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Assessment of Sun and Shade Drying Techniques on Some Selected Vegetables in Sokoto, Nigeria

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ABSTRACT: *Vegetables are one of the most consumable foods in Sokoto, Nigeria because of its richness in vitamins. This research was carried out to determine the effect of solar radiation on the nutritional composition of some selected vegetables which include: Bitter leaf (Vernonia amygdalina), spinach (Spinacia aleracea), and pepper (Vernonia amygdalina) which were coded as Sample A, B, and C using proximate analysis method. It was observed that sample A shows that shade drying technique maintains the nutritional composition of the moisture, fibre, lipid and carbohydrate with 14.80%, 3.50% 2.08% and 48.26% respectively. While the sun drying technique maintained protein and ash content with 28.00% and 12.50% respectively. Sample B result showed that the shade drying technique has more effect in maintaining the moisture, protein, ash, fibre and lipid content with 2.20% 17.78%, 20.00%, 22.50% and 1.50% respectively. While carbohydrate maintained 47.12% on the sun dried sample. Similarly, Sample C maintained the nutritional composition of moisture, protein and fibre on the sample dried under the shade with 5.50%, 8.48% and 27.50% respectively, and the ash, lipid, and carbohydrate content was maintained on the sun dried sample with 8.50%, 3.00% and 57.38% respectively. This implies that the shade drying technique is more efficient in maintaining the nutritional composition of the selected vegetables.*

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I. INTRODUCTION

The importance of vegetables in the human system, ranging from its health to its nutritional benefit cannot be over emphasized especially in the area of this study, Sokoto, where the consumption of vegetable is visibly noticeable. It is worthy to note that the consumption of vegetables among the locals of Sokoto have been attributed to a lot of speculation ranging from the claim that it is because it is cheap to afford, as such, it is at the disposal of both the rich and poor. Vegetables drying is generally done either for preserving the perishable raw commodity against deterioration or due to reduce the cost of packing, handling, storing and transportation. The most serious constraint for shelf-life enhancement is the activity of microorganisms. Water in food is reduced to very low level during drying, thus achieving better microbiological preservation and regarding many undesirable reactions during storage (Ibarz *et al.,* 2000). In the process of drying some of the nutrients are always deteriorated particularly the vegetables dried directly on the sun light, as the sun produces enormous amount of energy including cosmic, gamma rays, X-rays, ultraviolet radiation, infrared radiation visible radiation etc, (Aletor *et al.,* 1995).

Bitter leave (Vernonia amygdalina) variously known as bitter leaf (English), oriwo (Edo), ewuro (Yoruba), shuwaka (Hausa), and olubu (Igbo), a tropical shrub, 1-3m height with petiole leave of about 6 mm in diameter, and elliptic in shape, (Igile et al., 1995). The leaves are dark green in colour with a characteristics odour and bitter taste. The species are indigenous to tropical Africa and is found wild or cultivated all over sub-Sahara Africa. It can grow under a range of ecological zones in Africa and produces large mass of forage and is drought tolerant, (Akah and Okafor, 1992). All parts of the plant are pharmacologically useful in phyto-medicine; to treat fever, hiccups, kidney disease and stomach discomfort, among others, (Gill, 1992). It has anti-emetic and anti-malarial, (Hamowia and Saffaf, 1994); as well as anti-tumourigenic properties, (Abosi and Raseroka, 2003). It also finds application in the area of skin infection, loss of memory, prostate cancer, stroke, pneumonia, insomia, arthritis and general weakness. Studies have also demonstrated the hypoglycaemic and hypolipidaemic effect of the leave extract on animals, (Izevbigie *et al.,* 2004). Also, Spinach (Spinacia aleracea) is a leafy green vegetable that came originally from Southwestern Asia and is now grown in most parts of the world. Its leaves, which are broad and smooth and about ten inches long, make one of the most popular, though maligned by children everywhere, of cooked leafy vegetables. Spinach is also used raw in salads (Victor *et al.,* 1949). Red pepper is a commercially important agricultural product of Turkey. Annual red pepper (Capsicum annuum) production in Turkey is about 25000 tons (Oztekin *et al.,* 1999). Most of the produced red pepper is processed to make powdered red pepper. The powdered red pepper production process involves washing; sorting; removal of the stems and seeds; slicing; drying; grinding and packaging (Hayoglu, 1999).

Therefore, the aim of this study is to compare the effect of sun and shade drying technique on the nutrients composition of some selected vegetables which include; Bitter leaf (Vernonia amygdalina), spinach (Spinacia aleracea), and pepper (Vernonia amygdalina) in Sokoto, Nigeria. The selected vegetables were coded as Sample A, B, and C respeectively..

II. MATERIALS AND METHOD

2.1 Sample Collection

Sample B and Sample C were collected from the fadama farm located immediately after the first gate of Usmanu Danfodiyo University Sokoto, Nigeria, where the samples were harvested. While Sample A was collected from Biological garden Usmanu Danfodiyo University Sokoto, Nigeria.

Usmanu Danfodio University lies between the coordinates of 13.1246° N, 5.1994° E and Sokoto state lies between the coordinate of 12.9374° N, 5.2267°E. all the samples were separated into two half after sorting out the stems from the leaves, in the case the pepper, it was sliced before drying the separated samples under the sun and shade.

2.2 Determination of Proximate Analysis

Proximate analysis was determined using the standard procedures of AOAC, (1990) after drying the samples under the sun for 5, 7, and 5 days respectively, and under the shade for 7, 10 and 7 days respectively.

III. RESULTS

Table 1. Result of proximate analysis for SAMPLE A

PARAMETERS	(SD) %	(SU) %
MOISTURE CONTENT	14.80	13.40
ASH CONTENT	10.35	12.50
PROTEIN CONTEN	21.00	28.00
CRUDE LIPID	2.08	0.07
CRUDE FIBRE	3.50	3.35
CARBOHYDRATE	48.266	42.678

KEY: SD = sample dried under shade
SU = sample dried under sun
Sample A = Bitter Leaf
Sample B = Spinach
Sample C = Red Pepper

Table 2. Result of proximate analysis for SAMPLE B

PARAMETERS	(SD) %	(SU) %
MOISTURE CONTENT	5.50	3.50
ASH CONTENT	20.00	19.00
PROTEIN CONTENT	17.78	16.38
CRUDE LIPID	1.50	1.00
CRUDE FIBRE	22.50	13.00
CARBOHYDRATE	32.65	47.12

KEY: SD = sample dried under shade
SU = sample dried under sun
Sample A = Bitter Leaf
Sample B = Spinach
Sample C = Red Pepper

Table 3. Result of proximate analysis for SAMPLE C

PARAMETERS	(SD) %	(SU) %
MOISTURE CONTENT	5.500	3.500
ASH CONTENT	7.500	8.500
PROTEIN CONTENT	8.483	7.613
CRUDE LIPID	2.000	3.000
CRUDE FIBRE	27.500	20.000
CARBOHYDRATE	49.017	57.380

KEY: SD = sample dried under shade
SU = sample dried under sun
Sample A = Bitter Leaf
Sample B = Spinach
Sample C = Red Pepper

Table 4: Result of proximate analysis of selected samples

Vegetable	Drying Method	Moisture Content	Protein Content	Ash Content	Crude Fibre	Crude Lipid	Carbohydrate
Sample A	SU (%)	13.40	28.00	12.50	3.35	0.07	42.67
	SD (%)	14.80	21.00	10.35	3.50	2.08	48.26
Sample B	SU (%)	3.50	16.38	19.00	13.00	1.00	47.12
	SD (%)	5.50	17.78	20.00	22.50	1.50	32.65
Sample C	SU (%)	3.50	7.61	8.50	20.00	3.00	57.38
	SD (%)	5.50	8.48	7.50	27.50	2.00	49.01

KEY: SD = sample dried under shade
SU = sample dried under sun
Sample A = Bitter Leaf
Sample B = Spinach
Sample C = Red Pepper

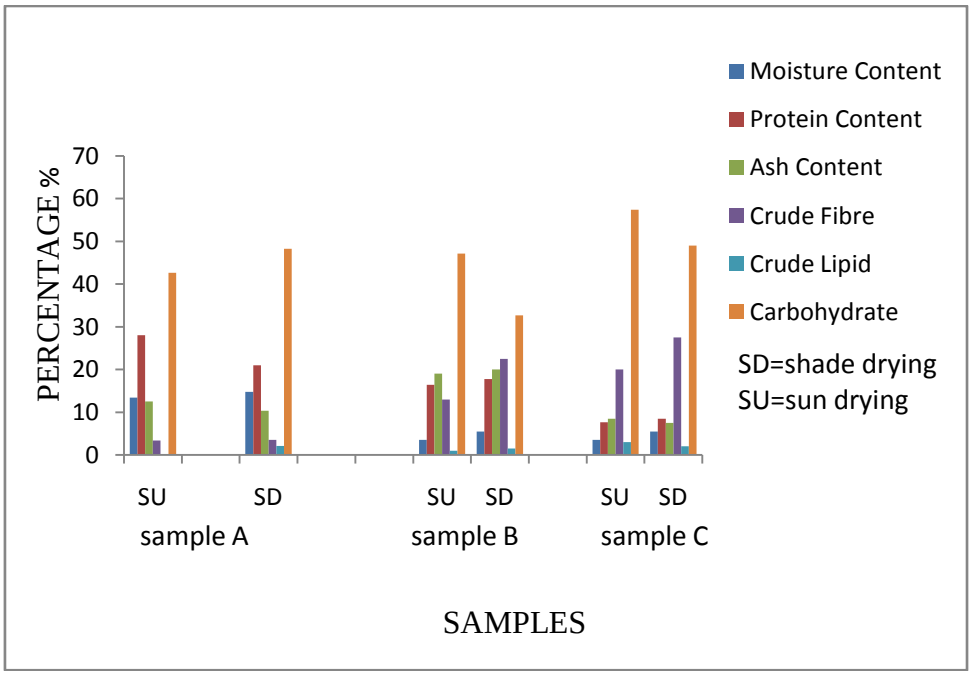

Figure 1. Variation of Drying Method on Selected Vegetables

IV. DISUSSION

Figure 1 depicts the Moisture content of Sample A to be 14.80% for the sample dried under shade, against the sample dried under sun which was obtained as 13.40%. The Moisture content of the Sample A was more maintain on the sample dried under shade with 1.40% greater than the sample dried under sun. The Ash content result shows that the sample dried under shade maintains 10.35% against the sample dried under sun which has 12.50%, giving a difference of 2.15%. For Protein Content, the result obtained shows that the sample dried under shade has less protein content of 21%, and the sample dried under sun has more protein content of 28%, the different between the two samples is 7%, which shows that sun maintains the protein content of the sample. While for Crude Lipid, the sample dried under shade was obtained as 2.08%, whereas the sample dried under sun was 0.07%. the difference of the two samples was 2.01%, showing that the crude Lipid was best maintained by the sample dried under shade. While for Crude Fibre, the sample dried under shade was obtained as 3.50%, and the sample dried under sun was obtained as 3.35%. The difference between the two samples was 0.15%, in which the Crude fibre is more maintained on the sample dried under shade. And Carbohydrates content show to have 48.266% on the shade dried sample and 42.678% on the sun dried sample having a difference of 5.588%.

For Sample B, the moisture content of the sample dried under shade was 5.50%, against the sample dried under sun which was 3.50%; showing that sunlight reduces the Moisture content of the sample against the shade drying method with a difference of 2.0%. The Ash content shows to have 20.0% on the shaded dried

sample and 19.0% on the sun dried sample, giving that sunlight reduces Ash content over shade with a difference of 1.0%. The Protein Content result shows to have 17.78% on the sample dried under the shade while the sun dried sample resulted to 16.38%, again showing that protein is more maintained when the spinach is shade dried over sunlight with a difference of 1.4%. Crude Lipid and Crude Fibre have a difference of 0.5 % and 9.5% respectively as the result show to have 1.50% and 22.50% on the shaded dried sample respectively, and 1.00% and 13.00% on the sun dried sample respectively; again implying that the parameters are more maintained when they are dried under the shade. But Carbohydrate showed to be more maintained when it is sun dried than when it is dried under shade with values of 32. 65% and 47.12% for the shade and sun dried sample respectively, with a huge difference of 14.47% when compared with the variation of other parameters from the proximate analysis.

Also for the Sample C, we see the results of the proximate analysis showing that moisture content of the sample dried under shade was 5.50%, against the sample dried under sun which was 3.50%; showing that sunlight reduces the Moisture content of the sample against the shade drying method with a difference of 2.0%. The Ash content shows to have 20.0% on the shaded dried sample and 19.0% on the sun dried sample, giving that sunlight reduces Ash content over shade with a difference of 1.0%. The Protein Content result shows to have 17.78% on the sample dried under the shade while the sun dried sample resulted to 16.38%, again showing that protein is more maintained when the spinach is shade dried over sunlight with a difference of 1.4%. Crude Lipid and Crude Fibre have a difference of 0.5 % and 9.5% respectively as the result show to have 1.50% and 22.50% on the shaded dried sample respectively, and 1.00% and 13.00% on the sun dried sample respectively; again implying that the parameters are more maintained when they are dried under the shade. But Carbohydrate showed to be more maintained when it is sun dried than when it is dried under shade with values of 32. 65% and 47.12% for the shade and sun dried sample respectively, with a huge difference of 14.47% when compared with the variation of other parameters from the proximate analysis.

V. CONCLUSION

The effect of solar radiation on the nutritional composition of three different samples of vegetables were evaluated after performing proximate analysis.

Sample A showed that shade drying technique maintains the nutritional composition of the moisture, fibre, lipid and carbohydrate with 14.80%, 3.50% 2.08% and 48.26% respectively. While the sun drying technique maintained protein and ash content with 28.00% and 12.50% respectively. Sample B result showed that the shade drying technique has more effect in maintaining the moisture, protein, ash, fibre and lipid content with 2.20% 17.78%, 20.00%, 22.50% and 1.50% respectively. While carbohydrate maintained 47.12% on the sun dried sample. Similarly, Sample C maintained the nutritional composition of moisture, protein and fibre on the sample dried under the shade with 5.50%, 8.48% and 27.50% respectively. and the ash, lipid, and carbohydrate content was maintained on the sun dried sample with 8.50%, 3.00% and 57.38% respectively.

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