Effect of Mixing Pumpkin Puree with Wheat Flour on Physicochemical and Sensory Properties of Stick Snacks.

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ABSTRACT

Pumpkin products tend to taste naturally sweet and desirable, and the addition of pumpkins into food increases its beta-carotene. Continuous growth in the snack market has motivated producers to introduce new products using a variety of ingredients in order to improve nutritional values and appearance of their products. This study was carried out to investigate the effect of mixing pumpkin puree with wheat flour on the physicochemical and sensory properties of stick snacks. Four samples were produced using a different percentage of the pumpkin puree content; 10% for Formulation 1 (F1), 20% for Formulation 2 (F2), 30% for Formulation 3 (F3) and 0% for control (C). All samples were analyzed to determine moisture content of samples and texture analysis is performed to determine the degree of hardness and fracturability of pumpkin stick snack. Sensory analysis is performed to determine the level of panel acceptance of attribute such as texture, color, taste, appearance and the overall acceptance of pumpkin stick snacks. Moisture content results show that C has the highest and F3 has the lowest moisture content. For texture analysis, as the percentage of pumpkin puree increased, the hardness and fracturability was increased. Sensory analysis results show that F3 is most accepted by panelist because the highest percentage of pumpkin content compared to other formulations.

Keywords*: Stick snacks, Pumpkin puree, Texture analysis, Physicochemical, Sensory analysis*

1. INTRODUCTION

Stick snacks are the most popular snacks among today's society. Recently, most stick snacks are produced using fish, crab and shrimp products. In order to diversify the product and increase fiber intake among the community, stick snacks are produced using vegetable and fruit sources. There is a limited amount of research that looks into processed pumpkin products. Therefore, this study will look into the potential of local pumpkin commercialization in Malaysia based on product innovation. Since pumpkin planting in Malaysia is mainly for domestic consumption and export (Anim Hosnan, 2010), there is a potential to commercialize its processed products. Addition of pumpkin puree to stick snacks products will increases dietary fibre intake and decreases the caloric density of snacks. Supplementation of wheat flour with pumpkin puree will improve the nutritional quality of biscuits with changed sensory attributes. However, the use of vegetables and fruits that contain high fiber will affect the production of stick snacks in terms of taste, appearance and texture (De Pilli *et al*., 2013). The main objective of the present study was to evaluate the effect of incorporating pumpkin puree to whole wheat flour for developing dietary fiber enriched snacks and to evaluate their physicochemical properties and acceptability.

2. LITERATURE REVIEW

Pumpkin is a member of the *Cucurbitaceae* family, is one of the largest families in the vegetable kingdom, consisting of largest number of edible plant species (Manjunath *et al*., 2008). Pumpkin is an important dietary source of fiber, carotene, minerals (copper, zinc, iron and magnesium) and vitamins (Loy & Broderick, 1990). Pumpkin is consumed in a variety of ways such as fresh or cooked. It is a good source of β-carotene, fibre, pectin, mineral salts, vitamins and other substances that are beneficial to health (Kundu *et al*., 2014). The yellow-orange characteristic colour of pumpkin is due to the carotenoids content which are the primary source of vitamin A for most of the people in the developing countries (Boileau *et al*., 1999). Numerous studies have been conducted on pumpkin (Kampuse *et al*., 2015). It has commercialization potential (Margaret et al., 2016), and can be consumed fresh, boiled, steamed, or as processed food items such as *masak lemak labu*, *labu sira*, and *pengat labu* in Malaysia (Norshazila et al., 2014) and as soup and curry in Thailand (Pongjanta et al. 2006). Some products of the fruit are biscuit (Kulkarni, A.S. and Joshi, 2013), bread, pasta (Lucia *et al*., 2017), cracker (Kuchtová *et al*., 2016) and dried white seeds called kuaci and candied pumpkins (Norshazila *et al*., 2014). However, the availability of processed pumpkin products is low, since the market demands fresh pumpkins. Hence, pumpkin has commercialization potential into various food products (Nurhuda *et al.*, 2013) since it is inexpensive, widely planted all over Malaysia (Norshazila *et al*., 2014; Margaret *et al*., 2016).

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3. MATERIAL AND METHODS

Pumpkin, wheat flour and material for stick snack preparation were bought from local market in Kuantan, Pahang.

3.1 Formulation of stick snack

Various formulations of stick snack samples were prepared by different percentage of pumpkin puree except for control sample. The different percentage of pumpkin puree is shown as below:

Table 1: Percentage of pumpkin puree in different formulation

Formulation	Percentage of pumpkin puree (%)
F1	10%
F2	20%
F3	30%
C	0%

3.2 Preparation of stick snack samples

The sample of stick snacks was prepared according to Han *et al.* (2010) with some modifications. Ripe pumpkin fruit was obtained from the local market of Kuantan, Pahang. It was washed, peeled, seeds removed and cut in small pieces. The pieces of pumpkin were steamed for 5 minutes and blender to smooth puree. Pumpkin puree was added in different proportions to whole wheat flour, butter, ground sugar, salt and potable water. All these ingredients were mixed together to make soft dough. The dough was rolled out in a 2 mm thin uniform layer and cut into desirable long stick shapes. These were fried at 180°C for 5 min. Then the stick snacks were cooled, packed in air-tight boxes and stored at room temperature.

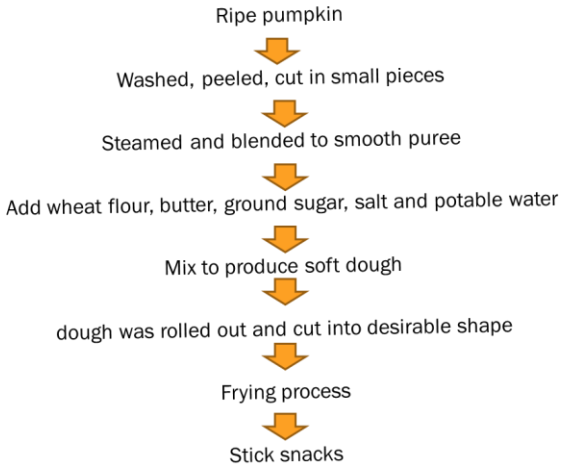

Figure 1: Flow chart of stick snacks production

3.3 Physicochemical analysis

Moisture content of the stick snacks samples were determined in triplicate according to AOAC Method 930.04 (AOAC, 1990). Different samples of stick snacks as prepared above were studied for the effect of replacement of refined wheat flour with pumpkin puree for its fracturability and hardness using Texture Analyzer (Brookfield-CT3 Texture Analyzer). The measurement of each sample was done in triplicate.

3.4 Sensory analysis

A fifty member untrained panellists were used to evaluate the various sensory parameters (appearance, taste, colour, texture and overall acceptability) and the scores were based on a 7 points hedonic scale. The samples were assessed using 7 point hedonic scale ranging between 7 (like very much) to 1 (dislike very much). Data obtained from analysis were evaluated statistically using a variance analysis (One Way ANOVA).

4. RESULTS AND DISCUSSIONS

4.1 Physicochemical properties

3.1.1 Moisture content

The results of moisture content of different stick snacks samples are shown in Table 2. It was observed that moisture content of the sample decreased after replacing wheat flour with pumpkin puree over the control sample. This result shows that the addition of pumpkin puree in the sample will reduce the water absorption of the samples. The decreased of moisture content may be attributed to fiber content in pumpkin stick snacks. Water absorption capacity of biscuit was lower when pumpkin powder is added in biscuit compared to control sample (Kulkarni, A.S. & Joshi, 2013). This results also comply with other research which showed increased crude fibre content in biscuit made with added Bambara groundnut flour (Slade & Levine, 1994)

Table 2: Moisture content of different stick snacks samples

Formulation	Moisture content (%)
C	3.01% ± 0.03
F1	2.72% ± 0.02
F2	2.35% ± 0.06
F3	2.14% ± 0.01

3.1.2 Textural properties

Mixing of pumpkin puree with wheat flour with in the formulation of stick snacks showed in a significant change in the textural quality of the samples. Figures 1 and 2 illustrate the effect of mixing of pumpkin puree with wheat flour on the textural quality such as hardness and fracturability of stick snacks. It is showed that as increasing the percentage of pumpkin puree, the amount of force required to break the samples increased considerably. On mixing 10% of pumpkin puree, the hardness of the stick snacks increased to 5265 g from that of 3256 g for the control sample. Further increase in mixing percentage of pumpkin puree to 20% and 30%, increased the hardness of sample to the further level of 5970 and 6510 g, respectively. The result was similar to Huma *et al*., (2017) which reported that biscuits had harder texture by increasing the level of Carrot Pomace Powder and Beetroot Pomace Powder in whole wheat flour.

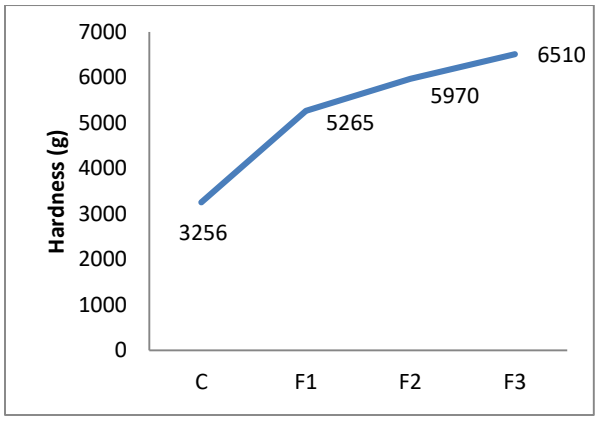

Figure 2: Hardness value of different types of samples

Similarly, increasing the percentage of pumpkin puree, the amount of force required to give first crack on the stick snacks while breaking (fracturability) also increased. The fracturability of control sample of stick snack was 645g, but as the percentage of pumpkin puree was increased to 10, 20, and 30%, the fracturability of samples increased to 820g, 1170g and 2545g respectively. The results comply with other work which showed increased crude fibre content in biscuit made with added pumpkin powder, carrot powder and beet root powder increased the hardness of biscuit (Kulkarni, A.S. & Joshi, 2013; Huma *et al.*, 2017)

Gradual increase in hardness and fracturability with increase in mixing pumpkin puree with wheat flour might be due to the fact that water absorption capacity of wheat flour is more as compared to that of the pumpkin puree (Kuchtová *et al*., 2016). The addition of pumpkin puree causes the reduction of moisture absorption. Hence, during frying the optimum moisture could not retained in the stick snack due to the addition of pumpkin puree in the samples.

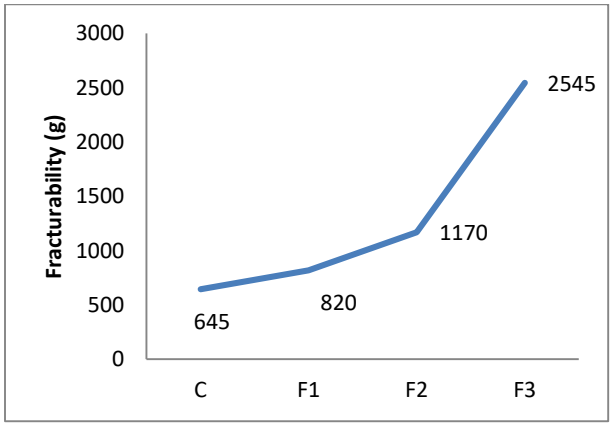

Figure 3: Fracturability value of different types of samples

3.2 Sensory analysis

The mean sensory scores of the organoleptic evaluation and acceptability for the different stick snack samples are shown in Table 3. The statistical analysis revealed that there were significant differences (P<0.05) among the samples in the sensory attributes observed except for appearance. The highest score for taste, colour, texture and overall acceptability mean score were recorded for F3.

3.2.1 Appearance

According to Table 3, it was observed that the stick snack sample prepared by mixing pumpkin puree with wheat flour showed no significant different (P>0.05). But the highest mean score for appearance of stick snack is F3. As the percentage of pumpkin puree was increased, the appearance of the stick snack became superior.

3.2.2 Taste

The mean score for taste varied from 4.20 to 5.73 with significant different (P<0.05). It showed that samples stick snack prepared by mixing 30% (w/w) pumpkin puree scored the maximum and high over the control. It is evident from the score that increase in percentage of pumpkin puree from 10 to 30%, the gradual increase in panel acceptance was recorded because of sweetness of the sample.

3.2.3 Color

For the color, sample F3 showed the highest mean score for color 6.01 compared to other sample. This is caused by the highest percentage of pumpkin puree mix in this formulation. Similar result was reported in other experiment that improve color of cookies carrot pomade powder is due to increase of the carotenoids pigment (Gurung *et al*., 2016). It can be seen that the stick snack sample prepared with pumpkin puree at 30% level, scored the maximum score of mean. Increase in percentage of level of pumpkin puree increased the likeness of stick snack with color became gradually yellowish. This finding is in agreement with other experiment which reported that color of biscuit was better when the ratio of pumpkin puree is increased compared to sample without pumpkin puree (Hernandez-Ortega *et al.,* 2013).

3.2.4 Texture

The mean score for texture varied from 4.25 to 6.07. The maximum and the minimum value corresponded to the samples of stick snack prepared by mixing pumpkin puree at the level of 10 and 30%, respectively. The sensory score for texture increased gradually with increase in percentage of pumpkin puree. As the level of percentage was increased, the texture of the stick snacks became increase in hardness. It is also evident from the data mentioned in Figure 2 that hardness of stick snacks increased with increase in percentage of pumpkin puree. The results are in agreement with other experiment which done earlier that addition of Carrot Pomace Powder at 30% level gave a harder texture (Kumari & Grewal, 2007).

3.2.5Overall acceptability

It was observed that the maximum percentage level of 30% (w/w) of pumpkin puree was more accepted and scored high. The liking for stick snack samples prepared with percentage level beyond 10% was gradually increased with increase in percentage level as they were found superior in appearance, taste, color and texture.

Table 3: Sensory score of stick snacks samples

Attributes	Sample			
	C	F1	F2	F3
Appearance	5.25^{a}±0.61	5.31^{a} ± 0.30	5.93^{a} ± 0.21	5.47^{a} ± 0.18
Taste	4.20^{a}±0.22	4.23^{a} ± 0.26	4.70^{ab} ± 0.16	5.73^{b} ± 0.25
Colour	4.21^{a}±0.24	5.28^{b} ± 0.22	5.17^{b} ± 0.17	6.03^{c} ± 0.24
Texture	4.25^{a}±0.31	4.40^{a} ± 0.26	4.93^{a} ± 0.26	6.07^{b} ± 0.18
Overall acceptance	5.21^{a}±0.57	5.28^{a} ± 0.24	5.21^{a} ± 0.23	6.30^{b} ± 0.22

**Different superscripts in the same row indicate significant differences (P<0.05)*

5. CONCLUSIONS AND FUTURE WORKS

The aim of this study was to check the effect of mixing of pumpkin puree with wheat flour on the physicochemical properties of stick snack samples and to determine panellist acceptability of the samples. It was observed that mixing pumpkin puree with wheat flour decreased moisture content meanwhile increased the hardness and fracturability properties of pumpkin stick snacks. Sample that mixed with highest percentage of pumpkin puree (F3) is most accepted by panellist for overall acceptance. There's significant difference (P<0.05) between stick snacks samples for all taste, texture and colour attributes. Thus pumpkin puree can be used with wheat flour to produce acceptable snacks in order to increase fibre and nutritional intake among the consumers. Further work should be perform to investigate the chemical composition and shelf life of the pumpkin stick snacks samples.

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