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Influence of Breed on the Organoleptic Properties of Rabbit

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Abstract: An investigation was made on the influence of breed on the organoleptic characteristics of rabbit. The experiment was carried out at the rabbitry unit of the Department of Environmental Biology and Fisheries, Adekunle Ajasin University Akungba-Akoko, Ondo state. Forty eight (48) rabbits which include California white, Palomino brown, New Zealand white and Havana black were used for this study. At 12 weeks of age, rabbits were slaughtered and cooked samples were evaluated on a 9-point hedonic scale for colour, flavour, taste, juiciness, tenderness, texture and overall acceptability. The breed of rabbit had significant ($P<0.05$) influence on the flavour, tenderness, juiciness and overall acceptability of the meat samples. Meat samples from Havana black rabbit had the best ranking for flavour, tenderness, juiciness and overall acceptability while the Californian breed was the least preferred. However, the influence of breed was not significant ($P>0.05$) on the colour and texture of rabbit meat. Meat from New Zealand white and Palomino brown rabbit had the similar ranking for flavour and juiciness. Male rabbit meat was preferred to female rabbit meat in colour, flavour, tenderness, juiciness, texture and overall acceptability. In conclusion, Havana black rabbit meat had better organoleptic traits compared with meat from New Zealand white, Californian and Palomino brown rabbit.

Key words: organoleptic traits, breed, rabbit.

Introduction

Rabbit meat quality can be described by its chemical, physical and sensorial traits, which are the most critical characteristics for the final consumer (Chrenek, et al. 2012). Rabbit meat contains less fat and high protein content. Rabbit meat also has a highly desirable fatty acid profile. It has relatively high concentrations of polyunsaturated fatty acids (Dalle Zotte, 2002). According to Polak et al. (2006), rabbit meat contains monounsaturated acids of 34.15%, polyunsaturated acids of 25.10%, and saturated fatty acids of 40.9%. Another indicator of rabbit meat good quality is its exceptionally low cholesterol level that ranges between 45 and 85 mg/100 g of fresh meat (Dalle Zote, 2002; Polak et al., 2006). Rabbit meat has about 1380 to 1820 calories per kilogram. It is rich in phosphorus, iron, calcium, sodium and iodine while potassium is the most abundant of the elements (Tarnauceanu, et al. 2010)

Colour and flavour constitute the most cherished attributes of meat that attract consumers to accepting any type of meat (Apata and Akinfemi 2010). The first criterion of rabbit meat attractiveness for the consumers is appearance, which is primary given by the colour of meat (Combes et al., 2008). Meat colour can be affected by many factors. One of the most important factors is the content of pigment myoglobin, which is dependent on primary production factors such as species, nutritional status and age of animal. Pre-slaughter period and the slaughter process, stress immediately before and during the slaughtering also affect meat colour (Bizkova and Tumova, 2010). As in all slaughter animals, the colour of rabbit meat may be indirectly influenced by environmental factors related to management conditions (Dal Bosco et al., 2002), pre-slaughter stress (Maria et al., 2004) as well as the housing system(Dalle Zotte, 2009) . The juiciness of meat is perceived in two ways, first the sensation of moisture in the first moments of mastication produced by the rapid release of juices and the stimulating effect of fat on the secretion of saliva (Beriain et al, 2000)

Flavour is one of the most important factors in determining consumer acceptability of meat. The basic flavour of meat is related to water soluble compounds in the muscle, such as sugars, amino acids and nucleotides, which are common to different species. The characteristic flavour of meat of a particular species is determined, however, by the proportions of different fatty acids which contribute to the aroma of meat. Phospholipids, which are rich in polyunsaturated fatty acids, also play a fundamental role in the flavour of meat (Beriain et al, 2000)

Weight or age, greatly influences the quality of rabbit meat, while food restriction has a moderate effect (Dalle Zotte, 2002). Liste et al. (2009) reported significant effect of housing system on meat quality. Maria et al. (2004) studied the influence of summer and winter time slaughtering on meat quality and they found a significant effect of season on the quality of rabbit meat. Daszkiewicz etal (2012) also reported the effect of intensive and extensive production systems on meat quality of rabbits. Stress cannot only influence the pH and darkness of meat, but also affects tenderness (Liste et al., 2009).

Modern consumers look for valuable, soft and tender meat, rich in nutrients and vitamins, with a positive influence on human health (McMichael and Bambrick, 2005). This study was therefore carried out to investigate the influence of breed on the organoleptic traits of Californian, New Zealand white, Havana Black and Palomino Brown rabbits raised and slaughtered under the same environmental condition.

Materials and Method

Experimental site

The experiment was carried out at the rabbitry unit of the Department of Environmental Biology and Fisheries, Adekunle Ajasin University Akungba-Akoko, Ondo state. Akungba–Akoko is located in Akoko South West Local Government Area of Ondo state, Nigeria. The area lies in the south western region of Nigeria (7º 28' and 5º43') and has the following environmental condition: ambient temperature of 27^0C and relative humidity of 46mm Hg.

Experimental animals and management

Forty eight (48) rabbits which include California white, Palomino brown, New Zealand white and Havana black were used for this study. Palomino brown rabbits are golden brown and lynx, they are large meaty rabbits. Californian white rabbits are rounded in body and have short smooth coat they are first bred in the 1920's with the intent of creating a better commercial meat rabbit, as a result of crosses between the Himalayan, and the standard Chinchilla. New Zealand white are multipurpose breed because they can be raised for meat, pets and laboratory purpose.

The experimental animals were kept in a wooden cage with each compartment of dimension of lenght× width× height: 80× 50 ×30 cm^3. The cages were constructed of wood and a wire mesh. The hutch was constructed in a way that it allow there waste to drop on the floor easily and has a single roof which covers all cages from rain or sunlight. They were fed with commercial pelleted diet; the diet used contained 15% Crude protein, 7% fat, 10% Crude fibre, 1.0% Calcium, together with available phosphorus of 0.35% and 2550Kcal/kg metabolisable energy. Clean water was also supplied to the rabbits ad- libitum.

Data Collection

At 12 weeks of age rabbits were slaughtered and samples for sensory evaluations were taken from the thigh muscle and cooked to an internal temperature of 75°C. Adult individuals aged between 25 and 40 years were used to assess the cooked meat samples. Equal bite size from each treatment was coded, replicated four times and served in an odourless plastic plate. Each sample was evaluated independent of the other. The samples were evaluated on a 9-point hedonic scale for colour, flavour, taste, juiciness, tenderness, texture and overall acceptability.

Statistical analysis

Data obtained from the measurements was analysed using SAS 2010. The linear model is as specified below:

$Y_{ijk} = \mu + A_i + B_i + (AB)_{ij} + e_{ijk}$

Y_{ijk} = the parameter of interest

μ = overall mean for the parameter of interest

A_i = Fixed effect of ith breed (I=1-3)

B_j = Fixed effect of jth sex (j=1-2)

(AB)ij = Interaction effect of ith breed and jth sex

e_{ijk} = random error associated with each record (Normally= Independently and identically distributed with zero mean and variance ($ð^2e$)

Results and Discussion

The least square means of the organoleptic traits as affected by breed was presented on Table 1. The effect of breed was not significant (P>0.05) on the meat colour. The ranking of the colour of meat from New Zealand white, California, Palomino and Havana black rabbits were statistically similar. The colour of meat predominantly depends on the chemical state of myoglobin (Brewer, 2004; Mancini and Hunt, 2005), which is affected by the partial pressure of O2, the concentration of hydrogen ions (pH), temperature, light access, tissue structure, the presence of substrates and cofactors, the activity of reducing enzymes and lipid oxidation (Mancini and Hunt, 2005). Meat colour, one of the most important criteria in initial selection by the consumer, is related to the concentration of pigments, mainly myoglobin, and the chemical state of the myoglobin on the surface of the meat, the structure and physical state of muscle proteins (Beriain et al, 2000).

However the effect of breed was significant ($P<0.05$) on the flavour of rabbit meat. Meat samples from Havana black rabbit had the highest ranking for flavour (8.23±0.05). There was no significant difference in the flavour of New Zealand white and Palomino brown meat while the California breed had the least flavour (6.69± 0.19).

Meat tenderness is one of the most important physical and sensory characteristic of meat (Bizkova and Tumova, 2010). Meat tenderness depends mainly on the post-mortem changes affecting myofibrillar proteins and on the connective tissue that represents the toughness (Arino et al., 2006). Stress cannot only influence the pH and darkness of meat, but also affects tenderness (Liste et al., 2009). The study of Arino et al. (2006) indicated an influence of the genetic type and selection on meat tenderness. In this study, Havana back meat was the most tender meat. This was followed by meat samples from New Zealand white and Palomino brown rabbit. Californian breed also had the least ranking in tenderness (5.88±1.23). Small amounts of intramuscular fat, which are necessary to lubricate the muscle fibres, affect the flavour and juiciness of cooked meat. The highest grade for juiciness (7.85±0.21) was also recorded for Havana black rabbit. The juiciness of New Zealand white and Palomino brown meat were similar.

The effect of breed was not significant ($P>0.05$) on the texture of the rabbit meat samples. Gasperlin et al. (2006) studied the effect of genotype on meat texture but they did not confirm any significant effect. Meat texture mainly depends on the post mortem changes and on the structure of the muscle (Bizkova and Tumova, 2010). Elevated hardness is linked with lower fatness and higher collagen level in meat (Łapa et al., 2008). However, Łapa et al. (2008), who estimated texture parameters and shear force of meat from New Zealand White and California rabbits, stated that meat from California breed had lower shear force and texture compared to New Zealand white rabbit. Larzul et al. (2005) also observed an influence of genotype (different genetic lines of rabbits) on shear force values and meat texture. The overall acceptability of meat is dependent on both processing and general qualities which can be physical, chemical or organoleptic (Omojola and Adesehinwa, 2006). Meat from Havana black rabbit had the best overall acceptability (6.87±0.21). This was followed by New Zealand white (5.94±0.17) and Palomino brown (5.60±0.28). Meat samples from California white breed had the least overall acceptability (5.22±0.31).

Table 2 shows the least square means of the organoleptic properties as affected by sex. The effect of sex was significant on all the organoleptic properties studied. Meat samples of male rabbit had better colour, flavour, tenderness, juiciness, texture and overall acceptability than meat samples from their female counterparts. Apata et al (2012) reported that meat from male rabbit had better colour, flavour, tenderness, juiciness, texture, and overall acceptability than female rabbit meat. Omojola (2007) observed sexual dimorphism of some organoleptic characteristics in duck. The author reported that in terms of flavour, tenderness and juiciness, the taste panelist has higher preference for meat from male duck. However, no effect of sex on meat tenderness was found out by Carrilho et al. (2009) and Pla (2008). According to Larzul et al. (2005) there is no influence of sex on shear force and texture of rabbit meat. The Pearson correlation on Table 3 shows a range of correlation coefficients among the organoleptic traits. There was a high positive correlation between flavour and juiciness (0.85). There was also a positive correlation between overall acceptability and other organoleptic traits. However the correlation coefficients between colour and other traits such as flavour, tenderness, juiciness, and texture were low.

Conclusion

The breed of rabbit influenced the flavour, tenderness, juiciness and overall acceptability of the meats. Meat samples from Havana black rabbit had better ranking for flavour, tenderness, juiciness and overall acceptability compared with meat from New Zealand white, Californian and Palomino brown rabbit. Meat from New Zealand white and Palomino brown rabbit had the similar ranking for flavour and juiciness. The influence of breed was not found in the colour and texture of the meat samples. Male rabbit meat was preferred to female rabbit meat in colour, flavour, tenderness, juiciness, texture and overall acceptability.

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TABLE 1: Least square means of the organoleptic properties as affected by breed

Parameters	New Zealand	California	Palomino	Havana black
Colour	6.54±0.12	6.34±0.35	6.42±0.21	6.48±0.33
Flavour	7.77±0.01^{b}	6.69± 0.19^{c}	7.89±0.09^{b}	8.23±0.05^{a}
Tenderness	8.33±1.67^{b}	5.88±1.23^{d}	7.45±0.89^{c}	8.68±0.07^{a}
Juiciness	7.34±0.34^{b}	5.11±0.62^{c}	7.19±0.43^{b}	7.85±0.21^{a}
Texture	4.65±0.35	4.67±0.51	5.00±0.24	4.96±0.15
Acceptability	5.94±0.17^{b}	5.02±0.31^{d}	5.60±0.28^{c}	6.87±0.21^{a}

$^{a\,b\,c\,d}$Mean on the same row with different superscripts are significantly (P<0.05) different

TABLE 2: Least square means of the organoleptic properties as affected by sex

Parameters	**Female**	**Male**
Colour	6.56±0.07[b]	7.21±0.05a
Flavour	7.01± 0.12[b]	7.77±0.38[a]
Tenderness	6.33±1.67 [b]	7.55±0.89 [a]
Juiciness	5.89±0.34 [b]	7.19±0.43 [a]
Texture	4.77±0.35 [b]	4.86±0.24 [a]
Acceptability	5.54±0.17 [b]	6.02 ±0.38[a]

[a b] Mean on the same row with different superscripts are significantly ($P<0.05$) different

TABLE 3: Pearson correlation of the organoleptic traits

	Colour	Flavour	Tenderness	Juiciness	Texture	Acceptability
Colour	1.00					
Flavour	0.56	1.00				
Tenderness	0.23	0.68	1.00			
Juiciness	0.42	0.85	0.79	1.00		
Texture	0.35	0.49	0.52	0.41	1.00	
Acceptability	0.67	0.62	0.53	0.73	0.32	1.00