

Chemical, Nutritional and Analysis Squash (*Cucurbita maxima* L.) Pickles

Marina S. Villar¹

¹Partido State University College of Education Goa, Camarines Sur, Philippines

Publication Date: 2025/05/26

Abstract: Nowadays consumers are not only concerned about the taste of the food but it is more concerned about the nutrients existing on the food. Squash (*Cucurbita maxima* L.) is locally known as “kalabasa” is an important crop in the Philippines which is prepared with coconut milk, pork and smoked fish and served during meal as viand. This study determines chemical properties, proximate and nutritional of processed pickled Squash (*Cucurbita maxima* L.). The results showed that the moisture is higher while protein, carbohydrate and fat content were within the limit. Ash content is very minimal. Based on the USDA mineral standard of pickled vegetables, the mineral content of the pickled products is below from the standard. Moreover, the only available nutrients are sodium and Carbohydrates. The available calories content was only 30% in pickled squash. Hence, using this product is recommended as an appetizer and supplementary food particularly for adult male 19-29 years’ old.

Keywords: Chemical, Nutrition, Analysis, Pickle, Squash.

How to Cite: Marina S. Villar (2025), Chemical, Nutritional and Analysis Squash (*Cucurbita maxima* L.) Pickles *International Journal of Innovative Science and Research Technology*, 10(5), 1541-1545.
<https://doi.org/10.38124/ijisrt/25may075>

I. INTRODUCTION

Nowadays consumers are not only concerned about the taste of the food but it is more concerned about the nutrients existing on the food. Recent study of the researcher found out that squash can be included for the product of “atsara” or pickled (fermented) vegetables ^[1]. The researcher wishes to determine the nutritional component of the squash pickled product so that consumers will buy the products particularly if this will be sold in the market. Squash is commonly prepared squash as viand by the Bicolanos (people living in Bicol Region V.). The usual method of cooking the squash by bicolanos is with coconut milk, pork and smoked fish served during meals. Sometimes sautéed with meat, fish or shrimps and mixed with other vegetables ^[2].

In Bicol Region, Philippines there are some innovative variations that were prepared for squash products like jam and “pastillas” which serve dessert after meals. Most of the Bicolanos enjoy eating squash because of the yellowish color of the edible portion of the crop, they believe that it is rich in vitamin A which is good for eyesight. Some do not like the taste of the squash for this reason during surplus supply of the crop it is used as animal feed. Villanueva, M.K. C., et al. (2024) ^[3] stated that despite Squash being rich in vitamins and minerals it is observed that there is a lack of buyers and market access. Hence, the researcher tried to process this squash into pickled products and it was proven from the previous research of the researcher that it improves the flavor and the taste of the squash. However, for the intention of

encouraging more customers to eat the product it is important to inform the consumer of the amount of the chemical and nutritional content of the pickled product since most of the consumers today are already conscious of the benefit of eating the food products. Besides, Filipinos are already aware of checking the nutritional facts inside the packaging of the products. Pickled vegetables in the Philippines are served as appetizers, during special occasions like fiestas, birthdays, wedding day and anniversary. Millesca, A. B., (days etc. 2021) ^[4] stated that pickles improve digestion by boosting gastric juice flow. The common processed pickles are papaya, sayote or chayote and turnips however this product was not studied for the chemical and nutritional content.

In Southeast Asia, the phrase “pickle” refers to fruits and vegetables that have been preserved with vinegar and salt. Pickling is a preservation process that is said to be the oldest (Battock and Ali, 1991) ^[5]. Pickles are a type of acidic cuisine. Pickled foods are used as culinary accompaniments and appetizers. Squash is plentiful, easy to find, and inexpensive in the Philippines. In the previous study by the researches and was proven that squash can be utilized in processing into pickles or “atsara” and was extremely acceptable to the consumers. Therefore, it is important to investigate also the chemical and nutritional component of the product. Hence, this study was conducted.

II. MATERIALS AND METHODS

➤ Preparation of the Added Vegetable.

Fresh squashes were gathered from the farm. The fresh fruits were placed in a container and washed in running water, washed, peeled, cut into halves and separate the seeds from fleshy portion of the squash were removed and the squash were washed again. The washed squash was cut into small strips and set aside.

➤ Preparation of the Added Vegetable.

Carrots, ginger, onion, red & green pepper, garlic were purchased from the market, peeled and cut into strips then set aside.

➤ Preparation of the Pickling Solution

Squash and all needed ingredients were prepared and weighed. 400 grams of vinegar were boiled. While boiling the sugar (250g), salts (10g), black pepper (10g) and pineapple juice (100g) were added. The 500g of squash, 100g raisin, 75g green pepper, 75g red pepper, 50g garlic and 50g onion were mixed together. The pickling solution was cooled until 80°C. The pickling solution was poured into the mixed vegetable, stirred and blended thoroughly.

➤ Packing the Pickled Products.

The pickled products were packed into the 9 oz glass jar. Stored for one week then submitted to DOST V, Ligaspi City.

➤ Proximate and Nutritional Analysis.

Chemical Analysis. Proximate composition of all the content of the pickled squash were determined according to the method of Association of Official Analytical Chemistry (AOAC, 2016), Microwave Plasma-Atomic Emission Spectroscopy (MP-AES) and USFDA- NLR and DOST-FNRI-PDRI, 2015, respectively. The pickled sample were determined at Department of Science and Technology V (DOST V) Legaspi City.

III. RESULTS AND FINDINGS

➤ Proximate Chemical Analysis of Squash (*Cucurbita Maxima*) Pickles

One of the main purposes of this study is to commercialize the pickled squash not only to small enterprises but on a large scale. This is to maximize the utilization of the surplus supply of the squash crop. Hence it is necessary to determine the Proximate and nutritional composition of pickled squash. This analysis is important to provide information about the chemical characteristics of the pickled squash. Results will provide literature for those researchers who would like to undergo research on the pickling process and on the squash development product. The method used for determining the proximate chemical was TM-CHE-001 with reference to AOAC 900.02A, 21ST Ed. The result was shown in table 1.

Table 1 Comparison of Proximate Chemical Analysis of Squash (*Cucurbita maxima*) Pickles

Parameters	Squash Pickles In Glass Jar
Ash %	.61
Total Fat %	1.08
*Protein %	10.76
Moisture %	76.09
**Carbohydrates %	21.77
**Energy	99

Legend: *Protein Factor

**Test within the scope of accreditation

The proximate chemical analysis was carried out by the AOAC methods. The proximate composition of processed squash pickles showed in Table 1. The moisture content is 76.09 which is higher to the standard moisture content for vegetable products. This result shows that the pickled products are susceptible for the growth of microorganism. Therefore, there is a need to lower the moisture at least below 50%.

The crude ash content obtained the lowest percentage (.61%). The Fermentation process is aided with microorganisms. Ojokoh and Babatunde (2014)^[6] in their research on millet-soybean blends stated that the increase in ash content is maybe caused by incomplete utilization of minerals by fermenting organisms during their metabolism. Hence, in this recently developed squash pickled the minimal ash content may be there was a complete consumption of mineral during fermentation.

According to the World Health Organization (2007)^[7] and the United States recommended daily allowance (RDA), a minimum (0.45 g) and maximum (0.8 g) per kilogram of an ideal body weight per day or Protein should account for 10% to 35% of your calories. So, if your daily needs are 2,000 calories, that's 200-700 calories from protein or 50-175 grams. The protein content of the squash pickles sample is within the limit. According to Dari, L. and Yaro, N.S., (2018)^[8] Protein serves as an immune booster thus for the production of antibodies that help the body fight against infectious diseases and also for growth and repair worn out tissue. Oboh and Akindahumisi (2003)^[9] studied the biochemical changes in cassava product (flour and garri) subjected to solid media fermentation, results suggested that increased in protein content of the samples could be attributed to the ability of the yeast that was present in the course of the fermentation to secrete some extracellular enzymes (protein) into the fermented sample during their metabolic activities on the products. The high protein content of fermented food samples has a good implication in a

society with high protein deficiency and will no doubt complement protein from cereals and other plant foods (Eromosele IC, Eromosele CO (1993); Hassan, Sanni, Dangoggo, Lada, 2008) ^[10,11].

As reported by FAO, (1995) ^[22], the minimum intake of fat should be 15 percent of an adult's energy intake. As shown Table 1 The estimated crude fat for pickled squash is only 1.08 which is very minimal. Onwordi *et al.*, (2009) ^[12] stated quash are poor source of which could serve as a healthy choice for consumers particularly cautious of the amount of fats and oils in foods.

With regards to carbohydrates content of pickled squash was 21.77 % which is lower than the recommended 25-35g of fiber per day (Dari and Mahunu, 2010) ^[13]. According to Campos, V., *et al.*, (2022) ^[14] stated that Dietary carbohydrates are our main source of energy. However, the abusive consumption of low-quality carbohydrates has a direct implication on the physical and mental pathophysiology. Then, carbohydrate consumption is postulated as a crucial factor in the development of the main

diseases of the 21st century (Bigueja, 2020) ^[15]. In this research the classification of carbohydrates was not the main focus, therefore, it is recommended for further study on the classification of carbohydrates found in the pickled squash.

➤ Mineral Composition of Squash (*Cucurbita maxima*) Pickles

Mineral composition was determined using TM-CHE-049 with reference to Agilent 4200 MP-AES Method. The mineral contents were found minimal in the products. The products contain sodium, potassium, calcium, iron, zinc and crude fiber with the value of 83%, 20%, 18%, .55%, .36%, .93%, and 3.74%, respectively. USDA, reported the mineral contents of sodium 809mg/100g, magnesium 7mg/100g, calcium 57mg/100g in pickled vegetables ^[21]. Hence, in this present study the mineral content of the squash pickles is below based from the standard of pickled vegetables as recommended by USDA ^[16]. Hence, this squash pickled products is just recommended for supplementary food to enhance the appetite of the consumer.

Table 2 Comparison of the Mineral Composition of Squash (*Cucurbita maxima*) Pickles

Parameters	Squash (<i>Cucurbita maxima</i>) Pickles
Sodium, mg/100g	83
Potassium, mg/100g	20
Calcium, mg/100g	18
Iron, mg/100g	.55
Zinc, mg/100g	.36
Crude fiber	.93
PH	3.74

Legend: *Protein Factor

**Test within the scope of accreditation

The main role of these minerals can be described as structural and functional. Structurally, they stand out for their role as integrators of organic compounds in the body, while functionally, they are important in controlling biological functions (Ozden *et al.*, 2010) ^[17].

➤ Nutritional Analysis (%Daily Value) of Squash (*Cucurbita maxima*) Pickles

Nutrition facts and calorie content is usually indicated in the labels. In this way the consumers will be informed what are the nutrients in the food items on food labels. What are usually nutrients in the label are fats, proteins, cholesterol, salt, sugar and vitamins. However, in this new develop pickled product in 5 serving per container of serving size (14g, the daily value was tested, the results for fat, protein calcium Iron, potassium and zinc is zero%. The only available calories are 30%, sodium (1%) and Carbohydrates (3%). For those who want weight loss this product can be

recommended. In the present time, awareness about the use of food labels is important because various health related conditions are prevailing due to consumption of unhealthy food products (Huang Z, Li H, Huang J. (2021) ^[18]. It is advice by the health conscious that buying food items should read first the nutrition facts because this will inform if the food is unhealthy or healthy. The nutrition fact in squash pickled is in contradiction with results as stated by several researchers. (Staughton, 2020) ^[19] stated that squash (*Cucurbita maxima* L.), locally also known as kalabasa in Filipino, is highly recommended vegetable due to its richness of minerals, nutrients, vitamins, and organic compounds that keep people's lives healthier. Squash is well known for being a healthy vegetable (Mercadal, E.C., 2022) ^[20]. As in Table 3 the absence of some minerals may be due to the method of processing the pickled squash. Further investigation of this developed product is recommended.

Table 3 Nutrition Facts Computation (%Daily Value) Squash (*Cucurbita maxima*) Pickles

Nutrition Facts 5 Serving per container Serving size 1tsp (14g)	
Amount Per Serving	% Daily value
Calories	30
Total fat 0g	0%
Sodium 1220mg	1%
Total Carbohydrates 0g	3%

Protein 0g	0%
Calcium 610mg	0%
Iron 1mg	0%
Potassium 50mg	0%
Zinc 0mg	0%
*Percent daily values (DV) tells you how much a nutrient in a serving of food contributed to a daily diet, 2,000 calories a day is used for general nutrition advice	

For general nutrition advice a man and woman need 2,000 calories per day. Hence, this product is not enough to attain the needed nutrition of the body. There is a need to take more serving to at least add an additional calorie. As shown in Table 4 the other nutrients such as fat %kcal (20-30) sodium mg (2,300), carbohydrates g (45-65), protein g (45-56), calcium mg (1,200), iron g (8), potassium mg (4,7000)

and zinc mg (11) does not reach to daily requirements of the body. Moreover, fat protein, calcium, iron, potassium & zinc is not found in the pickles. Therefore, another kind of food product needs to be eaten in order to attain the daily requirements of the body to become healthy. Although pickles are just an appetizer, therefore this product may be recommended as a supplement to the diet.

Table 4 Nutrition Facts Computation (%RENI) Squash (Cucurbita maxima) Pickles

Nutrition Facts Serving size ½ cup (30g) Serving per container /pack:5			
Amount Per Serving			% RENI*
Calories (kcal)	30		1
Calories from Fat	3		
Total fat (g)	0		
Sodium mg	25		
Total Carbohydrates g	7		<2
Total Protein g	0		<2
Calcium (mg)	5		<2
Iron	0		<2
Zinc	0		<2
*Percent RENI values are based on a 2002 for male 19-29 years old			

The RENI is used to denote recommendations for energy and 21 nutrients including protein, folate, calcium, and zinc for the maintenance of health and well-being of nearly all healthy persons in the population. Moreover, some nutrients should be consumed more frequently, such as water-soluble vitamins like vitamin C. Other nutrients, on the other hand, can be harmful if more than what is recommended is taken, like vitamin A. RENI is the standard of achieving adequate energy and nutrient intakes for Filipinos (FNRI-DOST,2014) ^[21].

In this study, the computation for RENI was based on a 2002 PDRI reference of male adults 19-29 years of age with 2000 calorie needs. The calorie in this study per serving is 1/2 cup (30 grams) Since there are 5 servings per container therefore if you use the content of the container in preparing the menu you have an equivalent of 150 calories which is less than the daily values of 2000. Hence, eating the total serving of this product is not enough to attain the required daily calorie. Another food with numbers of calories is recommended to reach the required calories per day.

Moreover, based on the standard of other mineral elements, the sample is below the standard. Hence, this product may be included for daily intake of an adult individual. The Adequate Intake (AI) for sodium is 1,500 milligrams daily for males and females ages 9-50. This value is less than 1 teaspoon of table salt per day. The maximum recommended level of sodium intake is 2,300 milligrams daily. On average, more than 85% of men and

women consume sodium in amounts that far exceed the maximum recommended level of intake (Bellows, L and R. Moore, R (2013) ^[22]. Therefore, since the sodium content is very low, it will not affect human health.

IV. CONCLUSION AND RECOMMENDATION

Squash is one of the most versatile and delicious vegetable available throughout the world. The squash pickles prove as delicious and nutritious, however there are some critical consideration to be observed, in processing squash pickles the most critical to be considered the maturity of the squash to be used and the quality of ingredients added in the preparation of pickles solution. The squash should not too young and not to matured. The vinegar to be used is also one consideration in order to produce quality squash pickles. Further studies are recommended particular on the shelf life of product and other micronutrients of the products.

REFERENCES

- [1]. Villar, M. (2025). Sensory Evaluation and Microbiological Analysis Squash (Cucurbita maxima L.) Pickles. International Journal of Innovative Science and Research Technology, <https://doi.org/10.38124/ijisrt/25mar1238>, pp.1601
- [2]. Department of Agriculture, Regional Field Office, (2017). Squash Production Guide.

- <https://cagayanvalley.da.gov.ph/wp-content/uploads/2018/02/Squash.pdf>, pp. 2
- [3]. Villanueva, M.K. C., et al. (2024). Development of Squash-Based Products for Food Security and Sustainable Livelihood. *International Journal for Multidisciplinary Research (IJFMR)*. Volume 6, Issue 6, November-December 2024.
- [4]. Millesca, A.B., 2021. Product development and chemical composition analysis of sweet pickled green papaya (*Carica papaya*). *EPRA International Journal of Multidisciplinary Research*, 5: 2455- 3662.
- [5]. Battock, M. & Ali, S.A. (1991). Fermented fruits and vegetables: A global perspective. *FAO: Rome*.
- [6]. Ojokoh and Babatunde (2014). Effect of Fermentation on Nutrient and Anti-nutrient Composition of Millet (*Pennisetum glaucum*) and Soyabean (*Glycine max*) Blend Flours. *Journal of Life Sciences*, ISSN 1934-7391, USA. Volume 8, no. 8.
- [7]. World Health Organization (2007). Protein And Amino Acid Requirements In Human Nutrition Report of a Joint WHO/FAO/UNU Expert Consultation WHO Technical Report Series 935. https://iris.who.int/bitstream/handle/10665/43411/WHO_TRS_935_eng.pdf
- [8]. Dari, L. and Yaro, N.S., (2018). Nutritional Composition and Storage of Butternut Squash. *Ghana Journal of Horticulture* Vol. 12, Issue. 1 pp. 27
- [9]. Oboh, G. And Akindahunsi, A.A. 2003. Biochemical changes in cassava products (flour and gari) subjected to *Saccharomyces cerevisiae* solid media fermentation. *Food Chem.* 82(4), 599–602.
- [10]. Eromosele IC, Eromosele CO (1993). Studies on the chemical composition and physicochemical seeds of some wild plants, *Plant food Hum Nutr* 43: 251-258.
- [11]. Hassan, L.G., Sani, N.A., Dangoggo, S.M. and Ladan, M.J. (2008): Nutritional Value of Bottle Gourd (*Lagenaria siceraria*) Seed, *Global Journal of Pure and Applied Sciences*, 14(3): 301-306.
- [12]. Onwordi, C. T, Ogungbade, A. M. and Wusu, A. D. (2009). The proximate and mineral composition of three leafy vegetables commonly consumed in Lagos, Nigeria. *African Journal of Pure and Applied Chemistry* Vol. 3 (6), pp. 102-107. Available online at [http:// www.academicjournals.org/AJPAC](http://www.academicjournals.org/AJPAC) ISSN 1996 – 0840. Accessed: 20/9/2012
- [13]. Dari, L. and Mahunu, G. K. (2010). Nutritional Composition of Some Indigenous Leafy Vegetables. *Ghana Journal of Horticulture* ISB 0855-6350. Pp112-115.
- [14]. Campos, V., et.al., (2022). Importance of Carbohydrate Quality: What Does It Mean and How to Measure It?. Published by Oxford University Press on behalf of the American Society for Nutrition.
- [15]. Bigueja, Myrna, et.al. (2020). Sensory and Nutritional Characteristics of Thermally Processed Tilapia (*Oreochromis niloticus*) in Coconut (*Coconuts nucifera* L.) Sauce. *International Journal of Life Sciences Research* ISSN 2348-3148 (online) Vol. 8, Issue 2, pp: (38-45), Month: April - June 2020, Available at: www.researchpublish.com
- [16]. USDA, 2016a. Composition of foods raw, processed, prepared. USDA national nutrient database for standard reference, release 28 (2015). Documentation and User Guide (2016). (Retrieved October 6, 2016 from). <https://data.nal.usda.gov/dataset/composition-foods-raw-processed-prepared-usda-national-nutrient-database-standard-referen-14>
- [17]. Ozden, O., Erkan, N. and Ulusoy, S. (2010). “Determination of Mineral Composition in Three Commercial Fish Species (*Solea solea*, *Mullus barbatus* and *Merlangius merlangius*)”.
- [18]. Huang Z, Li H, Huang J. (2021). Analysis of Chinese Consumers' Nutrition Facts Table Use Behavior Based on Knowledge-Attitude-Practice Model. *International Journal of Environmental Research and Public Health*. 2021 Jan; 18(22): 12247. doi: 10.3390/erph182212247
- [19]. Staughton, J. (2020, October 27). 8 Amazing Benefits of Pumpkin. *Organic Facts*. <https://www.organicfacts.net/pumpkin.html>.
- [20]. Mercadal, E.C., et.al., (2022). Sensory Acceptability of Squash (*Cucurbita maxima*) Cupcake in The Municipality of Isabel, Leyte. *Irish Interdisciplinary Journal of Science & Research (IIJSR)* Vol 6, Iss 4
- [21]. FNRI- DOST, (2014). Recommended Energy and Nutrient Intakes. <https://fnri.dost.gov.ph/index.php/programs-and-projects/news-and-announcement/133-fnri-presents-2014-recommended-energy-and-nutrient-intakes>
- [22]. Bellows, L., Moore, R., Potassium and the Diet Extension, Fact sheet No. 9.355, Food and Nutrition series, Health, Colorado State University, Fort Collins, CO 80523-4061, 2013.