Popped snack made with spent fowl meat

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Key words: spent fowl, corn starch, popped snack,

Background

Spent fowls have the minimal economic value in Korea although they are good as a protein source. Since spent fowl meat is very tough in comparison to that from broilers and roasters(Baker et al., 1969) because of its higher collagen content, it is not well accepted to consumers. Therefore, it has been utilized primarily for chicken soups and emulsified chicken products such as frankfurter and bologna. As a result, it has been competing in price with turkey meat as a raw material for those emulsified products in Korea. Accordingly, additional usage needs to be developed for the value-addition of the spent fowl meat.

Objective

The objective of this study was to develop a popped chicken snack product with the optimum mixing ratio of spent fowl and grains.

Methods

Fresh spent fowl carcasses were purchased from a commercial processor. They were cooked in preheated autoclave (112°C) until an internal temperature of 71°C reached. The cooked meats were harvested, ground and dried. Dried chicken meats were mixed with grains (corn starch, potato starch, and rice flour) to have different ratios of meat and grain (3:1, 2:1, 1:1, 1:2 and 1:3). And then the moisture content was adjusted to 20% for pelletting. The popping conditions studied were 260, 270 and 280℃ for the popping temperature, 5, 7 and 10 sec for the popping time, and 2 and 3g for the amount of inlet. The popping machine used was Auto cereals popping machine (JT-03, JINTO FOOD CO., Korea). After the mixture compounds were popped on these popping conditions. popping ratio(Bhattacharya et al 1986), color, breaking strength and sensory characteristics were analyzed. Through these results, the optimum popping time, temperature and the mixing ratio were determined by using RSM. The textures of the snacks were observed by using a scanning electron microscope (JSM-5410LV, JEOL, Japan)(Voller et al. 1996), and the change of the water activity(Prior et al., 1979) and VBN in snacks during storage was measured.

Results and discussion

The results (Fig. 1) shows that as the content of meat increased, the popping ratio of the popped snacks decreased ($P<0.001$). Gogoi et al. (1996) reported that when blends of pink salmon and rice flour were extruded through a twin-screw extruder, there was a linear decrease in expansion ratio as the percentage of fish solids increased. In this study, the higher the popping temperature, the tougher the snack particles were formed. The ratio of 1:3 for meat : corn starch at 280℃ resulted in the highest popping ratio(Fig. 1). The increase in expansion ratio of starch with the increasing temperature is attributed to its higher degree of gelatinization at such temperature (Aguilera and Kosikowski, 1976). Snacks with corn starch and potato starch had a higher popping ratio than that with rice flour (Fig.1). Best (1989) suggested that the degree of expansion in corn and rice be affected by the amylose-amylopectin ratios in the grains. High soluble amylose levels and swelling powers increased gel elasticity, whereas high levels of soluble amylopectin were detrimental to gel formation and reduced elasticity (Hansen, 1991). In the sensory test, as the percentage of spent fowl meat increased, the burnt flavor and bitter taste was more prominent. Observing the texture of snacks after popping (Fig. 2-6), popped snacks with higher grain ratio [1:2 (Fig.5) and 1:3 (Fig.6)] produced the snacks with particles popped more evenly, whereas those with the higher meat ratio [3:1 (Fig.2) and 2:1 (Fig.3)] resulted in the snack with uneven particle size. Level of VBN of snack was increased gradually during the storage period. Water activity of all the snacks were significantly different at room temperature during the storage period ($P<0.001$)(Table 1). But they were less than 0.62 in all the snacks during 6 months. When rosemary was added to popped snacks for the better shelf life, it did not make any significant difference.

Conclusions

As the content of meat increased, the popping ratio of the popped snacks decreased. The higher the popping temperature, the tougher the snack particles were formed and the higher grain content resulted in the better particles of the popped snack. The optimum conditions for a popped chicken meat snack were the mixing ratio of 1: 3 for meat : corn starch and 1: 3 for meat : potato starch for 5 sec at 280℃. The optimum shelf life of popped snacks appeared to be 6 months.

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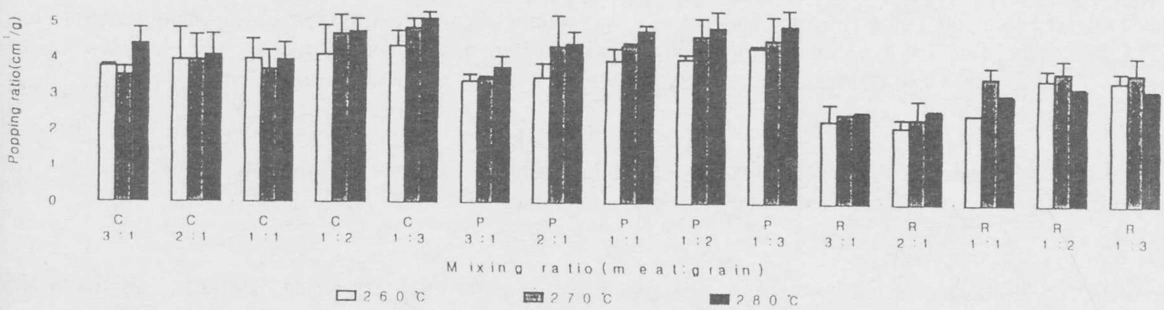

Figure 1.The popping ratio of chicken meat snacks under conditions of popping temperature and mixing ratio. (C: corn starch, P: potato starch, R: rice flour)

Table 1. Water activity of popped snacks during storage at room temperature

Treatment \ Day	32	64	96	128	160	192
AC	$^{A}0.42\pm0.01^{d}$	$^{C}0.43\pm0.01^{c}$	$^{B}0.42\pm0.01^{d}$	$^{B}0.44\pm0.01^{c}$	$^{C}0.47\pm0.00^{b}$	$^{C}0.54\pm0.00^{a}$
AR	$^{B}0.34\pm0.01^{d}$	$^{B}0.48\pm0.04^{b}$	$^{B}0.42\pm0.01^{c}$	$^{C}0.39\pm0.01^{c}$	$^{A}0.50\pm0.01^{b}$	$^{A}0.60\pm0.01^{a}$
NC	$^{B}0.37\pm0.04^{d}$	$^{C}0.43\pm0.01^{c}$	$^{A}0.46\pm0.01^{bc}$	$^{A}0.49\pm0.01^{b}$	$^{B}0.49\pm0.01^{b}$	$^{B}0.56\pm0.01^{a}$
NR	$^{A}0.43\pm0.01^{d}$	$^{A}0.52\pm0.01^{b}$	$^{B}0.41\pm0.01^{e}$	$^{C}0.40\pm0.01^{b}$	$^{C}0.47\pm0.00^{c}$	$^{A}0.59\pm0.01^{a}$

^{a,b,c,d} Means± SD with different superscripts in the same row are significantly different(P<0.001)
^{A,B,C,D} Means± SD with different superscripts in the same column are significantly different(P<0.001)
A: Air, N: N_2, C: Control, R: Adding 0.2%

Fig 2-6 Scanning electron micrographs of popped snacks (popping temp: 280°C, popping time: 5 sec)

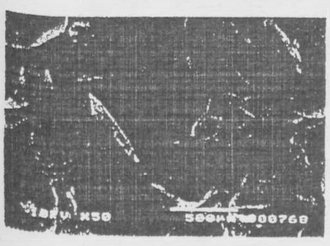

Fig. 2 mixing ratio(3:1=meat:grain)

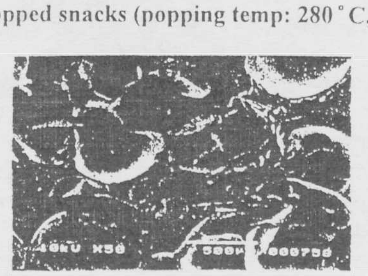

Fig. 3 mixing ratio(2:1=meat:grain)

Fig. 4 mixing ratio(1:1=meat:grain)

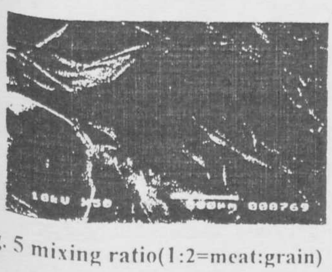

Fig. 5 mixing ratio(1:2=meat:grain)

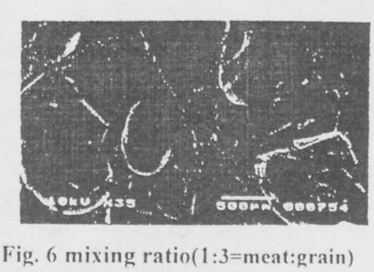

Fig. 6 mixing ratio(1:3=meat:grain)