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# Nutritional Composition and Storage of Butternut Squash

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## ABSTRACT

Butternut squash is an emerging economic crop in Ghana with ready market and high nutritional value. Government of Ghana under the Export Development and Investment Fund (EDIF) introduced butternut squash as a new export product from Ghana on pilot base in some selected communities and the aim was to promote the cultivation and export of butternut squash in the Northern sector of the country, as a strategy to increase the incomes of farmers and help reduce poverty. The main objective of the study was to assess the proximate composition and storability of butternut squash to provide nutritional information for consumers while and reducing postharvest losses on butternut squash grown in Ghana. The samples were randomly picked from Kukobila in Savelugu-District of the Northern Region of Ghana for proximate composition and storage. Recommended methods of the association of official analytical chemist were used for the determination of fat, fibre, protein, ash, carbohydrate, moisture and vitamin C. Storage of butternut samples was by the wooden platform method with the compacted bare floor as control. From the results of the proximate composition, butternut squash contained moisture content (82.15g), ash content (9.9g), carbohydrate (5.51g), crude fibre (1.45g), crude protein (0.86g), crude fat (0.13g) and 15.33 mg of vitamin C which can supplement the nutrient needs for normal body function, maintenance and reproduction especially for persons cutting down or reducing the consumption of fats and proteins. Butternut squash stored in a warehouse on pallets with an average monthly temperature of 30.7 $^{o}$C and 76 % relative humidity could aid in maintaining the shelf life for more than five months.

**Key Words:** Butternut Squash, Nutrition, Shelf-life, Temperature, Relative humidity

## INTRODUCTION

Vegetables provide a variety of nutrients essential for human development, maintenance and repair such as vitamins, minerals, dietary fiber, protein and fat (Barthel, 2011). Consumption of vegetables and fruits plays a positive role in the prevention of obesity, heart disease, stroke, cancer, and other chronic diseases (Tohill *et al.,* 2004 and Boffeta *et al.,* 2010).

Butternut squash (*Cucurbita moschata*) also known as "butternut pumpkin" is a fruit vegetable from the family *cucrbitaceae* and genus *Cucurbita*. Every part of the squash plant can be eaten including leaves and tender shoots, which can be cooked into omelets or soups. Butternut squash is a vigorous growing plant that takes 85-90 days to mature and produce good uniform fruits weighing about 650-1000g. According to Tindall (1983) however, butternut squash matures between 80-

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140 days and yields are 3-6 fruits per plant with each crop weighing 2-5kg. Among all cucurbits such as courgettes, pumpkin and cucumbers, butternut squash is gaining preference because of its early maturity, appealing orange colour and small size that makes it attractive to producers, traders and consumers (Bonjour *et al.*, 1990). Also the hardy nature of butternut squash enable the crop to tolerate moderately harsh environmental conditions and resistant to many pests of cucurbits (Bonjour *et al.*, 1990) and has ready local and export markets (African, 2007). Most of the vegetable species that are used by rural household play not only a nutritive role, but also play a role in income generation and subsistence (Schippers, 2000).

There has been major improvement in butternut squash production in Africa and this was achieved when more than twenty–four metric tonnes of butternut squash produced by a commercial farmer at Kukobila a suburb of the Northern Region was exported to the United Kingdom (*Masahudu, 2012).* Despite the fact that butternut squash is an emerging economic crop with ready export market (Isaboke *et al.*, 2012), data on the nutritional composition and storage characteristics of butternut squash locally is limited. The knowledge of these constituents would enable consumers choose food of their dietary needs while aiding researchers in further storage studies (Dari and Mahunu, 2010). Post-harvest losses have been a major problem in the world especially in developing countries (Salunkhe and Desai, 1985) as about 5-40% of fruits and vegetables produced are lost during the value chain (Awuah, 2006).

## MATERIALS AND METHODS

### Sample Collection and Data Analyses

Matured Butternut squash fruits were sampled at Kukobila in the Savelugu District in the Northern Region of Ghana. Samples were taken to the laboratory of the University for Development Studies for proximate analysis and storage. The recommended methods of analysis of the Association of official Analytical Chemist (A.O.A.C., 1997) were used for the determination of proximate composition. The parameters analyzed were crude fat, crude protein, crude fibre, ash, moisture content and vitamin C. All proximate analyses were in triplicate. Standard deviation was predicted for means of values and presented in tables.

Storage samples were placed on pallets to aid aeration whiles some samples were placed on the bare floor to serve as control. During storage, temperature and relative humidity were measured to establish its effect on the shelf life of butternut squash. The storage duration was five months.

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## RESULTS AND DISCUSSION

### Proximate Composition of Butternut Squash

Result of the proximate composition indicate butternut squash fruits have an appreciable amount of nutrients as indicated in Table 1.

Table 1: Mean nutrient composition of butternut squash

| Parameters | Mean (g/100 g) |
|---|---|
| Crude Protein | 0.86 ± 0.10 |
| Crude Fat | 0.13 ± 0.05 |
| Crude Fibre | 1.45 ± 0.01 |
| Ash | 9.90 ± 0.05 |
| Carbohydrate | 5.51 ± 0.01 |
| Moisture content | 82.15 ± 0.01 |
| Vitamin C (mg/100g) | 15.33 ± 0.02 |

*± standard deviation

Protein content of butternut squash was within the protein content of the World Health Organisation (2007) and the United States recommended daily allowance (RDA), minimum (0.45 g) and maximum (0.8 g) per kilogram of an ideal body weight per day. Protein serve as immune booster thus for the production of antibodies the help the body fight against infectious diseases and also for growth and repair worn out tissue. In an effort to ensure correct nutrient intake and to maintain a healthy balance diet it is also important be aware of the protein content in food consumed. In terms of the economic impact of protein, it has been reported that the market value for major food commodities is partially determined by the content of protein present in the food. This makes butternut squash a good income generation crop if well processed.

According to (FAO, 1995), the minimum intake of fat should be 15 percent of an adult's energy intake. From this estimate, the crude fat for butternut squash was lower. This confirms the fact that most vegetables and for that matter butternut squash are poor sources of fat which could serve as a healthy choice for consumers particularly cautious of the amount of fats and oils in foods (Onwordi *et al.*, 2009).

The crude fibre was lower than the recommended 25-35g of fibre per day (Dari and Mahunu, 2010). Eventhough the value is low, it can still contribute to decreasing the concentration of high cholesterol level in the body (Onwordi *et al*., 2009).

The ash content confirms the mineral content of butternut squash such as beta-carotene which affirms the fact that vegetables species are good sources of minerals (FAO, 1968). The human body converts beta-carotene into vitamin A (retinol), for healthy skin and mucous membranes, immune health and good eye health and vision.

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The result indicated that butternut squash has quiet high carbohydrate content but it is lower than (Tindall, 1983) which obtained 8g and this could be attributed to different of butternut squash, climate, soil.

Butternut squash has high moisture content which confirms (Jenson, 1978) that fruits and vegetables contain as high as 85% water.

The vitamin C was 15.33 mg and affirms 15 mg established by Tindall (1983) but was lower than 30 mg according to USDA (2013). This variation can be attributed to differences in variety, climate and agronomic practices.

**Storage Characteristics of Butternut Squash**

At the end of the storage process, 60% of butternut squashes in the control deteriotrated while 40% were shrinked beyond market acceptance. Butternut squash on the wooden platform had 40% lost due to shrinkage and 60% wholesome. These losses could be partlly due to the fluctuation in temperature and relative humidity in the storage room as indicated in Table 2 which confirms (Tecson, 2001 and Siemonsma *et al.,* 1994) that temperatures above 15°C promote high respiration and shrinkage of squashes which encourages spoilage. With an average monthly temperature of 30.7 $^{o}$C and average monthly relative humidity of 76% the shelf life could exceed five months than when placed on the bare floor.

Figure 2: Butternut squash on bare before and after storage.

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Table 2: Mean temperature and relative humidity during storage of butternut squash.

| Month | Mean Temperature $^{o}$C | Mean humidity % |
|---|---|---|
| February | 30.1 | 70 |
| March | 34.4 | 65 |
| April | 29.9 | 81 |
| May | 29.6 | 80 |

## CONCLUSION

The analysis indicates butternut squash contained fibre, protein, vitamin C, ash, fat, and moisture content in different proportions. These nutrients could be used to argument the nutrient needs of consumers which will result in the prevention of chronic diseases such as heart disease, cancer, diabetes and obesity, as well as for the prevention and alleviation of several micronutrient deficiencies, especially in less developed countries (FAO/WHO, 2004). The storage result indicates that butternut squash when stored in a warehouse on pallets of average monthly temperature of 30.7$^{o}$C or less coupled with an average monthly relative humidity of exceeding 76% could aid extend the shelf life will beyond five months. The wooden platform method of storage proved better than the bare floor as heat exchanges within the floor affected the produce. The consumption and utilisation of butternut squash should be promoted locally for consumer health benefits which could contribute to the reduction in postharvest losses.

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