

CHEMICAL COMPOSITION, pH AND ORGANOLEPTICAL QUALITY OF HORSE MEATBALL MADE OF DIFFERENT FILLER RATIO AND KIND OF MUSCLE

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Abstract

This study was conducted to investigate the effect of ratio difference of filler to meat and kind of muscle on chemical composition, pH, and organoleptical quality of horse meatball. The meatballs were made from horse meat in backbone (*Longissimus dorsi* muscle) and thigh (*Biceps femoris* muscle). Tapioca was used in this experiment with ratio of filler to meat 40:60, 30:70, and 20:80. Every batter was mixed with onion, pepper, salt, and were crushed delicately, and then were blended homogenously. The dough was made into small balls, boiled on boiling water until floating. Parameters observed were chemical composition (water content, protein and fat), pH, organoleptical quality (taste, colour, texture, tenderness and general appearance). The chemical and pH data were analyzed by variance analysis of 2x3 factorial (2 muscles, 3 ratios of filler to meat) pattern. The differences between means were tested by Duncan's New Multiple Range Test. The organoleptical test was done by scoring method by 17 panellists and analysed by non-parametric with chi square method. The result showed that differences in proportion of filler and kind of muscle significantly affected ($P<0.01$) on water contents, protein and fat. Proportion of filler and kind of muscle did not significantly affected pH and organoleptical quality including taste, colour, tenderness, and general appearance but affected significantly ($P<0.05$) on texture. It was concluded that the best meatball was observed on filler ratio of 20% with BF muscle on physical quality and chemical composition and filler ratio of 30% with LD muscle on organoleptical quality. There were interactions between filler and kind of muscle on water content protein and fat.

Key words: Horse meatball, Filler, Kind of muscle, Chemical composition, pH, Organoleptical quality

Introduction

Meatball is one kind of processed meat made of ground meat mixed together with filler, seasonings, and salt. It was formed like balls and dipped into a hot water

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(Astuti, 1983). The main ingredient of meatball is meat. Beef is the usual and common meat used to make meatball. However, other kinds of meats such as chicken, fish and horse meat can be used to make meatball as well.

Horse meat contains 28% protein (USDA, 1997) and 72% moisture. This content is almost similar to beef (Arcos *et al.*, 1999). Protein content of beef is 19% and moisture 75% (Soeparno, 1998). Forrest *et al.* (1975) stated that the meat contained 65-80% moisture, 1.5-13% fat and 18-25% protein. Water and fat play an important role in the acceptance of meatball. The increase of water or fat will subsequently improve tenderness and juiciness of meat.

Meatball made of horse meat is a possibility, since it never be used to produce meatball. But horse meat has dark colour and its pigmentation is higher than beef. Lawrie (1982) stated that pigment of meat derived from myoglobin. As the animal getting older the myoglobin content increases. Besides that, higher physical activity of muscle will increase the myoglobin content. The dark colour of horse meat and the toughness are the disadvantages of the meat and it is not preferable.

Many factor influenced the colour of meat such as feed, species, breed, age, sex, stress, pH, and oxygen. The determinant factor of meat colour was the concentration of myoglobin (Soeparno, 1998). The used of starch (filler) is purposely to improve the quality of meatball especially their ingredients used in the making of meatball cost (Tranggono, 1991). Salt (sodium chloride) serves specific function in the quality of meatball especially its texture and consistency (Soeparno, 1998). Several seasonings like garlic and pepper possess preservative effect (bacteriostatic) (Naruki and Kanoni, 1992).

Based on the above reasons we made of meatball using horsemeat with different filler ratio to know the pH, chemical and organoleptical characteristics of its meatball to improve the acceptability of horse meat.

Materials and Method

The main ingredient used to make meatball was horse meat divided other ingredients were filler tapioca starch (filler), garlic, white pepper, salt. The equipments for making meatball were meat grinder, mixer, electronic balance, knives and so on.

Fat, connective tissues, tendons were removed from meat. The meat was ground using electronic meat grinder and mixed with the filler (tapioca starch) thoroughly. The ratio of meat and the filler were 80:20, 70:30, and 60:40, garlic (3%), white pepper (0.5%) and salt (3%) of the amount of the horse meat used were ground and added into the dough. They were mixed with crushed ices during mixing. The final dough was formed into small balls.

The tests

The tests were pH, chemical composition (water, protein, and fat) (AOAC, 1975), and organoleptical characteristics (flavor, colour, texture, tenderness and general appearance).

Result and Discussion

pH of meatball

The pH of meatball was presented in Table 1. The result showed that pH of meatball was not influenced by ratio of filler and kind of muscle. The pH of meatball ranged from 4.6 - 4.86, it was lower than the pH of fresh meat i.e. 5.3-6.0. The decrease of pH of meatball might be due to the other ingredients added including the filler (Manullang et al., 1995).

Table 1. pH of meatball made using different filler ratio and kind of muscle

Muscle	Ratio of filler and meat		
	40:60	30:70	20:80
BF	4.56	4.55	4.53
	4.50	4.65	4.54
	4.59	4.60	4.50
LD	4.58	4.62	4.60
	4.61	6.08	6.05
	4.73	4.61	4.50

Chemical composition of meatball

Data of chemical analysis especially moisture, protein, and fat content were presented in Table 2.

Table 2. Chemical composition of horse meatball made using different ratio of filler and kind of muscle

Ratio	Kind of muscle	Moisture	Protein	Fat
40/60	BF	58.77 ^d	8.22 ^d	2.66 ^d
	LD	59.34 ^d	10.21 ^e	8.13 ^e
30/70	BF	62.37 ^e	11.31 ^f	5.10 ^f
	LD	64.90 ^f	11.42 ^f	11.30 ^g
20/80	BF	69.36 ^g	13.10 ^g	18.97 ⁱ
	LD	65.40 ^f	14.34 ^h	17.30 ^h

d,e,f,g,h,i different superscript on the same column indicated the differences at P < 0.01

Result of statistical analysis showed that moisture content was not determined by kind of muscle. However, different filler ratio was significantly influenced the chemical composition ($P < 0.01$). High percentage of filler in the meatball decreased its moisture content. According to Kramlich (1971) moisture was the biggest components of meatball, but the content varied depending on the kind of muscle and the ingredients added. Meatball made of BF muscle and using filler 20% possessed higher moisture content.

Percentage of filler and kind of muscle influenced significantly ($P < 0.01$) protein content of meatball. The higher the percentage of meat in the meatball, the higher was its protein content. Meatball made using LD muscle and filler amounting to 20% had the highest protein content i.e. 14.34%. The use of starch would strengthen the bond between protein and water in the meatball. The protein content of meatball decreased and it was lower than the meat since there were losses of nutrients during the processing (Romans and Ziegler, 1974) besides the addition of tapioca starch in the meatball.

Fat content of meatball was different among the treatment ($P < 0.01$) especially the percentage of filler. However, kind of muscles did not influence the fat content of the meatball. The percentage of tapioca starch added influenced the fat content of meatball. The increase of filler caused the decrease of fat content of meatball. There was interaction between ratio of filler and kind of muscle. Meatball of 20/80 had the highest fat content whereas meatball of 40/60 possessed the lowest fat content.

Organoleptical characteristics of meatball

Result of statistical analysis showed that filler ratio and kinds of muscle did not affect the flavor of meatball. However, the use of high percentage filler tent to reduce the flavor of meatball. There was in agreement with Tranggono (1991) that the increase in filler added would reduce the flavor. According to Kartika et al. (1988) the flavor of meatball produced was derived especially from other ingredients used such as salt, pepper, and garlic. The panelists assessed that the highest score was commercial meatball (the best flavor) followed by beef meatball and the last one was horse meatball.

Result of statistical analysis indicated that filler ratio and kinds of muscle influenced the colour of meatball. However, horse meat produce grey meatball. The grey colour produced might be due to the denaturation of meat pigment especially myoglobin and browning reaction (maillard reaction) (Soeparno, 1998). The addition of tapioca flour darkened the colour of meatball. This was caused by complex compound of ferrum and HCN that produced blue and grey when the tapioca was heated (Muljoharjo, 1987).

Filler ratio and kinds of meat influenced texture of meatball. The homogen dough emulsion usually resulted in good texture of meatball, but unstable emulsion of dough often produced many spaces or air globules, fat, and gelatin aggregates

found in the meatball. Eventually the meatball had coarse texture (Triatmojo, 1992). The coarse meatball produced might be reduced by adding filler. Yuliasari (1993) stated that tapioca flour used might improve the texture of commercial meatball. The best texture of meatball was commercial meatball followed by horse meatball and finally beef meatball.

Product of meat ball considered very tender according to the panelists. This was probable due to the fat content of the horse meat. Kramlich (1975) stated that tenderness of meat processed was influenced by moisture, protein, and fat. Connective tissue of the muscle was removed in the present experiment, therefore the meatball produced was very tender. Soeparno (1998) reported that muscle with less connective tissue tenderer meatball than muscle with much more connective tissue.

Tapioca starch used as food ingredients increased the consistency of meatball. Tapioca starch had 17% amylose and 83% amilopectin (Muljoharjo, 1987).

General appearance of meatball is the perception of panelists on the overall performance of the products (meatball) such as colour, texture, and its form. Result of statistical analysis showed that panelists slightly like to meatball made of LD muscle with ratio of filler and meat 20/80.

Table 3. χ^2 values of organoleptical characteristics of meatball made using different filler ratio and kinds of muscles

Parameter	dislike	grey	Slightly coarse	Very tender	Slightly like
Flavor	5.67 ^{ns}				
Colour		2.67 ^{ns}			
Texture			7.26*		
Tenderness				1.54 ^{ns}	
General appearance					1.71 ^{ns}

Table 4. The number of panelists gave similar score on the organoleptical characteristics of meatballs

Parameter	meatball		
	horse	beef	Commercial
Flavor	0	1	7
Colour	4	13	1
Texture	3	1	10
Tenderness	5	0	1
General appearance	0	0	8

Conclusion

The used of tapioca starch as filler decreased moisture, protein and fat contents of horse meatball, further were it influenced organoleptical characteristics of meatball as well. Meatball made of BF possessed higher moisture content, more palatable and tenderer. However, general appearance of meatball made of LD muscle was preferable by panelists. The best meatball based on chemical and organoloptical characteristics was made from LD muscle with ratio of 20/80.

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