PHYSICOCHEMICAL PROPERTIES OF EMULSION-TYPE SAUSAGE ADDED BUCKWHEAT POWDER

S.H. Lee[1], G.W. Kim[1], J.H. Kim[1], B.K. Kim[1], C.S. Kim[1], J.A. Lee[1] and H.Y. Kim[1*]

[1]Department of Animal Resource Science, Kongju National University, Yesan, Chungnam, 32439, Korea

*Corresponding author email: kimhy@kongju.ac.kr

I. INTRODUCTION

The intake of dietary fiber-rich foods reduces the incidence of conditions such as obesity, cardiovascular, and coronary heart disease [1]. In meat products, fiber plays an important role that enhances cooking yield and emulsion stability due to its water and fat binding abilities, as well as its textural properties [2]. Buckwheat contains significant levels of essential amino acids, polyunsaturated fatty acids, and vitamins B and E. In addition, buckwheat possesses functional properties that include anti-oxidant, anti-inflammatory, and anti-carcinogenic properties due to the high levels of rutin and other flavonoids that are key components of buckwheat [3]. The objective of this study was to determine the effect of buckwheat powder on the physicochemical characteristics of sausages including pH values, instrumental color, cooking yield, viscosity, and texture profile analysis.

II. MATERIALS AND METHODS

Emulsion-type sausages were manufactured with pork, back-fat, ice and buckwheat powder (0, 1, 2, 3%).Homogenates were prepared using 4 g samples and distilled water (16 mL). The pH of each homogenate was measured with a pH meter (Model S220, Mettler-Toledo, Switzerland). Cooking yield (%) was determined for individual samples by calculating the weight before and after cooking. The color of uncooked and cooked meat samples were determined using a colorimeter (CR-10, Minolta, Tokyo, Japan; illuminate C, calibrated with a white plate, CIE L* = +97.83, CIE a* = −0.43, CIE b* = +1.98). Meat batter viscosity was measured in triplicate with a rotational viscometer (MerlinVR, Rheosys, USA) at 20 rpm. The temperature of each sample (25 ± 1 °C) during testing was also recorded. TPA was performed in triplicate for each sample at room temperature using a texture analyzer (TA 1, Lloyd Co., USA). Samples (Ø 25 × 50 mm) were cut from the central region of each sausage. TPA values were measured using a cylinder probe (Ø 100 mm) and were calculated from force and time plots. Values of hardness (kg), springiness, cohesiveness, gumminess (kg), and chewiness (kg) were determined for each sample.

III. RESULTS AND DISCUSSION

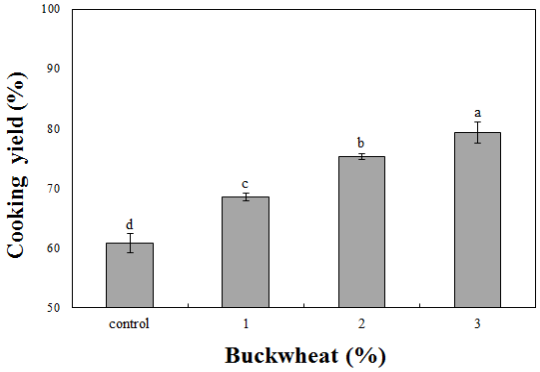
The pH and color of sausages were observed to depend on the levels of added buckwheat powder (Table 1). The pH values of the sausages increased significantly with increasing levels of added buckwheat powder, irrespective of cooking, which is due to the pH of buckwheat powder (6.0). The addition of 3% buckwheat powder resulted in the highest L* and b* values. However, the opposite trend was observed for a*; decreasing the levels of added buckwheat powder.

Table 1. pH and color of pork emulsion type sausage formulated with various levels of buckwheat powder

Traits		Buckwheat powder (%)			
		0(control)	1	2	3
pH		5.84±0.02^{d}	5.90±0.01^{c}	5.96±0.01^{b}	6.00±0.01^{a}
Color	CIE L*	69.67±0.64^{c}	70.83±0.47^{b}	70.73±0.50^{ab}	71.70±0.30^{a}
	CIE a*	7.28±0.46^{a}	6.93±0.22^{ab}	6.53±0.21^{b}	6.40±0.44^{b}
	CIE b*	15.03±0.45^{c}	15.63±0.06^{bc}	16.33±0.57^{ab}	16.75±0.39^{a}

All values are mean ± SD.
$^{a-d}$ Means in the same row with different letters are significantly different (p<0.05).

The cooking yield of sausage according to the amount of buckwheat powder are shown in Fig. 1. The cooking yields of the sausage samples were increased by the added buckwheat powder (p<0.05). As depicted in Fig. 2, higher levels of added buckwheat powder resulted in higher initial viscosities of the sausage samples (p<0.05). There were no significant differences in the texture profiles among the treated samples (Table 2).



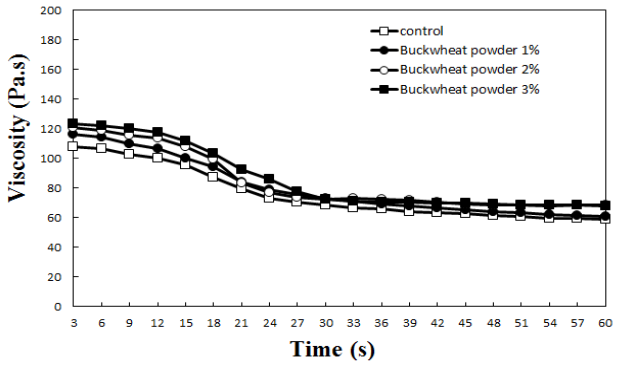


Figure 1. Cooking yield of pork emulsion type sausage formulated with various levels of buckwheat powder. Error bars mean standard deviation of the mean. [a-d] Means with different letters are significantly different (p<0.05).

Figure 2. Change of apparent viscosity on pork emulsion type sausage formulated with various levels of Buckwheat powder.

Table 4. Texture properties of pork emulsion type sausage formulated with various levels of buckwheat powder

Traits	Buckwheat powder (%)			
	0(control)	1	2	3
Hardness (kg)	3.60±0.31	3.76±0.44	3.82±0.36	4.15±0.67
Springiness	0.88±0.08	0.92±0.01	0.92±0.01	0.93±0.02
Cohesiveness	0.42±0.07	0.43±0.06	0.36±0.12	0.33±0.17
Gumminess (kg)	1.52±0.69	1.56±0.26	1.25±0.25	1.28±0.57
Chewiness (kg)	1.34±0.64	1.43±0.24	1.15±0.23	1.17±0.53

All values are mean±SD.

IV. CONCLUSION

We conclude that adding buckwheat to emulsion-type sausage formulation can improve the quality characteristics such as cooking yield and viscosity.

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