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Development of Functional Sausage Manufactured Organic Farming Purple Sweet Potato and Jeju Island Black Pork

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Abstract: The studies were carried out to develop the functional meat new product manufactured organic farming purple sweet potato and Jeju Native Black Pork. The people's interest to the healthy, low-calories food is growing up, the food service industry is developing and making functional food which helps to a sale strategy. The survey for the recognition and preference for sausage using organic farming purple sweet potato and Jeju Island Black Pork performed from December 1-20 in the year of 2016 by subjecting 45 majoring in food engineering and belonging to food resource development laboratory and frequency analysis was used for the statistical technique. Through the survey results organic farming purple sweet potato black pork sausage products and recipes. Questionnaire investigation result for the group revealed that 50% or more of the group showed common level of their interest in the development of organic farming purple sweet potato Jeju native black pork sausage. Improved texture added organic farming purple sweet potato. Sausage dietary fiber improved hygiene is important and flavor, convenience of cooking, kind of product. Sausage functionality has been improved. Modern men, colorectal cancer, adult diseases such as cardiovascular disease and increase as the increase of dietary fiber and carbohydrate reduction seem to have a very positive effect.

Key words: Jeju Native Black Pork organic farming purple sweet potato, sausage, functional food, new product, group, improved, common

INTRODUCTION

Meat products which are rich in high quality proteins, provide nutrition and health benefits. Meat products have become prevalent in people's diet and sausages with the Korean diet getting more westernized in modern times. In particular, emerged as one of the favorite and the most consumed food products in Korea (Lee *et al*., 2003). Usually, it is known that meat contain 30% of fat content and the fat contained in meat product plays important roles in product quality by stabilizing meat emulsion, reducing cooking loss, improving water holding capacity and providing juiciness and hardness (Morin *et al*., 2002). However, recent consumers concern about the adverse effects associated with the overconsumption of fat have led to the reduction of fat contented in the meat food product (Shand, 2002). Owing to their fat, saturated fatty acid and cholesterol content these products are associated with cardiovascular diseases, certain types of cancer, obesity and other issues. Recently, all consumer was interesting in health food related to low fat and low cholesterol as times go by.

Nitrite, a coloring agent of sausages was classified as class 1 carcinogen and increased the potential as a harmful substance (Choi *et al*., 2003). Purple sweet potato and black pork were used to manufacture the functional sausage without addition of nitrite.

Purple sweet potato has great value as functional food because it contains comparatively more anthocyanin content than general sweet potato. Accordingly, new food product development using purple sweet potato is needed for further processing (Liu *et al*., 2013). Purple sweet potato powder and pigment demonstrate antioxidative activity and lipid oxidative stability in sausages, making them suitable ingredients for manufacturing sausages (Lee *et al*., 2015a, b). Addition of purple sweet potato powder and purple pigment showed the possibility of substitution of the nitrite (Lee *et al*., 2015a, b). Jeju native black pigs are a robust breed of pig that are highly resistant to disease and highly adaptable to environment changes that have a diverse range of taste according to quality of meat (Lim, 2015). Also, because their image fits naturally well with the plush and green back setting of the clean environment of Jeju, Jeju native black pigs are a highly favored product of consumers with high quality meat that can more than adequately satisfy the demands of customers. In this study based on these studies, research has also been required to produce health-oriented products that reflect ongoing needs.

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MATERIALS AND METHODS

Jeju Native Black Pork was purchased from Jeju samdamall (http://www.samdamall.com/) located in Jeju-do Island and organic farming purple sweet potato was purchased from Haeya farm located in Mooan-gun.

Organic purple sweet potato and Jeju black pig sausage manufacturing: Fresh bonelss black pork trim, black pork fat, glutinous rice, purple sweet potato, chili pepper, garlic, leek, salt and black pepper were purchased from local processors. Purple sweet potato, glutinous rice were prepared by stirring appropriate amount of flour in DW for 1 h at room temperature by heating at 95°C with continuous stirring for 30 min. In the case of bum addition, chapped garlic, chapped leek, kidney bean and gum solutions were prepared, respectively, prior to paste production by hydrating the appropriate amount of gum in water at 82°C (Fig. 1). As shown in Fig. 2, primary machining-material milling and material mixing. As shown in Fig. 3, the process of making black pork purple sweet potato. Figure 4 shows an example of completed black pork purple sweet potato. Table 1 is the standard recipe for purple sweet potato black pork sausage.

Analysis methods

Proximate composition of purple sweet potato black pork sausages: Moisture, crude protein, crude fat and ash contents of purple sweet potato black pork sausages were determined according to the AOAC.

Water activity (aw) and pH measurement: Water activity was measured at 25°C using a water activity device (Aqua Lab. CX-2, Decagon Device Inc, Germany).

pH was measured using a suspension homogenized 2 g sample and 18 mL distilled water for 1 min with a pH meter device (pH 900, Precisa Co, Diet Ikon, Switzerland).

Color measurement: Color was measured using Handy colorimeter 9 (NR-300, Nippon Denshoku, Tokyo, Japan). The machine was calibrated with a white square plate (CIE L* = +94.48, a* = -0.67, b* = +3.31). Values for CIE L* (lightness), CIE a* (redness) and CIE b* (yellowness) were determined at 30 days.

Sensory evaluation: Sensory evaluation was performed by thirteen trained panels (majoring in food engineering and belonging to food resource development laboratory 20 males and 25 females; age, 21-31 years). The samples were evaluated using a 5-point scale (1, dislike very much; 7, like very much). The samples were sliced into equally sized pieces and presented on a white plastic dish. Color, smell, taste, texture, hardness, chewiness and overall preference were measured.

Table 1: Purple sweet potato black pig sausage standard recipe

Ingredient	Amount (g)	Percentage	Recipe (5 portion)
Black pig ham	100	29.4	Black pig ham, black pig fat, black pig picnic are mixed together for 5 min
Black pig fat	30	8.8	
Black pig picnic	100	29.4	
Purple sweet potato	50	14.7	Teamed glutinous rice and purple sweet potato steamed, pepper is added
Pepper	20	5.8	
Soybean paste	15	4.4	
Chopped leak	5	1.4	Put (1) into the charger and fill the casing with sausage dough
Chopped garlic	5	1.4	
Rosemary	5	1.4	
Black pepper	5	1.4	Boil at 82°C for 20 min and cool
Salt	5	1.4	

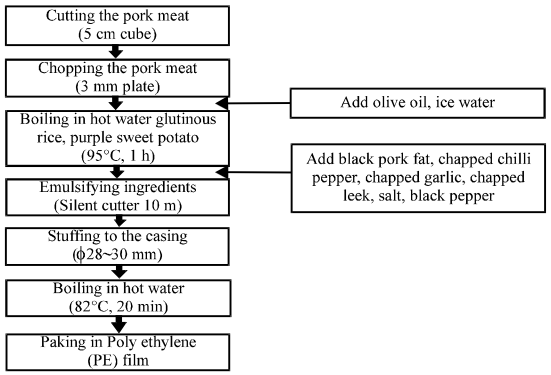

Fig. 1: The manufacturing process of sausage with Jeju native black pork purple sweet potato

Fig. 2: Primary machining-material milling and material mixing

Fig. 3: SOC development system of purple sweet potato black pork sausage

Fig. 4: Completed black pork purple sweet potato

Statistical analysis: An analysis of variance was performed on all the variables measured using the General Linear Model (GLM) procedure of the SAS Statistical package (1999). Duncan's multiple range test ($p<0.05$) was used to determine the differences between treatment means.

RESULTS AND DISCUSSION

Proximate compositions: Proximate compositions of for purple sweet potato black pork sausages are shown in Table 2. The moisture and fat contents of PBS (Purple sweet potato Black Pig Sausage) and OFS (Other Frank sausage) were significantly different. The protein and ash, dietary fiber contents of PBS were higher than those of OFS. However, carbohydrate contents dietary fiber contents lower than OFS. As modern people are increasingly on the rise of adult diseases such as colorectal cancer and cardiovascular disease, the increase in dietary fiber and the decrease in carbohydrate and crude fat are very positive effects.

It is desirable to increase the amount of ash and dietary fiber including moisture, minerals in various social aspects such as childhood obesity caused by the westernization of the taste of adolescents and pediatric geriatric diseases.

pH, color and water holding capacity: Purple sweet potato addition affected pH values or CIE a* color space values of the LEOs (Table 3), however, just in case of treatment added with purple sweet potato there was significant difference of lightness, yellowness and aw between OFS. Depending on the type of sausage, color intensity such as brightness, redness and yellowness showed significant difference. The higher value of commercial sausages on the market is due to the use of coloring agents. It is thought that it is very important to develop meat products while minimizing the use of coloring agents as the sodium nitrite is controversial as a substance that can cause cancer. However, water activity was higher in purple sweet potato black pork sausage.

Table 2: Proximate composition of purple sweet potato black pig sausage

Composition (%)	OFS	PBS	SEM
Moisture	25.23	29.4	0.210
Ash	4.23	5.2	0.050
Protein	18.21	29.4	0.040
Fat	17.81	14.7	0.020
Dietary fiber	1.23	5.8	0.050
Carbohydrate	15.00	4.4	0.051

OFS: Frankfurter sausage with natural casing produced by companies, PBS: Purple sweet potato Black pork sausage

Table 3: pH, color and water holding capacity

Composition	OFS	PBS	SEM
pH	5.94	6.00	0.051
CIE (L*(Lightness))	45.71^{c}	37.33^{ab}	0.610
Color (a*(Redness))	9.39	5.39	0.810
Space value (b*(Yellowness))	5.62^{b}	4.59^{a}	0.460
a_w	0.70^{c}	0.87^{ab}	0.010

OFS: Frankfurter sausage with natural casing produced by companies, PBS: Purple sweet potato Black pork sausage; SEM = Standard Error of the Mean; aw = water activity; $^{a-c}$Mean values within a column followed by different letters indicate a significant difference ($p<0.05$)

Table 4: Textual properties

Parameter	OFS	PBS	SEM	p-values
Hardness (kg)	5.81	7.59	0.15	0.94
Springiness (mm)	2.31	2.62	0.22	0.24
Cohesiveness	0.25	0.25	0.01	0.26
Gumminess (kg)	1.99	1.68	0.27	0.17
Chewiness (mJ)	45.63	42.57	5.84	0.42

OFS: Frankfurter sausage with natural casing produced by companies, PBS: Purple sweet potato Black pork sausage; SEM = Standard Error of the Mean

Sensory evaluation: Table 4 shows the Texture Profile Analysis (TPA) results for the fermented sausages. There were no significant differences in TPA ($p>0.05$) between PBS and OFS. Texture Profile Analysis (TPA) is the most commonly used technique for measuring the textual properties of foods (Herrero *et al*., 2008). Hardness, cohesiveness, gumminess and chewiness are related to water activity and moisture contents (Lorenzo,

2014). When the water activity and moisture contents of sausages decrease, the hardness, cohesiveness, gumminess and chewiness of the sausages increase.

CONCLUSION

Customer's desire is constantly changing and efficient promotion of new product development is important. It is no exaggeration to say that securing competitiveness through active new product development that reflects this paradigm has become a task for the ground. In addition with the improvement of the income level, the desire for the eating habits are becoming more and more interested in the stability of the food as well as the quality. To develop sausages with high quality and functionality by using black and sweet potatoes which are nutritionally superior to ordinary pigs but which increase the abundance and nutritional aspect of our diet and provide high quality protein.

In this study, demonstrated that addition of purple sweet potato to emulsion type sausage made with irradiated pork meat improved the sensory acceptance of the sausage. Starch content in sausage increased because purple sweet potato has abundant starch in it and then it showed the possibility to substitute starch with purple sweet potato. Addition of purple sweet potato raised antioxidant activity and suppressed protein deterioration and lipid oxidation. Addition of purple sweet potato could have potential as a source of dietary fiber which be used as functional ingredient. Purple sweet potato for meat products higher the texture such as hardness, gumminess and chewiness and the sensory evaluation of taste, textures and overall acceptability. Consumer awareness of the color of purple sweet potato is improved, purple sweet potato could be a sufficient potential as a raw material in sausages.

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