INCORPORATION OF SOYBEAN HUSK WITH DIFFERENT THICKENING AGENTS IN SOYBEAN JAMS

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Abstract: A series of soybean jams were prepared from soybean (Glycine max L.) with different types of thickening agent such as pectin, xanthan gum and gelatine. The jams also have been added with soybean husk as fiber enrichment, besides it helps recycling soybean by-products. Soy milk was weighed and TSS (°Brix) was measured using a hand refractometer. Jams were prepared according to experimental plan. The pH of the pulp was adjusted to pH = 3.4 by addition of 1% (w/v) citric acid. The mixture was heated on a gas burner at low flame temperature. The thicken mixture was poured into 250 mL glass container and cooled under ambient condition. The elaborated jams were evaluated for physicochemical, and proximate analysis. The physicochemical and chemical characteristics evaluated were total soluble solid, TSS (°Brix), pH, energy, protein, fat, saturate fats, carbohydrate, dietary fiber, sodium, moisture, potassium, calcium and iron. Results revealed that soybean jam with xanthan gum had lower in energy (284 kcal), acceptable moisture content (31.5 g) and protein (7 g), dietary fiber (4.5 g) and potassium content (330 mg); while soybean jam with gelatine had higher protein (8.6g) and calcium (78mg) compared to the other soybean jams product. These indicated that soybean jam with functional ingredients can increase nutritional value of conventional jams.

Keywords*: Jam, soybean, soybean husk, xanthan gum, gelatine, pectin, thickening agents*

1. Introduction

Soybean jams were produced to explore the potential use of soybean and its by-products in making fiber enriched functional jams. Jams has been chosen as main product as it is product with high acceptance. Producing soybean jams offer an easy alternative of healthy jam either for breakfast or for baked goods, that contain high nutritional value. Soybean jams can be processed and preserved in suitable small-scale commercial operations using simple techniques. The production cost also low and inexpensive. Soybean jams also suitable for those who want to boost fibre and protein in daily diet. The incorporation of soybean husk in jam's production also reduces soybean by-product and fulfil the Sustainable Development Goals, SDG 12 (responsible consumption and production). Soybean jams were produced using three types of thickening agents that are pectin, xanthan gum and gelatine, and further added with soybean husk. Consumer can use the soybean jam like conventional jam, or exploring other uses such as adding in smoothie or sweeten in tea, enrich the protein shake, or as flavouring in milk, fresh fruit, and yoghurt.

2. Materials and Methods

Functional soybean jams were prepared using three types of thickening agents, which are pectin, xanthan gum and gelatine. Soymilk was weighed using a balance and TSS (°Brix) was measured using a hand refractometer (Atago, Japan). Jams were prepared according to experimental plan. The pH of the pulp was adjusted to pH = 3.4 by addition of 1% (w/v) citric acid and measured using a pH meter (Hanna Instruments). The production of jams was also added with soybean husk. The mixture was heated on a gas burner at low flame temperature. Pulp-thickening agent-sugar-acid mixture was stirred continuously with a spatula during boiling. Heating was stopped when the combination thickens and the mix was poured into 250 mL glass container and cooled under ambient condition. Soybean jam production was produced based on the flow chart in Figure 1.

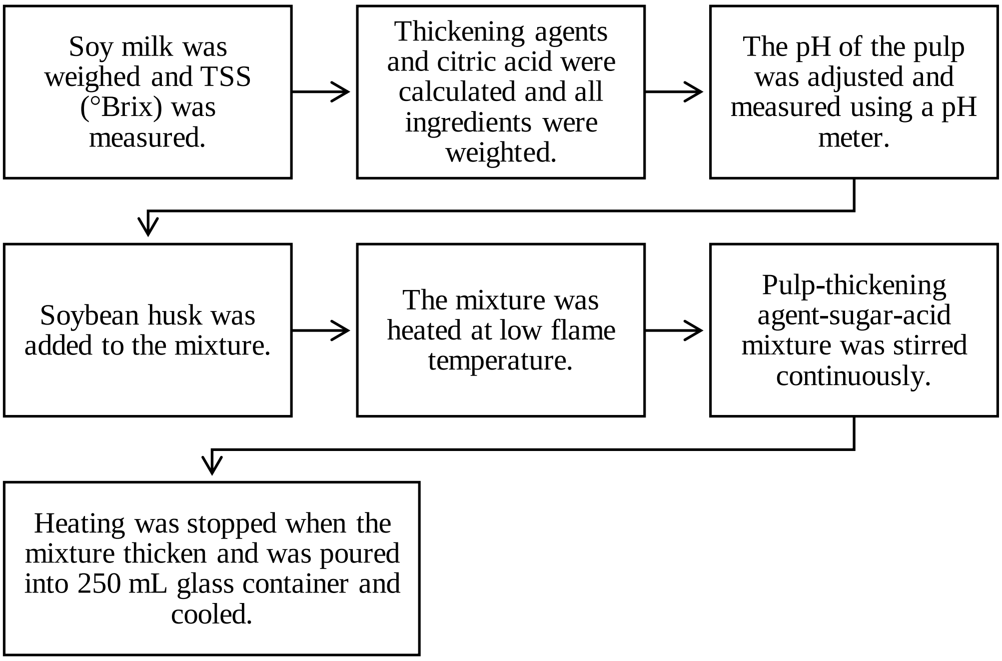

Figure 1: Flow chart of soybean jam production

3. Results

Total soluble solid and pH of soybean pulp used in jam manufacturing were 7.2°Brix and 6.35, respectively. Physicochemical and chemical composition of the jams prepared from soybean are described in Table 1. The total soluble solid values (°Brix) of final jam samples varied between 59.8 and 63. pH values ranged between 3.44 to 3.02. Xanthan soybean jam exhibited low °Brix with 3.44 pH.

Chemical composition varied for all soybean jams. Incorporation of soybean jam with xanthan gum had lower in energy, acceptable moisture content and protein, dietary fibre and potassium content; while soybean jam with gelatine had lower fat, higher protein and calcium compared to the other soybean jams product. Pectin soybean jam exhibit highest carbohydrate content.

Table 1. Physical chemical composition of soybean jams

	Xanthan Gum	**Gelatine**	**Pectin**
Energy	284 kcal	288 kcal	287 kcal
Protein	7g	8.6g	6.9g
Fat	4.2g	4.1g	4.2g
Saturates	0.5g	0.5g	0.5g
Carbohydrate	52g	51.9g	53.3g
Dietary Fibre	4.5g	3.1g	3.2g
Sodium	0.00mg	0.01mg	0.01mg
Moisture	31.5g	31.2g	31.3g
Potassium	330mg	329mg	329mg
Calcium	73mg	78mg	73mg
Iron	1.6mg	1.6mg	1.6mg
TSS (°Brix)	59.8	60.7	63
pH	3.44	3.52	3.02

4. Discussion

pH of soybean pulp was beforehand fixed to 3 by addition of the citric acid to the jam's formulation. Acidity of the pulp or its pH value is one of the most important factors in jam process which should be monitored and controlled. Indeed, acidity is an imperative fact influencing pectin gelation, texture and overall quality of fruit jams. (Garrido, Lozano & Genovese, 2015). The range of °Brix of formulated jams was between 59.8 and 63, with the lowest values for jams obtained by xanthan gum. That is, 63°Brix together with pectin and the total °Brix attained for all the products containing xanthan gum and gelatine were range 59.8 and 60.7, respectively, which is within the stipulated range of 60-65ºBrix or greater for conventional jam (CAC,2017).

The chemical composition of soybean jams varied, depends on different thickening agent that's been used. This observation is in line with different gelling agents have different nutrient composition and thus, such findings are expected. Xanthan gum has a low energy intake (0.5 kcal g-1) and, as a bonding agent, it improves texture, increases soluble solids content and promotes stability by avoiding syneresis of products without added sugar (Fiszman; Durán, 1989) especially when compared to soybean jam with gelatine. Moisture content can be used as an indirect measure of shelf life of a product. Naeem et al. (2017) suggested moisture content in the range of 31-33% for four types of Malaysian conventional jam products, which soybean jam's moisture content are similar. Soybean jam with xanthan gum had higher dietary fibre and potassium composition while soybean jam with gelatine had higher calcium. Other soybean jams had lower fibre and carbohydrate content as xanthan gum is a high molecular weight polysaccharide composed of a backbone of β-(1→4) linked d-glucose molecules that is soluble fibre. This explains the reason for an increase in fibre content in product containing the gum. However, the amount of carbohydrate content for all soybean jams are lower than that reported in other high sugar jam products (Naeem et al., 2017).

5. Conclusion

Generally, the soybean jams in this study would give fewer calories per serving as compared to conventional jams in the market. Besides, soybean jams with xanthan gum gets a product closer to the conventional jams. Moreover, adding xanthan gum had higher components of dietary fibre and acceptable protein content. Thus, soybean jams could be the promising alternative jam for use in food products, such as flavouring in smoothie or sweeten in tea, protein shake, milk, fresh fruit, and yoghurt. Besides benefitting the nutritional value of the products, recycling of soybean husk as fibre enrichment could also increase the economic value of waste in SDG 12 by potentially reducing food waste. In summary, it is proven in the results, that incorporating of xanthan gum and soybean husk can produce good quality of soybean jam.

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