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FULL PAPER

Characteristics of jerky made from ground rabbit meat

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Abstract

Jerky is lean meat that is sliced into strips and dehydrated to prevent spoilage. Considering the suitability of rabbit meat for people with heart disease or obesity, this study aimed to characterise jerky prepared from ground rabbit meat (GRM). The characteristic evaluation involved chemical (moisture and total solids), physical (water activity, cooking losses, and colour appearance), and microbiological parameters. Furthermore, the characteristics of jerky prepared from GRM were compared with jerky prepared from sliced rabbit meat (SRM). The utilisation of GRM compared to SRM as raw material in jerky production showed significant differences in the lightness and cooking losses of the final product. There were no significant differences between the jerky made from GRM and SRM in terms of chemical characteristics, water activity, the intensity of red and yellow colour, and microbiological aspects. Jerky prepared using GRM had a brighter colour and greater cooking loss than those jerky prepared using SRM. GRM can thus be used as an alternative raw material in the jerky production process, even though it results in a final product with slightly lower quality.

1. Introduction

Jerky is a meat-based food product prepared from sliced or ground fresh meat, which is seasoned and dried (Kemalawaty *et al.,* 2019). Processing meat into jerky is one of the methods used to increase the economic value of meat, in addition to extending its shelf life by up to 6 months (Sabtu and Armandianto, 2019). The preparation of jerky is based on the drying of meat, with the addition of spices aiming to produce a distinctive taste and increase durability (Purnomo, 1996). The main spices used for making jerky include brown sugar, salt, coriander, garlic, galangal, and cumin. These materials contribute to the unique properties of jerky products, providing stable colour, aroma, texture, and delicacy. Drying jerky decreases the water content and water activity, resulting in reduced bacterial content, and increased durability. The presence of sugar during drying results in caramelisation, giving rise to a distinctive taste (Legowo *et al*., 2002). In general, jerky is prepared from beef because it has long meat fibres and is easier to slice. The high cholesterol content in beef makes it unsuitable for consumption by people with obesity, elderly people, and patients with heart disease; therefore, it is necessary to modify jerky using other meats such as rabbit meat.

Rabbit meat is a white meat group that is high in protein, but low in fat, cholesterol, and calories (Damron, 2006). The low cholesterol and high protein content make rabbit meat a recommended food for patients with heart disease, children in their infancy, especially toddlers, parents, and people with obesity (Sarwono,2008). Another advantage of rabbit meat is that it has short, fine fibres, which make it easy to chew (Farrel and Rahardjo, 1984), but difficult to slice in the process of preparing rabbit meat jerky. The process thus needs to be modified to prepare rabbit meat jerky using grinding methods. Another advantage of preparing rabbit meat jerky with ground meat is increased efficiency due to easier handling and the ability to obtain uniform size. Considering these factors, the objective of this study was to characterise jerky prepared from ground rabbit meat.

2. Materials and methods

2.1 Materials

Approximately forty female Australian rabbits, aged 1.5–2 years, with an average body weight of 3.4 kg were obtained from Ungaran, Semarang Regency, Indonesia. The curing ingredients used were brown sugar (30%), NaCl salt (5%), coriander (2%), garlic (2%), galangal

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(1%), and cumin (1%) concerning the weight of rabbit meat. Bacterial culture was performed using nutrient agar and peptone water diluent solution.

2.2 Jerky production

Rabbit jerky was prepared using two methods. The first method involved the use of sliced rabbit meat. Rabbit meat was sliced to a thickness of 4 mm, mashed, and soaked in the curing material for 6 hrs in a refrigerator at a temperature of 3–5°C and a humidity of 50–55%. The rabbit meat was then drained, laid out on a baking sheet, and dried in an oven at 55°C for 32–35 hrs.

The second method was performed using ground rabbit meat. Rabbit meat was cut into small pieces and milled. The curing material was then smeared on the mince for 6 hrs in a refrigerator at a temperature of 3–5° C with an air humidity of 50–55%; it was then drained, moulded to a thickness of 4 mm, placed in a baking dish, and dried in an oven at 55°C for 32–35 hrs.

2.3 Chemical analysis

Chemical testing included analysis of the moisture content and total solids using the AOAC (2005) method. First, 5 mL of the jerky sample was placed into a porcelain cup with a known empty weight, placed in an oven, and dried at 105°C for 4 hrs. The sample was then removed from the oven, placed in a desiccator, and weighed again. Then, the total solid contents of rabbit meat jerky were calculated as the percentage of the initial weight after removing the moisture content.

2.4 Physical analysis

Physical testing included water activity, cooking shrinkage, and colour testing. Water activity was calculated according to the method described by Bintoro (2008). The water activity indicates the free water in food that is needed for microbial growth and was tested using an AW-meter.

Cooking shrinkage was calculated using the method described by Soeparno (2005). First, 10 g of the sample was placed in a plastic bag and cooked in a 60°C water bath for 30 mins; the sample was then removed from the plastic bag, wiped with absorbent paper (tissue) without pressing, and then weighed.

Colour testing was performed according to the method described by Johansyah *et al.* (2014). The colour measurements were carried out using a chromameter CR400 (Konina Minolta Sensing Japan), with the L* a* b* system, where L* indicates brightness, a* indicates redness, and b* indicates a yellowish colour.

2.5 Microbiology analysis

Total bacterial counts were calculated according to the method described by Harrigan (1998). Briefly, 10 g of the jerky sample was placed in 90 mL of 0.85% NaCl solution. The sample was serially diluted up to 10^{-7} using a 9 mL diluent solution. The dilutions of 10^{-5} to 10^{-7} were inoculated on nutrient agar (NA) in a Petri dish, which was then incubated at 37°C in an inverted position. Inoculation was performed in duplicate for each dilution. The growing colonies were counted after 48 hrs based on the ISO method and expressed as CFU/mL.

3. Results and discussion

3.1 Chemical characteristics

Our results indicated that using ground rabbit meat did not affect the moisture and total solid contents of rabbit meat jerky ($p > 0.05$). The moisture content of rabbit jerky in the control treatment (sliced meat) was 12.98% and that in the ground meat treatment was 13.38% (Figure 1). The water content of rabbit jerky was not by the SNI-2908 (2013) requirements for beef jerky as the maximum allowed water content for beef jerky is 12%. This difference in moisture content was due to the oven drying method at a temperature of 55°C for 32–35 hrs. The relatively similar moisture content was attributed to the texture of both sliced and chopped rabbit meat, with relatively the same thickness of 4 mm, as 4 cm long and 4 cm wide layers, which resulted in similar evaporation of water during drying in the oven. The drying process at the time of jerky preparation along with the drying time and temperature contribute to the decrease in water content. Therefore, the water content of rabbit jerky was relatively low, and the treatment using ground rabbit meat did not affect the water content of rabbit jerky. Further, the drying process can increase the total solids in rabbit jerky, contributing to the low water content in rabbit jerky (Holley, 1985), because increased total solid contents accelerate the evaporation process.

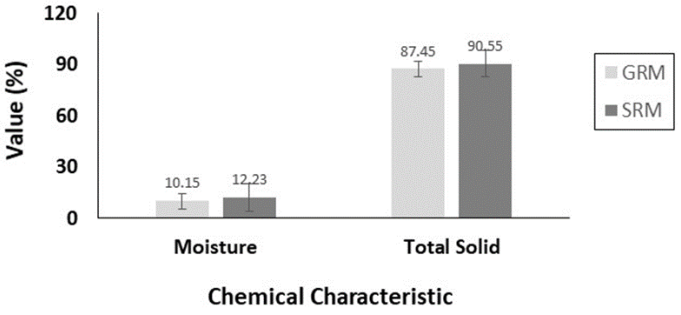

Figure 1. Comparison of the chemical characteristics between jerky prepared from ground (GRM) and sliced (SRM) rabbit meat.

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3.2 Physical characteristics

The water activities of sliced and ground rabbit meat jerky are shown in Figure 2. The water activity of sliced and ground jerky was not significantly different ($p > 0.05$), and the results showed that the water activity obtained was low. The water activity of beef jerky products is reported to range from 0.70–0.85 (Liem *et al*., 2014). The low water activity in rabbit jerky is influenced by the relatively low water content of rabbit jerky because drying and curing were performed simultaneously; thus, the results are not significantly different. Brown sugar is one of the ingredients used in jerky production. The presence of sugar in the manufacture of rabbit jerky can reduce the water activity and water content of rabbit jerky via osmotic dehydration (Chen *et al.,* 2002). In contrast, water activity is associated with a higher water content in food products (Sorapukdee and Tangwatcharin*,* 2018).

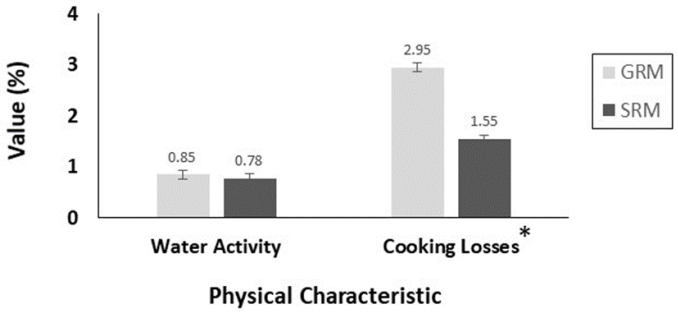

Figure 2. Comparison of the physical characteristics between jerky prepared from ground (GRM) and sliced (SRM) rabbit meat. *Significant difference between GRM vs. SRM ($p < 0.05$).

Based on Figure 2, the cooking loss of rabbit jerky was significantly different between the sliced and ground rabbit meat groups ($p < 0.05$). Cooking shrinkage is the loss of water during cooking which is influenced by time and cooking time (Soeparno, 2005). The cooking loss in jerky prepared using ground rabbit meat was higher than that in jerky prepared using sliced rabbit meat. This is because the grinding process physically damages the meat, thus decreasing its ability to hold water at the time of cooking.

The rabbit jerky was then tested for colour quality based on brightness (L*), redness (a*), and yellowish hue (b*). The brightness parameter based on Figure 3, showed on a significant difference, where the jerky prepared using ground rabbit meat had a higher brightness than that of the sliced meat group ($p < 0.05$). However, no significant difference was observed in the parameters of redness (a) and yellowness (b*) ($p > 0.05$). The brightness of the rabbit jerky is increased because the meat contains haem pigments including haemoglobin and myoglobin (Arief *et al*., 2006). Myoglobin is soluble in water and is easily oxidised to metmyoglobin; as the grinding process increases the dissolution of myoglobin in water, jerky prepared from ground rabbit meat has higher brightness (and is faded) (Winarno, 1984).

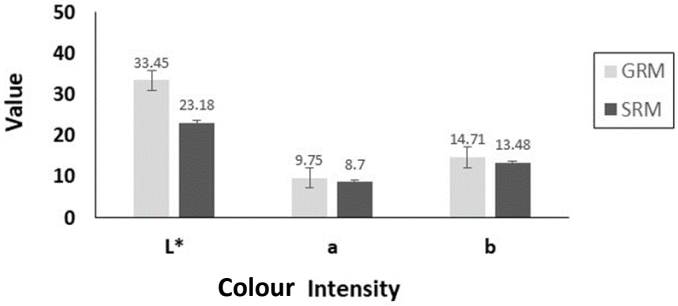

Figure 3. Comparison of colour intensity (L = brightness, a = redness, and b = yellowish hue) between jerky prepared from ground (GRM) and sliced (SRM) rabbit meat. *Significant differences between GRM *vs*. SRM ($p < 0.05$).

3.3 Microbiological characteristics

The results showed on the Figure 4, that the bacterial content of sliced and ground meat jerky was not significantly different ($P < 0.05$); the average bacterial content of sliced rabbit meat was 1.6×10^6 CFU/g, whereas that of ground rabbit meat was 2.9×10^6 CFU/g. This indicates that using ground meat does not affect the total bacterial counts. The bacterial content of rabbit meat was higher than that of rabbit meat jerky after the heating and drying processes. The temperature used in this study was 55°C with a duration of 32–35 hrs (Bintoro, 2008). It is essential to use the optimal heating temperature when cooking food that needs to be preserved because lower temperatures allow bacterial growth (Fardiaz, 1996). The temperature required to kill bacteria is at least 66°C, whereas the temperature used for this research was an average of 55°C, which can still allow bacterial growth (Nurwantoro and Djarijah, 1997). Thus, the bacterial content of rabbit jerky is still relatively high, and the process temperature used for rabbit jerky needs to be increased to decrease bacterial

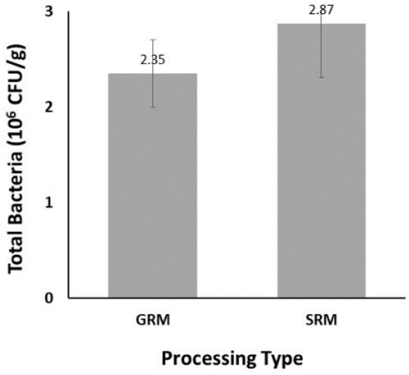

Figure 3. Comparison of colour intensity (L = brightness, a = redness, and b = yellowish hue) between jerky prepared from ground (GRM) and sliced (SRM) rabbit meat. *Significant differences between GRM *vs*. SRM ($p < 0.05$).

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growth. The bacterial content in rabbit jerky is also influenced by water activity and water content. The critical water activity in food is 0.6–0.7, which if exceeded, can facilitate bacterial growth in food (Pittia and Antonello, 2016).

4. Conclusion

Using ground rabbit meat to prepare jerky did not affect water content, water activity, redness, and yellowish and total bacterial growth compared to those obtained with sliced rabbit meat. However, the jerky prepared from ground rabbit meat had a brighter colour and had higher cooking shrinkage than the sliced rabbit jerky. Thus, the grinding method does not provide optimal results because high cooking losses generally reduce the product's taste.

References

Association of Official Analytical Chemists (AOAC). (2005). Official Methods of Analysis of The Association of Official Agriculture Chemists. 16th ed. Virginia, USA: AOAC International.

Arief, I.I., Suryati, T. and Maheswari, R.A.A. (2006). Physical properties of dark firm dry beef (DFD) fermented by lactic acid bacteria *Lactobacillus plantarum. Media Peternakan*, 29(2), 76-83.

Badan Standarisasi Nasional. (2013). Quality of beef jerky (SNI-2908). Jakarta, Indonesia: Badan Standarisasi Nasional.

Bintoro, V.P. (2008). Meat Processing Technology and Product Analysis. 2nd ed. Semarang, Indonesia: Diponegoro University Publisher Agency.

Chen, W.S., Liu, D.C. and Chen, M.T. (2002). Effects of the high level of sucrose on the moisture content, water activity, protein denaturation and sensory properties in Chinese-style pork jerky. *Asian-Australasian Journal of Animal Sciences*, 15(4), 585-590. https://doi.org/10.5713/ajas.2002.585

Damron, W.S. (1998). Introduction to Animal Science: Global, Biological, Social, and Industry Perspectives. 3rd ed. New Jersey, USA: Pearson Prentice Hall.

Fardiaz, S. (1995). Antimicrobial activity of coffee (*Coffea robusta*) extract. *ASEAN Food Journal*, 10, 103-106.

Farrel, D.J. and Rahardjo, Y.J. (1984). The Potential for Meat Production from Rabbit. Bogor, Indonesia: Central Research Institute for Animal Science.

Harrigan, W.F. (1998). Laboratory Methods in Food Microbiology. 3rd ed. San Diego, USA: Academic Press.

Holley, R.A. (1985). Beef jerky: viability of food-poisoning microorganisms on jerky during its manufacture and storage. *Journal of Food Protection*, 48(2), 100-106. https://doi.org/10.4315/0362-028X-48.2.100

Johansyah, A., Prihastanti, E. and Kusdiyantini, E. (2014). The effect of low-density polyethylene (LDPE), high density polyethylene (HDPE) and polypropylene (PP) packaging on the maturation of tomatoes (*Lycopersicon esculentum* Mill). *Buletin Anatomi dan Fisiologi*, 22(1), 46-47.

Kemalawaty, M., Anwar, C. and Aprita, I.R. (2019). Kajian Pembuatan Dendeng Ayam Sayat dengan Penambahan Ekstrak Asam Jawa. *Jurnal Peternakan Sriwijaya*, 8(1), 1-8. [In Bahasa Indonesia]. https://doi.org/10.33230/JPS.8.1.2019.7623

Legowo, A.M., Soepardie, R., Miranda, I.S., Anisa, N. and Rohadiyah, Y. (2002). Effects of pre-curing meat immersion in betel leaf juice on rancidity and organoleptic properties of beef jerky during storage. *Teknologi dan Industri Pangan Journal,* 13, 64-69.

Liem, H.J., Kim, G.D., Jung, E.Y., Seo, H.W., Joo, S.T., Jim, S.K. and Yang, H.S. (2014). Effect of curing time on the physicochemical and sensory properties of beef jerky replaced salt with soy sauce, red pepper paste and soybean paste. *Asian-Australasian Journal of Animal Sciences,* 27(8), 1174-1180. https://doi.org/10.5713/ajas.2013.13853

Nurwantoro and Djarijah, A.S. (1997). Animal-Vegetable Food Microbiology. Yogyakarta, Indonesia: Canisius Publisher.

Pittia, P. and Antonello, P. (2016). Safety by control of water activity: Drying, smoking, and salt or sugar addition. In Prakash, V., Martin-Belloso, O., Keener, L., Astley, S.B., Braun, S., McMahon, H., Lelieveld H. (Eds.) Regulating safety of traditional and ethnic foods, p. 7-28. USA: Academic Press. https://doi.org/10.1016/B978-0-12-800605-4.00002-5

Purnomo, H. (1996). Meat Processing and Preservation Basics. 1st ed. Jakarta, Indonesia: PT Grasindo.

Sabtu, B. and Armadianto, H. (2019). Effect of soaking duration in red ginger extract (*Zingiber officinalle rosc*) on the chemical and organoleptic properties of the. *Jurnal Peternakan Lahan Kering*, 1(3), 490-497.

Sarwono, B. (2008). Cut and Ornamental Rabbit. 10th ed. Jakarta, Indonesia: Agromedia Pustaka.

Soeparno. (2005). Meat Science and Technology. 4th ed. Yogyakarta, Indonesia: Gadjah Mada University Press.

Sorapukdee, S. and Tangwatcharin, P. (2018). Quality of steak restructured from beef trimmings containing microbial transglutaminase and impacted by freezing and grading by fat level. *Asian-Australasian Journal of Animal Sciences*, 31(1), 129-137. https://doi.org/10.5713/ajas.17.0170

Winarno, F.G. (1984). Food chemistry and nutrition. Jakarta, Indonesia: PT Gramedia.

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