

EFFECT OF SODIUM TRIPOLYPHOSPHATE ON PHYSICAL QUALITY OF CRISPY MEATBALL MADE FROM SPENT LAYER OR BROILER MEAT

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Abstract – This study was carried out to investigate the effect of sodium tripolyphosphate (STPP) on the physical quality of crispy chicken meatball made from spent layer meat compared with broiler. The pH and shear force value increased in both chicken groups with STPP. Spent layer meatball had significantly lower pH, higher cooking yield, shear force value and hardness than broiler meatball did. Sensory studies revealed that no significant differences were found on texture and overall acceptance of the products with or without STPP in spent layer group. However, meatball with STPP was more preferred than meatball without STPP in broiler group. These suggest that spent layer meat and STPP can be used for manufacturing crispy chicken meatball.

Key Words – emulsion, product development, texture

I. INTRODUCTION

Spent layer meat has higher insoluble collagen content than broiler, resulting in lower tenderness, thus lowering consumer acceptance [1]. To solve these problems, many emulsified products are being produced using spent layer meat. Meatball is one of emulsified products and can be found throughout the world. However, the type of the meatball differs among regions. In South East Asia, the low-fat meatball is the most preferred type, which has hard and chewy texture and is cooked by boiling and served with stocks and noodles. In contrast, greasy, soft, tender and juicy meat ball is mostly preferred in Western countries and is cooked by stir-frying and served with gravy. Recently, animal product development is still progressing in Korea in order to expand the market to other Asian countries and the availability of crispy meatball is still limited in Asian market. Sodium tripolyphosphate (STPP) is mainly used in the meat industry to increase emulsification capacity. STPP extracts salt-soluble proteins from myofibrils to aid in the binding of water [2]. To observe the effect of using spent layer meat and sodium tripolyphosphate on the physical quality of crispy chicken meatball, this study was performed.

II. MATERIALS AND METHODS

Frozen breast meat from 75-week old spent layer and 5-week old broiler was purchased from local slaughter house. The frozen meat was thawed overnight and the visible fat and connective tissue were removed. Meat was ground using a 6-mm plate grinder (M-12S, Hankook Fjeee Industries, Korea). To the ground meat, salt (1.25%), water (10%), canola oil (5%), potato Starch (5%), seasonings (0.69%) and sodium tripolyphosphate (0.3%) were added, while STPP was not added to control group. Ground meat and other ingredients were mixed (Heavy Duty Stand Mixer, Kitchen aid, USA) for 5 minutes. Meatball was shaped to about 30 g and then coated with beaten egg and flour mixture (wheat flour, corn starch and seasonings). Coated meatball was stored at 2±2 °C overnight and fried on the following day. Two-steps frying was done using soybean oil, the first frying was carried out at 150 °C for 5 minutes. Then, second frying was carried out at 180 °C for 3 minutes. After frying, the samples were cooled for 20 minutes. Cooking yield was measured. Shear force and hardness of 1 cm³ samples (inner part) were performed at room temperature with a texture analyzer (compression rate 60%, test speed 60 mm/s). The pH of homogenized samples was measured. Sensory evaluation was conducted using 10 panelists. The hedonic scores ranged from 1 (dislike extremely) to 9 (like extremely) points were used to determine the preferences in flavor, texture and overall. Data were subjected to two-way analysis of variance (ANOVA) using R version 3.3.3 with “Agricolae” library (The R-foundation for Statistical Computing, Austria). The statistical significance of the differences between means from different treatments was determined by Duncan’s multiple range test (p<0.05).

III. RESULTS AND DISCUSSION

In both spent layer and broiler group, the addition of STPP resulted in an increase in pH (Table 1) as STPP increased the ionic strength [3]. STPP increased cooking yield in spent layer group but not in broiler. Shear force increased with addition of STPP in both groups. In addition, hardness showed a tendency to increase with the addition of STPP ($p=0.051$) but the effect only appeared in spent layer group. Spent layer meatball had lower pH, higher cooking yield, shear force value and hardness than broiler meatball did.

Table 1 Physical properties of chicken meatball made from spent layer or broiler meat with or without sodium tripolyphosphate

Items	Spent layer		Broiler		SEM	p value		
	STPP 0%	STPP 0.3%	STPP 0%	STPP 0.3%		Chicken	STPP	Chicken:STPP
pH	6.05 ^d	6.20 ^c	6.32 ^b	6.38 ^a	0.04	<0.001	<0.001	<0.001
Cooking yield (%)	93.8 ^b	95.9 ^a	92.4 ^c	92.6 ^c	0.24	0.041	0.831	0.997
Shear force (kgf)	1.32 ^b	1.62 ^a	1.08 ^c	1.24 ^b	0.06	<0.001	<0.001	0.100
Hardness (kgf)	3.28 ^b	4.26 ^a	2.95 ^b	3.08 ^b	0.19	0.014	0.051	0.117

SEM, standard error of the mean.

^{a-c} Means within each row with different superscripts are significantly different ($p<0.05$).

Sensory evaluation revealed that no significant differences were found in all groups for flavor, texture and overall acceptance (Table 2). Even so, the texture and overall acceptance scores showed the lowest in broiler group without STPP. These suggest that the differences on physical attributes such as instrumental shear force and hardness have no effects on panelists' preferences. Therefore, the addition of STPP to meatball made from spent layer could produce meat ball with sensory attributes similar to that of broiler.

Table 2 Sensory evaluation of Chicken nugget made from different mixing ratios sodium tripolyphosphate

Items	Spent layer		Broiler		SEM	p value		
	STPP 0%	STPP 0.3%	STPP 0%	STPP 0.3%		Chicken	STPP	Chicken:STPP
Flavor	6.5	6.7	6.5	6.5	0.18	0.793	0.793	0.793
Texture	6.2	6.2	4.8	6.3	0.21	0.218	0.157	0.157
Overall acceptance	6.3	6.6	5.7	6.5	0.17	0.423	0.211	0.566

SEM, standard error of the mean.

IV. CONCLUSION

Spent layer meat can be used for manufacturing crispy chicken meatball and STPP is considered to increase its cooking yield.

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