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Use of Chitosan and White Glutinous Rice Flour Quality of Chicken Meat Burger

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A B S T R A C T

This research aims to increase the economic value of chicken meat by diversifying processed products, such as burgers. The study focuses on finding the right concentration ratio between white glutinous rice flour and chitosan to produce high-quality chicken meat burgers. The research used factorial RAL and analyzed parameters such as pH, WHC, color, water content, protein content, fat content, micro-element content (calcium and phosphor), and reducing sugar. Results showed that the moisture content of chicken burgers using white sticky rice was lower, while chitosan had a lower water content. The color of burgers using white sticky rice was reddish and greenish, while chitosan had a lower reduction sugar. Ca content was also lower, while phosphorus levels were higher in chitosan burgers. The WHC ranged from 18.869 - 48.7573 for chitosan burgers and 25.023 - 41, 2855 for chitosan burgers.

INTRODDUCTION

Chicken meat contains protein, essential fatty acids and a source of vitamin A, which are useful for health. The essential fats in chicken meat are prone to rancidity and spoilage due to oxidation and the formation of free radicals, which can be harmful to health. Therefore, chicken meat needs to be processed.

Meat has a good economic value of chicken meat because it needs to increase its economic value. To increase its selling/economic value, namely by diversifying processed products. One of the diversified processed products is burger. Burgers are favored by all people, both young and old.

Burger is one of the side dishes that is quite complete and very popular in the community as a fast food dish. In the wider community burgers are easy to make and practical to be one of the treats. The main ingredients for making burgers are animal meat (chicken meat) and mixed ingredients such as flour which are useful for improving quality, both in terms of texture, and nutritional value.

The addition of starch-containing flour such as white glutinous rice flour in making burgers functions as a filler and binder. But the binder derived from starch is not so strong that it is necessary to add emulsion formation such as chitosan.

With the description above, the researcher wants to conduct a study entitled "The Use of Chitosan and White Glutinous Rice Flour on the Quality of Chicken Meat Burger".

METHODOLOGY

Place and Time of Research

The research site was at the Faculty of Animal Husbandry Laboratory and Integrated Laboratory of Jambi University with a research time of 6 (six) months from May to October.

Materials and Research Tools

The materials used in this study were chicken meat, burger casing, chitosan, white glutinous rice flour, pepper, salt, garlic. The tools used were scales, knives, ovens, soxlets, kjedhal tubes, stoves, filter paper, weights, desiccators, pH meters, cameras.

Experiment Design

The experimental design in this study was RAL Factorial, where factorial: chitosan concentration (0, 2, 4, 6%) and white glutinous rice flour concentration (0, 10, 20, 30%).

Parameters Observed

The parameters observed were moisture content, fat, protein, pH, reducing sugar, WHC, color, calcium and phosphorus content.

RESEARCH RESULT AND DISCUSSIONS

Water Content

Table 1. Chicken burger moisture content (%)

Concentration of white glutinous rice (%)	Chitosan (%)				
	0	2	4	6	Average
0	70,48245	68,5997	337820,5	66,86525	84506,61
10	68,9557	66,6083	66,85465	66,83015	67,3122
20	60,1493	64,41905	62,4035	64,12295	62,7737
30	62,2509	59,2081	59,8017	59,76	60,25518
Average	65,45959	64,70879	84502,39	64,39459	

He moisture content of chicken burgers using white glutinous rice is 60.255 - 84.506% (P <0.05), where the concentration of white glutinous rice is high the moisture content of chicken burgers is getting smaller. While using chitosan is 64.394 -84.502% (P<0.05) the higher the chitosan has a lower water content. According to Snyder and Orr (1984) the water content in chicken meat is 73.7%. According to Buckle et al. (2007) high water content is one of the factors that support the development of fungi or microorganisms when chickens experience stress, muscles will lose energy faster and rigor mortis occurs faster. Chicken meat cut without stress will have a high enough glycogen content that will affect the pH and water content in the meat.

Fat Content

Table 2 Fat content of chicken burgers (%)

Concentration of white glutinous rice (%)	Chitosan (%)				
	0	2	4	6	Average
0	5,2552	4,17585	2,65895	3,6848	3,9437
10	5,0935	4,32235	3,62575	3,73625	4,194463
20	5,154	4,5078	3,41835	3,761	4,210288
30	4,8015	3,53455	2,93635	3,32065	3,648263
Average	5,07605	4,135138	3,15985	3,625675	

Fat content in chicken burgers using white sticky rice is 3.648 - 3.9437% (P>0.05), while those using chitosan is 3.1596 - 5.07605% (P<0.05).

According to Soeparno (2005), the fat content in chicken carcasses varies according to age, sex and species. Chicken meat fat consists of white fat and yellow fat, usually white fat contains more saturated fat and is not rancid quickly while yellow fat contains a lot of vitamin A. Chicken meat generally contains less cholesterol and more unsaturated acids. Meat fat content ranges from 3 - 7%.

Protein Content

Table 3: Protein content of chicken burgers (%)

Concentration of white glutinous rice (%)	Chitosan (%)				
	0	2	4	6	Average
0	24,0253	19,3822	16,186	17,45115	19,26116
10	20,6744	18,60723	16,83745	17,9174	18,50912
20	19,87605	18,60535	16,8505	16,717	18,01223
30	16,8402	15,8787	15,93755	16,84195	16,3746
Average	20,35399	18,11837	16,45288	17,23188	

z is 16.3746 - 19.26116%, while between chitosan and white glutinous rice is 16.45288 - 20.35399%. All treatments were not significantly different (P>0.05) in chicken burgers using white glutinous rice and chitosan. Chicken meat protein is 16-20% (Buckle et al., 2007). Meanwhile, according to Babji et al. (2000) chicken burgers have 14.26% protein. Meanwhile, according to Soeparno (2005) chicken meat protein ranges from 18-20%. The total protein content in white muscle is higher than in red muscle. The higher total protein in white muscle is in structural proteins, namely actin and myosin.

pH

Table 4. pH of chicken burger

Concentration of white glutinous rice (%)	Chitosan (%)				
	0	2	4	6	Average
0	4,61	4,9	5,25	5,75	5,1275
10	4,725	5,1	5,27	5,53	5,15625
20	4,545	5,25	4,7	5,175	4,9175
30	4,835	4,325	5,285	4,98	4,85625
Average	4,67875	4,89375	5,12625	5,35875	

The pH of chicken burgers using white sticky rice is between 4.856 - 5.156 (P>0.05), while the pH of chicken burgers using chitosan is 4.678 - 5.358 (P<0.05), where the pH gets bigger when the concentration of chitosan gets bigger.According to Soeparno (2005), changes in pH after post mortem are influenced by intrinsic factors, namely species, muscle type and other variations of livestock and extrinsic factors, namely handling of livestock before slaughter and meat storage temperature. The rate of decline in carcass pH at post mortem will be fast at high storage temperatures while low temperatures will inhibit the rate of pH decline. Storage temperature affects post mortem pH changes due to the direct effect of temperature on the rate of post mortem glycolysis. the final pH value of 5.1 - 6.1 makes the meat structure open. pH is directly proportional to WHC if the pH is low WHC is low so that the durability of the meat is high and the meat fibers are open.

Color

The color of chicken burgers using white glutinous rice flour (P<0.05) is reddish and greenish while the color is bluish. While chicken burgers that use chitosan (P>0.05).

Color changes during post mortem are related to changes in pH in the meat muscle. The speed of pH decrease and the ultimate pH value greatly affect the color characteristics of meat. A rapid decrease in post mortem pH results in pale meat color. Meanwhile, a high post mortem pH value results in dark red meat. In addition to the influence of pH, color change is also influenced by the chemical reaction of myoglobin in the presence of oxygen. With the availability of sufficient oxygen, oxygenation will occur to form oxymyoglobin which is bright red, and in other processes will Metmioglobin which can cause discoloration of fresh meat. The color of meat is determined by myoglobin, myoglobin denatures at a cooking temperature of 80 - 90 oC. The normal color of chicken meat is grayish white to faint red or purple. The color of the meat can change or color deviation to brown, bright red, pink and green because myoglobin reacts with other compounds or undergoes oxygenation, oxidation, reduction and denaturation. (Soeparno, 2005).

Reduced Sugar

Table 5. Reducing sugar content of chicken burgers

Concentration of white glutinous rice (%)	Chitosan (%)				Average
	0	2	4	6	
0	0,205	0,215	0,22	0,185	0,20625
10	0,245	0,24	0,25	0,225	0,24
20	0,295	0,285	0,24	0,255	0,26875
30	0,35	0,315	0,32	0,32	0,32625
Average	0,27375	0,26375	0,2575	0,24625	

Reducing sugar in chicken burgers using white sticky rice is between 0.206 - 0.326% (P <0.05), where the reduction sugar is low with a low concentration of

white sticky rice, where white sticky rice contains sugar. Meanwhile, chicken burgers that use chitosan have a reduction sugar of 0.246 - 0.2737% (P>0.05). According to Soeparno (2005) the glucose content of mammals is 0.1% of 1% carbohydrate. Meanwhile, according to the Indonesian Ministry of Health (1992), chicken has 0% carbohydrate.l 5. Reducing sugar content of chicken

Microelements

Table 6. Ca content of chicken burger (mg/kg)

Concentration of white glutinous rice (%)	Chitosan (%)				Average
	0	2	4	6	
0	0,115	0,12	0,12	0,125	0,12
10	0,13	0,125	0,115	0,115	0,12125
20	0,135	0,14	0,125	0,125	0,13125
30	0,115	0,125	0,15	0,13	0,13
Average	0,12375	0,1275	0,1275	0,12375	

Ca content of chicken burgers using white sticky rice was 0.12 - 0.13125%, while using chitosan was 0.1237 - 0.1275%. All treatments were not significantly different (P>0.05).

Table 7. Phosphorus content of chicken burgers (mg/100 g)

Concentration of white glutinous rice (%)	Chitosan (%)				Average
	0	2	4	6	
0	181,5	183,5	179,5	179	180,875
10	176,5	181	178,5	178,5	178,625
20	178	178	181	178,5	178,875
30	175	176	182	182,5	178,875
Average	177,75	179,625	180,25	179,625	

Phosphorus levels in chicken burgers using chitosan were 177.75% - 180.25%, while those using white sticky rice were 178.625 - 180.875%. All treatments were not significantly different (P>0.05)

Water Holding Capacity (WHC)

Table 8. WHC of chicken burger

Concentration of white glutinous rice **(%)**	**Chitosan (%)**				**Average**
	0 (kode P0)	**2 (kode P1)**	**4 (kode P2)**	**6 (kode P3)**	
	% air bebas	% air bebas	% air bebas	% air bebas	
0	62,3825598	51,834037	43,043601	37,769339	48,757384
10	41,2855134	30,73699	30,73699	28,978903	32,934599
20	32,4950774	30,73699	21,946554	23,704641	27,220816
30	28,978903	21,946554	14,914205	9,6399437	18,869902
Average	41,28551336	33,8136428	27,6603376	25,0232068	

WHC of chicken burgers using white glutinous rice ranged from 18.869 - 48.7573 ($P<0.05$), while those using chitosan ranged from 25.023 - 41, 2855 ($P<0.05$).

Water holding capacity by meat is the ability of meat to bind its water or added water during the influence of external forces, such as meat cutting, heating, grinding or pressure. The ability to retain water is an important factor especially for meat that will be used in industries that involve crushing and/or emulsifying processes, such as the production of meat paste, sausages, meatballs, cooked ham, and others. Water binding capacity is also closely related to water loss when meat is frozen and thawed. In the pre rigor phase, the water binding capacity of meat is still relatively high, but gradually decreases along with changes in pH value and the amount of muscle tissue ATP (Soeparno, 2005).

Ockerman (1983) stated that an increase in DIA will be followed by an increase in tenderness. Conversely, a decrease in DIA will be followed by a decrease in tenderness. Soeparno (2005) suggests that meat that has a high water binding capacity, where the pH is far above the isoelectricity of actomyosin, the protein will bind more water and as a result the surface of the meat becomes dry, but when cooked it loses little water and is able to trap more water so that it gives a wet taste and gives the impression of being tender. Post-mortem ATP depletion in the rigor mortis phase causes a strong bond between actin and myosin filaments. The strong bonding of the myofibrillar protein network can also cause narrowing of the space to bind water, so the water binding capacity of meat in the rigor mortis phase is very low. During the post-rigor process, the water binding capacity of meat can increase again, this is associated with changes in the electrical charge of muscle protein molecules, or with the loosening of the myofibrillar network due to proteolytic enzyme activity. Meat tenderness is largely determined by at least three components of meat, namely the structure of myofibrils and their contraction status, the content of connective tissue and the degree of cross-linking, and the water binding capacity of meat proteins and meat juice. The higher the protein contained in an ingredient, the greater its water-binding ability.

Usmiati and Komariah (2007) stated that if the water binding capacity is high, the viscosity of the gel formed can increase the elasticity of the product so that it affects the tenderness of the product. Meanwhile, according to Purnomo (2000) during cooking, the amylose and amylopectin fractions bind to each other both with proteins and between fellow starch through hydrogen bonds will expand and be accompanied by a weakening of hydrogen bonds so that water molecules can infiltrate between protein and starch molecules.

CONCULSIONS AND RECOMMENDATIONS

 The moisture content of chicken burgers is not significantly different using white sticky rice and chitosan.
 Fat content of chicken burgers fat content is not significantly different using white sticky rice and chitosan.
 The protein content of chicken burgers is not significantly different in all treatments.
 pH in chicken burgers using white sticky rice is not significantly different, chicken burgers using chitosan are significantly different.
 Reduced sugar in chicken burgers using white sticky rice is not significantly different but those using chitosan are significantly different.
 Ca and phosphor content of chicken burgers were not significantly different using white sticky rice or chitosan.
 The color of chicken burgers using white glutinous rice flour ($P<0.05$) is reddish and greenish while the color is bluish. While chicken burgers using chitosan ($P>0.05$)

The suggestion of this research is that it is necessary to research burgers derived from other animal meat using chitosan and white glutinous rice flour.

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