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INFLUENCE OF WEANING AGE ON THE ORGANOLEPTIC PROPERTIES OF PORK

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ABSTRACT: A trial was conducted to compare organoleptic properties of piglets weaned at 21, 28 and 35 days of age and slaughtered at 70 kg target body weight. A total of 24 pigs (Landrace x Large white x Topigs x Topigs cross) which were weaned at three weaning ages were randomly selected and slaughtered upon reaching target body weight. Each treatment comprised three replicates of two animals each. Out of this number, 18 carcasses were selected for organoleptic evaluation. Piglets were provided with creep diet from 10 to 35 days, a weaner diet from 36 to 70 days of age and pig grower diet from 71 days to target slaughter weight. Thereafter, pigs were sacrificed and their carcasses chilled for 20 hours at 5 ^{0}C before cuts were removed. The four meat cuts (the pork chop, chuck, Top sirloin and pork leg) were removed, cooked and tested for organoleptic evaluation, *i.e.*, texture, tenderness, juiciness, appearance and flavour. Data on organoleptic properties were analysed using frequencies and percentages in IBM SPSS statistics for Windows, version 20.0. Results showed that the panelists preferred pork from pigs weaned at 28 days followed by 21 days and 35 days. The appearance of pork was the most preferred characteristic across all weaning periods as it showed high rankings by panelists while juiciness appeared to be the less preferred attribute. These results suggest that weaning age influenced organoleptic properties of pork with 28 days weaning age giving better results.

Keywords: *Ad libitum*, Organoleptic Properties, Piglets, Pork, Weaning Age

ORIGINAL ARTICLE

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INTRODUCTION

The two major weaning methods that are practiced to improve production in pig operations are early and late weaning. In early weaning, piglets are weaned from 10 to 21 of days of age (Fangman et al., 1997; Hohenshell et al., 2000), whereas in late weaning piglets are weaned at 24 to 30 days of age (Drum et al., 1998; Hohenshell et al., 2000). Globally, weaning age varies between 14 to 56 days (English et al., 1988). In South Africa, weaning age ranges from 21 to 28 days (Grimbeek, 2004) while in Botswana it ranges from 35 to 42 days. It, however, appears that the common weaning age in large-scale pig operations in Botswana is 35 days.

Many producers and scientists are re-evaluating weaning age decisions, comparing growth differences and herd-health issues among pigs weaned at different ages (Smith et al., 2007). Therefore, this study was conducted to compare organoleptic properties of pigs weaned at 21, 28 and 35 days and slaughtered at a target body weight of 70 kg.

MATERIAL AND METHODS

Experimental site

The experiment was carried out at Chemae Farm in Oodi-Matebeleng in Kgatleng District from January to April 2014. The site is situated on coordinates 24^0 40' 54.12" S 26^0 1' 3.55"E, at an altitude of 980 m above sea level. The area has an average daily temperature of 15 ^{0}C in winter (May to July) and 29 ^{0}C in summer (August to November).

Experimental animals and management procedure

The animals used in this study were obtained from an on-going experiment at Chemae Farm. The experiment comprised three treatments (weaning ages), *i.e.*, 21, 28 and 35 days. Each treatment comprised four replicates of four animals (2 females and 2 males). All piglets were fed creep diet from 10 to 35 days. This feeding regime was in accordance with BOS 190:2006, which is the Botswana standard for pig feeds. Water and feeds were provided *ad libitum* throughout the study. Pigs were housed in a grow-to-finish facility in solid pens equipped with a long trough and nipple drinker. Body weight of piglets were recorded at birth and weekly after weaning until 70 kg target body weight was reached.

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Processing procedure

A total of 24 pigs (Landrace x Large white x Topigs x Topigs cross) which were weaned at three weaning ages (*i.e.*, 21, 28 and 35 days) were randomly selected and slaughtered at 70 kg target body weight. Out of this number, 18 carcasses were selected for organoleptic evaluation. At target body weight, pigs were inspected to determine their fitness for slaughter and movement permit issued by the Department of Veterinary Services. Thereafter, pigs were transported in an open truck with rails to a slaughterhouse. Prior to slaughter, pigs were starved for 12 hours and offered water *ad libitum* and thereafter sacrificed. *Post mortem* inspection was conducted on the carcasses and carcasses were passed as fit for human consumption. Carcasses were then transported to Meat Science Laboratory at Botswana College of Agriculture (BCA) where they were chilled at 7 ^{0}C for 24 hours before meat cuts were removed. The four meat cuts (*i.e.*, pork chops, chuck, Top sirloin and pork leg) were removed and tested for sensory qualities with respect to texture, tenderness, juiciness, appearance and flavour. Meat samples were kept in the freezer at -8 ^{0}C for about a month. Prior to cooking meat was thawed at 4 ^{0}C for 24 hours (Aaslyng et al., 2007). Thereafter, meat samples were cooked at the College Refectory according to treatment with every cut put in its own tray. Before the meat samples were put on an oven, 0.41 g of salt, 0.43 g barbeque spice and 250 ml of cooking oil was mixed and spread all over the meat in each treatment. Meat temperature was brought to a room temperature before cooking. Meat samples were oven-fried at 80 ^{0}C for 60 minutes and turned every 30 minutes. After frying the samples were cut into small cubes and taken to the Meat Science Laboratory at BCA for assessment by panelists.

Sensory descriptive analysis

The panel for the sensory descriptive analysis which consisted of 10 assessors (panelists) from BCA, irrespective of gender was assembled. The panel underwent basic training in sensory assessment in accordance with ISO 4121,ASTM-MNL 13, DIN 10964 (Aaslyng et al., 2007) in order to familiarise it (panel) with sensory assessment of meat. During training, the profile of the sensory attributes was developed in cooperation with the assessors. The panel determined flavour, texture, tenderness, moisture (juiciness) and appearance of pork. Each panelist was allowed to assess each sample at a time and had a sip of water before he/she could assess another sample.

Statistical analysis

Data on organoleptic properties were analysed using frequencies and percentages in IBM SPSS Statistics for Windows, version 20.0 (2011).

RESULTS AND DISCUSSION

Texture

Eighty percent of the panelists ranked texture of chuck and sirloin as liked moderately to liked extremely followed by chop and pork leg with 70% each (Table 1). Chuck from pigs weaned at 28 days had 100% acceptability (liked moderately to liked extremely) followed by sirloin (80%), pork leg (80%) and chop (60%) (Table 2). Again, chuck from pigs weaned at 35 days had the highest frequency and percentage of the preferred texture ranging from like moderately to like extremely (90% ranking) followed by sirloin (80%), pork leg (80%) and chop with 60% (Table 3). Overall, pork from pigs weaned at 28 days ranked highest in texture with an average of 80% followed by 35 and 21 days with 77.5% and 75%, respectively. Beilken et al. (1990) attributed the differences in texture to physico-chemical processes occurring in the meat tissue during heating, which causes the next significant changes in its microstructure, texture and water-holding capacity. Dransfield and Macfie (1980) mentioned that the variation in texture within the *longissimus dorsi* in pork was possibly due to higher degree of localized muscle shortening. Furthermore, Warriss (2000) stated that dietary manipulations and cooking methods may offer greater potential to enhance meat texture.

Flavour

Eighty percent of the panelists ranked the flavour of chuck and sirloin from pigs weaned at 21 days between like moderately and like extremely while the chop and pork leg had the least ranking with 70% each (Table 1). Sirloin from pigs weaned at 28 days had acceptability of 100% while the chop had 70% acceptability (Table 2). The chop and sirloin from pigs weaned at 35 days had the highest acceptability of 90% each while the chuck and pork leg had lower acceptability of 80% each (Table 3). Overall, pork from pigs weaned at 28 days was ranked the highest in flavour with an average of 90% followed by 35 days and 21 days with 85% and 75%, respectively. It has been demonstrated that flavour can be influenced by precursors such as feed (Koutsidis et al., 2007), pre-slaughter stress (D´ Souza et al., 1998) and ageing (Koutsidis et al., 2003). Bejerholm and Aaslyng (2003) studied the influence of cooking technique on the sensory evaluation of pork with different raw meat qualities and found that pan-frying gave more intense fried/roasted flavour compared to roasting in an oven. According to Mottram (1991), pork flavour is mainly generated during the heating process, with Maillard reactions involving reducing carbohydrates and amino acids, as one of the most important routes to flavour formation.

Tenderness

Over 85% of the panelists rated pork from pigs weaned at 21 days to be just about right to too tender (Table 1). All the respondents rated chuck to be tenderer compared to other cuts. According to Table 2, chuck from pigs weaned at 28 days was the most preferred (90%) and sirloin the least preferred (70%). In this study, chop from pigs

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weaned at 35 days was less preferred (50%) while chuck was highly preferred (80%). On average pork from pigs weaned at 21 days was ranked the highest in tenderness with 85% followed by 28 days and 35 days with 80% and 65%, respectively. The current results indicate that tenderness decreases with age. According to Enfalt et al. (1977), the variation in tenderness could be due to the connective tissue surrounding the muscle fibre not breaking down easily during mastication. Tenderness can be influenced by cooking methods; long cooking times, in particular cooking by boiling can tenderize meat containing larger amount of connective tissues by converting it to gelatin (Warriss, 2000). Culler et al. (1978) reported myofibril fragmentation to be a more important effector of tenderness than sarcomere length or collagen solubility. For Seideman et al. (1986), one of the reasons of variation in tenderness of meat could be the muscle characteristics, including fibre type frequency, which may affect palatability.

Table 1 -Sensory evaluation of pork from pigs weaned at 21 days of age

Parameters	Chuck		Sirloin		Chop		Pork leg	
	Frequency	%	Frequency	%	Frequency	%	frequency	%
Texture								
Dislike moderately	1	1	0	0	0	0	1	10
Dislike slightly	0	0	2	20	2	20	2	20
Neither like nor dislike	1	10	0	0	1	10	0	0
Like moderately	3	30	2	20	3	30	2	20
Like very much	3	30	3	30	2	20	4	40
Like extremely	2	20	3	30	2	20	1	10
Total	10	100	10	100	10	100	10	100
Flavour								
Dislike slightly	0	0	2	20	2	20	0	0
Neither like nor dislike	1	10	0	0	1	10	1	10
Like moderately	6	60	3	30	4	40	5	50
Like very much	2	20	3	30	2	20	3	30
Like extremely	1	10	2	20	1	10	1	10
Total	10	100	10	100	10	100	10	100
Tenderness								
Too tough	0	0	2	20	2	20	2	20
Just about right	3	30	3	30	5	50	6	60
Too tender	5	50	3	30	2	20	2	20
Much too tender	2	20	2	20	1	10	0	0
Total	10	100	10	100	10	100	10	100
Juiciness								
Dislike very much	0	0	1	10	1	10	0	0
Dislike moderately	0	0	1	10	1	10	0	0
Dislike slightly	0	0	2	20	1	10	2	20
Neither like nor dislike	0	0	1	10	2	20	2	20
Like moderately	5	50	3	30	3	30	4	40
Like very much	1	10	1	10	1	10	0	0
Like extremely	4	40	1	10	1	10	2	20
Total	10	100	10	100	10	100	10	100
Appearance								
Dislike very much	0	0	0	0	1	10	0	0
Dislike moderately	0	0	1	10	0	0	0	0
Dislike slightly	0	0	1	10	0	0	0	0
Neither like nor dislike	0	0	0	0	1	10	1	10
Like moderately	4	40	4	40	3	30	3	30
Like very much	4	40	1	10	3	30	3	30
Like extremely	2	20	3	30	2	20	3	30
Total	10	100	10	100	10	100	10	100

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Table 1 -Sensory evaluation of pork from pigs weaned at 28 days of age

Parameters	Chuck		Sirloin		Chop		Pork leg	
	Frequency	%	Frequency	%	Frequency	%	frequency	%
Texture								
Dislike very much	0	0	1	10	0	0	0	0
Dislike slightly	0	0	1	10	1	10	2	20
Neither like nor dislike	0	0	2	20	1	10	0	0
Like moderately	6	60	2	20	4	40	2	20
Like very much	3	30	2	20	3	30	6	60
Like extremely	1	10	2	20	1	10	0	0
Total	10	100	10	100	10	100	10	100
Flavour								
Dislike moderately	0	0	0	0	0	0	1	10
Dislike slightly	0	0	2	20	0	0	0	0
Neither like nor dislike	1	10	1	10	0	0	0	0
Like moderately	1	10	3	30	6	60	3	30
Like very much	4	40	3	30	3	30	4	40
Like extremely	4	40	1	10	1	10	2	20
Total	10	100	10	100	10	100	10	100
Tenderness								
Much too tough	0	0	0	0	0	0	1	10
Too tough	1	10	3	30	2	20	1	10
Just about right	5	50	5	50	4	40	4	40
Too tender	3	30	2	20	3	30	4	40
Much too tender	1	10	0	0	1	10	0	0
Total	10	100	10	100	10	100	10	100
Juiciness								
Dislike extremely	0	0	1	10	0	0	0	0
Dislike very much	0	0	1	10	1	10	3	30
Dislike moderately	0	0	0	0	0	0	0	0
Dislike slightly	1	10	1	10	3	30	1	10
Neither like nor dislike	0	0	1	10	0	0	0	0
Like moderately	4	40	4	40	3	30	5	50
Like very much	5	50	1	10	3	30	1	10
Like extremely	0	0	1	10	0	0	0	0
Total	10	100	10	100	10	100	10	100
Appearance								
Dislike moderately	0	0	1	10	0	0	0	0
Dislike slightly	1	10	1	10	0	0	2	20
Neither like nor dislike	1	10	2	20	0	0	0	0
Like moderately	3	30	0	0	3	30	4	40
Like very much	3	30	6	60	6	60	1	10
Like extremely	2	20	0	0	1	10	3	30
Total	10	100	10	100	10	100	10	100

Juiciness

All the panelists ranked chuck from pigs weaned at 21 days to be more juicy (*i.e.,* between like moderately and like extremely) while chop and sirloin were ranked less juicy with 50% each (Table 1). Again, 90% of the panelists ranked chuck from pigs weaned at 28 days to be more juicy compared to the chop, sirloin and pork leg which were ranked less juicy with 60% each (Table 4). Chuck and sirloin from pigs weaned at 35 days had 50% ranking each in terms of juiciness while chop was ranked 20% suggesting that the chop was the driest meat cut

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(Table 3). FAO (2001) stated that dark, firm and dry (DFD) meat results from depletion of glycogen during handling, transportation and pre-slaughter, thus giving rise to little production of lactic acid. On average, pork from pigs weaned at 28 days had the highest acceptability (67.5%) in terms of juiciness followed by 21 days and 35 days with 60% and 40%, respectively. This finding suggests that pork from pigs weaned at 35 days was drier compared to other weaning periods. Toscas *et al.* (1999) observed that cooking loss alone does not explain the entire variation observed in juiciness but that the biochemical–biophysical state of the water in the meat, *i.e.*, water mobility and distribution play a major role in meat juiciness. According to Naude (1985), the variation in juiciness can be due to the amount and distribution (marbling) of intramuscular fat. Fat sustains the sensation of juiciness during chewing because it stimulates secretion of saliva. For Ngapo *et al.* (2003), juiciness can be influenced by low quality protein diets leading to slightly drier meat.

Table 3: Sensory evaluation of pork from pigs weaned at 35 days of age

Parameters	Chuck		Chop		Sirloin		Pork leg	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Texture								
Dislike extremely	0	0	1	10	0	0	0	0
Dislike moderately	1	10	1	10	0	0	0	0
Dislike slightly	0	0	2	20	1	10	1	10
Neither like nor dislike	0	0	0	0	1	10	1	10
Like moderately	1	10	5	50	4	40	6	60
Like very much	6	60	0	0	3	30	2	20
Like extremely	2	20	1	10	1	10	0	0
Total	10	100	10	100	10	100	10	100
Flavour								
Dislike very much	0	0	0	0	0	0	1	10
Dislike moderately	0	0	0	0	1	10	0	0
Dislike slightly	1	10	0	0	0	0	1	10
Neither like nor dislike	1	10	1	10	0	0	0	0
Like moderately	0	0	8	80	3	30	5	50
Like very much	6	60	0	0	4	40	2	20
Like extremely	2	20	1	10	2	20	1	10
Total	10	100	10	100	10	100	10	100
Tenderness								
Too tough	2	20	5	50	3	30	4	40
Just about right	2	20	2	20	5	50	4	40
Too tender	6	60	3	30	2	20	2	20
Total	10	100	10	100	10	100	10	100
Juiciness								
Dislike extremely	0	0	0	0	0	0	1	10
Dislike very much	0	0	1	10	0	0	0	0
Dislike moderately	3	30	3	30	0	0	1	10
Dislike slightly	1	10	3	30	5	50	2	20
Neither like nor dislike	1	10	1	10	0	0	3	30
Like moderately	0	0	2	20	3	30	2	20
Like very much	5	50	0	0	2	20	0	0
Like extremely	0	0	0	0	0	0	1	20
Total	10	100	10	100	10	100	10	100
Appearance								
Dislike slightly	1	10	0	0	0	0	0	0
Neither like nor dislike	0	0	1	10	0	0	1	10
Like moderately	4	40	3	30	4	40	4	40
Like very much	2	20	4	40	4	40	2	20
Like extremely	3	30	2	20	2	20	3	30
Total	10	100	10	100	10	100	10	100

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Appearance

Table 1 shows that sirloin from pigs weaned at 21 days was less preferred (80%) in terms of colour, whereas chuck was the most preferred (100%). However, sirloin had 100% acceptability in terms of colour compared to chop (60%) (Table 2). According to Table 3, sirloin had the highest responses (100%) while chuck, chop and pork leg had 90% ranking each. On average pork from pigs weaned at 35 days had the highest preference (92.5%) in all cuts in terms of appearance followed by 21 days (87.5%) and 28 days (80%). In the present study, meat appearance ranged from light brown to brown. Walker (2000) stated that the colour range of light brown to tan colour is ideal for cooked pork. According to van Oeckel et al. (1999), the perception of colour is very dependent on the observer and hence it is important to know the value of relative objective colour measurements to the subjective judgement of acceptable colour. Colour perception plays a major role in the consumer evaluation of meat quality (Lanari et al., 1995) and as such appearance of meat influences its acceptance by consumers.

CONCLUSION

Weaning age appeared to influence the eating quality of pork. Generally, the panelists preferred pork from pigs weaned at 28 days in terms of texture, tenderness, juiciness, flavour and appearance followed by 21 days and lastly 35 days. It seemed that the appearance of pork was the most preferred attribute across all weaning periods.

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