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A Comparative Study on Sodium, Potassium and Calcium Concentrations in Locally Fermented Locust Beans, Condiment M and Condiment R Produced in Kano, Nigeria in Relation to High Blood Pressure, Using Flame Photometry

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Abstract: ***The concentrations of sodium, potassium and calcium in locally fermented locust beans, and two other condiments M and R produced by some multinational companies in Nigeria, were determined using flame photometry, owing to the fact that, salt intake contribute towards the development of high blood pressure (Hypertension). The results shows high concentration of sodium in condiment M andcondiment R (12.309mg/g and 12.748mg/g respectively), compared to the ill-favored locally fermented locust beans 0.193mg/g. The concentration of potassium in the locally fermented locust beans was found to be 0.60mg/g, which is higher than that of condiment M and condiment R (0.365mg/g and 0.537 respectively). Calcium concentration was found to be almost equal in all the three samples with little variation, 0.37mg/g, 0.302mg/g and 0.332mg/g for locally fermented locust beans, condiment M and condiment R respectively.***

Keywords: Locally fermented locust beans, Condiment M, Condiment R, Concentrations, Flame photometry, Sodium, Potassium, Calcium, Hypertension

1. Introduction

Locally fermented locust beans (Daddawa), is a traditional condiment produced by local fermentation of locust beans of *parkiabiglobosa* plant in many parts of Nigeria. Condiment M and R, are also food seasonings industrially produced by some multinational companies also in Nigeria. High blood pressure is a public health problem [1]. The prevalence estimates for hypertension is about 1 billion individuals, world-wide [2]. It causes about 7.1 million deaths per year [3]. Data on sodium intake shows that population worldwide are consuming more sodium than is physiologically needed [4].

Despites some evidence suggesting that obesity coupled with a lack of exercise were important factors involved in development of high blood pressure (Hypertension), there are still stronger evidences indicating that salt intake is even more strongly related to development of hypertension, most especially the rise in blood pressure with age [5]. Evidences shows that, dietary magnesium, potassium and calcium have each been inversely associated with blood pressure in society [6,7,8,9].From these evidences, low dietary sodium coupled with intermediate potassium and calcium dietary food can contributes towards maintaining normal blood pressure.The World Health Organization (WHO) recommendation on sodium intake for adults is 2g sodium/day which is equivalent to 5g salt/day [10].

2. Methods

2.1 Samples digestion

The three samples were dried in an oven to constant weight, and then ground to powder using mortar and pestle. 5g of each sample was measured using analytical weighing balance into a pre-weighed crucible. The samples were then taken into an electric furnace and set at 600˚C, heated for 8 hours, and then transferred into desiccator and allowed to cool for about 30 minutes. After cooling, the samples weight was measured and then taken back into the furnace and heated for about 2 hours. This process of heating and weighing was repeated three times until constant weight and clear ash was obtained.

The samples ashes in the crucible were then transferred into three different 100ml volumetric flask using glass funnel. The crucibles were then washed with 6M nitric acid (HNO_3), transferring the washate into their respective 100ml volumetric flask using glass funnel. The volume of the flask was then made up to the mark using 6M HNO_3 and a clear solution was obtained. Portions of each was transferred into a glass bottles labeled as A, B, and C for fermented locust beans (Daddawa), condiment M and R respectively, ready for analysis.

2.2 Preparation of standard solution

A stock solution containing 1000ppm sodium ions, 1000ppm Calcium ions was prepared using standard procedure, from which 2ppm, 4ppm, 6ppm, 8ppm and 10ppm working

solution was prepared. Similarly, 1000ppm stock solution containing potassium ions was prepared and from which 5ppm, 10ppm, 15ppm, 20ppm and 25ppm working solution was prepared.

2.3 Blank solution

Blank solution for sample solutions was made by taking small amount of the 6M HNO_3, while the blank solution for the standard solutions was made by taking small amount of distilled water used in preparing the standard solutions.

3. Results and Discussion

3.1 Results

The result for absorbance of the standard as well as the sample solution is given in the tables below:

Table 1: Absorbance of sodium standard solution

Concentration (ppm)	*Absorbance*
2	0.06
4	0.12
6	0.20
8	0.26
10	0.31

Table 2: Absorbance of potassium standard solution

Concentration (ppm)	*Absorbance*
5	0.13
10	0.29
15	0.44
20	0.61
25	0.73

Table 3: Absorbance of calcium standard solution

Concentration (ppm)	*Absorbance*
2	0.08
4	0.19
6	0.27
8	0.38
10	0.49

Table 4: Absorbance of the sample solutions

Sample/Absorbance	Na	K	Ca
A	0.30	0.87	0.87
B	19.08	0.53	0.71
C	19.76	0.78	0.78

3.1.1 Concentration of the elements in the samples

From the equation of a straight line $y=mx+c$, concentration of the elements in the samples was calculated. Where:y is the absorbance, m is the slop of the calibration plots of the standard solutions, x is the concentration (ppm), and c is the intercept which is zero. The slops of the calibration plot of the standard solutions was found to be 0.03ppm^{-1} for sodium, 0.029ppm^{-1} for potassium and 0.047ppm^{-1} for calcium.

Table 5: concentration of the elements in the samples in ppm

Sample/Concentration (ppm)	Na	K	Ca
A	9.68	30.00	18.51
B	615.48	18.27	15.11
C	637.42	26.89	16.59

Table 6: Concentration of elements in mg/g of the sample

Sample/Concentration (mg/g)	Na	K	Ca
A	0.193	0.600	0.370
B	12.309	0.365	0.302
C	12.748	0.537	0.332

Table 7: Percentage composition of the elements in the samples

Sample/Percentage composition (%)	Na	K	Ca
A	0.019	0.060	0.037
B	1.231	0.036	0.030
C	1.275	0.054	0.033

4. Discussion

Within the limit of experimental error, the concentration of sodium in the fermented locust beans was found to be 0.193mg/g, which is lower than in condiment M and condiment R, 12.309mg/g and 12.748mg/g respectively, this high concentration of sodium in the condiments M and R may be due to the monosodium glutamate used in the condiments as a flavor enhancer.

Potassium concentration in locally fermented locust beans was found to be 0.60mg/g which is higher than that of condiment M and R, 0.365mg/g and 0.537mg/g respectively, while calcium concentration was almost equal in all the three samples with little variations, 0.37mg/g, 0.302mg/g and 0.332mg/g for locally fermented locust beans, condiment M and condiment R respectively.

5. Conclusion

Comparing the results obtained with the World Health Organization (WHO) recommendation on sodium intake for adults which was given as 2g sodium/day equivalent to 5g salt/day [10], sodium content in all the three samples is within the recommended level for normal consumption. But, higher intake may leads may be out of the recommended level.

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