TEXTURAL AND SENSORY PROPERTIES OF LOW FAT SAUSAGES ADDED WITH RICE POWDER

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Background and objective

Due to concerns with obesity and related diseases, consumers are looking for no fat or low fat meat products. With excessive fat reduction, however, the products desire bland and dry and texture can be hard, resulting in less acceptable to consumers. Fat substituents based on proteins and carbohydrates have been widely used in meat industry to overcome the problems. Rice is number one cereal crop in Asia. Moreover, rice has shown promise for increasing yield and juice retention in meat (Huang et al., 2005). Although all segments of the meat industry are attempting to market low-fat products, the beef, pork and poultry industries offer a wider variety of products. Duck is still very popular and in strong demand in many area of the world, especially in Asia. However, duck meat product does not get enough attention by the researcher. Duck breast meat composed of 70 to 90 % with oxidative red fibers (Type IIA) (Baeza, 1995), where as chicken breast meat is almost Type IIB (white) (Smith & Flether, 1992). The objectives of this research were to evaluate how the addition of rice affects the quality properties of low fat sausages and to compare the effectiveness of incorporated rice on sausages prepared with different types of meats such as pork, chicken and duck.

Materials and methods

Pork, chicken and duck were purchased from a local market, trimmed visible fat to reduce the fat content before grinding through a 3 mm plate. Prior to incorporation into the sausage batter, the moisture content of all type of meats was adjusted to 71%, and rice powder was added with water to provide final 71% moisture content as well. These steps were taken to ensure that any differences observed for the added rice powder would not be biased by different moisture contents. Sausage batters were prepared in a cold room at 4ºC. With hydrated rice powder group, rice powder was added at a level of 10% (w/w) after adjusting the water at 71%. Control sausages were also prepared but without the addition of rice powder. For each batch of sausages, other ingredients were mixed thoroughly using a mixer for 3 min at 4-6℃. After mixing, the mixtures were stuffed into synthetic cellulose casings (approximate diameter of 30 mm) using a stuffer. The sausages were then held for 24 h at 4℃ to allow for the ingredients to equilibrate. The sausage samples were then cooked for 30 min in a steam chamber (SAA10, Absury, Germany) until the center temperature of the sausages reached 70℃. For sausages batter, proximate composition, TEF (total expressible fluid) and cooking loss was measured. TPA (texture profile analysis) and sensory evaluation were done for different meat type sausages.

Results and discussion

The proximate composition of sausage samples with or without rice is shown in table 1. Moisture contents of the sausage batters ranged from 68.20 to 70.95%, and there was no significant difference among the sausage samples. Fat contents in different sausages ranged from 2.39 to 4.71%, protein content ranged from 16.94 to 21.05% and ash content ranged from 2.57 to 3.18. In general, fat, protein and ash contents for pork, chicken and duck were slightly reduced by the addition of rice powder ($P<0.05$). Total expressible fluid and cooking loss were decreased with the addition of rice powder in all meat type sausage batters. Again, the highest cooking loss was found in pork sausages with out rice powder and lowest in chicken sausages with 10% rice powder ($P<0.05$). Table 2 showed the TPA of the sausages with different types of meat and with or without rice powder. Significant differences in texture attributes such as hardness, cohesiveness were found in all meat type sausage samples ($P<0.05$). For examples, sausages from duck showed highest values in hardness, cohesiveness, gumminess, chewiness, while chicken had lowest one. On the other hand, hardness, gumminess and chewiness for all sausages decreased by addition of rice. The textural properties of the sausages prepared with duck were most affected by addition of rice. Table 3 showed sensory evaluations of the sausages with different types of meat and with or without rice powder. There were significant differences in color, flavor, off-flavor, juiciness, tenderness and overall acceptability among sausages prepared with different types of meat with or without rice powder ($P<0.05$). Tenderness value was increased by addition of rice powder. Although duck meat sausages without rice powder had a good color attribute from sensory evaluation, the off-flavor of duck

meat sausages without rice powder reduced its overall acceptability. However, when duck meat sausages prepared with addition of rice powder, the overall acceptability increased.

Conclusions

Fat and protein contents of trimmed low fat sausages were further reduced by the addition of rice powder. Addition of rice powder in different meat type sausages reduces the hardness, and highest reduction of hardness was found in duck meat sausages. Duck sausages had the good color attributes, however the off-flavor of duck meat reduced its overall acceptability. This study demonstrates that a likable low-fat duck sausage can be made in which duck meat is replaced with 10% hydrated rice powder, which reduces the off-flavor.

Table 1. Proximate composition, total expressible fluid and cooking loss in low fat sausages with/without hydrated rice

Treatment	Moisture %	Crude protein %	Crude fat %	Ash %	TEF %	Cooking loss %
*Pork	68.79±0.99	21.05±0.05^{A}	4.71±0.10^{A}	3.16±0.05^{A}	2.93±0.35^{A}	11.52±0.60^{A}
*Chicken	70.10±0.28	18.29±0.91^{BC}	3.64±0.38^{B}	3.11±0.09^{A}	0.97±0.03^{D}	6.88±0.11^{C}
*Duck	70.95±2.19	17.98±1.93^{BC}	3.58±0.34^{B}	3.18±0.20^{A}	2.53±0.05^{B}	8.38±0.93^{B}
Pork + 10% hydrated rice	68.20±1.06	20.45±0.02^{AB}	3.90±0.32^{B}	2.57±0.07^{B}	0.76±0.08^{D}	6.45±0.22^{C}
Chicken + 10% hydrated rice	69.70±1.03	16.94±0.64^{C}	2.39±0.11^{C}	2.74±0.21^{B}	0.39±0.11^{E}	5.02±0.73^{D}
Duck + 10% hydrated rice	68.99±2.12	16.77±0.90^{C}	2.49±0.04^{C}	2.65±0.09^{B}	1.55±0.18^{C}	7.36±0.36^{BC}

• $^{A-D}$ Means with different superscripts within a column differ significantly ($p<0.05$).
• * : Control; without hydrated rice.

Table 2. TPA (textural profile analysis) in low fat sausages with/without hydrated rice

Treatment	Hardness (kg)	Cohesiveness	Springiness (mm)	Gumminess (kg)	Chewiness (kg*mm)
*Pork	0.41±0.04^{AB}	54.74±5.72^{A}	13.90±0.27	22.60±3.28^{AB}	313.69±43.22^{A}
*Chicken	0.34±0.08^{C}	51.99±3.38^{AB}	13.64±0.24	17.72±4.32^{C}	241.07±55.24^{B}
*Duck	0.45±0.06^{A}	56.30±3.23^{A}	12.29±2.92	25.19±4.23^{A}	319.29±102.47^{A}
Pork + 10% hydrated rice	0.36±0.04^{BC}	54.48±3.50^{A}	13.77±0.09	19.70±2.84^{BC}	271.07±38.28^{AB}
Chicken + 10% hydrated rice	0.27±0.02^{D}	44.11±2.28^{BC}	13.84±0.20	12.12±0.91^{D}	167.78±12.81^{C}
Duck + 10% hydrated rice	0.22±0.09^{D}	42.69±15.44^{C}	12.45±3.59	11.25±5.01^{D}	159.21±76.62^{C}

• $^{A-D}$ Means with different superscripts within a column differ significantly ($p<0.05$).
• * : Control; without hydrated rice.

Table 3. Sensory evaluation of in low fat sausages with/without hydrated rice

Treatment	Color	Flavor	Off-flavor	Juiciness	Tenderness	Overall acceptability
*Pork	5.31±0.43^{C}	3.41±1.90	2.97±2.16^{AB}	4.60±1.20^{AB}	5.17±0.75^{B}	6.43±1.40^{A}
*Chicken	3.23±0.61^{D}	4.27±1.94	3.27±1.61^{AB}	4.21±1.12^{AB}	5.90±0.83^{AB}	5.49±0.68^{AB}
*Duck	8.22±0.44^{A}	4.26±1.95	4.71±1.39^{A}	3.81±1.51^{AB}	5.14±0.99^{B}	4.39±1.52^{B}
Pork + 10% hydrated rice	4.93±0.82^{C}	4.01±1.73	2.16±1.83^{B}	5.66±1.88^{A}	6.10±0.95^{A}	6.54±1.44^{A}
Chicken + 10% hydrated rice	2.79±1.01^{D}	3.61±1.84	2.86±1.64^{AB}	3.51±1.30^{B}	6.31±0.30^{A}	5.27±0.43^{AB}
Duck + 10% hydrated rice	6.74±0.57^{B}	3.39±1.80	3.89±1.81^{AB}	4.89±1.99^{AB}	6.73±0.77^{A}	6.09±1.39^{A}

• $^{A-D}$ Means with different superscripts within a column differ significantly ($p<0.05$).
• * : Control; without hydrated rice.

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