IFMA 22

Congress sub theme:

Downstream linkages - customer and societal expectations, urban-rural divide

HOW CAN THE SOUTH AFRICAN BEEF CLASSIFICATION SYSTEM BE ADAPTED TO MEET MODERN CONSUMERS' DEMANDS

M.J.J. van den Heever[1], W.A. Lombard[2] & H. Jordaan[3]

[1]Postgraduate student, Department of Agriculture Economics,
University of the Free State
[2]Lecturer, Department of Agricultural Economics, University of the Free State
[3] Senior lecturer, Department of Agricultural Economics,
University of the Free State

Corresponding author:
M.J.J van den Heever
Department of Agricultural Economics,
University of the Free State
PO Box 339,
Bloemfontein 9300,
Republic of South Africa
051 401 3990
vandenheevermjj@ufs.ac.za

Number of words: 3416 (excluding references)

Academic paper

The authors of this paper verify that the research done for this paper is original and has not been submitted elsewhere.

March 2019 - ISBN 978-92-990062-7-6
www.ifmaonline.org - Congress Proceedings

HOW CAN THE SOUTH AFRICAN BEEF CLASSIFICATION SYSTEM BE ADAPTED TO MEET MODERN CONSUMERS' DEMANDS

Abstract

Beef consumption in South Africa increased by 1.6% from 2016 to 2017 and it is expected that the total beef consumption will expand by 19% over the next decade. Most South African consumers focus on affordability followed by health and appearance when buying meat and don't necessarily look at the meat classification. Research has shown that the South African beef classification system is used as a grading system due to the preference of classes, which defeats the original purpose of the system. The aim of this study is to compare the current red meat classification system used in South Africa to classification and grading systems used in other countries to provide alternatives when amending the shortcomings of the current classification system. Using international classification/grading systems can provide guidance on how to amend the current South African classification system. This study provides an adapted beef grading system adapted according to the Meat Standard Australia system that can be used in South Africa. In the suggested system beef will be graded according to pH measurements and days aged. This study can be used by decision makers when to assist in adapting the current beef classification system.

Keywords: beef, grading, standard, red meat

Introduction

Over the past 10 years urbanisation, growing income levels and improved living standards have changed traditional diets and supported dietary diversification. In 1994, the average South-African consumed almost 41 kilogram of all types of meat annually, increasing to

65 kilograms of meat per person in 2014 (Gaille, 2018). During this period, the total income per family increased 55% leading consumers to develop a larger preference for beef in their diets (BFAP, 2017). Beef consumption in South Africa increased with 1.6% between 2016 and 2017, furthermore it is expected that total beef consumption will expand by a further 19% from the 2014-2016 levels leading up to 2026. A study done by Vermeulen, Schönfeldt & Pretorius (2015), showed that most South African consumers focus on affordability followed by health and appearance when buying meat and don't necessarily look at the meat classification (Vermeulen, Schönfeldt & Pretorius, 2015). With a growing red meat industry, the question on whether the red meat classification system is still satisfactory for modern consumers has been raised. This question has also been frequently asked by other researchers such as Soji & Muchenje (2017), Webb (2015) and Chingala, Raffrenato, Dzama, Hoffman & Mapiye (2017). No available study to date has evaluated the South African classification system against international grading systems, thus decisions cannot be made yet when considering alternatives for the current classification system used. The aim of this study is to compare the current red meat classification system used in South Africa to classification systems used in other countries to provide alternatives when amending the shortcomings of the current classification system. Once the grading systems have been compared, recommendations will be made regarding whether the current classification system, or an alternative, should be adopted and/or adapted. Information on this topic will assist researchers and decision makers with valuable information. The current classification system of South Africa can be applied to both beef and mutton, while this study only focusses on beef classification.

Current classification system

Introduction of the current South African meat classification system occurred on 26 June 1992, and replaced the carcass grading system in place since 1985 (Department of Agriculture, 2015). The South African Meat Industry Company (SAMIC) - which sets the specifications for different classifications of meat - regulates the classification of carcasses. South African beef is currently classified according to the following attributes; age of the animal, fat content of the carcass, carcass conformation and the damage to the carcass (Soji & Muchenje, 2017). The system is illustrated in Table 1.

March 2019 - ISBN 978-92-990062-7-6
www.ifmaonline.org - Congress Proceedings

Table 1 South African Carcass Classification System

Trait	Beef/sheep/mutton						
Age	A		AB		B	C	
Permanent incisors (#)	0		1 to 2		3 to 6	>6	
Roller mark	AAA		ABAB		BBB	CCC	
Colour	Purple		Green		Brown	Red	
Tenderness	Most tender		Tender		Less Tender	Least Tender	
Fat grade	0	1	2	3	4	5	6
Beef (fat thickness mm)	0	<1	>1<3	>3<5	>5<7	>7<10	>10
Sheep (fat thickness mm)	0	<1	>1<4	>4<7	>7<9	>9<11	>11

Source: SAMIC (2018), Spies 2011.

Attributes such as age and fat thickness (see Table 1) are the two main parameters in defining the class of carcasses (Spies, 2011). After the carcass is classified according to the two main parameters, further classification is then done and the carcass marked accordingly. Age of the animal before slaughter is one of the main determinants of meat tenderness as seen in Table 1. This is however wrong as indicated by Chingala *et al.* (2017), who found that various factors not measured in the current system can influence the tenderness of meat. The main objective of the carcass classification system was to be consumer focused in order to help the consumer with their choice of meat by giving the carcass physical and compositional qualities (Webb, 2015).

Limitations of South Africa's system

Different combinations of fat, age and conformation, was found by Webb (2015) who concluded that there can be 120 different combinations, however classes "A2", "A3", "AB2" and "AB3" are the classes mostly used. This indicates that only 5% – 10% of the system is used correctly (Webb, 2015). With such a wide spectrum of choices given to the consumer and little practical application of the system, it seems that the existence of the current classification system is open for debate. Kempster *et al.* (1982) is of the opinion that the carcass classification system is relevant because it highlights the fundamental aspects of a carcass. However, Webb (2015) stated that the classification system recently became a grading system due the preferred classes and this defeats the original purpose of the system. According to Chingala *et al.*(2017) the beef carcass and classification systems used in Southern Africa are becoming less useful because of considerable increases in variation in their categories, mainly because of differences among cattle breeds and

production systems, and the use of modern feedstuffs and growth enhancing technology (Chingala et al., 2017).

Vermeulen *et al.,* (2015) tested the consumer's knowledge about the beef classification system. Their overall objective was to investigate South African consumer behaviour towards and perceptions of red meat. By dividing the consumers into different socio-economic classes, they formed three living standard measurement (LSM) groups. These groups were; low income consumers (LSM 1-4), middle-income consumers (LSM 5-8) and the high-income consumers (LSM 9-10) (Vermeulen *et al.,* 2015). The consumers were questioned whether they had knowledge regarding the classification system of red meat, how often they check for the classification of red meat and to define red meat classification if possible. They found that only 19% of the low-income group (LSM 1-4) check the classification mark. This figure increased almost 50% towards the middle and high-income groups. Only 4% of the lower income group associated red meat classification with red meat quality, increasing to 8% in the middle-income group and 11% within the high-income group. Vermeulen *et al.* (2015) concluded that the poor segment (LSM 1-4) gave little attention to the red meat classification system and had limited understanding to how this system works while the middle (LSM 5-8) and high-income (LSM 9-10) class also had insufficient knowledge regarding this system even though they checked more often for the classification indicator (Vermeulen et al., 2015). This could be seen as a sign of the need that consumers have to be ensured that the beef they buy is a certain standard or quality; however, the current classification system does not seem to be so consumer friendly.

Background to the current classification system

Before amending the current classification system, the difference between a grading and a classification system should first be established. In carcass classification, the emphasis is shifted to classifying carcasses in order to provide the meat industry and consumers with a choice of different carcasses in terms of carcass composition and physical attributes, while there is no indication of perceived quality as is provided in a grading system (Webb, 2015). Grading refers to the placing of different values on several carcass attributes such as age, fat composition and tenderness. By combining these attributes a grade is developed that relates to meat quality for pricing purposes. A carcass grading system provides an indication of the standard of the meat quality such as select, choice or supreme meat quality (Chingala et al., 2017). Carcass classification is essential to determine the

efficiency of animal production, meat prices and to meet consumer demands. According to Webb (2015), the purpose of carcass classification is to classify carcasses based on clearly defined quality attributes to ensure more consistent meat quality and consumer satisfaction. This means that a carcass of similar quality attributes and composition will classify in the same category. In short, this implies that a grading system considers attributes such as marbling and tenderness to give value to the carcass, while the classification system is only a visual evaluation of the carcass for the description of the attributes to the consumer.

International practices

The United States Department of Agriculture (USDA) developed their own quality grading system based upon the degree of marbling and maturity of the meat. The USDA defines marbling as the intramuscular fat within the lean meat. Graders evaluate the distribution and amount of marbling. The ribeye muscle surface area is used for the marbling and grading after the carcass has been ribbed between the 12^{th} and 13^{th} rib (Goodson, Hale & Savell, 2013). Maturity is determined by the ossification of cartilage, texture and colour of the ribeye. As the animal gets older cartilage becomes bone, texture becomes coarser and the lean colour darkens. Due to lean tissue being influenced by other factors, cartilage is the main measure characteristic of maturity. The final quality grade is achieved by combining the maturity grade and the marbling grade. Most of the meat used for consumption in the USA consists of Prime, Choice or Select with Prime being the highest scored meat (Goodson et al., 2013).

Meat Standards Australia (MSA) is the main grading system used to grade meat in Australia. Each carcass is graded according to the score it receives in different categories. These categories include; carcass weight, sex, tropical beef content, hanging method, ossification, marbling, rib fat, pH and temperature (Meat & Livestock Australia and Meat Standards Committee, 2011). Reasons for non-compliance are also indicated in their grading. Meat Standards Australia (MSA) is an independent non-profit organisation that regulates the Australian meat industry and grades carcasses. This system was built upon the collection of over 94 000 results from consumers that scored more than 660 000 beef samples. Meat that was tasted by the taste panel was given a final score out of 100% which was then awarded to each sample. These scores determine the eating quality grade that the sample achieves, which the consumer can easily identify. The analysis also determines a

cut-off point for each grade where a beef cut has to achieve a minimum of 46 % for certification by the MSA.

The MSA found that problems occur with meat containing a high pH. All beef with pH levels above 5.7 will have lower and variable eating quality, thus 5.7 has been set to be the maximum pH level for MSA grading (Meat & Livestock Australia and Meat Standards Committee, 2011). Other problems obtained from meat with a pH higher than 5.7 was that it is often darker cutting meat with a purple appearance, higher water holding capacity (WHC), reduced shelf life and a coarser texture. Carcasses that have a pH above 5.7 are rejected by the MSA and excluded from meat brands, markets and food service operations.

The majority of grading and classification systems in Southern African countries apply similar schemes to or derivatives of the world's major systems (Chingala et al., 2017). Grading and classification systems in Southern Africa are applied voluntarily in licensed and registered slaughterhouses (Strydom, 2015). Botswana makes use of a grading system to distinguish beef carcasses which are graded into hierarchical quality grades of prime, super, first, second, third, fourth and canning. Grading is based on carcass maturity, dentition, and subjective scores of a degree of subcutaneous fat distribution, conformation, bruising, fat cover and colour (Botswana Livestock & Meat industries, 2017). Beef carcasses penalised on one of the previously mentioned attributes may be graded one or more grades lower than the one which they would have qualified for (Chingala et al., 2017). Namibia uses the same classification system as South Africa, but forbid the use of antibiotics. With a correctly applied classification and traceability system it enables Namibia and Botswana to export meat to European countries.

Results and discussion

Should the South Africa's classification system be amended?

It is evident that there exists different meat classification or grading systems and that the classification system of South Africa can compete against the rest of the world. South Africa applies the classification system incorrectly as a grading system, fortunately with some amendments to the current system, it can be world class (Webb, 2015). According to Hugo (2015), the MSA system is the best point of reference to amend South Africa's meat classification system. The adaption of this system will most likely place less emphasis on marbling and beta-antagonistic factors (Strydom, 2015). Grading with the MSA system requires a well-organised infrastructure, high technical skills, high level of

integrity from role players and proper traceability (Meat & Livestock Australia and Meat Standards Committee, 2011). South Africa's meat industry lacks some requirements such as full integrity and a traceability system (Strydom, 2015). If the system is amended according to the Australian system, proper regulation of abattoirs and the implementation of standard slaughtering methods is needed.

Strydom (2015) found that the South African classification system is limited by indirect measurements such as the age that is determined by the number of permanent incisors or the visual evaluation of the carcass fat content. By implementing direct measurement of fat, marbling, pH and ageing the problems of indirect measurements can be overcome. These measurements are shown in Table 2 and can be added to South Africa's existing classification system. The use of these measurers, along with the current classification system, is the recommended route to be followed, and will describe carcasses better for the consumers. Webb (2015) stated that the current classification system is already being used as a grading system, so further recommendations would include the change from a classification system to a grading system (Webb, 2015).

Table 2 Amendments to the South African meat classification system

Trait	**Beef**			
SAMIC Classification	**A**	**AB**	**B**	**C**
pH	**5.4**	**5.5**	**5.6**	**5.7**
Days aged	**35**	**14**	**5**	**No indication of ageing**
Differentiate between				
Feeding method	**Grain fed**		**Pasture fed**	
Hang method	**Achilles (AT)**		**Tenderstrech**	
PUFA (%)[1]	**Omega 3**		**Omega 6**	

Source: Author's illustration

With implementation of the amended system (see Table 2) meat colour and marbling should be graded according to a colour sheet, and age according to ossification instead of looking at the dentition of the animal (Meat & Livestock Australia and Meat Standards Committee, 2011).

[1] PUFA - Poly unsaturated fatty acids

March 2019 - ISBN 978-92-990062-7-6
www.ifmaonline.org - Congress Proceedings

Based on Table 2, beef carcasses currently classified by the proposed system as an "A" (based on age), must then have a maximum pH of 5.4. If the pH of 5.5 is achieved it is automatically downgraded to an "AB". The minimum ageing for class "A" must be 35 days, if the ageing is less than 35 days, the meat should be penalised by giving the carcass a lower grade. If meat is graded "AB" according to the proposed system it should have a maximum pH of 5.5 and aged for a minimum of 14 days.

By giving scores to each of these attributes, carcasses will be graded into their different categories based on the SAMIC classification. pH measurement can be used as the main determinant of grading, as used by the MSA system. The pH of the carcass is one of the characteristics that can influence meat tenderness the most (Frylinck et al., 2015). Boundaries for the pH can be defined, or alternatively the existing MSA ones used (Meat & Livestock Australia and Meat Standards Committee, 2011). There are various factors that influence the meat quality and to an extent the current classification of the carcass (Frylinck, Hope, Hugo, Liebenberg, Moholisa, Sehoole, Strydom, van Heerden & Webb, 2015). Ageing is one of the important factors that can influence the quality of meat. Ageing is a process that occurs as the muscle fibres in meat are slowly broken down. Naturally occurring enzymes continue to act in the meat resulting in a slow breakdown of proteins that make up the muscle fibres. MSA research has shown that ageing can improve eating quality. The rate of ageing also decreases over time with most improvement in the first 21 days (Meat & Livestock Australia and Meat Standards Committee, 2011).

South Africa's beef industry pushes for carcasses with low fat content that is possibly driven by socio-economic factors, including an increasing population of consumers with high disposable incomes that seek healthier foods (BFAP, 2017). Instead of valuing beef on fat content alone, evidence shown for grading and classification to be based on fatty acid composition can be used. Fatty acids can influence the fat composition of meat (O'Neill and Webb, 2008) and determine the health quality of meat which can be important information for consumers. By using near-infrared spectroscopy (NIRS), abattoirs can quickly and easily measure the fatty acid composition of meat (Chingala et al., 2017).

Different measurements exist for the tenderness of meat and can influence the classification system (Frylinck, Heinze, Modika, Moloto, Strydom & Webb, 2015). The MSA system uses a sensory panel, but using a sensory panel will mean human preferences and variation exists. Another method for measuring tenderness is the Warner –Bratzler

method which uses a machine with little room for error. Although this method is standardized, it does not account for consumer preference.

Other possible solutions may be distinguishing between organic and non-organic meat, grass fed and grain fed and the method of hanging animals. These production practices could be indicated on the packaging of the meat itself and would be possible with a proper traceability system (Chingala et al., 2017). The MSA found that growth promotants could have a negative effect on the eating quality of beef. Some of these effects are increased ossification and a reduced amount of marbling. None, if any of South-African feedlots can produce carcasses profitable without growth promotants (Strydom, 2015). These effects vary across different muscles in the carcass and can be managed using different post-slaughter management methods. By increasing the ageing period of carcasses and hanging it using the tender stretch method can improve eating quality. Thus by just indicating that these management methods have been applied to the final product and with the current classification system, consumer trust can be gained. This can be indicated on the packaging.

Factors such as pre-slaughter stress, electrical stimulation and chilling can influence meat tenderness and colour (Frylinck et al., 2015). This may be caused by different slaughtering practises due to a lack of technical knowledge, infrastructure and only basic service delivery as their goal. By applying, the measurements as presented in Table 2 it can lead to standardized abattoir practices thus giving less variation in meat from the same classification.

Conclusion

Using international classification/grading systems can give guidance on how to amend the current South African classification system. There are various analyses that producers can apply to affect the classification of their meat, which they can use to their own advantage. This study provides an adapted beef grading system adapted according to the MSA system that can be used in SA. This is due to the high rating that the system scored from butcheries using the system as well as the ease of mind the system provides consumers by making use of pH measurement to determine the quality of the beef. It is clear that the current classification system is not being used to its full potential by retailers and consumers and needs clarification. With a growing demand for beef, the classification system will have to be adapted sooner rather than later due to rising costs. Education of the beef consumer is critical and may be a good starting point to improve the use of the classification system

for its original purpose. Consumers also need to benefit from the current system and not only a certain part of the value chain.

References

Burea for Food and Agricultural Policy (BFAP), 2017. BFAP Baseline Agricultural Outlook 2017 – 2026. July 2017. Pretoria South Africa. pp 68-81.

Chingala, G., Raffrenato, E., Dzama, K., Hoffman, L.C., Mapiye, C., 2017a. Towards a regional beef carcass classification system for Southern Africa. South African Journal of Animal Science 47, 408. https://doi.org/10.4314/sajas.v47i4.1

Frylinck, L., Hope-Jones, M., Hugo, A., Liebenberg, B.E., Moholisa, E., Strydom, P.E., Sehoole, O.C., van Heerden, S.M., Webb, E.C., 2015. Sources of variation in quality of South African beef: Case studies in relation to the red meat classification system. South African Society for Animal Science 45, 289.

Goodson, K., Hale, D.S., Savell, J.W., 2013. USDA Beef Quality and Yield Grades [WWW Document]. Meat Science. URL https://meat.tamu.edu/beefgrading/ (accessed 11.11.18).

Gaille, B., 2018. 19 South African Meat Industry Statistics, Trends & Analysis. BrandonGaille.com.

Meat & Livestock Australia, Meat Standards Committee (Australia), 2011. Meat Standards Australia beef information kit. Meat & Livestock Australia, North Sydney.

Meat & Livestock Australia, Meat Standards Australia, 2018. Meat Standards Australia Annual Outcomes Report. Meat & Livestock Australia, North Sydney.

Frylinck, L., Heinze, P.H., Modika, K.Y., Moloto, K.W., Strydom, P.E., Webb, E.C., 2015. Visual evaluation of beef tenderness by using surface structural observations and its relationship to meat colour. South African Journal of Animal Science 45, 8.

O'Neill, H.A., Webb, E.C., 2008. The animal fat paradox and meat quality. Meat Science, 54th International Congress of Meat Science and Technology (54th ICoMST), 10-15August 2008, Cape Town, South Africa 80, 28–36. https://doi.org/10.1016/j.meatsci.2008.05.029

SAMIC, 2018. Classification of Red-Meat. SAMIC.

Soji, Z., Muchenje, V., 2017. Should the South African red meat classification system be revised or maintained? A review. South African Journal of Animal Science 47, 583. https://doi.org/10.4314/sajas.v47i5.1

Strydom, P.E., 2015. The SA beef classification system in 2015 - a critical reveiw of age classification.

Vermeulen, H., Schönfeldt, H.C., Pretorius, B., 2015. A consumer perspective of the South African red meat classification system. South African Society for Animal Science 45, 339.

Webb, E.C., 2015. Description of carcass classification goals and the current situation in South Africa. South African Journal of Animal Science 45, 5.