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Research Article

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The Proximate Composition, Bacteriological and Determination of Selected Heavy Metal Level in Unbranded Sphagetti Sold in Singa Market of Kano State of Nigeria, West Africa

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Abstract This work involves the proximate composition, bacteriological and some heavy metals level of different samples of unbranded spaghetti sold in *Singa* market, Kano State of Nigeria using standard analytical method. The proximate analysis revealed the presence of moisture content (%) (7.16 to 9.12), ash (%) (3.11 to 3.68), Lipid (%) (2.17 to 2.75), crude fiber (%) (1.96 to 2.21), crude protein (%) (5.2 to 6.0) and the carbohydrate was obtained by difference. Heavy metals concentrations (ppm) were determined in the unbranded spaghetti samples using Atomic Absorption Spectroscopy (AAS) after digestion of the sample. Lead concentration were found in samples A, B, C and D ranges from (0.014 to 0.151), the cadmium concentration were found in A, B, C and D ranges from (0.003 to 0.013), the arsenic concentration were found in A, B, C and D ranges from (0.220 to 0.350). The bacterial load was higher in B and A (6.4×10^{-8} and 6.0×10^{-8}) respectively compared to A and C (4.4×10^{-8} and 3.6×10^{-8}) respectively. The result revealed that the sampled pasta are safe for human consumption, though continuous monitoring is required.

Keywords proximate composition, bacteriological, heavy metal, spaghetti

Introduction

Spaghetti is long, thin, solid and cylindrical pasta eaten as staple food of traditional Italian cuisine. Like other pasta, spaghetti is made of milled wheat, water, sometimes enriched with vitamin and mineral. Spaghetti is one of the most popular meals at restaurant and even in our home. Spaghetti is the plural form of the Italian word *spaghettis* which is diminutive of *spago* meaning "thin string". Spaghetti a single noodle has helped to form our society from the Neolithic age until today. Spaghetti is made with milled wheat and water. It's an easy to prepare food, versatile, cheap and commonly consumed around the world especially by the middle class. It is an energetic food, which present deficiencies regarding nutritional value, quality of protein and fibre content since they are mainly produced with whole wheat.

Unbranded Spaghetti

It's one of the spaghetti that is sold under the name of a shop or under the name spaghetti rather than the name of the Company that made it. Unbranded spaghetti can be half price of the branded spaghetti. Unbranded spaghetti is made of milled wheat and water but it is not package [1].

This work is aimed at determining the proximate composition, bacteriological and heavy metals level of unbranded spaghetti sold at *Singa* market of Kano State, Nigeria West Africa.

Materials used in the study include

Desiccators, Soxhlet extraction apparatus, Analytical weighing balance, Atomic absorption spectroscopy (AAS), Nutrient agar, Incubators, thermostatic ovens, Muffle furnace.

Sample collection

Four different samples of unbranded spaghetti were collected from *Singa* market of Kano state, Nigeria.

Proximate Analysis of the Samples

Moisture content determination: A clean dried humidity dish was weighed as (W_1). 5.0 g of the sample was place on it and weighed (W_2), It was placed in an oven at 105.0 ^{0}C for three hours. The dish was removed and cooled in the desiccators for 30.0 minute and it was weigh for (W_3). The procedure was repeated for the rest of the sample. The percentage moisture content was calculated as: $\frac{W2-W3}{W2-W1}\ X\ 100$ [2].

Ash content: 5.0 g of the sample was weigh and placed in a clean crucible. The sample was subjected to ashing in muffle furnace at constant temperature of 550.0 ^{0}C until a constant final weight was obtained. The sample was covered with lid and cooled in desiccators. The procedure was repeated for the rest of the sample. The Ash content was calculated as: $\frac{W2-W3}{W2-W1}\ X\ 100$ [2]

Lipid content: The thimble was weigh as W_1. A 10.0 g of the sample was placed on a thimble and weigh as W_2. The boiling flask was filled with calculated quantity of petroleum ether. The extraction thimble was plug with cotton wool. The Soxhlet apparatus was assembled and was allow refluxing for four hours. The sample was removed and it was dry at 105.0 ˚C for one hour in oven. It was transferred from the oven into the desiccators and it was allowed to cool and was weighed as W_3. The procedure was repeated for the rest of the sample and the percentage lipid content was calculated as: $\frac{W2-W3}{W2-W1}\ X\ 100$ [2].

Crude protein: A 10.0 g of the sample was transfer into a macro digestion flask, a tablet of Khedjel catalyst was added and 20.0 cm^3 of concentrated H_2SO_4 added. The flask was placed into the digestion block in the fume cupboard to heat. The heating was carried gently and then strongly at interval. The heating was continued for one hour until the mixture becomes clear then the heating was stopped and allowed to cool. A 25.0 cm^3 of distilled water and anti-bumping granules was added to digest the mixture. Distillation apparatus was connected and 10.0 cm^3 of NaOH was poured into the receiver of the distillation apparatus. About 20.0 cm^3 of boric acid with 2-3 drop of methyl red indicator was added to 500.0 cm^3 conical flask. A vacuum was maintained when passing distillate to the boric acid mixture in the volumetric flask. The distillate was collected up to about 50.0 cm^3. This was titrated with 0.4 M of HCl acid until the green colour changes to pink [2].

$$\%Nitrogen = \frac{(T-B) \times N \times 14.007}{Wt\ of\ sample\ (mg)} \times 100$$

$$\%Protein = \%N\ \times factor$$

Where: T = Volume of titrant used for sample (ml)

B = Volume of titrant used for blank (ml)

N = Normality of titrant (to 4 decimal places)

14.007 = Molecular weight of Nitrogen

Crude fiber: A 5.0 g of the sample was weigh as W_1. It was boiled under reflux for 30 minutes with 200.0 cm^3 of a solution containing of 1.25 g of H_2SO_4. The solution was filtered with linen on a funnel. It was washed with boiling water. The residue was transferred into a beaker and boil with 1.25g of NaOH. The final residue was dried in an oven, It residue was weigh after drying and expressed as a fraction of the initial weight of the sample digested [2].

Determination of Heavy Metals in the said samples

A 5.0 g of the sample was weighed in a crucible using Analytical balance, concentrated nitric acid of 1.0 cm^3 was add and then heated at 300.0 ºC for 30.0 minutes. The sample was transfer into a muffle furnace at a temperature of 550.0 ^{0}C for four hours after which it was allowed to cool. The content was then dissolved in 50.0 cm^3 0.1 N HCl in a sample bottle and taken to AAS for analysis [3].

Bacteriological Determination

Media preparation: Nutrient agar was prepared by following the manufacturer's instruction on the label to the pack. The mouth of the flask was plug with cotton wool wrapped with aluminum foil .The flask was shake to mix, it was heated on hot plate to boil and dissolve completely. It was placed in the autoclave at 121ºC for 15 minute and it was allowed to cool [4].

Serial dilution: The stock solution was prepared by introducing 10.0 g of the sample into 100.0 cm^3 of distill water in a clean beaker. Test tube rack was arranged with a sterile test tube containing 9.0 cm^3 of distill water, a serial dilution was carried out by taking 1.0 cm^3 of the stock solution and introduced to the first test tube containing 9.0 cm^3 of distill water labeled as 10^{-1}, it was shake and 1ml was taken from the 10^{-1} and transferred into the next test tube 10^{-2} and also 1.0 cm^3 of the solution was taken from 10^{-2} and transferred into the 10^{-3} also 1.0 cm^3 of the solution from the 10^{-3} into 10^{-4} also 1ml of solution was taken from 10^{-4} into 10^{-5} and also 1mlof the solution was taken from the 10^{-5} and it was discarded [4].

Inoculation: A 1.0 cm^3 from the dilution of 10^{-4} was taken using sterile syringe and it was introduced into sterile petri dish, these was done for 10^{-5} and 10^{-6}, the prepared media were poured into the petri dishes these was done for the rest of the diluents. The plates were swirled to mix. All plates were allowed to solidify on the working bench before incubation. The plates were incubated at 37.0 ˚C for 24.0 hours in the incubators. The colonies formed on the plate were counted and recorded [5].

Results and Discussion

Table 1: The results proximate composition of the sampled unbranded spaghettis

samples	Moisture (%) *(X ± SD)*	Ash (%) *(X ± SD)*	Protein (%) *(X ± SD)*	Fiber (%) *(X ± SD)*	Lipid (%) *(X ± SD)*	CHO (%) *(X ± SD)*
A	9.12 ± 0.05	3.15±0.035	6.0 ± 0.03	2.2 ± 0.06	2.75± 0.05	78 ± 0.04
B	8.18 ± 0.02	3.11 ± 0.01	5.2 ± 0.05	2.1± 0.01	2.20± 0.03	79 ± 0.03
C	8.11 ± 0.02	3.68 ± 0.03	*ND*	2.91± 0.01	2.21± 0.03	83 ± 0.02
D	7.16 ± 0.35	3.11 ± 0.02	*ND*	1.96± 0.04	2.17± 0.02	85 ± 0.03

Note:

ND = Not Detected

X = Mean values obtained

SD = Standard deviation

CHO = Carbohydrates

The result in Table one show that the moisture content, it ranged from 7.16 to 9.12 %, the values were below moisture content study by Chuhwu and Ismail [6] which is 12.26%. The low moisture content is an indication of tendencies to reducing microbial growth and gives longer storage time of any perishable food sample. The ash content of any food sample is the mineral index of the sample after digestion at 550 ºC. The ash content ranged from 3.11 to 3.68 %, protein content ranged from 5.2 to 6.0 %. The protein is necessary part of diet because it contains

amino acid which is important in building the various tissues in the body. The crude fiber ranges from 1.96 to 2.2 %. Lipid ranges from 2.17 to 2.75%. The lipid contents were below the lipid content reported by Akhtar [7] and Ajani [8]. The higher carbohydrate content of the unbranded spaghetti suggests that they can be considering as a potential source of energy giving foods [6].

Table 2: The heavy metal level of the sampled unbranded spaghetti

Samples	Cd *(ppm)* *(X ± SD)*	As *(ppm)* *(X ± SD)*	Hg *(ppm)* *(X ± SD)*	Pb *(ppm)* *(X ± SD)*
A	0.013 ± 0.001	0.315 ± 0.001	ND	0.151 ± 0.002
B	0.008 ± 0.001	0.220 ± 0.001	ND	0.014 ± 0.001
C	0.003 ± 0.002	0.272 ± 0.002	ND	0.017 ± 0.001
D	0.009 ± 0.001	0.350 ± 0.001	ND	0.014 ± 0.002

Note:

ND = Not detected

X = Mean values obtained

SD = Standard deviation.

The result of heavy metal analysis (Using AAS) is shown in Table two. The results generally show the present of cadmium (Cd), arsenic (As) and lead (Pb) in unbranded spaghetti sample. Cadmium concentrations (ppm) were: (0.013, 0.008, 0.003, 0.009). All the values were below the allowable limit set by FAO/WHO [9]. Lead was also determined, the concentrations (ppm) were: 0.151, 0.114, 0.017, 0.014 and the values were below allowable limit of 0.300 set by FAO/WHO [9] and Belay [10]. There is need to improve on the equality of the unbranded spaghetti during processing and hacking by limiting the spaghetti to the lowest possible lead level. Arsenic was also determined and the concentrations (ppm) are: 0.315, 0.220, 0.272, and 0.350. Mercury was not detected in all the samples analysed.

Table 3: The total bacteriological load of the unbranded spaghetti

Samples	Dilution Factor	Mean of Colonies (*cfu/g)*	Number of Colonies *(cfu/g)*
A	10^{-6}	91.0	9.1×10^{7}
B	10^{-6}	150 .0	1.5×10^{8}
C	10^{-6}	111 .0	1.1×10^{8}
D	10^{-6}	160.0	1.6×10^{8}

Table three shows the result of bacterial load of the sampled unbranded spaghetti which are 9.1×10^{7}, 1.5×10^{8}, 1.1×10^{8}, 1.6×10^{8}. The bacterial load was higher in sample B, C, and D which are 1.5×10^{8}, 1.6×10^{8}, 1.1×10^{8} respectively and low in sample A which is 9.1×10^{7}. The heavy bacterial load is an indication of poor handling and storage as reported by Ottogalli and Galli [4].

Conclusion

The study revealed that the sampled unbranded spaghetti contained appreciable amount of nutrient such as protein, carbohydrate, fat and it is not toxic to human health since the heavy metals present in it does not exceed the allowable limit by FAO/WHO. This indicates that the spaghettis are nutritionally acceptable since their composition provide essential nutrient needed for human health though continuous monitoring is encouraged.

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