Comparative Analysis on Nutritional and Anti Nutritional Composition of Fresh and Dried Tomatoes (*Lycopersicom esculentum, Solanum Lycoperiscum*) Obtained from Gusau Central Market Zamfara State, Nigeria

Abstract:

Tomatoes are one of the essential fruit consumed throughout the world. Lacks of storage facilities to mitigate post harvest loss still remain a greater problem. Drying is an important and traditional process to remove the moisture from the food. The basic principle of drying is to prevent microorganisms and increases shelf life without deteriorating. The aim of the study was to determine the proximate, mineral and anti nutritional compositions of dried and fresh tomato obtained from Gusau central market Zamfara State. Using A.O.A.C and statistical method. Results showed that moisture content reduced from 91.70% **-** 10.52%, Carbohydrate content increased from 7.60% **-** 76.4%**,** lycopene reduced from 89.52% - 70.91%, total energy increased from 32.68% - 317.67%, while protein, fiber, ash and vitamin c had no significant reduction from fresh to dried sample. There was no loss of mineral content from fresh to dried tomatoes, only reduction of content in mg/100g from fresh to dried sample; Calcium 30.06 – 25.35mg, Phosphors 28.52 – 20.60mg. The phytochemical screening showed the presence of Tannin, Oxalate, phytate, Sapoin, Phenolic, flavonoid and alkaloid in both fresh and dried samples. Tannin had low concentration from 0.09 – 0.21mg, while alkaloid and flavonoid had 20.51 – 15.23mg and 28.62 – 20.51mg respectively. The traditional way of drying still remains the available method for farmers to prevent post harvest loss of tomatoes; therefore, Conducive environment has to be provided for the farmers to avoid possible contamination during drying.

Keywords: Tomatoes, Phytochemicals, Mineral Contents and Proximate Analysis

INTRODUCTION

Tomatoes (*Lycopersicom esculentum, Solanum Lycoperiscum.*) belong to the *solanaceae* family and correspond to one of the most widely grown vegetable in the world. The fruit vegetable is typically produced in the spring summer season, but in many countries including Nigeria, it is produced throughout the years with the help of irrigation farming (Arah. *et al*; 2015).

Nigeria, with a population of above 180 million, the demand for tomatoes over shadows the supply. The challenge is attributed to the seasonality and inadequacies in post-harvest handling of the tomatoes (Arah *et al.,* 2015; Adenegan & Adeoye, 2011). Thus post harvest losses accounts for 40-50% loss annually due to lack of proper storage (Adegbola *et al.,* 2012).

As a result, drying of tomatoes becomes the only way farmers can economically provide alternative to fresh ones, which are available in most vegetables markets (Abdulmalik *et al.,* 2014, Akinmutimi, 2006).

Drying is an important and traditional process to remove the moisture from the food. The basic principle of drying is to prevent microorganisms such as bacteria and fungi, which required water for their growth and multiplication, which causes food spoilage and decay. Since water is a potential vehicle for pathogens in the food chain it therefore has to be removed to increase the shelf life of the food products. Drying and dehydration is an ideal process applicable to all food materials such as tomatoes and other vegetables (Sheshma & John. 2014, Sagar & Kumar.2010, Jorge *et, al;* 2014).

The total annual production of tomatoes in Nigeria is estimated to be about 1.701 million tones. Zamfara state located Northwest of Nigeria is among the state with high production tomatoes for commercial purpose. Tomatoes farmer's faces a lot of problems such as transportation and lack of storage facilities to mitigate post harvest loss. Therefore, tradition drying is the only alternative method to prevent loses and makes dried tomatoes available for consumers. The availability of dried tomatoes in the market called for nutritional and anti-nutritional content evaluation of both the fresh and dried tomatoes.

MATERIALS AND METHODS

Samples collection: both fresh and dried tomatoes samples were obtained from Gusau central market, where various vegetable produced in this state were sold every Monday and Friday.

The samples were stored in cleaned polythene bags while the fresh samples were kept in the refrigerator FGTGKL NY69 806 06

Chemicals/ reagents: All the chemicals used were of analytical grade and obtained from Sigma and Co.

PROXIMATE ANALYSIS OF THE SAMPLES

Proximate analysis was carried out to determine moisture content, Ash content, fat/lipid, protein, fiber and carbohydrate.

Moisture content (%) and Ash content (%) were determined according to method adopted by AOAC, (2005).

Determination of crude protein content: crude protein content was determined using kjeldal digestion flask. 2g was weighed and digested with 25mL of concentrated H_2SO_4, digest and distilled at 420^oC for 45minute and titrate the 0.02M hydrochloric acid (AOAC, 2005)

%crude protein =$\frac{titre\ blank\ \times normality \times 14.01 \times 6.25}{weight\ of\ sample \times 10}$

Determination of fat/lipid

Fat contents were determined as crude ether extract using Automatic sohxlet extraction unit

The extraction took place for 60 minutes after which the thimble containing samples were raised up to another 60 minutes and weighed (AOAC, 2000).

Determination of crude fibre: the crude fibre content of samples was determined by boiling the samples with 1.25% of dilute sulphuric acid and washed with water and later boiled with 0.0313M sodium hydroxide. The remaining residues were weighed and find the percentage as shown in the equation below (AOAC, 1997).

% crude fibre = $\frac{final\ weight \times 100}{original\ weight}$

Determination of carbohydrate content: carbohydrate contents were determined by subtracting the total value of moisture, fat, protein, ash, and crude fiber contents from 100 (AOAC, 1980)

i.e **carbohydrate content (%)** = 100 – (moisture + ash + protein + crude fiber).

Energy computation in (Kcal): this was determined by multiply protein, fat, and carbohydrate value obtained from the analysis by 4, 9, 4 respectively (AOAC, 1980).

Energy in Kcal = (protein×4) + (fat×9) + (carbohydrate ×4).

Determination of lycopene content

Acetone was used to extract lycopene in the both dried and fresh tomato sample, a mole of lycopene extract was dissolved in petroleum ether. Absorbance of lycopene was taken at 503nm and concentration of lycopene was estimated from standard calibration curve (Ranganna, 2003).

DETERMINATION OF ANTI NUTRIONAL FACTORS

Determination of Tannin: Tannin was determined using spectrometric method, after a series of extraction and the concentration was estimated from tannic acid calibration curve (Onuwka and Onwuka, 2005,Marklar et al; 1993).

Determination of oxalate content: oxalate was determined by titrimentry method after the extraction, the extract was titrated against 0.05M potassium permanganate.

Determination of phytate content: phytate content was determined by method discussed by (Marklher et al; 1993). Using ammonium thiocynate as an indicator and the extract was titrated with standard iron chloride solution until brownish yellow was persisted for 5 minute as the end point. The phytate content was estimated as phytic acid.

Determination of phenolic acid: the samples were weighing and boiled with 25ml of ether with addition of ammonium hydroxide and alcohol. The solution was allowed to stand for 30 minute to developed color which was measured at 505nm using UV/ visible spectrophotometer for the absorbance of the samples and estimated from standard curve (Sofowora, 1993).

Determination of saponin content: 20% of aqueous ethanol was added to the sample in the cleaned conical flask and placed in the water bath and heat for 4hours with continue starring at temperature of 55^{o}C, the solution was filtered and the filtrate was concentrated at 90^{o}C before transfer to separating funnel with addition of diethyl ether, and the aqueous layer was discarded. The extract was washed with aqueous sodium chloride. This was now dried in oven and weighed, until constant weight was determined as the weight of saponin (Sofowora, 1990)

Determination of Flavonoid: 100ml of 80% aqueous methanol was used to extract 10g of sample repeatedly at room temperature and filtered through Whitman filter paper No 42 (125mm). The filtrate was evaporated to dryness in a crucible over a water bath until a constant weight was reached (Bohnm & Kocipal-Abyazan, 1994).

DETERMINATION OF MINERALS ELEMENTS

The samples were analyzed for mineral elements such as potassium, sodium, magnesium, calcium, and zinc using atomic absorption spectrophotometry. 5g of samples were weighed and heated into ashes using muffle furnace at 550^{o}C for 5 hours in platinum crucible. This was cooled in desiccators' and digest with 10% HCL and filtered. The filtrate was filled with deionized water to the mark, before analyzed for K, Na, Mg, Ca, and Zn. Phosphorus was determined using UV- visible spectrophotometer at 436nm the samples was acidified with concentrated nitric acid and ammonium vanadate molydate was also added and take the absorbance Phosphate ion present (Onuwka, 2005,Marklar *et al*; 1993).

RESULTS AND DISCUSSION

Proximate analysis results are as shown in table 1. The results indicated that moisture content of fresh tomatoes decreased from 91.70% to 10.525% during drying. This made the dried tomatoes to be free from microbial activities as reported by (Aliyu *et al.,* 2018) that microbial activity increased in a higher moisture content of food substance. Decrease in moisture content of dried tomatoes increased the carbohydrate content; this may be the reason of high calories of energy in the dried sample.

Statistical analysis showed no significant difference in nutritional contents between dried and fresh tomato samples at 95% degree of confidence. Result is not in agreement with Aliyu *et al.,* 2018, that there is significant different in nutritional value of dried healthy and dried infected tomatoes. The fibre, protein and vitamin content of fresh and dried are 0.17% - 6.42, 2.5% - 0.23%, 14.32% - 12.12%. This indicate that both dried can also provide fiber content which is very essential to reduce circulation of cholesterol and increase in glucose tolerance level in body (Opega *et,al.,* 2017). Vitamin C is an antioxidant that removed free radicals and increase immune system can also be provided by dried tomatoes. Protein also present in a reasonable amount in dried tomatoes samples despite loss of total moisture contents.

The mineral composition of both fresh and dried tomatoes samples are as shown in table 2. There was a slight reduction in the dried sample but not significantly different from the fresh sample and this may be attributed to the loss of the moisture or water content of the fresh tomatoes, as a result most of the soluble ions escaped during drying as reported by (Turkan, A, *et,al*; 2010).

Calcium is an important constituent of bone formation and strong teeth, hence both fresh and dried tomato can provide enough calcium to the body tissue to prevent osteoporosis in adult and rickets in children and also colon cancer. All the essential mineral elements are present in both fresh and dried tomatoes in a reasonable amounts for bone formations, enzyme reactions, blood formation and other health body tissue (Oyetayo.& Ibitoye, 2012).

Phytochemicals compositions of fresh and dried tomatoes as shown in table 3. Indicate the presence of tannin, oxalate, phytate, saponin, phenolic, flavoid and alkaloid in both fresh and dried tomatoes but showed a significant reduction in mg/100 during drying. These maybe attribute to the volatility of phytochemical that lead significant amounts to escape during drying (Opega *et al*; 2017)

Phytate concentration can influence the functional and nutritional properties of foods, depending on the concentration and also has ability to lower blood glucose and cholesterol, reduces the risk of cancer by absorbing the divalent and multivalent minerals required by cancerous cell to multiply. Phytochemicals in the tomatoes neutralize the free radical and inhibit the oxidative activity (oyetayo, F. & Ibitoye, M. 2018, Opega *et,al.,*2017).

Table 1: Proximate Analysis of fresh and dried tomatoes

Samples	Fresh tomatoes %	Dried Tomatoes %	% Difference
Moisture	91.70	10.52	81.18
Ash	0.21	3.93	3.72
Carbohydrate	7.60	76.4	68.80
Protein	2.50	0.98	1.52
Fiber	0.17	6.42	6.25
Lipid	0.20	0.23	0.03
Vitamin C	14.32	12.21	2.11
Lycopene	89.52	70.91	18.61
Total Energy	32.68	317.67	284.99

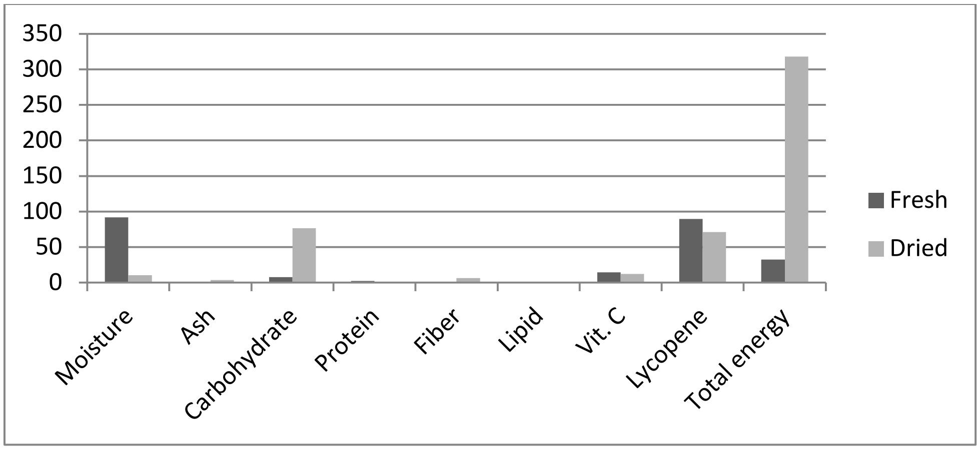

Fig: 1 Graph of proximate analysis of fresh and dried tomatoes

Table 2. Mineral Elements of fresh and dried tomatoes

Elements (mg/100g)	Fresh tomatoes	Dried tomatoes
K	**12.90±0.01**	**9.80 ±0.00**
Na	**4.45 ± 0.12**	**2.45 ±0.01**
Mg	**9.75 ±0.02**	**0.35 ±0.21**
Ca	**30.06 ±0.00**	**25.35 ±0.00**
Zn	**0.36 ±0.01**	**0.26±0.00**
P	**28.52 ± 0.15**	**20.60± 0.16**

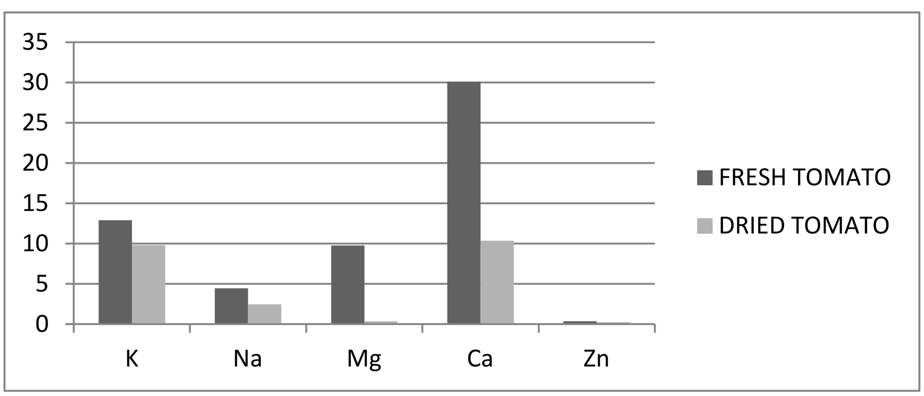

Fig 2: Graph of mineral elements in fresh and dried tomatoes

Table 3: Anti -Nutritional Factors (phytochemical) in fresh and dried tomatoes

Phytochemicals mg/100g	Fresh tomatoes	Dried tomatoes
Taninn	0.09 ±0.00	0.21 ±0.00
Oxalate	0.68 ±0.00	0.42 ±0.00
Phytate	1.13 ±0.00	0.30±0.00
Saponin	1.31 ±0.00	0.13 ±0.00
Phenolic acid	1.25 ±0.00	0.94 ± 0.00
Flavonoid	28.62 ± 0.00	20.51 ± 0.00
Alkaloid	20.51 ± 0.00	15.23 ± 0.00

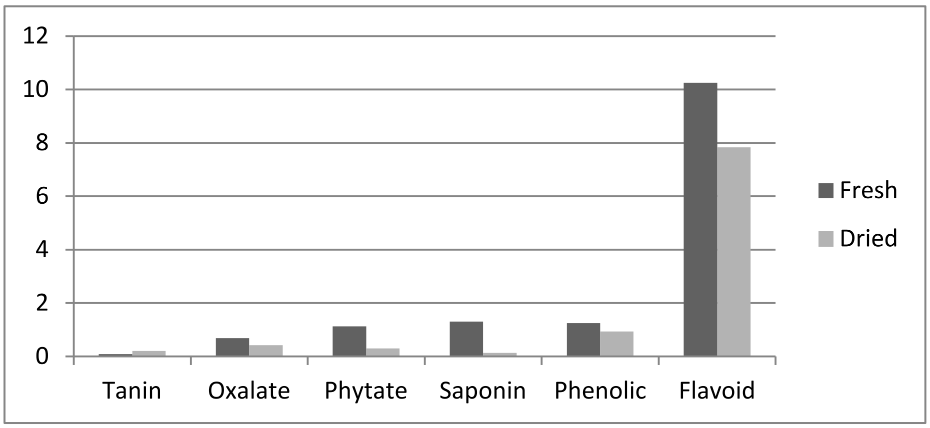

Fig 3: Graph of phytochemicals in fresh and dried tomatoes

CONCLUSION

Since the only available method of storing tomatoes in the post harvest season by farmer is traditional drying method. The study concluded that despite the fact that the drying method was done in traditional ways by the farmers to prevent losses of post harvest tomatoes, there was known significant difference in loss of nutritional contents between fresh and dried tomatoes. There is need to educate farmers and provide a conducive environment for drying process in order to reduced possible contamination to meet the global standard of food processing practice. Also there is need for further research to check the amino acid contents of both fresh and dried tomatoes.

References:

AOAC (2005). Official methods of analysis of the AOAC International. (18thed.). Gaithersburg (USA): AOAC International; 2005.

AOAC (2003). Official Methods of Analysis, Association of Official Analytical Chemist, Wahington, D.C, 2003.

AOAC (2000). Official method of Analysis of Association of Analytical Chemists Intrnational. 17th Edition, Horowitz, Maryland, 2000

AOAC (1997). Official Methods of Analysis. Association of Official Analytical Chemists.15th Edition. Washington D.C, 1997

AOAC (1995). Non-enzymatic methods of crude methods of analysis international. 1 Edition Method 4.6.01(962.09), 6th International, Maryland, USA;

Arah, I. K., Kumah, E. K., Anku, E. K., &Amaglo, H. (2015). An overview of post-harvest losses in tomato production in Africa: causes and possible prevention strategies. *Journal of Biology, Agriculture,and Healthcare*, *5*(16), 78-88.

Abdulmalik, I. O., Amonye, M. C., Ambali, A. O., Umeanuka, P. O., & Mahdi, M. (2014). Appropriate Technology for Tomato Powder Production. *International Journal of Engineering Inventions*, (*3)*, 29-34

Adegbola, J. A., Awagu, F., Adu, E. A., Anugwom, U. D., Ishola, D. T., & Bodunde, A. A. (2012). Investment opportunities in tomato processing in Kano, Nothern Nigeria. *Global Advance Research Journal of Agricultural Science*, *1*(10), 288-297

Adenegan, K. O., & Adeoye, I. B. (2011). Price analysis of tomato in rural and urban retail markets of Oyo State. *International Journal of Agricultural Economics & Rural Development*, *4*(2), 90-96.

Akinmutimi A.H. (2006) Chemical analysis of Nutritive value of raw and processed Jack fruit seeds (*Artocaptus heterophyllus)* Agricultural Journal. (1):266-271.

Aliyu L., Usman A., & Mani U. (2018) Evalution of nutritional composition of healthy and infected dried Tomato chips sold in sokoto metropol. A journal of innovation food.6 (2): 1-4

Jorge, A., Almeida, D. M., Canteri, M. H. G., Sequinel, T., Kubaski, E. T., &Tebcherani, S. M. (2014). Evaluation of the chemical composition and color in long-life tomatoes (*Lycopersicon esculentum* Mill) dehydrated by combined drying methods. *International journal of food science & technology*, *49*(9), 2001-2007.

Oyetayo, F.L.,& Ibitoye, M.F., (2012). Phytochemical and nutrient/antinutritional interactions in cherry tomato fruit, international journal of advanced Biological research vol.2(4) 2012: 681-684.

Opega J.L., Yusuf P.A., Kadiri, A.O., & Nurudeen, A. (2017). Effect of Drying methods and storage condition on nutritional value and sensory properties of dehydration tomato powder. International journal of biochemistry research and review. 19(1): 1-7.

Sagar, V. R., & Kumar, P. S. (2010). Recent advances in drying and dehydration of fruits and vegetables: a review. *Journal of food science and technology*, *47*(1), 15-26.

Sheshma J., & Raj John D. (2014). Effect of Pre-Drying Treatments on Quality Characteristics of Dehydrated Tomato Powder, International Journal of Research in Engineering & Advanced Technology. ; 2(3):1- 15

A.O.A.C. (*1980*) Official Methods of Analysis, 13th ed. Association of Official Analytical. Chemists. Washington D.C. 376-384.

Ranganna, K., Yousefipour, Z., Yatsu, F. M., Milton, S. G., & Hayes, B. E. (2003). Gene expression profile of butyrate-inhibited vascular smooth muscle cell proliferation. *Molecular and cellular biochemistry*, *254*(1-2), 21-36.
Onwuka, G. I., & Onwuka, N. D. (2005). The effects of ripening on the functional properties of plantain and plantain based cake. *International Journal of Food Properties*, *8*(2), 347-353.
Sofowora, A. (1993). Recent trends in research into African medicinal plants. *Journal of ethnopharmacology*, *38*(2-3), 197-208.