212 except for the product name unlike the industrially packaged food that have name, address of  
213 manufacturer, nutritional fact, shelf life and batch number.

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

217

218

219



### 251 **3.2 Total plate count of the pre-packaged snacks**

252 The total plate counts results of the pre-packaged snacks bought from IFOs in six LGA in  
253 Oyo State are shown in Table 3. The microbial growth after 72 h was still below the  
254 recommended standard for all the food samples. The total plate count of Coconut chips also  
255 increased with increase in days of incubation. The results were similar with highest values  
256 ( $4.01 \times 10^3$ ,  $4.20 \times 10^3$  and  $4.20 \times 10^3$  cfu/g) after 72 h of incubation. The microbial growth  
257 from Chin chin were  $3.30 \times 10^3$  cfu/g (Oluyole LGA),  $3.50 \times 10^3$  cfu/g (Atiba LGA) and  $3.35$   
258  $\times 10^3$  cfu/g (Ibarapa LGA). There was slightly difference in microbial growth in Chin chin  
259 and this may be due to different handling after processing and effects of packaging material  
260 on the product.

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

269 Biscuits bought from the informal food operators have total plate count of  $1.45 \times 10^1$ ,  $2.70 \times$   
270  $10^2$ , and  $3.10 \times 10^3$  cfu/g, (Atiba LGA),  $1.50 \times 10^1$ ,  $2.65 \times 10^2$ ,  $3.00 \times 10^3$  cfu/g (Kajola LGA)  
271 and  $1.45 \times 10^1$ ,  $2.60 \times 10^2$ , and  $3.20 \times 10^3$  cfu/g (Ibarapa LGA) for 24, 48 and 72 h of  
272 incubation. The total plate count of Biscuit was similar in the three LGA sampled. Akara  
273 Ogbomoso has total plate count of  $3.75 \times 10^1$ ,  $4.70 \times 10^2$  and  $5.80 \times 10^3$  cfu/g (Ogbomoso  
274 LGA) for 24, 48 and 72 h of incubation respectively. Meat pie has total plate count of  $4.40 \times$   
275  $10^1$ ,  $4.40 \times 10^2$ ,  $4.80 \times 10^3$  cfu/g (Ogbomoso LGA) for 24, 48 and 72 h of incubation. The  
276 total plate count of Meat pie was the highest for the first 24 h when compared to the rest of  
277 the samples, and there was a slight increase in the total plate count after 72 h. Sausage roll  
278 total plate count was  $2.25 \times 10^1$ ,  $2.55 \times 10^2$  and  $3.70 \times 10^3$  cfu/g (Ibadan Northeast LGA) for  
279 24, 48 and 72 h of incubation.

280  
281  
282

**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)
<b>Cracker Biscuit</b>				
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	$1.45^a \times 10^1$	$2.60^a \times 10^2$	$3.20^a \times 10^3$
<b>Dodo Ikire</b>				
Oluyole	NG	$1.30^a \times 10^1$	$1.90^b \times 10^2$	$2.95^b \times 10^3$
Ibadan Northeast	NG	$1.35^b \times 10^1$	$1.85^a \times 10^2$	$2.90^a \times 10^3$
<b>Coconut Chips</b>				
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	$1.75^a \times 10^1$	$2.80^b \times 10^2$	$4.20^a \times 10^3$
<b>Chin chin</b>				
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	$1.85^b \times 10^1$	$2.20^a \times 10^2$	$3.35^a \times 10^3$
<b>Phocus Crunchy</b>				
Ogbomoso	NG	$3.30^a \times 10^1$	$4.35^a \times 10^2$	$5.15^a \times 10^3$
Kajola	NG	$3.35^a \times 10^1$	$4.40^a \times 10^2$	$5.30^a \times 10^3$
<b>Potato Chips</b>				
Ibadan Northeast	NG	$1.20^a \times 10^1$	$2.30^a \times 10^2$	$3.15^a \times 10^3$
Kajola	NG	$1.25^b \times 10^1$	$2.50^b \times 10^2$	$3.20^a \times 10^3$
<b>Meat pie</b>				
Ogbomoso	NG	$4.40^a \times 10^1$	$4.40^a \times 10^2$	$4.80^a \times 10^3$
<b>Sausage roll</b>				
Ibadan Northeast	NG	$2.25^a \times 10^1$	$2.55^a \times 10^3$	$3.70^a \times 10^3$
<b>Akara Ogbomoso</b>				
Ogbomoso	NG	$3.75^a \times 10^1$	$4.70^a \times 10^2$	$5.80^a \times 10^3$

283  
284  
285  
286

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

287 **3.3 The activities of food health inspectors on the operation of the informal**  
288 **foodservice system.**

289 The Table 4 report the activities of the food health inspector towards ensuring that  
290 wholesome food is produced by the IFO. The frequency of visit by the health inspector to the  
291 IFO was mainly on a quarterly basis (65.3 %) This may be due to lack of enough resources to  
292 increase their visit to the operation sites of the IFOs. About 23.1% of the health inspectors  
293 visited them monthly for inspection area although this is not the case for this operator who  
294 have a high attitude towards food hygiene practices this is similar to the report of (Osagbemi  
295 *et al.*, 2010) that food handlers in Okene area have positive attitude towards food safety.

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

301

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

308

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

314 From the table 4.21 below it was gathered that the mean rating for the quality of meal served  
315 by the operator was satisfactory to the health inspectors, and they also satisfied with the  
316 safety of meal served (1.9) the FHIs was also satisfied with the hygienic practice of the  
317 operators within the study area. The FHI were satisfied with availability of facilities to ensure  
318 safe quality meals are prepared. In the same vein, 42.3% and 23.1% of the sampled food  
319 inspectors were satisfied and also highly satisfied with the quality of the meal served.

320

321 In related form, trainers also need training, which is popularly refers to train the trainers  
 322 program. The Table 4.22 below report the frequency of the training received by the food  
 323 health inspectors. The outcome of the analysis shows that they train the food health  
 324 inspectors yearly either as a refresher course and new training programme. Which is similar  
 325 to what (Osagbemi *et al.*,2010) and (Pepple, 2017) suggested that both the operators and  
 326 health inspectors require to be trained frequently in order to have a wholesome food being  
 327 served in the community where they operated.

328

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

329 **Table 5 Food health inspector’s (FHIs) evaluation of the informal IFOs activities**

330 **Source: Author’s survey, (2020)**

331 1 -Not Satisfactory

332 2 -Satisfactory

333 3 -Highly Satisfactory

334 **Conclusion**

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

342

343

344

345 **APPENDIX 1**            **Effect of the Activities of FHI's on the operation of the Informal**  
 346 **Foodservice System**

347 Please rate the followings parameters as it concerns the informal foodservice  
 348 operators in your LGA based on the degree of importance within your LGA on the  
 349 following scale as. Not satisfactory (NS), Satisfactory (S), Highly satisfactory (HS).  
 350 (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			

351

352 **Acknowledgement**

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

355 **Conflict of Interest**

356 The authors declare that there is no conflict of interest among them on this manuscript.

357 **References**

358 Akanji, A. M., Fasina, O. E., and Ogungbesan, A. M. (2015). Effect of raw and processed  
 359 cowpea on growth and haematological profile of broiler chicken. *Bangladesh Journal*  
 360 *of Animal Science*, 45(1), 62-68.

361 AOAC. 2000. Official methods of analysis of the Association of Official Analytical Chemists  
 362 17th Edition AOAC International, Gaithersburg MD.

363 Brown, K. H., Black, R. E., and Becker, S. (1991). Relative effects of diarrhea, fever, and  
 364 dietary energy intake on weight gain in rural Bangladeshi children. *The American*  
 365 *journal of clinical nutrition*, 53(6), 1499-1503.

366 Capuano, E. (2017). The behaviour of dietary fiber in the gastrointestinal tract determines its  
 367 physiological effect. *Critical reviews in food science and nutrition*, 57(16), 3543-  
 368 3564.

369 De Neve, J. E., & Sachs, J. D. (2020). Sustainable development and human well-being.  
 370 *World happiness report*, 112-127.

371 Ezirigwe, J. (2018). Much ado about food safety regulation in Nigeria. *Journal of Sustainable*  
 372 *Development Law and Policy*, 9(1), 109-132.

- 373 Fellows, P., and Hilmi, M. (2018). Selling Street and Snack Foods. Diversification booklet  
374 retrieved from <http://www.fao.org/dorcep/015/i247e.pdf>
- 375 Hardy, K., Bocherens, H., Miller, J. B., and Copeland, L. (2022). Reconstructing Neanderthal  
376 diet: The case for carbohydrates. *Journal of human evolution*, 162, 103105.
- 377
- 378 Kasapila W, and Shawa P. (2011): Use and understanding of nutrition labels among  
379 consumers in Lilongwe, Malawi. *African Journal of food Agriculture Nutritional*  
380 *Development* 11(5): 5171-5186.
- 381 Kayode, R. M. O., Ajiboye, A. T., Babayeju, A. A., Kayode, B. I., Oladoye, C. O., and Adu,  
382 K.T. (2013). Proximate, mineral composition and microbial counts of over-ripe fried  
383 plantain (*dodo-Ikire*) sold by vendors in Ikire town, Nigeria. *International Journal of*  
384 *Biotechnology*, 2(4), 68-82.
- 385 Manikantan, M. R. (2016). Coconut chips–Entrepreneurship driven ICAR-CPCRI technology  
386 for healthy alternative non-fried snack food.
- 387 Olatona, F.A., Nwankwo, C.O., Ogunyemi, A.O. and Nnoaham, K.E (2019). Consumer  
388 knowledge and utilization of food labels on pre-packaged food products in Lagos  
389 State. *Research journal of Health Science*, 7(1): 28-38.
- 390 Osagbemi, G., Abdullahi, A., and Aderibigbe, S. (2010). Knowledge, attitude and practice  
391 concerning food poisoning among residents of Okene Metropolis, Nigeria.
- 392 Osundahunsi, O. F., and Aworh, O. C. (2003). Nutritional evaluation, with emphasis on  
393 protein quality, of maize-based complementary foods enriched with soya bean and  
394 cowpea tempe. *International journal of food science & technology*, 38(7), 809-813.
- 395 Otemuyiwa, I. O., and Adewusi, S. R. (2014). Nutrient composition of some foods from a  
396 Nigerian eatery. *Journal of Food Chemistry and Nutrition*, 2(1), 11-18.
- 397 Pepple, N (2017). Environment and Food: Food safety knowledge and practice among Food  
398 vendors in Garki, Abuja, Nigeria. *Journal of health education Resources*  
399 *Development*, 5 (217), 2.
- 400 Sajilata, M. G. and Singhal, R. S. (2002). Speciality starches for snack foods. *Journal of*  
401 *Carbohydrate Polymers* 59 (2): 131-151.
- 402 Savov, A. V., and Kouzmanov, G. B. (2009). Food quality and safety standards at a glance.  
403 *Biotechnology and Biotechnological Equipment*, 23(4), 1462-1468.
- 404 Taiwo, K. A., Oladepo, O. W., Ilori, M. O., and Akanbi, C. T. (2002). A study on the  
405 Nigerian food industry and the impact of technological changes on the small-scale food  
406 enterprises. *Food Reviews International*, 18(4), 243-261.

407