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The Effect of Pumpkin Flour Filler Substitution on the Nutrition Facts of Beef Sausage

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ABSTRACT

The nutritional facts of sausage can be improved by using pumpkin flour as a filler to meet the body's daily intake. The objectives of the experiment were to determine the effect of pumpkin flour filler substitution on the nutrition facts of beef sausage. The research material was divided into five substitution treatments of pumpkin flour as a filler in sausage processing, namely: 0, 25, 50, 75, and 100% of the total filler. Each treatment consisted of five replications. The nutrition facts of sausages were calculated based on the nutritional adequacy rate of sausages which refers to the average energy sufficiency for the Indonesian population per person per day, which is 2,150 kcal, total protein 60 g, total fat 67 g, and 30 g food fiber with a 50 g serving size. The data from the calculation of the nutrition facts of sausages were analyzed by analyzing variance and then tested by using Duncan's New Multiple Range Test. The results showed that the sausages substituted filler with pumpkin flour had a highly significant effect ($p<0.01$) on total protein, fiber, and β-carotene, but did not affect the energy from fat and total fat of beef sausage. Sausages substituted filler with pumpkin flour up to 100% had a higher intake of total protein, fiber, and β-carotene than control sausages.

Keywords: β-carotene, beef sausage, filler, nutrition facts, pumpkin flour

INTRODUCTION

Meat is one of the most popular sources of animal protein in Indonesia. The need for meat is increasing along with the increase in population, per capita income, people's purchasing power, lifestyle, and public awareness of nutrition. The complete and balanced composition of the meat causes the meat to be easily damaged by microorganisms so that it can reduce its quality and usefulness. This situation can be overcome through further processing into one of the processed meat products, namely sausage.

Sausage is a product made from raw meat that is mashed with or without the addition of other food ingredients and permitted food additives and is inserted into sausage casings with or without a cooking process (SNI, 2015). The paradigm of some consumers has changed from a consumption pattern of fresh meat to a consumption pattern of processed meat products that are ready to serve. In addition, Indonesia's population continues to increase, and community activities are increasingly causing the pattern of meat consumption to change to ready-to-cook food and ready-to-eat food to increase coupled with the Covid-19 pandemic.

The tendency that occurs in society, especially children, to consume vegetables is very low because of the unfavorable taste even though vegetables are important for the body. Pumpkin (*Cucurbita moschata*) is one of the vegetables that are rich in β-carotene as a precursor of vitamin A (Henriques et al., 2012; Prabasini et al., 2013; Purwanto et al., 2013; Trisnawati et al., 2014; Fauzi et al., 2018; Wijaya & Wahyono, 2018; Pasanda et al., 2019; Azizah et al., 2021) and has high carbohydrate, protein, fiber, and vitamin content (Ranonto et al., 2015). β-carotene as a precursor of vitamin A serves to help vision for those who experience night blindness. The content of β-caroten in pumpkin is about 180.0 SI or about 1,000 to 1,300 IU/100 g of material (Hendrasty, 2003).

Pumpkin can be made into flour and has good quality because it has good gelatinization properties so that it can provide good consistency, elasticity, viscosity, and elasticity properties to the product (Hendrasty, 2003). It is possible that pumpkin flour can be used as an alternative filler in making sausages. Fillers commonly added to sausages are wheat flour, barley, corn or rice, starch from these flour or potatoes, and corn syrup or corn syrup solids (Soeparno, 2015). So far, there has been no research on sausages subsituted filler with pumpkin (*Cucurbita moschata*) flour.

The chemical composition of pumpkin flour includes 6.9% water, 22.8% protein, 1.1% fat, 5.7% ash, 47.4% starch, 22.1% dietary fiber (Azizah et al. 2021), 80.81% carbohydrates, and 67.83 mg of β-caroten (Trisnawati et al., 2014). Pumpkin carbohydrates play a very important role in making starch dough. Pumpkin flour contains gluten protein which is high enough to form a cohesive and elastic three-dimensional network (Hendrasty, 2003). Sausage innovation with substituted filler using pumpkin filler will be a new trend in consuming vegetables in animal protein. The sausage just needs to be opened from the packaging and can be consumed immediately and this situation will develop in line with the increasing flow of information and public welfare.

Sausage produced by substitution of pumpkin flour filler can meet the nutrition needs of the community. The chemical composition of beef sausage substituted with pumpkin flour filler up to 100% level is 70.78-71.18% moisture, 12.68-15.32% protein, 0.48-0.61% fat, 0.14-0.92% fiber, and 47.49-421.08 µg β-caroten (Prayitno et al., 2009). The nutrition facts of beef sausage substituted with pumpkin flour filler calculated based on the nutrition adequacy rate has never been studied before. This study aims to examine the nutrition facts of beef sausage substituted with pumpkin flour filler.

MATERIAL AND METHOD

Materials

The materials used in this study were beef shank, pumpkin, salt, garlic powder, pepper powder, skim milk, sodium tripolyphosphate, ice, and sausage plastic casings.

Methods

This research consists of several stages of the research process. The stages of this research include pumpkin flour processing, sausages processing, calculating nutrition facts, and statistical analysis.

Pumpkin flour processing

Pumpkin flour is made using pumpkin that has met the requirements (pumpkins are harvested approximately 5 to 10 days earlier than the proper harvest age). The steps in the process of making pumpkin flour are carried out through peeling and deseeding pumpkin washed, cut lengthwise with a thickness of 0.1 to 0.3 cm, placed on a baking sheet, oven-dried at 50°C for 48 hours, ground until smooth, sieved with a sieve size of 60 mesh to obtain pumpkin flour.

Sausage processing

The processing of sausage using beef. The stages of the sausage processing are done through ground beef, mincing (meat and salt), mincing (dough, garlic powder, pepper powder, STPP, skim milk, and half ice), mincing (dough, half ice, and pumpkin flour treatments were: 0, 25, 50, 75, and 100% of the total filler), filling the dough into a plastic casing, boiled, cooled, then calculated the nutrition facts. The treatment for subtituted filler with pumpkin flour of level was presented in Table 1.

Calculating nutrition facts

The nutrition facts of beef sausage was calculated based on the nutritional adequacy of sausages which refers to the average energy adequacy for the Indonesian population per person per day, which is 2,150 kcal, total protein 60 g, total fat 67 g, and dietary fiber 30 g with a serving size of 50 g with the number of sausages as much as 1 sleeve (BPOM 2011; BPOM 2016; BPOM 2019; Prayitno et al. 2020a; Prayitno et al. 2020b; Prayitno & Rahman 2020).

Table 1. The treatment of sausage substituted with pumpkin flour filler

Ingredients	Treatments				
	L0	L1	L2	L3	L4
Beef (%)	75	75	75	75	75
Tapioca flour (%)	12	9	6	3	0
Pumpkin flour (%)	0	3	6	9	12
Skim milk (%)	3.15	3.15	3.15	3.15	3.15
Salt (%)	1.10	1.10	1.10	1.10	1.10
Garlic powder (%)	2.50	2.50	2.50	2.50	2.50
Pepper powder (%)	0.75	0.75	0.75	0.75	0.75
Sodium tripolyphosphate (%)	0.10	0.10	0.10	0.10	0.10
Ice (%)	5.40	5.40	5.40	5.40	5.40
Total (%)	100	100	100	100	100

Note: L0 (0%), L1 (25%), L2 (50%); L3 (75%), and L4 (100%) subsitition pumpkin flour from filler total

Statistical Analysis

The data from the calculation of the nutrition facts of sausages were analyzed by analysis of variance in a completely randomized design and if there was a significant difference, it was further tested with Duncan's Multiple Range Test (Riadi, 2014).

RESULT AND DISCUSSION

The recommended dietary allowance (RDA) is an average daily nutritional adequacy for all people according to age group, gender, body size, body activity, and special physiological conditions to achieve optimal health status (BPOM, 2016). RDA is useful as a benchmark in the assessment and planning of food consumption, as well as a basis for formulating nutritional label references (Aulia et al., 2016). The nutrition facts (NF) written on processed food labels must include the percentage of the RDA calculated using the nutrition facts label (NFL). NFL calculated based on the average energy adequacy for the Indonesian population, which is 2,150 kcal per person per day. Nutrient content in processed food should not be more than one hundred percent NFL per day (BPOM, 2016). The nutrition facts and percentage of recommended dietary allowance of beef sausage sausage substituted with pumpkin flour filler were presented in Table 2 and Table 3.

The results showed that for subtituted filler with different pumpkin flour had a highly significant effect ($p<0.01$) on the nutrition facts and recommended dietary allowance (except energy from fat and total fat) of beef sausage. The higher the substitution level of pumpkin flour filler, the more the components of total protein and beef sausage fiber also increased. The recommended dietary allowance (Table 3) can be seen that by consuming 50 g of control beef sausage, it will be able to meet the daily needs of 0.36% fat, 10.57% protein, and 0.23% fiber. Pumpkin flour filler substitution up to a level of 100% can increase the nutrition facts of beef sausage in protein elements up by 20.81% and fiber up by 9.18%. The increase in nutrition facts of beef sausage with the substitution of pumpkin flour filler also affects increasing nutritional intake per serving of sausage consumed (Prayitno et al., 2020) especially total protein and fiber.

Table 2. Information on the nutrition facts of beef sausage with the substitution of pumpkin flour filler with a serving size of 50 g.

Component	L0	L1	L2	L3	L4
Calories from fat (kcal)^{ns}	2.16	2.43	2.57	2.70	2.75
Total fat (g)^{ns}	0.24	0.27	0.29	0.30	0.31
Total protein (g)	6.34^{a}	6.87^{b}	7.28^{c}	7.36^{c}	7.66^{c}
Fiber (g)	0.07^{a}	0.14^{b}	0.31^{c}	0.36^{c}	0.46^{d}
β-caroten (μg)	23.75^{a}	49.33^{b}	78.11^{c}	128.36^{d}	210.54^{e}

Note: ^{ns} Non significant; ^{abcde} Superscript on the same line showed a highly significant effect ($p<0.01$)

Table 3. Percentage of nutritional adequacy rate (RDA*) of beef sausage with the substitution of pumpkin flour filler with a serving size of 50 g.

Component	L0	L1	L2	L3	L4
Total fat (%)[ns]	0.36	0.40	0.43	0.45	0.46
Total protein (%)	10.57[a]	11.44[b]	12.13[c]	12.26[d]	12.77[d]
Fiber (%)	0.23[a]	0.47[b]	1.03[c]	1.20[c]	1.53[d]

Note: [ns] Non significant, [abcde] Superscript on the same line showed a highly significant effect ($p<0.01$), *Percentage of RDA based on energy needs 2,150 kcal

The serving size for sausages is 50 g per serving (BPOM, 2011; BPOM, 2016; BPOM, 2019) so that with an intake of 50 g per serving of control beef sausage is equivalent to energy from fat 2.16 kcal, total fat 0.24 g, total protein 6.34 g, fiber 0.07 g. and 23.75 μg β-caroten. Pumpkin flour filler substitution at 100% level with 50 g per serving showed the highest nutritional intake of all treatments, especially total protein 7.66 g, fiber 0.46 g, and 210.54 μg β-caroten. This value indicates that beef sausage substituted with edamame flour is included in good processed food because it meets the requirements for intake per serving for processed food, which is no more than 13 g of total fat, 4 g of saturated fat, 60 mg of cholesterol, and 480 mg of sodium (BPOM, 2011).

The intake of protein and fiber per serving of beef sausage substituted with edamame flour filler at the 100% level was the highest when compared to control beef sausage and other substitution levels. This is because it is influenced by the chemical content of pumpkin, namely 22.8% protein, 1.1% fat (Azizah et al., 2021), and 1.65-5.42% fibe(Pasanda et al. 2019). In addition, the protein, fiber, and β-caroten content of beef sausage substituted with pumpkin flour filler at 100% was the highest level when compared to other treatments, namely 15.35%, 0.92%, and 421.08 μg respectively (Prayitno et al., 2009).

CONCLUSION

The results showed that the sausages substituted with pumpkin flour filler had a highly significant effect on total protein, fiber, and β-carotene, but did not affect the energy from fat and total fat of beef sausage. Sausages sausages substituted with pumpkin flour filler up to 100% had a higher intake of total protein, fiber, and β-carotene than control sausages.

CONFLICT OF INTEREST

The authors whose names are listed have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

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