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RESEARCH ARTICLE

A REVIEW ON SENSORY AND CONSUMER EVALUATION OF MEAT

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ABSTRACT

The main objective of this review is to investigate the information available on meat sensory evaluation and characteristics of meat. Meat sensory evaluation is a scientific discipline used in experimental design and statistical analysis to measure, analyse, and interpret meat responses that are perceived by senses of flavour, aroma, juiciness and tenderness. Meat sensory characteristics can be evaluated by objective methods, instrumental or sensorial with trained panels and by subjective methods, with a consumer panel. It is very important to evaluate the meat for consumption purposes.

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INTRODUCTION

Meat sensory evaluation is a scientific discipline used in experimental design and statistical analysis to measure, analyze, and interpret meat responses that are perceived by senses of flavour, aroma, juiciness and tenderness and they are highly affected by diet (Arsenos *et al.,* 2009), breed (Muchenje *et al.,* 2008), age (Simela 2005) and animal species (Stone and Sidel 1993). Meat sensory evaluations can be made through effective and affective analysis. Meat sensory characteristics can be evaluated by objective methods, instrumental or sensorial with trained panels and by subjective methods, with a consumer panel (AMSA, 1995). According to Risvik (1995), there is a fundamental difference in sensory evaluation performed by trained and consumer panel. Instrumental analysis of meat can only permit the evaluation of different treatments as well as determining their effect on a particular characteristic however the consumer evaluation can also tell about the acceptability of meat (Destefanis *et al.,* 2007). For this reason, consumer opinion is a key factor to establish meat value and justify purchase decision and therefore consumer meat evaluation is recommended (Destefanis *et al.,* 2007). Consumer meat evaluation has reported to be associated with some disadvantages such as time consuming, expensive and difficult to organize (Harris, 1976; Boccard *et al.,* 1981; Brady and Hunecke, 1985 and Platter *et al.,* 2003). This has bring in attention many attempts to invent instrumental methods of assessing meat sensory characteristics (Boccard *et al.,* 1981), whose results are to be a prediction of sensory characteristics mainly tenderness obtained by taste panel (Lawrie and Ledward, 2006)

Texture profile analysis (TPA) and Warner-Bratzler shear force (WBSF) were among of the invented instruments for meat sensory evaluation (Caine *et al.,* 2002). Previous reports indicate that TPA and WBSF have similar capabilities to evaluate sensory characteristics of meat primarily tenderness, however there is limited information comparing these two instrumental methods under similar test conditions (Caine *et al.,* 2002). Earlier work as reported by Szczesniak (1968)

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indicates variable correlations between sensory evaluation and consumer evaluation of meat tenderness. Therefore; type of sensory panel is among factors resulting in difference in those correlations.

MATERIALS AND METHODS

Consumer meat evaluation

It is concerned with obtaining subjective data and how well products are likely to be accepted. Usually large numbers of about 50 or more panels of untrained personnel are used for this evaluation. The range of testing can vary from simple comparative evaluation to structured questioning regarding the magnitude of acceptance of individual characteristics. Given that this type of meat evaluation involves actual consumers, results obtained are assumed as the real life results and are highly describing the consumer opinion about the meat sample. Such type of meat evaluation is recommended given that the results are simultaneously indicator of the consumer acceptability of meat (Simela *et al.,* 2008). It is encouraged to use consumers from different backgrounds in meat testing given that people from different countries, within each country, different segment of consumers exist with different preferences and reasons (Sveinsdóttir *et al.,* 2009).

The differences between and within countries might be explained by different consumption patterns of chevon i.e. in countries such as South Africa consumption of chevon is assumed as to be as more suitable during traditional activities (Mahanjana and Cronje, 2000; Masika and Mafu, 2004). Among problems attached with consumer evaluation is non-significant result which commonly obtained during analysis. The major possible reason might have been due to lack of experience of people used for meat tasting where people are unable to identify some sensory characteristics and turn to confuse them. The other reason could be due to experimental errors which are affected by conditions of the treatments and the way of controlling error such as blocking. Such data did not used for discussion purposes.

Sensory meat evaluation

Effective evaluation of sensory characteristics is concerned about obtaining objective facts about meat quality. This could range from basic discrimination testing where analysis of two or more meat samples differs from each other and to descriptive profiling where the characteristics of two or more meat samples is analyzed. This type of evaluation may be done by the use of laboratory instruments and trained panellists. Trained sensory panels function as laboratory instruments, and hence their conclusions usually equivalent to the results of instrumental evaluations (Simela *et al.,* 2008). Laboratory instruments used would directly; and some will indirectly measure meat sensory characteristics. Among those directly measuring meat sensory characteristics is Warner Bratzler shear forces which is used to measure meat tenderness. The pH meter and calorimeter are used for measuring of meat pH and meat colour respectively which are then indirectly measures of some meat sensory characteristics among those are meat juiciness for meat pH and meat tenderness for meat colour.

Sensory characteristics of meat

Sensory properties of meat impact on consumer appreciation. This also determines their perception of its acceptability and quality (Simela, 2005). Sensory properties are pivotal in this respect because consumers need to be entirely satisfied with the sensory properties before other elements become relevant. Acceptability of meat can be predicted from tenderness, juiciness and flavour (Tshabalala *et al.,* 2003). Tenderness has been identified as the most important factor influencing the acceptability of beef. Juiciness and flavour have greater effect on consumer satisfaction as toughness increases (Miller *et al.,* 2001).

Tenderness

Tenderness appears to be the most important sensory characteristic of meat and a predominant quality determinant (Sebsibe, 2006). Meat tenderness is rated as the most important attribute of eating quality and is the factor that determines the consumers continued interest in meat (Simela, 2005). It is a function of the collagen content, heat stability and the myofibrillar structure of muscle (Muchenje *et al.,* 2009). Factors affecting meat tenderness include animal species; breed (Muchenje *et al.,* 2008), diet (Arsenos *et al.,* 2009), age (Simela, 2005), aging, fatness and muscle location (Sebsibe, 2006). Goats may have less intramuscular fat because they deposit more fat around visceral organs than in the carcass and then results in poor tenderness (Swan *et al.,* 1997). Tenderness varies, mainly due to changes to the myofibrillar protein structure of muscle in the period between animal slaughter and meat consumption (Muir *et al.,* 2000). This is explained by the carcass which is refrigerated too hastily immediately after slaughter, muscle fibres contract severely, and results in cold-shortening which will require a force to shear the fibres after cooking (Razminowicz *et al.,* 2006).

Meat tenderness improves with ageing of the muscle (Simela, 2005). Sarcomere length, connective tissue and proteolysis of myofibrillar proteins are said to explain most of the variation observed in tenderness of aged meat, with proteolysis being the main biochemical factor contributing to the variation in tenderness (Muchenje *et al.,* 2009). Therefore ageing can be intentionally used to decrease shear force values during post-mortem storage. Two major determinants of meat tenderness are the content and state of the connective tissue and the structure and state of the myofibrils (Simela *et al.,* 2003). Connective tissue contributes to meat toughness and that is believed to be a product of the state of connective tissue in the perimysium. Myofibrillar contribution to meat tenderness depends on the extent of shortening during rigor development and proteolysis during conditioning (Simela, 2005). Breed effect and animal species greatly affect variety in meat tenderness (Muchenje *et al.,* 2008). There is a variation among animal species such as sheep and goats and among breeds within a species (Sebsibe, 2006). Variation among breeds reared in the same environment and slaughtered at the same age, weight, and degree of finish suggests a genetic cause for some tenderness variation. In beef, there is a heritability value of 60% for tenderness suggesting that heredity may be a major influence (Sebsibe, 2006). This is expected to be similar in sheep and goats.

Meat juiciness

Meat juiciness is one the major parameters considered in the assessment of meat quality (Muchenje *et al.,* 2008). It is the wetness during first bite and sustained juiciness due to fat in meat. The sensation of juiciness in chevon is closely related to the quantity and composition of intramuscular fat (Muchenje *et al.,* 2008) and age of an animal (Simela *et al.,* 2005). Meat juiciness together with meat tenderness accounts for the overall eating quality. Meat juiciness is usually determined by sensory evaluation from measures of water in meat such as water holding capacity (WHC) and cooking losses (Simela, 2005). Water holding capacity is the ability of meat to retain its water during application of external forces, such as cutting, heating, grinding or pressing (Lawrie and Ledward, 2006).

Chevon have reported to be less juicy, especially for sustained juiciness (Tshabalala *et al.,* 2003), given that goat carcasses are attributed to the low fat content. Within animal species, meat juiciness is affected by age of an animal given that goat carcasses ranging from 10 to 25kg are juicier than the older goats with carcasses ranging from 15 to 30kg (Simela *et al.*, 2005). (Muchenje *et al.,* 2008) reported that meat juiciness is high in well-marbled carcasses. This is in agreement with Webb *et al*. (2005) who reported that meat Juiciness is directly related to the intramuscular lipids and moisture content of the meat. Meat juiciness is determined by water-holding capacity.

Aroma and meat flavour

Flavour is a very important component of the eating quality of meat as it consists of taste-active compounds, flavour enhancers and aroma components (Stelzleni and Johnson, 2007). It is thermally derived, in view of the fact that uncooked meat has little or no aroma and only a blood-like taste (Donald *et al.,* 1998). Flavour was found to be the most important factor affecting consumer meat buying habits and preferences when tenderness was held constant as it is the most considered (Sitz *et al.,* 2005). It is a complex attributes of meat and is affected by genetic and environmental factors where animal species is the most important genetic factor (Carmack *et al.,* 1995) and feed source is the most important environmental factor (Lee *et al.* 2004; Descalzo *et al.,* 2005). Among factors affecting meat flavour are lipid content (Webb *et al.,* 2005, Calkins and Hodgen, 2007), cooking method, age and gender (Webb *et al.,* 2005), oxidation, myoglobin, and pH (Calkins and Hodgen, 2007).

There are literally hundreds of compounds in meat that contribute to flavour and aroma. Many of them are altered through storage and cooking (Calkins and Hodgen, 2007). The main reactions during cooking, which result in aroma volatiles, are the Maillard reaction between amino acids and reducing sugars, and the thermal degradation of lipid (Donald *et al.,* 1998). The same author has reported Maillard reaction as a complex reaction; however pH plays a major role, and is one of the most important routes to flavour compounds contributing to cooked meat flavour. Meat above the normal pH range is perceived to have a decrease in meat flavour intensity (Miller, 2001). The recommended pH range for fresh meat is around 5.5–6.0 with a good buffering ability. Flavour intensity also increases with age of animal although reports disagree as to which age group is the most acceptable (Simela *et al.,* 2003). Lipids serve several roles in flavour development. They act as a solvent for the volatile compounds that develop during production, handling, and thermal processing (Moody, 1983). Although flavour of cooked meat is influenced by compounds contributing to the sense of taste (Donald *et al.,* 1998), it is the volatile compounds, formed during cooking, that determine the aroma attributes and contribute most to the characteristic flavours of meat (Moody, 1983).

Conclusion

Both sensory and consumer evaluation of meat is accomplished on the bases of meat palatability components such as meat tenderness, juiciness and flavour. Beside the fact that it expensive to achieve, consumer evaluation is more precised given that results are strictly achieved from consumers of meat and are believed to be representative of real life situation. It is for this reason that consumer evaluation could be considered as the best in meat evaluation.

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