ORIGINAL SCIENTIFIC PAPER

Physical and sensory properties of burgers affected by different dry ageing time of beef neck

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Abstract

The objective of this study was to determine the effects of dry ageing on the yield and physical quality indicators of beef neck and to determine the sensory characteristics of burgers. Neck meat from castrated male Angus steers weighing 600 kg and 22 months old was used for the study. Neck samples (N = 12) were hung for 7 days (group Z-7) and 21 days (group Z-21) in a dry ageing chamber at a temperature of 2 °C ± 1 °C and a relative humidity of 77 % ± 3 %. Weight and pH of the meat were measured at the beginning and end of the ageing period. After ageing, the neck was dissected into muscle, subcutaneous and intermuscular fat, bone, and remaining parts. Burgers were prepared from the ground neck meat (73.9%) and fat (24.6%) to which 1.2% sea salt and 0.3% ground black pepper were added. The burgers (average weight 150 g) were then heat treated in a steam convection oven at a temperature of 230°C until an internal temperature of 64°C was reached. After heat treatment, the burgers were weighed again to calculate cooking weight loss and their diameter was measured in two perpendicular dimensions to calculate surface area reduction. Quantitative descriptive analysis and likability test were performed with nine trained sensory assessors in the sensory laboratory. The study revealed no significant differences in the proportions of each tissue obtained during dissection. The necks from group Z-21 had significantly higher pH (6.16) and weight loss (12.23%) at the end of dry aging. Significantly lower cooking loss was observed in group Z-21 (26.52%) compared to group Z-7 (31.31%), but no significant difference was observed in the reduction of the surface area of the burger. The descriptive sensory attributes and likeability traits of the burgers were not significantly different between groups Z-7 and Z-21. In view of this, it is considered that a shorter maturation period of beef necks should be used for the production of burgers.

Keywords: beef, burger, sensory analysis, cooking loss, surface area reduction

Introduction

Maturation or ageing of meat is done by storing meat at low temperatures to improve characteristics that affect consumer satisfaction, such as tenderness and flavour (McGee, 2004). The main methods of implementation are dry and wet ageing. Dry ageing of meat is usually done by hanging whole halves or individual cuts in chambers with controlled conditions for temperature

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and relative humidity for several weeks and even several months (Dashdorj et al., 2016). There are many opinions on how long dry ageing should take, depending on the type of final product you want to achieve and which characteristics you want to emphasise more. Numerous scientists claim that the best period for ageing beef is between 14 and 50 days (Savell, 2008; DeGreer et al., 2009; Lepper-Blilie et al., 2012; Dashdorj et al., 2016; Lee et al., 2017; Kim et al., 2017). During dry ageing of the meat, enzymatic degradation of proteins and fats takes place, resulting in a more intense taste and specific aromas. Furthermore, the enzymes break down the connective tissue proteins in the muscles, making the meat softer. During dry ageing, a crust forms on the meat because of surface desiccation, which, viewed positively, is a hurdle to the development of microorganisms. However, before the meat is sold, the crust has to be cut off, which means an additional loss that increases the price of the product (Garlough and Campbell, 2012). The process of dry ageing is relatively expensive for producers because it causes the cuts to dry out, which leads to a significant loss in weight of the meat, i.e., the yield. For all these reasons, dry ageing is used for halves or cuts that achieve a higher market price. There is a certain group of consumers who are willing to pay more for a certain taste that is obtained through the process of dry ageing, and this group is growing year by year, contributing to a new dimension of the meat market (Dashdorj et al., 2016). Neck meat is not classified as an expensive cut of meat, and when whole halves are aged, it is usually not sold as a separate cut but used to make minced meat products such as burgers. The aim of this work was therefore to determine the influence of the duration of dry ageing on the yield and physical quality indicators of beef neck and to determine the physical and sensory properties of burgers made from that meat.

Material and Methods

Processing of beef carcasses

The carcasses of castrated Angus steers with a live weight of about 600 kg and an age of 22 months were used for the study. After slaughter at the approved slaughterhouse, the carcasses were classified and chilled for 48 hours prior to fabrication into meat cuts. For research purposes, carcasses of class U and fatness level 3 were used, from which the neck with bone was removed by cutting on the cranial side between the occipital bone and the first cervical vertebra and on the caudal side between the last cervical vertebra and the first thoracic vertebra. Then the individual beef necks were weighed on a balance with an accuracy 0.5 g (G&G, Germany, model E15KY-0.5), labelled and placed in a dry ageing chamber at a temperature of 1°C to 3°C and a relative humidity of 74% to 80%. For the study, the beef necks were randomly divided into two groups (Z-7 and Z-21) that differed in the duration of ageing. In the Z-7 group, ageing lasted 7 days and in the Z-21 group, it lasted 21 days. Slaughtering and cutting took place 14 days apart, with the necks of the Z-21 group (N=6) being processed and aged first and the necks of the Z-7 group (N=6) 14 days later. In this way, the ageing period of both groups was completed at the same time so that all analyses especially sensory tests could be carried out on the meat without freezing.

Physical analysis of meat

Measurements of pH were made on the trimmed neck by direct puncture into the meat at the beginning of dry ageing and at the end of ageing using a HI98191 portable pH metre (Hanna Instruments, USA) equipped with a BlueLine 21pH puncture electrode (Schott AG, Germany). A total of 5 measurements of the pH of each piece of necks were taken. After dry ageing, the necks were weighed again to calculate the ageing weight loss. Afterwards, a dissection into muscle tissue, subcutaneous adipose tissue, intermuscular adipose tissue, bone and other parts (blood vessels, lymph glands, tendons, cartilage) was performed. A balance with an accuracy of 0.1 g (G&G, Germany, model JJ6000Y) was used to weigh individual tissues and dissection parts, and the proportion of an individual tissue or part in relation to the total mass was calculated.

Preparation of burgers

The muscle and the fat tissue obtained by dissection were ground separately to a size of 6 mm on an electric grinder machine (Tre Spade, Facem, Italy, model TC -22 Elegant). Burgers were then prepared from the ground neck meat (73.9%) and fat (24.6%) to which 1.2% sea salt and 0.3% ground black pepper (Paper nigrum L.) were added. After mixing all the components, burgers were made

with a diameter of 10 cm and an average weight of 150 g. The shaped burgers were wrapped in a transparent adhesive film made of high-density polyethylene and stored at a temperature of 2°C until sensory analysis.

Physical measurements and sensory analysis of burgers

Sensory analysis of the burgers was carried out in the Laboratory for Sensory Analysis of Agricultural and Food Products at the University of Zagreb Faculty of Agriculture. For the sensory analysis, 9 randomly selected burgers from each group were used, weighed individually on a balance with an accuracy of 0.1 g (G&G, Germany, model JJ6000Y) and their diameter measured in two mutually perpendicular dimensions. The burgers were then heat treated to an internal temperature of 64°C at a temperature of 230°C in a UNOX steam convection oven (Italy, model Cheftop Mind Maps ONE XEVC-0511). After heat treatment, the burgers were weighed again to calculate the cooking weight loss and their diameter was measured again in two mutually perpendicular dimensions to calculate the reduction in burger area. After heat treatment, the burgers were left at room temperature for 7 minutes and then cut into quarters, which later served as a sample for serving. The burger samples were kept at a temperature of 40°C until serving. The sensory test involved a modified descriptive quantitative analysis using Compusense20 software (Compusense, Ontario, Canada) and a Samsung Galaxy Tab A tablet, with 9 trained assessors aged 24 to 48 years. When performing the test, each assessor was given 6 samples in monadic way, three from each treatment, presented in random order. The assessors had to rate the intensity/expressiveness of the descriptive attributes and likability of the samples on a scale of 0 to 100 (0 indicated total absence of intensity/expressiveness/likability of the trait, while 100 indicated the highest intensity/expressiveness/likability of the trait). Assessor's performance was monitored using repeatability, panel conformity and sample discrimination. The assessors were asked to take bread, apple and water to neutralise the mouth after tasting each sample.

Statistical analysis

The procedures of the statistical programme SAS Studio (SAS Institute, 2019) were used for data processing. The PROC MEANS procedure was used to calculate descriptive statistics and the PROC GLM procedure with the Tukey post hoc test was used to compare pH values, proportion of each tissue, ageing weight loss, cooking weight loss, and area reduction of burgers between groups at p=0.05 significance level. The PROC MIXED procedure with the Tukey post-hoc test was used in the analysis of the sensory analysis data to compare the sensory attributes of the burgers with the group as a systematic effect and the assessor as a random effect at a significance level of p=0.05. The results are presented as mean ± standard deviation.

Results and Discussion

Table 1 shows the proportions of each tissue and other parts obtained during dissection of the neck. The study revealed a higher proportion of muscle tissue in the Z-7 group, while the proportion of intermuscular fat tissue was higher in the Z-21 group. The proportion of subcutaneous fat, bone and other parts differed little between treatments (the difference between groups is less than 1%). The results obtained are in agreement with those of Lee et al. (2017), who found that the proportion of water in meat decreases and the proportion of fat in meat

Table 1 Proportions of individual tissues in beef neck aged 7 and 21 days (*mean ± standard deviation*)

Proportion (%)	Group[1]	
	Z-7	Z-21
Muscle tissue	66.36 ± 3.07	62.62 ± 1.06
Subcutaneous adipose tissue	4.45 ± 1.11	3.54 ± 1.34
Intermuscular adipose tissue	9.03 ± 1.62	13.20 ± 2.98
Bone	14.97 ± 0.53	14.93 ± 0.54
Other parts	5.18 ± 0.18	5.71 ± 0.01

[1] *Z-7: beef neck aged 7 days; Z-21: beef neck aged 21 days*

increases with a longer ageing period. Since water in meat is mainly contained in the muscle tissue with a share of more than 70% (Fisher and Bayntun 1983), it is mainly the mass of the muscle tissue and thus its share that decreases during ageing. The mass of adipose tissue, on the other hand, changes little because of the low water content (<20%; Fisher and Bayntun 1983). This is supported by the findings of Laster et al. (2008) who found a significant decrease (P<0.05) in muscle weight of 4.9% at 21 days of maturation. The same authors also found a significant increase (P<0.05) in the proportion of adipose tissue amounting to 2% at an ageing time of 35 days, while no differences were found in the proportion of bone during the ageing process. The results obtained in the present study are in agreement with the referring literature, but there was no statistically significant difference, probably due to the greater variability of the samples.

Table 2 shows the results pH measurements at the beginning and at the end of dry ageing of beef neck. An increase in the final pH values was observed in both groups compared to the values at the beginning of ageing, but a statistically significant difference (P<0.05) was only observed in the group with longer ageing duration (Z-21). Moreover, no significant difference was found between groups in initial pH values, which were very uniform (5.71 in group Z-7 and 5.65 in group Z-21). In contrast, a statistically significant difference (P<0.05) was found between the groups in the final pH values, where group Z-21 had a significantly higher final pH value at the end of ageing than the group Z-7. Similar results were presented by Kim et al. (2017), who found a significant increase in pH during 40 days of ageing. The authors stated that the pH of the meat was 6.11 during the 20-day dry ageing which is similar to our results. Similar conclusions

Table 2 pH of beef necks at the beginning and at the end of ageing (*mean ± standard deviation*)

Trait	Group[1]	
	Z-7	Z-21
pH at the beginning of ageing	5.71 ± 0.06	5.65 ± 0.06^{B}
pH at the end of ageing	5.90 ± 0.02^{b}	6.16 ± 0.04$^{a;A}$

^{ab}: values within the row designated with different letters differ significantly (P<0.05)
^{AB}: values within the column designated with different letters differ significantly (P<0.05)
[1] Z-7: beef neck aged 7 days; Z-21: beef neck aged 21 days

were presented by Aksu et al. (2005) and Jayasooriya et al. (2007), who indicated that meat ageing leads to the hydrolysis of proteins, resulting in the formation of free amino acids and other nitrogenous compounds through proteolysis, leading to an increase in pH.

Figure 1 shows the results of the ageing weight loss by groups of beef necks. The study revealed a significantly higher ageing weight loss in necks with an ageing time of 21 days (12.23%) compared to necks with an ageing time of 7 days (4.62%). The results obtained are in agreement with

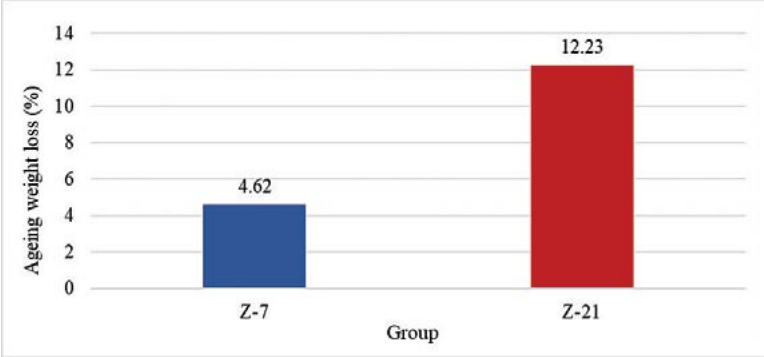

Figure 1 Ageing weight loss of beef neck aged 7 and 21 days
Z-7: beef neck aged 7 days; Z-21: beef neck aged 21 days

Table 3 Results of heat treatment of burgers made from beef neck aged 7 and 21 days (*mean ± standard deviation*)

Trait	Group[1]	
	Z-7	Z-21
Cooking weight loss (%)	31.31 ± 1.17[a]	26.52 ± 1.30[b]
Surface area reduction (%)	20.69 ± 0.82	20.12 ± 1.00

[ab]: *values within the row designated with different letters differ significantly (P<0.05)*
[1] *Z-7: burgers made from beef neck aged 7 days; Z-21: burgers made from beef neck aged 21 days*

the findings of Dashdorj et al. (2016) who stated that the ageing weight loss was 5% for 14 days dry ageing and 10% for 21 days ageing leading to the general conclusion that the ageing weight loss increases with the ageing duration. This is confirmed by the research data of Kim et al. (2017) who stated that the dry ageing of the beef loin after 20 days was 12.91%, which is very similar to the value obtained in the present study.

Table 3 shows the results of heat treatment of Z-7 and Z-21 burgers, indicating a significant difference (P<0.05) in cooking weight loss between the treatments; 31.31% in group Z-7 and 26.52% in group Z-21, respectively. Slightly lower cooking weight loss (25.65%) of burgers with 20% fat was determined by Patinho et al. (2021), which could be attributed to the use of water-binding polyphosphates in burger production. Higher values than this were shown by Turhan et al. (2008), who found that the cooking weight loss of beef burgers with 10% fat was 31.18%, while this loss was as high as 44.34% for burgers with 20% fat. The reason for the higher weight loss values could be due to the use of meat that has not undergone the ageing process.

No significant differences were found between the groups in the reduction of surface area of the burgers during heat treatment. Previous studies have shown that the reduction in surface area is related to fat content, and it was 24.87% for burgers with 10% fat and 31.15% for burgers with 20% fat (Turhan et al. 2008). The values obtained in the present study were lower than those mentioned (20.12 - 20.69%), although the share of fat was 25%. Patinho et al. (2021) obtained lower values for the area reduction of the burgers (16.57%), which could be explained by the addition of water-binding additives (polyphosphates) in the burger fabrication.

The graphical representation in Figure 2 shows the overlap of most lines of sensory attributes, pointing that no significant differences were found between the groups of burgers made form beef necks with different ageing times. One possible reason for this is the positive and pronounced effect of ageing, which was already achieved after 7 days, and subsequent ageing for 14 days (up to a total of 21 days) did not contribute to a significant

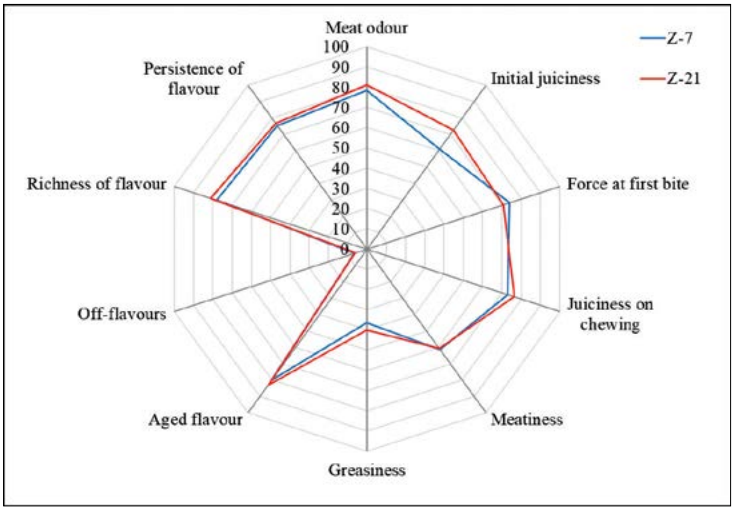

Figure 2 Sensory attributes of burgers made from beef neck aged 7 and 21 days
Z-7: burgers made from beef neck aged 7 days; Z-21: burgers made from beef neck aged 21 days

change of the attributes. The burgers in the Z-21 group were described as having higher values for most of the attributes that correlate positively with palatability traits (meat odour, initial juiciness, juiciness on chewing, greasiness, aged flavour, richness of flavour and persistence of flavour). In contrast, the attributes like force at first bite, meatiness and off-flavours were slightly more pronounced in the burgers of the Z-7 group. The results obtained are partly consistent with previously published findings on the influence of ageing time on sensory properties. For example, Brewer and Novakofski (2008) founded that the flavour and juiciness of beef tenderloin did not differ significantly between the groups without ageing and with ageing for 7 and 14 days. However, the authors noted that a significantly higher tenderness (softness) of the meat is achieved when the meat is aged for 7 and 14 days compared to meat without ageing. The above results are also confirmed by the firmness analysis results, which were significantly lower for chops with longer ageing period. Similar results were presented by Daszkiewicz et al. (2003), who found no statistically significant difference in the intensity of flavour and juiciness of beef loins but found that taste intensity and tenderness increased significantly with longer ageing duration (10 and 14 days) compared to short duration (3 and 7 days). The effect of the ageing process on sensory characteristics was highlighted in the study by Kim et al. (2019) who found that the juiciness, tenderness (softness) and flavour of butt and sirloin meat were significantly more pronounced when dry aging for 28 days compared to meat without ageing. Similarly, Lepper-Blilie et al. (2016) reported that no significant improvements in beef loin tenderness occurred after 28 days ageing. Considering above mentioned, it can be concluded that extending the ageing period of beef neck from 7 to 21 days does not lead to a significant increase in the expressiveness of the descriptive sensory characteristics.

Figure 3 shows the values of the likability attributes of burgers made from meat aged for 7 and 21 days. Higher values were found for all likability attributes of the burgers in the Z-21 group compared to the Z-7 group. However, statistical analysis of the data showed that these differences were not statistically significant ($P > 0.05$). Previous research (Daszkiewicz et al. 2003) founded no significant difference in aroma desirability between tenderloins aged at 3, 7, 10 and 14 days, but a significant difference in taste desirability was found between tenderloins aged at 3 and 7 days compared to tenderloins aged at 10 and 14 days. Clearer results are shown by the research of Kim et al. (2017), who found a statistically significant difference and better rated overall palatability of butt and sirloins when aged for 28 days compared to meat without ageing. In the present study, no differences were found in the likability attributes of burgers with different ageing durations (7 and 21 days), which is partly in line with published research. One possible explanation is the pronounced influence of ageing on the likeability of burgers already after 7 days of ageing, because most of these attributes (except texture) were rated with values above 80 out of 100 possible points.

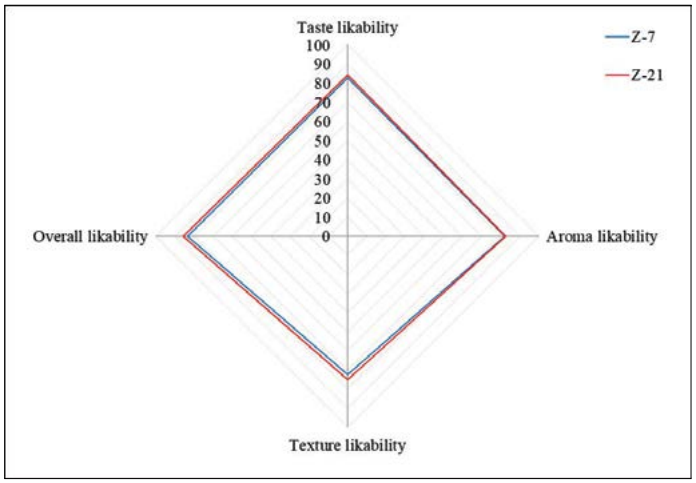

Figure 3 Likability attributes of burgers made from meat aged for 7 and 21 days
Z-7: burgers made from beef neck aged 7 days; Z-21: burgers made from beef neck aged 21 days

Conclusion

It can be concluded that the effects of ageing duration (7 and 21 days) of beef necks on the changes in physical and sensory properties of meat and burgers were only partially determined. No significant differences were found between the groups in the proportions of tissues determined by dissection. As expected, a significantly higher pH and ageing weight loss was observed in the group with longer ageing. In addition, lesser cooking weight loss was found in the longer ageing group and no differences in surface area reduction were found between the experimental groups. Although it was to be expected, no significant differences were found between the groups in descriptive sensory attributes as well as likability attributes. Most of the results are consistent with previous findings, with the exception of the sensory analysis results. It is assumed that the ageing effect of beef necks on the sensory attributes of the burgers was already evident after 7 days. Considering that a higher weight loss occurs with longer ageing without a significant difference in the sensory attributes of the burgers, it is concluded that ageing of beef necks for 7 days is sufficient and therefore recommended.

Acknowledgements

The paper is an excerpt from the diploma thesis of Hrvoje Maturanec, mag. ing. agr., entitled "Effect of ageing time on yield and quality of beef neck". This research was supported by the ″Food Safety and Quality Centre″ (KK.01.1.1.02.0004) project funded by the European Regional Development Fund.

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Dostavljeno/Received: 01.02.2023. **Prihvaćeno/Accepted: 06.02.2023.**

Fizikalna i senzorska svojstva burgera pod utjecajem različitog trajanja zrenja govođeg vrata

Sažetak

Cilj ovog istraživanja bio je utvrditi učinke suhog zrenja na prinos i fizičke pokazatelje kakvoće mesa govođeg vrata te odrediti senzorske karakteristike burgera. U istraživanju je korišteno meso vrata kastrirane muške junadi pasmine Angus prosječne tjelesne mase 600 kg i dobi oko 22 mjeseca. Uzorci vratine (N = 12) odležavani su 7 dana (skupina Z-7) i 21 dan (skupina Z-21) u komori za suho zrenje na temperaturi od 2 °C ± 1 °C i relativnoj vlažnosti od 77 ± 3 %. Masa i pH vratine mjereni su na početku i na kraju zrenja. Nakon zrenja provedena je disekcija vratine na mišićno, potkožno i međumišićno masno tkivo, kost i preostale dijelove. Potom su pripremljeni burgeri od mljevenog mišićnog (73,9 %) i masog tkiva (24,6 %) čemu je dodano 1,2 % morske soli i 0,3 % mljevenog crnog papra. Burgeri pojedinačne mase 150 g zatim su toplinski obrađeni u parno-konvekcijskoj pećnici na temperaturi 230 °C do postizanja unutarnje temperature 64 °C. Nakon toplinske obrade, burgeri su ponovo izvagani kako bi se izračunao gubitak mase kuhanjem, a promjer im je izmjeren u dvije okomite dimenzije kako bi se izračunalo smanjenje površine. Kvantitativna deskriptivna analiza i test dopadljivosti provedeni su korištenjem panela od devet educiranih senzorskih ocjenitelja u senzornom laboratoriju. Istraživanjem nisu utvrđene značajne razlike između skupina u udjelima svakog pojedinog tkiva dobivenog disekcijom. Meso vrata iz skupine Z-21 imalo je značajno veći pH (6,16) i gubitak mase (12,23 %) na kraju suhog zrenja. Značajno manji gubitak mase kuhanjem utvrđen je u skupini Z-21 (26,52 %) u odnosu na skupinu Z-7 (31,31 %), ali nije utvrđena značajna razlika u smanjenju površine burgera. Deskriptivna senzorska svojstva i svojstva dopadljivosti burgera nisu se značajno razlikovala između skupina Z-7 i Z-21. Temeljem rezultata istraživanja može se zaključiti da je za proizvodnju burgera preporučljivo koristiti kraći period zrenja govođeg vrata.

Ključne riječi: govedina, burger, senzorska analiza, gubitak mase kuhanjem, smanjenje površine

Physikalische und sensorische Eigenschaften von Burgern, die durch eine unterschiedliche Trockenreifung von Rindernacken beeinflusst werden

Zusammenfassung

Ziel dieser Studie war es, die Auswirkungen der Trockenreifung auf den Ertrag und die physikalischen Qualitätsindikatoren von Rindernacken zu ermitteln und die sensorischen Eigenschaften von Burgern zu bestimmen. Für die Studie wurde Nackenfleisch von kastrierten männlichen Angus-Ochsen mit einem Gewicht von 600 kg und einem Alter von 22 Monaten verwendet. Die Nackenproben (N = 12) wurden 7 Tage (Gruppe Z-7) und 21 Tage (Gruppe Z-21) in einer trockenen Reifekammer bei einer Temperatur von 2 °C ± 1 °C und einer relativen Luftfeuchtigkeit von 77 % ± 3 % aufgehängt. Gewicht und pH-Wert des Fleisches wurden zu Beginn und am Ende der Reifezeit gemessen. Nach der Reifung wurde der

Nacken in Muskel, subkutanes und intermuskuläres Fett, Knochen und übrige Teile zerlegt. Aus dem gemahlenen Nackenfleisch (73,9 %) und dem Fett (24,6 %) wurden Burger zubereitet, denen 1,2 % Meersalz und 0,3 % gemahlener schwarzer Pfeffer zugesetzt wurden. Die Burger (Durchschnittsgewicht 150 g) wurden dann in einem Dampfkonvektionsofen bei einer Temperatur von 230 °C bis zu einer Innentemperatur von 64 °C hitzebehandelt. Nach der Wärmebehandlung wurden die Burger erneut gewogen, um den Gewichtsverlust beim Kochen zu berechnen; außerdem wurde ihr Durchmesser in zwei senkrechten Dimensionen gemessen, um die Verringerung der Oberfläche zu berechnen. Eine quantitative deskriptive Analyse und ein Geschmackstest wurden mit neun geschulten sensorischen Prüfern im Sensoriklabor durchgeführt. Die Studie ergab keine signifikanten Unterschiede in den Anteilen der einzelnen Gewebe, die bei der Zerlegung gewonnen wurden. Die Nacken der Gruppe Z-21 hatten am Ende der Trockenreifung einen signifikant höheren pH-Wert (6,16) und einen Gewichtsverlust (12,23 %). In der Gruppe Z-21 wurde ein signifikant geringerer Kochverlust (26,52 %) im Vergleich zur Gruppe Z-7 (31,31 %) festgestellt, jedoch wurde kein signifikanter Unterschied bei der Verringerung der Oberfläche des Burgers beobachtet. Die beschreibenden sensorischen Attribute und die Geschmackseigenschaften der Burger waren zwischen den Gruppen Z-7 und Z-21 nicht signifikant unterschiedlich. Daher wird davon ausgegangen, dass für die Herstellung von Burgern die Reifezeit von Rindernacken gekürzt werden sollte.

Schlüsselwörter: Rindfleisch, Burger, sensorische Analyse, Verlust durch Kochen, Oberflächenreduktion

Propiedades físicas y sensoriales de hamburguesas afectadas por diferentes periodos de maduración del cuello de res

Resumen

El objetivo de esta investigación fue determinar los efectos de la maduración en seco sobre los indicadores de rendimiento y calidad física del cuello de res, tanto como determinar las características sensoriales de las hamburguesas. La investigación utilizó carne de cuello de novillos Angus macho castrados, con un peso corporal promedio de 600 kg y una edad de aproximadamente 22 meses. Las muestras del cuello (N = 12) fueron envejecidas durante 7 días (grupo Z-7) y 21 días (grupo Z-21) en una cámara de envejecimiento en seco a una temperatura de 2 °C ± 1 °C y una humedad relativa de 77 ± 3 %. El peso y el pH de la carne fueron medidos al inicio y al final del período de envejecimiento. Después del envejecimiento, el cuello se diseccionó en músculo, tejido adiposo subcutáneo e intermuscular, hueso y partes restantes. Las hamburguesas se prepararon a partir de carne de cuello molida (73,9 %) y grasa (24,6 %), a los que se añadió un 1,2 % de sal marina y un 0,3 % de pimienta negra molida. A continuación, hamburguesas con una masa única de 150 g se trataron térmicamente en un horno de convección y vapor a una temperatura de 230 °C hasta alcanzar la temperatura interna de 64 °C. Después del tratamiento térmico, las hamburguesas se pesaron nuevamente para calcular la pérdida de masa por cocción y se midió su diámetro en dos dimensiones perpendiculares para calcular la reducción del área superficial. Se realizaron análisis descriptivos cuantitativos y pruebas de palatabilidad utilizando un panel de nueve evaluadores sensoriales capacitados en un laboratorio sensorial. La investigación no encontró diferencias significativas en las proporciones de cada tejido obtenido durante la disección. La carne de cuello del grupo Z-21 tuvo un pH significativamente mayor (6,16) y una pérdida de masa (12,23%) al final de la maduración en seco. Se observó una pérdida de masa por cocción significativamente menor en el grupo Z-21 (26,52 %) en comparación con el grupo Z-7 (31,31 %), pero no se encontró una diferencia significativa en la reducción de la superficie de la hamburguesa. Las propiedades sensoriales y de palatabilidad de las hamburguesas no difirieron significativamente entre los grupos Z-7 y Z-21. En base a los resultados de la investigación, se puede concluir que para la elaboración de hamburguesas es recomendable utilizar un período de maduración más corto del cuello de res.

Palabras claves: carne bovina, hamburguesa, análisis sensorial, pérdida de masa por cocción, reducción de superficie

Proprietà fisiche e sensoriali degli hamburger sotto l'influenza dei diversi periodi di frollatura del collo di manzo

Riassunto

Lo scopo di questa ricerca consisteva nel determinare gli effetti della frollatura a secco sulla resa e sugli indicatori di qualità fisica della carne di collo di manzo e nel determinare le caratteristiche sensoriali degli hamburger. Ai fini della ricerca è stata utilizzata carne di collo di bovino Angus maschio castrato con una massa corporea media di 600 kg e un'età di circa 22 mesi. I campioni di collo di manzo (N = 12) sono stati frollati per 7 giorni (gruppo Z-7) e 21 giorni (gruppo Z-21) in una camera di frollatura a secco a una temperatura di 2 °C ± 1 °C e un'umidità relativa di 77 ± 3 %. La massa e il pH della carne sono stati misurati all'inizio e alla fine della frollatura. Dopo la frollatura, il collo è stato sezionato in muscoli, tessuto adiposo sottocutaneo e intermuscolare, ossa e parti rimanenti. Si è proceduto poi alla preparazione degli hamburger con muscolo macinato (73,9%) e tessuto adiposo (24,6%), a cui sono stati aggiunti l'1,2% di sale marino e lo 0,3% di pepe nero macinato. Gli hamburger, di 150 g ciascuno, sono stati poi trattati termicamente in un forno a convezione e vapore alla temperatura di 230 °C fino al raggiungimento della temperatura interna di 64 °C. Dopo il trattamento termico, gli hamburger sono stati ripesati per calcolare la perdita di massa durante la cottura, mentre il loro diametro è stato misurato in due dimensioni verticali per calcolare la riduzione di superficie. L'analisi descrittiva quantitativa e il test di appetibilità sono stati condotti utilizzando un gruppo di nove valutatori sensoriali addestrati in un laboratorio sensoriale. La ricerca non ha rilevato differenze significative tra i gruppi nelle proporzioni di ogni singolo tessuto ottenuto per dissezione. La carne del collo del gruppo Z-21 presentava un pH (6,16) e una perdita di massa (12,23%) significativamente più alti alla fine della frollatura a secco. È stata riscontrata una perdita di massa significativamente inferiore durante la cottura nel gruppo Z-21 (26,52 %) rispetto al gruppo Z-7 (31,31 %), ma non è stata rilevata alcuna differenza significativa riguardo alla riduzione della superficie dell'hamburger. Le proprietà descrittive sensoriali e di appetibilità degli hamburger non differivano significativamente tra i gruppi Z-7 e Z-21. Sulla base dei risultati ottenuti, si può concludere che per la produzione degli hamburger fatti con la carne del collo di manzo è consigliabile utilizzare un periodo di frollatura più breve.

Parole chiave: manzo, hamburger, analisi sensoriale, perdita di massa per cottura, riduzione della superficie