RESEARCH ARTICLE

EFFECT OF DIFFERENT PROCESSING METHODS ON THE NUTRITIONAL COMPOSITION AND ANTINUTRITIONAL FACTORS OF PEANUT MILK

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ABSTRACT

Comparative effects of different processing methods like blanching, soaking, roasting and germination methods on nutritional composition and antinutritional factors in peanut milk were investigated. Local and CO 6 peanut varieties were selected for peanut milk preparation and subjected to different processing methods. Peanut milk was extracted from fresh (control), blanched (2 mins), soaked (3 hrs), roasted (roasting 5 mins followed by soaking 3 hrs) and germinated (8 hrs) peanuts. Peanuts were washed, ground, slurry separated, filtered, homogenized, double pasteurized and stored. Different processing methods influenced the nutritional composition of local and CO 6 variety peanut milk. The nutritional composition like total solids, protein, fat, calcium and iron content of the different processed peanut milk were analyzed. The total solid content of the peanut milk does not change in soaking (13.98 and 15 g/ 100 mL), germination method (13.99 and 15.26 g/100 mL), less reduction in roasting method (13.96 and 15.20 g/ 100 mL), more significant reduction in blanching method (12.36 and 13.97 g/ 100 mL) in local and CO 6 variety of peanut milk respectively were recorded. Protein content was increased in germination ((6.1 and 6.4 g/ 100 mL), soaking (6.0 and 6.3 g / 100 mL), roasting method (5.6 and 5.8 g / 100 mL) and reduction in blanching method (4.1 and 5.0 g / 100 mL) in local and CO 6 variety peanut milk respectively. Fat content was significantly reduced in control (3.82 and 3.54 g / 100 mL), blanching method (3.63 and 3.32 g / 100 mL), soaking method (3.80 and 3.55 g/ 100 mL) and germination method (3.60 and 3.50 g/ 100 mL) in local and CO 6 variety peanut milk. Calcium and iron content was greatly reduced in blanching and lesser reduction in roasting method. Antinutritional factors like phytic acid, tannin, trypsin inhibitor, oxalate and phenol was greatly reduced in roasting and germination methods. It was observed that the nutritional properties were highly conserved and the antinutritional factor was greatly reduced in the roasting method.

Keywords: *Peanut milk; CO 6 variety; Nutritional composition; Antinutritional Factors.*

INTRODUCTION

Peanut *(Arachis hypogaea)* is an important oilseed crop belonging to the family Fabaceae and it originated in South America. Peanut is also considered as poor man's meat, poor man's cashew, monkey nut, groundnut and wonder nut (Madhusudhana., 2013). USDA 2015 reported that China was the largest peanut producer in the world,occupying 45%. India has 15%, America has 5% of total world peanut production [USDA 2015].

Plant-based milk is the most suitable alternative for cow's milk and other diary-based milk sources based milk sources do not contain any lactose content , so it is more suitable for people with lactose intolerance syndrome , cow 's milk allergy and hypercholesterolemic individuals. It has high nutritional value and more suitable for vegans, infants, children, under nourished and malnourished people. Satisfying customers' demands for special needs at the lowest possible cost has always been the major challenge faced by the food service industry.

The non dairy-based functional beverage sector development has increased dramatically. Plant based milk sources are the least expensive and are easily affordable. Peanut is a good source of protein (25%), fatty acid (50%) especially linoleic acid and

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oleic acid, fiber, vitamin B2, vitamin B6, vitamin B12, minerals like zinc, selenium, phosphorous and potassium (International Nut and Dried Fruit Council, 2019).

Substance presence in the food can reduce the nutrient bioavailability or may be toxic for human consumption.They are termed antinutritional factors; these substances must be eliminated or inactivated (Inuwa *et al*.,2011). Antinutritional factors like phytates, condensed tannin, trypsin and α amalase inhibitors are present in peanuts, which reduces the usages and nutritive value. (Embaby *et al.,* 2010). Antinutritional factors in the seeds can cause adverse health effects for humans (Martín-Cabrejas *et al*.,2009).

Different processing methods like soaking, cooking, blanching and germination can influence the physical, chemical, nutritional, antinutritional factors and sensory properties of the peanut milk(Lee *et al.,* 1992). The effect of different processing methods on the nutritional composition and antinutritional factors of peanut milk from local and CO 6 peanut milk were investigated and determine the best method for peanut milk preparation.

MATERIAL AND METHODS

2.1.Procurement of materials

Local peanut variety was purchased from a local market (Simmakal) and TNAU CO 6 peanut variety was purchased from the Department of Plant Breeding and Genetics, Tamilnadu Agricultural University, Coimbatore. Good quality, mold-free peanut seeds were selected for peanut milk preparation.

2.Processing Techniques of peanut milk

Peanut milk sample (local and CO 6 variety) was prepared by different processing methods like fresh (control), blanching, soaking, roasting and germination methods.

In each processing method, peanut kernels of 100 g each from local variety and CO 6 variety was taken, weighed and washed. In blanching (121 ºC 15 psi for 2 mins), soak for 3 hrs , roasting(roasting for 5 mins followed by soaking 3 hrs) and germination (8 hrs) pretreatments were done. Then treated peanuts were ground (1:3 ratio of the kernel to water) and filtered to extract peanut milk. The peanut milk was homogenized for 5 mins and double pasteurized (85 ºC for 15 mins), bottled and stored at 4 ºC.

2.3.Analytical methods

a) Nutritional analysis

Total solid, fat, protein, calcium and iron content of the peanut milk from local and CO 6 peanut variety was analyzed by following AOAC (2000) methods.

b) Anti-nutritional factors

The phytic acid content of the peanut milk sample was carried out as described by Aina *et al.,* (2012). The tannincontent of the peanut milk sample was measured by Vanillin –HCl method as described by Mazahib *et al.,* (2013).The trypsin inhibitor content of the peanut milk sample was estimated by Liu and Markakis(1989). Phenol content of the sample was determined by Sadasivam and Manickam (2016). The oxalate content of the peanut milk sample was determined by Munro and Bassiro (2000).

2.4 Statistical analysis

Data were analyzed by ANOVA (Analysis of variance) and the treatments were conducted in triplicate and means were compared using Fischer's least significant difference test ($P<0.05$).

RESULTS AND DISCUSSION

Nutritional and antinutritional factors of the local and CO 6 variety prepared peanut milk from fresh, roasting, blanching, soaking and germination methods were carried out in the laboratory of Community Science and Research Institute, Madurai.

Nutritional analysis

Figure 1 shows the nutritional composition of peanut milk extracted from fresh, blanching, soaking, roasting and germination method in both the selected local and CO 6 peanut variety. The total solid content of the peanut milk had a lesser reduction in germination method (13.99 and 15.26 g/ 100g) and soaking (12.78 and 15.20 g/100g) in local variety and CO 6 peanut variety, respectively. The local variety was (12.36 g/100g) and CO 6 variety was (13.97g/100g) in the blanching method. Results reported that the total solid content of the peanut milk was reduced during processing. There is slight change observed in both local varieties (13.96 g/100g) and CO 6 variety (15.20 g/100g) in the roasting method compared to fresh peanut milk (Figure 1).

Soaking and germination method of peanut milk extraction had significantly higher protein content compared to fresh peanut milk in both the selected peanut varieties. Mubarak also reported that the protein content (9.1 %) was increased in the processing of mungbean seeds (Mubarak 2005). Alonso *et al*., (2000) reported that during germination (3%) and dehulling (6%) there was a significant increase in the protein content of kidney beans compared to the raw kidney beans. In the germination and soaking method, the protein content of local and CO 6 peanut variety was significantly higher. In the blanching method, the protein content of both the selected varieties was reduced, but the roasting method does not affect the protein content in local and CO 6 peanut variety milk (Figure 1).

Figure 1 shows that the roasting method of peanut milk does not affect the fat content in local and CO 6 peanut varieties compared to fresh peanut milk.

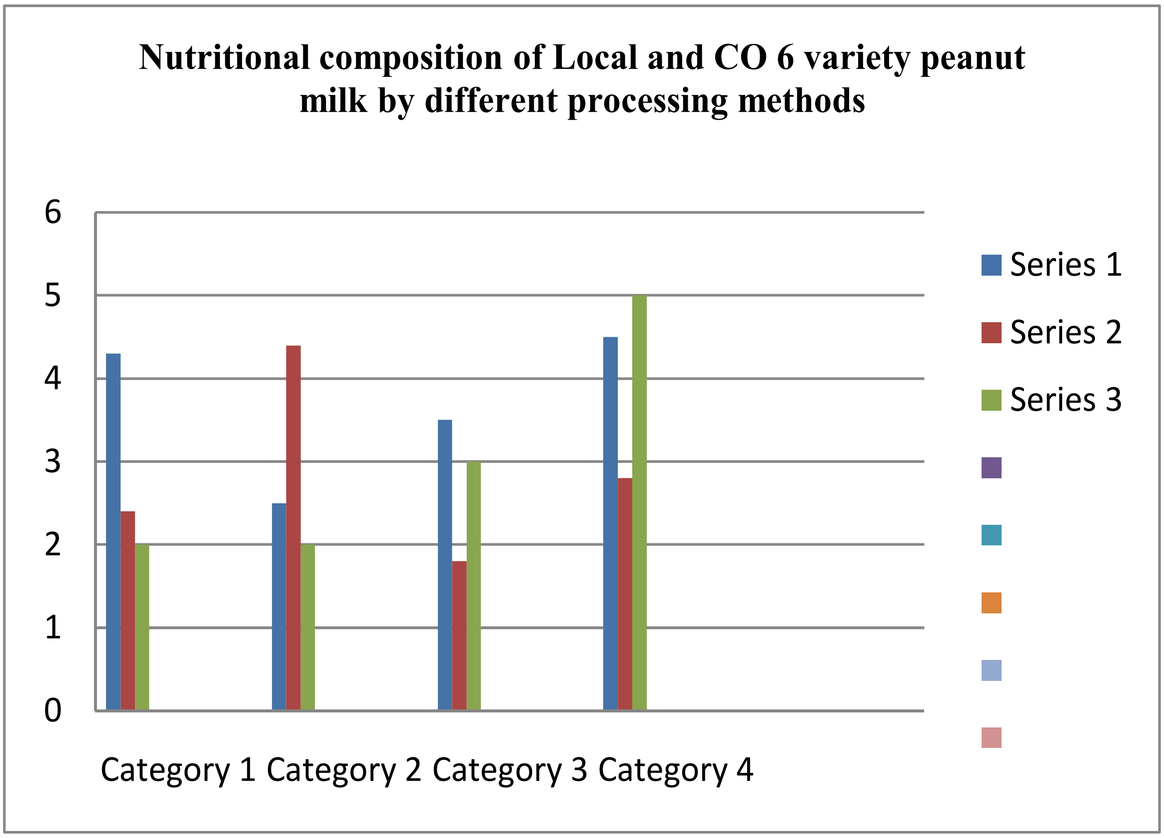

Figure 1. Nutritional composition of peanut milk from different processing methods in local and CO 6 peanut variety

L- Local peanut variety; C- CO 6 peanut variety

In the soaking and germination method, fat content was significantly reduced in local variety 3.80 g/100g, 3.60 g/100g, and CO 6 peanut variety 3.55 g/100g, 3.50 g/100g, respectively. During the germination and soaking process, the lipolytic enzymes were activated, hydrolyzed the fat into fatty acids and glycerol and reduced the fat content of the peanut milk. The blanching method reduced the fat content in the local variety by 3.63 g/100g and CO 6 variety by 3.32 g/100g, respectively, when compared to fresh peanut milk. Those findings are in agreement with those of Ejigui *et al.* (2005).

As shown in figure 1 calcium content of peanut milk in local and CO 6 peanut variety was significantly ($p<0.05$)reduced in the blanching, soaking, roasting and germination methods with a value of 11.5 mg/100g, 11.6mg/100g, 11.8 mg/100g, 11.7 mg/100 g in local variety and 11.9 mg/100g, 11.8 mg/100g, 12 mg/100mg, 11.7 mg/100mg in CO 6 peanut variety respectively when compared to fresh peanut milk in both the peanut varieties.

Figure 1 shows that the iron content of peanut milk in local and CO 6 peanut variety significantly ($p<0.05$)reduced in the blanching, soaking, roasting and germination methods with a value of 2.24 mg/100g, 2.27 mg/100g, 2.57 mg/100g, 2.49mg/100g in local variety and 3.04 mg/100g, 3.04 mg/100g, 3.07 mg/100mg, 3.05 mg/100mg in CO 6 peanut variety respectively when compared to fresh peanut milk in both the peanut varieties.

Parul Jain *et al*. (2013) reported that total solid content in the peanut milk prepared by soaking method , pressure blanching method was decreased due to leaching of solid contents. Normal soaking, 1 % $NaHCO_3$ and pressure blanching method, the total solid content in the peanut milk was 12.30 %, 11.58 % and 11.49 % respectively were reported.

Peanut milk was prepared by different blanching time intervals at (121˚C 15 psi 0 mins, 2 mins, 3 mins, 5 mins) among that 0 min pressure blanching method contain 3.76 % high protein when compared to 2 min, 3 min and 5 min contain less protein 3.27%, 3.23 %, 2.6 % respectively. It was observed that an increase in blanching time decreases the protein in the peanut milk (Parul jain *et al.,* 2013)

Adesola *et al*. (2013) described that groundnut milk was prepared from fresh, roasted (170 °C, 25 min) and steeped (water, 20 min) groundnuts. Nutritional properties like fat, protein and carbohydrate were observed and their value ranged from 2.40 to 3.48%, 2.05 to 2.33%, 5.50 to 5.60%, respectively. Azhari Siddeeg *et al*. (2020) reported that carbohydrate, protein, fat, calcium content of the peanut processed milk were 7.5 g/100g, 6.3 g/100g, 6.3 g/100g and 10-12 mg/100g, respectively. Agurbiade *et al*. (2011) reported that the calcium content of almond milk is 33.0 mg/100g. Kundu *et al*. (2018) stated that the total solids, fat, calcium, iron content of soymilk and almond milk was 8.11g/100g, 2.350mg/100g, 5.970mg/100, 1.587 mg/100g and 27.960 g/100g, 8.250 g/100g, 16.019mg/100g, 3.980 mg/100g respectively. During germination in legumes (peanut), carbohydrates, protein, fat content decreases significantly (Megat rusydi *et al.,* 2011).

Antinutritional factor analysis

As shown in figure 2, processing methods like blanching, soaking, roasting and germination methods significantly ($p<0.05$) reduced the phytic acid content compared to the fresh peanut milk in both the local and CO 6 peanut variety milks.

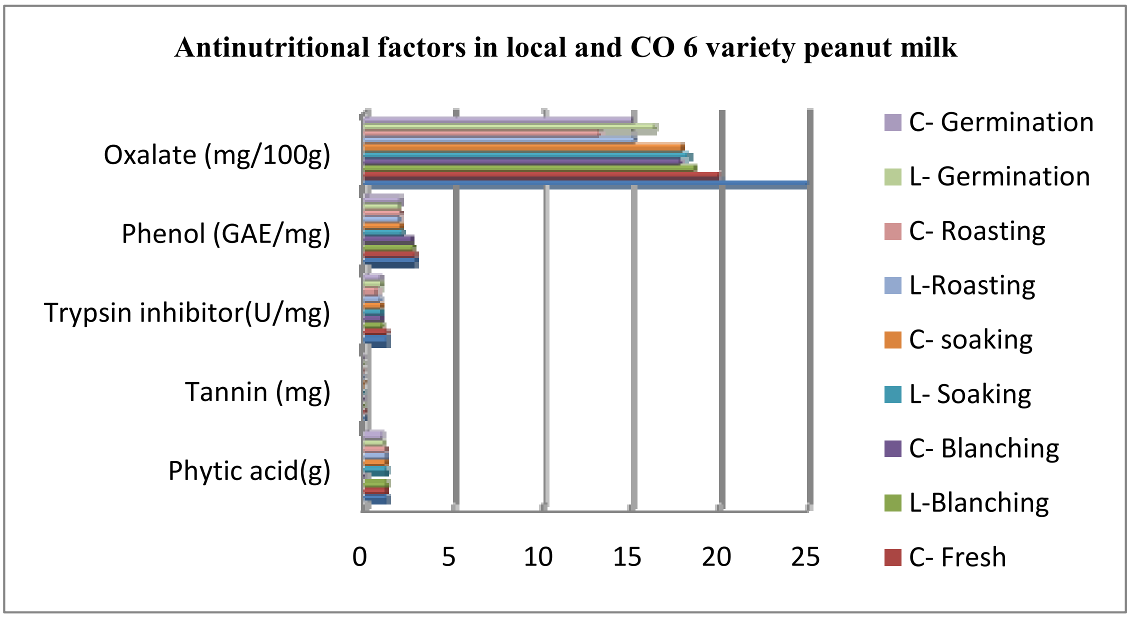

Figure 2. Effect of a different processing methods in antinutritional factors of local and CO 6 peanut variety milk

L- Local peanut variety; C- CO 6 peanut variety

The phytic acid content of the fresh peanut milk (without treatment) from local variety 1.20 (g/100g) and CO 6 peanut variety was 1.12 (g/100g). In the blanching method, the phytic acid content of the local variety was 1.15 (g/100g) and CO 6 variety was 1.10(g/100g), soaking method the phytic acid content of the local variety was 1.17 (g/100g) and CO 6 variety was 1.11(g/100g), Roasting method the phytic acid content of the local variety was 1.14 (g/100g) and CO 6 variety was 1.09(g/100g). Germination method the phytic acid content of the local variety was 1.00 (g/100g) and CO 6 variety was 0.92(g/100g). Among these different processing methods germination method reduced the phytate content compare with other methods because the germination process increases the activity of phytase enzymes which degrades the phytic acid content of the peanut milk.

Ejigui *et al*. (2005) found that the germination, roasting and germination-roasting method reduced the phytate content in red peanuts. During the roasting the phytic acid content in the peanut milk was reduced due to partial damage of the phytic acid content during roasting Ejigui *et al.* (2005). During the roasting, soaking and germination process, the phytase activity increased in peanut and reduced the phytate content in peanut milk. Alonso *et al*., (2000). During the blanching methods leaching out effect may reduce the phytate content in peanuts. Azeke *et al*. (2011) reported that phytic acid content decreased during the germination process because of higher phytase activity. During the blanching and soaking method, the phytic acid content was reduced due to decreased acid content by leaching and the process enhanced by high temperature (Mosha *et al*. 1995).

Figure 2 shows a significant reduction (p<0.05) in the tannin content in blanching, soaking, roasting and germination methods compared to fresh peanut milk in both the selected local and CO 6 peanut variety. The tannin content of fresh peanut milk (0.05 mg/100g) in local variety and (0.04 mg/100g) in CO 6 peanut variety milk. A small quantity of tannin content present in peanut (Local and CO 6 variety) was reduced by blanching, soaking, roasting and germination methods. Blanching and soaking methods were the most effective methods to reduce the tannin content in peanut milk due to its tannin leaching property.

Trypsin inhibitor activity of the local variety peanut milk from blanching, soaking, roasting and germination methods were significantly (p<0.05) decreased with the value of 0.90 (U/mg), 0.88 (U/mg), 0.78 (U/mg), 0.85 (U/mg) compared to fresh peanut milk. Trypsin inhibitor activity of the CO 6 variety peanut milk from blanching, soaking, roasting and germination methods were significantly (p<0.05) decreased with the value of 0.88 (U/mg) ,0.86 (U/mg), 0.67 (U/mg), 0.80 (U/mg) compared to fresh peanut milk. These different processing roasting methods greatly reduced the trypsin inhibitor activity in both the local and CO 6 variety peanut milk. Trypsin inhibitor was a thermosensitive compound it will reduce at 108 ºC so that high temperature during roasting will greatly reduce the trypsin inhibitor activity of peanut milk. Comparison between these two varieties CO 6 variety had low trypsin inhibitor activity (Figure 2).

Figure 2 shows the result of phenol content in fresh, blanching, soaking, roasting and germination method of both local and CO 6 peanut variety milk. These result showed that there is significantly (p<0.05) reduced phenol content in blanching, soaking, roasting, and germination methods than fresh peanut milk. Among these different processing methods, roasting had reduced phenol content in peanut milk, followed by germination, soaking and blanching methods in both the local and CO 6 variety peanut milk. Thermo instability nature of the phenol content in peanut seeds was subjected to the roasting process; its high temperature can provide the energy for free water molecules and, it causes cell destruction and hydrolyzes the phenolic compounds and reduce the phenol content of the peanut milk.

As shown in figure 2, oxalate content in local and CO 6 peanut variety milk is significantly (p<0.05) reduced in blanching, soaking, roasting and germination methods compared to fresh peanut milk. In local variety the oxalate content in fresh, blanching, soaking, roasting, germination methods and its value was 25mg/100mg, 18.56 mg/100g, 18.24 mg/100 g, 15.21 mg/100g, 16.3 mg/100g. In CO 6 variety the oxalate content in fresh, blanching, soaking, roasting, germination methods and its value was 20mg/100mg, 17.82 mg/100g, 17.91 mg/100g, 13.26 mg/100g,15.1 mg/100g. The roasting method in local and CO 6 peanut milk had greatly reduced oxalate content in peanut milk. Oxalate content was thermo liable in nature, so the roasting process's high temperature, so the high temperature of the roasting process can greatly reduce the oxalate content in peanut milk.

CONCLUSION

Peanut milk was prepared from different processing methods like blanching, soaking, roasting, fresh and germination methods had varying impacts on the nutritional properties and antinutritional factors in local and CO 6 peanut variety. Peanut milk from the roasting method had a lesser reduction in nutritional composition like total solid, fat, protein, calcium, iron content and thermosensitive nature of the antinutritional factors like phytate, tannin, trypsin inhibitor, oxalate and phenol content were greatly reduced during high-temperature roasting process in both the local and CO 6 variety peanut milk. From the findings of the research work, peanut milk from roasting treatment appears beneficial as it was relatively conservative of nutritional characteristics and a greater decrease in antinutritional factors when compared to soaking, blanching, fresh and germination methods in both local and CO 6 variety peanut milk.

Consent for publication

All the authors agreed to publish the content.

Competing interests

There was no conflict of interest in the publication of this content

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