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Articles

Determination of the Nutritional Values of Processed and Dried Tomatoes

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Abstract

This study was carried out to determine and compare the nutritional value of dried and processed tomatoes (Lycopersicon esculentum). Proximate analysis conducted on samples of dried tomatoes and processed tomatoes where moisture content, fat content, crude protein content, fibre content, and ash were determined. The analysis shows that, the processed tomatoes has high value composition of moisture content (12.00±0.05), crude protein content (2.60±0.01) and carbohydrate content (59.28±0.12) and it has less composition of ash content (12.00±0.02), fat content (2.0±0.06), fibre content (0.12±0.01) and energy (2.65±0.05) compared to the dried tomatoes with values of moisture content (20.00±0.13), ash content (14.00±0.08), protein content (1.68±0.02), fat content (5.00±0.12), fibre content (0.14±0.00) and energy (2.88±0.14). The study suggests the processed Lycopersicon esculentum is richer in nutrients than the dried Lycopersicon esculentum and recommended.

Keywords: Lycopersicon esculentum, proximate analysis, nutritional value and nutrients.

1. Introduction

The use of modern technologies and equipment for drying food material is escalating because it prolongs shelf life or good keeping quality and retains the bioactive nutrients (Betoret et al., 2016; Timilsena et al., 2020). These bioactive nutrients can combat nutritional related diseases and promote a state of well-being of the consumer (Timilsena et al., 2020). Tomatoes (Lycopersicon esculentum) contribute to a healthy and well-balanced diet as they are rich in dietary fibres and other nutrients (Alsuhaibani, 2018). Tomatoes are perishable crops of which deterioration starts immediately after harvest and continued till they experience spoilage due to high moisture contents and enzymatic activities (Arah et al., 2015). In Nigeria, tomato has short shelf life and considerable amounts of harvested tomatoes (over 50 %) are lost yearly due to poor storage system, poor transportation coupled with inadequate processing facilities and lack of processing enterprises (Osawaru et al., 2013). According to marketing of fresh tomato during the season is a great problem which needs to be handled (Osawaru et al., 2013). The percentage of tomatoes going into

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waste annually with no attentions paid to the loss of nutrients can lead to heavy revenue loss to farmers, decrease in market value, underutilization and to malnutrition due to food insecurity (Abimbola, 2014). Tomato as fruits vegetables and other green leafy vegetables can be dried using various methods (Sibomana et al., 2016). Dehydration does not check losses only but, related disease. Tomatoes are a highly perishable food crop in the fresh state that are excellent source of vitamin C, vitamin E, folic acid, potassium, and secondary metabolites such as b-carotene, lycopene, and phenolic compounds. Although epidemiological studies highlight the positive role of consuming fresh tomatoes, it is clear that, as tomatoes have a relatively short-life, there is need to preserve, dry or process them so that it does not lead to wastage and losses during the peak harvesting period and also this helps to provide tomatoes to commerce (Arslan, Özcan, 2011). The prevention of these wastage and losses is of great interest and value especially when there is subsequent imbalance in demand and supply so as to offer an alternative way of providing tomatoes into commerce, but however, processing and drying of tomatoes leads to loss of some antioxidant properties, change of colour, physical and structural changes such as migration of soluble solids, shrinkage, loss of volatiles and aroma (Raiola et al., 2014; Hussein et al., 2016). Tomato is a fleshy berry regarded as very popular perishable fruit as well as vegetable grown throughout the tropical and temperate regions of the world. These reasons coupled with the interest in studying different varieties of tomatoes makes it necessary for the determination of the nutritional value of tomatoes at different levels, that is, fresh, dried, and processed. delicious and stable products (Mendelová et al., 2013; Ilić et al., 2014). In some cases, processed. Industrially produced canned tomatoes are important product and subject to regular market analysis as well as trade considerations (Abdullahi et al., 2016; Campos et al., 2020). The aim of the study is to determine the nutritional value of processed and dried tomatoes.

2. Materials and methods

Collection of samples

A sample of fresh tomatoes was collected from FGGC garden, along Gombe road Bauchi, Bauchi state for its proximate composition and minerals analysis to evaluate its nutritive value to human.

Preparation of sample

Grinding; The tomatoes was cut and dried using shed drying method, and ground to powdered form by using a grinder.

Processed tomatoes were purchased and prepared for the analysis.

Proximate composition

Proximate composition: after bringing the sample to uniform size, they were analyzed for moisture, protein, fat, fiber by the methods AOAC (2003).

Determination of moisture

Moisture was determined by oven drying method. 5g of well-mixed sample was accurately weighed in clean, dried crucible (W_1). The crucible was allowed in an oven at 100-105^0 C for 6-12 h until a constant weight was obtained. Then the crucible was placed in the desiccator for 30 min to cool. After cooling it was weighted again (W_2). The percent moisture was calculated.

Determination of ash

For the determination of ash, clean empty crucible was placed in a muffle furnace at 600^{0}C for an hour, cooled in desiccator and then weight of empty crucible was noted (W_1). One gram of each sample was taken in crucible (W_1). The sample was ignited over a burner with the help of blowpipe, until it is charred. Then the crucible was placed in muffle at 550^{0}C for 2-4 hours. The appearance of grey white ash indicates complete oxidation of all organic matter in the sample. After aching furnace switch off. The crucible was cooled was weighted (W3).

Determination of crude proteins

Protein in the sample was determined by Kjeldahl method. 0.5-1.0g of dried sample was taken in diagram flask. Add 10-15 ml of concentrated H_2SO_4 $CuSO_4$ (8: 1). The flask was swirled in order to mix the contents thoroughly then placed in heater to start digestion till the mixture become clear (blue green in color). It needs 2 hrs to complete. The digest was cooled and transferred to 100 ml volumetric flask and volume was made up to mark by the addition of distilled water. Distillation of the digest was performed in Markam Still Distillation Apparatus (Khalil, Manan, 1990). Ten millilitres of Digest was introduced in the distillation tube then 10 ml of 0.5 N NaOH was gradually added through the same way Distillation was continued for at least 10 min and NH_3 produced was collected as NH_4OH in a conical flask containing 20 mi of 4 % boric acid solution with few drop of modified methyl red indicator. During distillation yellowish color appears due to NH_4OH. The distillate was then titrated against standard 0.1M HCL solution till the appearance of pink color. A blank was also run through all steps as above. Percent crude protein content of the sample was calculated.

Determination of crude fat

Dry extraction method of determination was implied. It consisted of extracting dry sample with some organic solvent, since all the fat materials e.g. fat, phospholipids, sterols, fatty acids, carotenoids, pigment, chlorophyll etc. are extracted together therefore, the result are frequently referred to as crude fat. Fat was determined by ether extract method using Soxhlet apparatus. Approximately 1 g of moisture free sample was wrapped in filter paper, placed in fat free thimble and then introduced in the extraction tube. Weighted cleaned and dried the receiving beaker was filled with petroleum ether and filled into apparatus. Turned on water and heater to start extraction. After 4-6 siphoning allow ether to evaporate and disconnect beaker before last siphoning. Transferred extract into clean glass dish with ether washing and evaporated ether on water bath. Then placed the dish in an oven at 105_0C hrs and cooled it in a desiccator. The percent crude fat was calculated.

Determination of crude fibre

A moisture free and ether extracted sample crude fibre made of cellulose was first digested with dilute H_2SO_4 and then with dilute KOH solution. The undigested residue collected after digestion was ignited and loss in weight after ignition was registered as crude fibre.

0.153 g sample weighed (W_0) was weighted and transferred to porous crucible. Then place the crucible into Dosi- fibre unit and kept the valve in “OFF” position.

150 ml of preheated H_2SO_4 solution and some drops of foam-suppressor were added to each column. The heating elements (power at 90 %) opened of the cooling circuit turned on until it started boiling, the power was reduced to 30 % and left for 30 mins. Valves were opened for drainage of acid and rinsed with distilled water thrice to completely ensure the removal of acid from sample. The same procedure was used for alkali digestion by using KOH instead of H_4SO_4. Dried the sample in an oven at 150^0C for 1 h. The sample was allowed to cool in a desiccator and weighted (W1). The sample was kept in the crucible in muffle furnace at 55^0C for 3-4 hrs. The sample was cooled in desiccator and weighted again (W_2) Calculations were done.

Determination of carbohydrate

Carbohydrate was determined by adding the sum of moisture, ashing, protein, fat and fibre of the sample in %, the remaining sum is the percentage of carbohydrate content.

Energy calculation

The percent calories in selected samples were calculated by multiplying the percentage of crude protein and carbohydrate with 4 and crude fat with 9. The values were then converted to calories per 100 gm of the sample.

3. Results

Table 1. Results of the nutrient and mineral contents of dried and processed tomatoes in mg/100 g

Parameters	Dried tomatoes(mg/100g)	Processed tomatoes(mg/100g)
Moisture	20	24
Ash	14	12
Protein	1.68	2.6
Fat	5.0	2.0

Fiber	0.14	0.12
Carbohydrate	59.18	59.28
Energy	2.88	2.65

3. Discussion

Proximate composition

The moisture content of the processed tomatoes is higher than that of the dried tomatoes and this indicates that its shelf life will be shorter since high moisture content is associated with increase in microbial activities, which is in agreement with the reports of Arslan & Özcan (2011). The dehydration of the tomatoes plays an important role on the microorganisms. According to Abdullahi et al. (2020) the removal of water is a method of controlling microbial growth, since they require water to develop their metabolic activities as reported in this study. High moisture content also promotes susceptibility to enzymes activity in a given tomatoes sample (Timilsena et al., 2020), this is also corroborated by current study.

With regard to ash content, the processed tomatoes was found to have the lowest ash content of 12 mg/100 g which is thought to result in high moisture content of the plant. According to the climatic conditions and the mountainous influences these allowed the retention of heat and subsequent diffraction by the plastic contained thus, increasing the thermal peak temperature. Looking at the percentage composition of crude protein, the processed tomatoes were found to have the highest crude protein (2.68) and differ significantly with the dried tomatoes. The dried tomato sample was found to have the highest fat content than the processed tomatoes, several factors might result to such differences. The difference of processing mechanism involved in the processes of preservation might have a different effect on the fat content. Also, geographical differences may also be a contributing factor for the differences as equally outlined by Hussein, Sanusi & Filli (2016). The crude fibre content of processed tomatoes is significantly lower than the dried tomatoes, this could be because the high water content contributes to the low dry matter which contains the crude fiber. With regard to carbohydrate and energy content, the dried tomatoes were found to have the lowest carbohydrate content of 59.18 while the processed tomatoes are slightly high with a value of 59.28. The energy content of dried tomatoes was 2.88 while the energy content of processed tomatoes was 2.65.

4. Conclusion

The starting point for retaining the tomatoes excellent nutritional properties during drying and processing into different products are the raw material. The quality of the vegetable is therefore, a primary key factor determining the nutritional quality of the end product. However, the processing of this material can be a major usually negative influence especially where incorrect sub-optimal procedures are applied. Hence great attention should also be given to understanding and then avoiding or minimizing the detrimental effects of these technological processing methods. The exact level of loss or even gain of antioxidants differs widely according to the type of treatment, the conditions of the process applied and also the source history of the tomatoes used.

5. Recommendations

1. Processed foods are often regarded as less nutritious than the dried foods. This is not always true for tomatoes as this research shows that processed tomatoes have high content of protein and carbohydrate than the dried tomatoes.

2. Proper drying method should be used because drying of tomatoes with direct sunlight makes the tomatoes to lose some of its essential nutrients, therefore shade drying or oven drying method should be employed.

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