12th Meat Symposium 2014

Relevance of the South African Carcass Classification Systems

Friday, 7 November 2014

SANLAM AUDITORIUM
UNIVERSITY OF PRETORIA, PRETORIA







WELCOME MESSAGE

Red Meat Research and Development South Africa have the pleasure of welcoming you to the 12th Meat Symposium.

The first Meat Science Symposium was held on the 11th to 12th September 1980 at Woolworths, Cape Town. Dr Raymund Naudé, Deputy Director of the former Animal and Dairy Science Research Institute (ADSRI), Irene delivered seven papers. This tradition was continued by the Agricultural Research Council and with their consent it is our privilege to be able to present to you the 12th Meat Symposium.

The South African cattle and small stock carcass description systems can be traced back to 1936. Over time these description systems have been adopted and refined as informed by research in consultation with industry role players. The time has now come for us to critically rethink the relevance of the current carcass classification system which will, therefore, be the theme of the day.

We encourage you to participate in as many presentations and discussions as possible. Please also visit the exhibition hall where posters are displayed. We trust there will be ample opportunity for informal interaction outside the scheduled sessions; thus creating new networking opportunities between delegates and researchers.

We would like to thank each of you for attending the symposium and sharing your experiences with us and your fellow participants so that together we will be able to increase the understanding and value of the South African Carcass Classification system.

Thank you

HSchönfeldt

Prof Hettie Schönfeldt
ADMINISTRATOR: RMRD SA





PREFACE

The red meat industry in South Africa has evolved significantly since the 1970's. The industry was mainly opportunity driven in the 1970's, followed by a more production driven approach in the 1980's. During the 1990's the main emphasis was on costs, while at the turn of the millennium the industry became more consumer driven. The evolution of the red meat industry was also characterised by changes in the classification system. In fact, the evolutionary process in the classification of red meat in South Africa started as early as 1936 when the age of animals was first used as a characteristic to grade carcasses. In 2011, in a paper by Dr Phillip Strydom a timeline of the development of the red meat classification system in South Africa was provided. In the same paper the general aims and objectives of carcass classification or grading systems were mentioned as:

- To provide a common language for use by those trading in livestock and carcasses to facilitate trade and intensify competition;
- To develop clearer market signals from the consumer to the producer by using premiums for desirable stock and discounts for less desirable stock;
- To act as a catalyst for breed and national herd/flock improvement;
- To act as a framework for the development of national price reporting schemes to enable those trading (and others such as statutory organisations) to determine which prices were paid for differing types of stock in different areas;
- To assist producers to market their stock more effectively, aided by better 'market transparency';
- To improve efficiency in transactions in what is today referred to as the 'supply chain' between producer, slaughterer and retailer; encouraging the use of buying specifications that could be filled and verified against classification descriptions;
- To allow those cutting meat to monitor and control their operations on a yield basis. Classification has a direct relationship to the amount of saleable meat in a carcass. Yields and returns from cutting and processing can therefore be predicted and monitored with a knowledge of the classification of the carcass raw material;
- To promote, by the marking or labelling of classification/grading information on meat up to the point of retail sale, a basis for 'quality' marks or promotional brands;
- To facilitate the development of any export markets.

Within the ambit of the aforementioned, recent years saw industry stakeholders enquiring about the adequacy of the existing red meat classification system in South Africa, i.e. whether the current system should be maintained or amended or changed completely. Such enquiries are not unreasonable in light of recent research in this area and publically available information such as:

"The South African red meat classification system only allows for classification of meat based on age and fat covering. Other attributes like for example tenderness, consistency and overall quality of product is not guaranteed by a certain class of meat."

Sparta website (http://www.sparta.co.za/products-and-recipes/red-meat-classification-13353)

According to SAMIC, meat classification provides for a sound basis for:

- Meat traders to describe their carcasses in simple terms for purchasing.
- The use of variety in the market for optimal consumer satisfaction.
- Price differences.
- Determination of sales prices.

(http://www.samic.co.za/downloads/Redmeat.pdf)

In light of the aforementioned industry stakeholders convened in October 2009 to discuss the existing red meat classification system in South Africa. Industry stakeholders agreed to establish a group of researchers to investigate the current classification system. The research team convened in April 2010 and recommended that the following issues must, amongst others, be addressed:

- A literature review encompassing, amongst others, the ability of the classification system to predict the impact of factors influencing quality of the product, a global overview of classification and grading systems, an overview of changing consumer needs and trends and indicate shortcomings of the local system, but also global systems and techniques available to predict and describe characteristics that influence consumer demands.
- A survey to investigate the South African consumers' perception towards red meat.
- Research should be conducted on unsolved issues that will be forthcoming from the literature survey, which could include, but not limited to (a) factors involved in variation of product quality other than those included in the current classification system, and (b) the ability/efficiency of new methods to describe or predict quality according to the needs of the industry and/or consumer

Subsequently, the Red Meat Research and Development system through which red meat research in the industry is governed was used to action research on this topic. The first preliminary research results was discussed in December 2013 by the research team, followed by another meeting inclusive of other researchers than the research team. At this meeting it was agreed that stakeholders should be informed collectively of the results of research. The end result is the 12th Meat Symposium with the theme of "Relevance of the South African Carcass Classification Systems".

I trust that this symposium will provide the necessary guidance and insight to answer the question: Should the current system should be maintained or amended or changed completely?

Finally, I want to thank all those that provided input and guidance into the process to date, and in particular the research team that consisted of Dr Phillip Strydom, Dr Arno Hugo, Dr Lorinda Frylinck, Dr Ina van Heerden, Prof Eddie Webb, Prof Hettie Schönfeldt and Ms Hester Vermeulen. My appreciation also goes out to those researchers that supported the research team, as well as to Carina Haasbroek and Dr Beulah Pretorius who always willingly and professionally supported this initiative in terms of administration and logistics.

Dr André Jooste

Chairperson: RMRD SA Project Committee



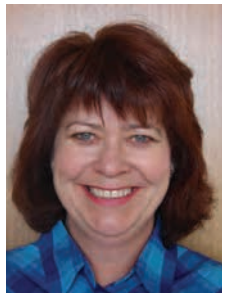


PROGRAMME

Friday, 7 November 2014

8:00 – 8:30	REGISTRATION, TEA & COFFEE		
	SESSION CHAIR: PROF HC SCHÖNFELDT		
08:30 – 08:45	Welcome and background		Dr A Jooste
08:45 – 09:15	Description of carcass classification goals and current situation		Prof EC Webb
09:15 – 9:45	The beef tenderness model: Effect of pre-slaughter feed withdrawal period (stress), post-slaughter electrical stimulation practices, ageing and production system on meat tenderness, colour and juiciness		Dr L Frylinck
09:45 – 09:55	Proteomics approach as a new way to predict tenderness as compared to classical South African Beef Carcass Classification System		Mr KW Moloto
09:55 – 10:05	Visual evaluation of beef tenderness by using surface structural observations and its relationship to meat colour		Ms KY Modika
10:05 – 10:15	Award presentation		Prof HC Schönfeldt
10:15 – 10:45	TEA & COFFEE		
	SESSION CHAIR: DR L SIMELA		
10:45 – 11:15	Relevance of a formal classification system in the informal sector		Prof V Muchenje
11:15 – 11:25	Carcass classification and meat inspection as quality assurance schemes used in selected abattoirs in the Eastern Cape Province, South Africa		Ms Z Soji
11:25 – 11:55	The effect of a beta-agonist and animal age on beef quality and its impact on variation in quality on retail level		Dr PE Strydom
11:55 – 12:05	The effects of a beta-agonist treatment, vitamin D3 supplementation and electrical stimulation on meat quality of feedlot steers		Dr M Hope-Jones
12:05 – 12:30	Fat quality of South African pigs with different carcass classification characteristics		Prof A Hugo
12:30 – 13:00	Changes in the nutrient content of South African red meat		Prof HC Schönfeldt
13:00 – 13:45	LUNCH		
	SESSION CHAIR: DR A JOOSTE		
13:45 – 14:15	A consumer perspective on the South African red meat classification system		Ms H Vermeulen
14:15 – 16:00	**Structured input from research and industry role players**		
	Feeding Regimes	Grassfed	Mr A Cloete
	Abattoir Association		Mr G Neethling
	Carcass Classification		Mr R vd Westhuizen
	Trade	Cavalier Foods	Dr K le Riche
		Woolworths	Mr D Houghton
	Producers	NERPO	Dr L Simela
		RPO	Mr L v Zyl
16:00 – 16:30	TEA & COFFEE		
16:30 – 17:00	Discussion and closure		Dr A Jooste
17:00	SNACKS & COCKTAILS		

Lorinda Frylinck



Dr Lorinda Frylinck is a Senior Researcher working as part of the Meat Science Research Team at the ARC-Animal Production Institute at Irene since 1995. She obtained her B.Sc (Biochemistry and Chemistry), B.Sc (Hons.) (Biochemistry) and M.Sc (Biochemistry) at the University of Johannesburg. Her Ph.D. entitled "Protein kinase activities in ripening mango fruit tissue: Classification, purification and biochemical characterisation" was obtained in April 1995 from the same university.

She is involved with research on meat quality, especially with manipulating mechanisms involved with meat tenderness, meat colour and juiciness. Her Enzymology and Proteomics background is valuable in studying enzymes and other proteins involved in these biological processes such as calcium activated proteolytic enzymes involved in ageing of meat.

THE BEEF TENDERNESS MODEL: EFFECT OF PRE-SLAUGHTER FEED WITHDRAWAL PERIOD (STRESS), POST-SLAUGHTER ELECTRICAL STIMULATION PRACTICES, AGEING AND PRODUCTION SYSTEM ON MEAT TENDERNESS, COLOUR AND JUICINESS

L Frylinck

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Scientists and producers question the merit of discriminating between the production systems producing meat from older animals especially if modern technology applications such as beta-agonist supplementation and post-slaughter electrical stimulation are taken into account. The beef tenderness model project was carried out at ARC-API and executed in two phases to help clarify some questions.

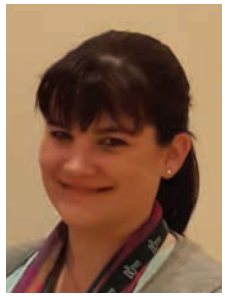
Phase 1 determined the ideal pre-slaughter feed withdrawal (FW) period studying typical conditions (24 h vs 3 h FW) used when slaughtering South African crossbred beef breeds. The effect of electrical stimulation (ES) (15 sec ES, and 120 sec ES) and no-stimulation (NS), on the meat tenderness (shear force measurements) under typical South African commercial abattoir practices (chilling at 4 °C within 2 hours post-stunning) were determined. The 180 bulls consist of Simmental crosses, Brahman crosses and Nguni crosses (Sanga) were raised, treated and slaughtered. Longer feed withdrawal in general correlated with higher shear force values, and other tenderness related measurements, although it was more evident in NS carcasses. All three cross breeds showed an improved tenderness after 15 sec ES. The toughest cross-breed (Simmentaler) had the most benefit from electrical stimulation (ES).

Phase 2 determined the effect of age and production system on colour, and eating quality under "ideal" slaughter conditions for typical South African crossbreed cattle.

Post-slaughter muscle energy metabolism, meat colour, and eating quality were compared. Steers (n=182) of Nguni, Simmental and Brahman crossbreeds were reared on pasture until A-, AB-, or B-age, and in feedlot until A- and AB-age. Young feedlot steers produced best colour stable meat (highest L*, b*, hue angle). Production system affected both energy status and chilling rate of the carcass that resulted in shorter sarcomere length/cold shortening and subsequent lower meat tenderness in the lighter pasture fed carcasses of the AP system. This toughening effect could not be overcome by ageing. Although the BP production system had significant lower glycolytic potential compared to the other systems (AF, ABF and ABP systems), the glycolytic rate of the pasture systems tended to be slower than that of feedlot systems. Energy status did not affect shear force results significantly but did affect the more visible attributes such as colour, drip loss and water holding capacity.

The results showed that nutritional status of the animal at slaughter is influenced by pasture condition, feed-withdrawal period and post slaughter procedures. Electrical stimulation influences meat tenderness more than animal age but the latter is considered to be the most important aspect in the current SABCCS classification, which does not seem justifiable based on the results of this study. This project did not investigate the effect of beta-agonists on meat tenderness.

Michelle Hope-Jones



Michelle Hope-Jones is a researcher for the Meat Science Program of the Animal Production Institute of the Agricultural Research Council at Irene. She obtained her B.Sc. Agric. (Animal Science), M.Sc. Agric. and her Ph.D. (both in production physiology) at the University of Pretoria. Her Ph.D. titled "Effects of dietary beta-agonist treatment, Vitamin D3 supplementation and electrical stimulation of carcasses on meat quality of feedlot steers" was obtained in February 2012. She then started her post-doctoral fellowship and obtained a permanent position at the ARC-API in January 2013. She is involved with research on meat production concerning various aspects of growth manipulation and pre- and post-harvest factors influencing optimal meat production and product quality.

THE EFFECTS OF A BETA-AGONIST TREATMENT, VITAMIN D_3 SUPPLEMENTATION AND ELECTRICAL STIMULATION ON MEAT QUALITY OF FEEDLOT STEERS

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The current classification system is utilised by meat traders to describe their specific requirements when purchasing carcasses, for the utilisation of variety in the market with a view to optimum consumer satisfaction, utilisation of price differences and to determine selling prices.

The current system classifies meat by age of the animal, fatness and conformation. A-age animals are considered to be the most tender and meat from A-age animals is sold for more. In reality this is not always the case as many other factors other than age can affect tenderness. One such factor is the use of beta-agonists which is common practice in many of South Africa's feedlots. Beta agonists are known to affect the aging potential of beef muscle negatively by increasing the activity of the enzyme calpastatin.

Both controlled electrical stimulation of carcasses as well as the supplementation of ultra-high levels of vitamin D_3, for short periods before slaughter, could enhance the aging potential of beef and alleviate this problem. In this study we evaluated the ability of various levels and durations of Vitamin D_3 supplementation, in combination with electrical stimulation (ES) after slaughter, to overcome the tenderness problems of beta agonist treated animals. One hundred and twenty Bonsmara steers were divided into six groups (n=20). The groups represented 6 treatments, namely a control (C), which received the feedlot diet only, while the five remaining groups were supplemented with the beta-agonist, zilpaterol hydrochloride, for thirty days during the final weeks of finishing. One of the five groups only received zilpaterol (Z), while the other four groups received zilpaterol and vitamin D_3 at the following levels and durations before slaughter: 7 x 106 IU/animal /day for 3 days prior to slaughter (3D7M); 7 x 10^6 IU/animal / day for 6 days prior to slaughter (6D7M); 7 x 10^6 IU/animal /day for 6 days followed by 7 days of no supplementation prior to slaughter (6D7M7N) and 1 x 10^6 IU/animal /day for 9 days prior to slaughter (9D1M). Zilpaterol was withdrawn from feed 4 days prior to slaughter. Carcasses were split and the left sides were electrically stimulated for 30 seconds (400V peak, 5ms pulses at 15 pulses per second) within 30 minutes of slaughter.

Warner Bratzler shear force and myofibril fragment length were measured on loin (*M. longissimus lumborum*) samples aged for three and 14 days. Beta agonist treated loins were significantly tougher than control loins irrespective of the aging period. Vitamin D_3 did not improve the tenderness of beta agonist treated loins. Both aging and ES improved meat tenderness significantly and showed a slightly larger benefit for Z and vitamin D_3 treatments than for C. Vitamin D_3 does not seem to overcome tenderness problems experienced with beta agonists and more success would be experienced with ES and prolonged aging.

Arno Hugo

Arno Hugo is an Associate Professor in the Food Science Division of the Department of Microbial, Biochemical and Food Biotechnology at the University of the Free State. He is specializing in Meat Science and Technology. He authored or co-authored more than 80 publications in accredited, peer-reviewed scientific journals and presented more than 130 papers at national and international congresses. He supervised or co-supervised more than 30 Ph.D. and M.Sc. students. He is a professional member of the South African Association for Food Science and Technology, The South African Association of Animal Science and the American Meat Science Association.The focus of his research is the chemical stability of food, with a special interest in the lipid component of meat and meat products. Current research projects include investigations into the manipulation of the lipid component of diets of meat producing animals with the aim of improving technological and health properties of fat tissue.

FAT QUALITY OF SOUTH AFRICAN PIGS WITH DIFFERENT CARCASS CLASSIFICATION CHARACTERISTICS

A. Hugo and E. Roodt

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Fat quality of backfat from 2107 pig carcasses, sampled within the different pork classification groups at a major South African pig abattoir, were evaluated to determine the relationship between carcass classification and backfat quality of South African pigs. Extracted fat was used to determine iodine and refraction index values as well as fatty acid profiles of these samples. Significant differences ($p < 0.001$) in terms of backfat quality were observed between the different classification groups. Improved fat quality was associated with increased backfat thickness and decreased lean meat content, caused by an increase in the total saturated and mono-unsaturated fatty acid contents and a decrease in the total unsaturated and polyunsaturated fatty acid contents as well as double bond and peroxidizability indexes. The P and O classification groups (with backfat thickness measurements less than 17 mm) could not conform to the international standards proposed for backfat of good technological quality. The C, U and S groups (with backfat measurements of 23 to more than 32 mm) possessed backfat with good technological qualities. The R group had borderline fat quality. A high linoleic acid content, leading to a high dienoic fatty acid content, in turn influencing the total polyunsaturated fatty acid content, is the main cause of soft fat with poor technological quality.

Correlation analyses and statistical techniques were employed to acquire equations to describe the relationships between iodine value, international fat quality parameters and South African carcass classification data. By substituting the international fat quality criteria into the equations it became clear that pigs had to have an iodine value of not more than 70 to comply with most of these criteria. The French system predicts fat quality by utilizing backfat thickness and lean meat content. It was proposed, through modification of this system, that South African pig carcasses with a backfat thickness of more than 17 mm and a lean meat content of less than 67% would have the potential to deliver backfat with good technological properties in terms of iodine value. If these new criteria were applied, the P and O classification groups did not possess good quality fat. The probability of selecting a pig with an iodine value < 70 (indicating good fat quality) from the R group would then be $>55\%$. In the S group, $>77\%$ of the pigs conformed to these new criteria. Pigs with poor fat quality may escape detection, but the risk of selecting a pig with poor fat quality from these groups is reduced. These values are applicable to either method of carcass evaluation (Hennessey Grading Probe or Intrascope) employed in South Africa. Results from this study indicate that carcass classification data may be used to improve the probability of selecting pig carcasses with good fat quality.

Kedibone Modika

She is a junior researcher at the Agricultural Research Council in the Biochemistry Section. She is currently studying towards a PhD in animal Science under the guidance of Dr Lorinda Frylinck and supervision of Prof EC Webb.

VISUAL EVALUATION OF BEEF TENDERNESS BY USING SURFACE STRUCTURAL OBSERVATIONS AND ITS RELATIONSHIP TO MEAT COLOUR

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Meat tenderness is the most important meat quality assessment attribute among consumers. If the connection between visual surface structural properties of meat can be an indication of non-visual attributes it could be used as an additional measure by experienced classifiers and if visual characteristics of meat are over emphasized, consumers can be educated accordingly to be able to classify the tenderness of meat. The aims of this study were to determine the possibility to predict beef tenderness by means of visual analysis, to determine the possibility of evaluating meat colour by visual analysis and to determine if an association exists between colour, surface structure (morphology) and tenderness.

Five South African beef breeds; *Bos indicus* (Brahman), Sanga type (Nguni), British *Bos taurus* (Angus), European *Bos taurus* (Charolais) and the composite (Bonsmara), 10 animals per genotype, n=50 were used in the study. The animals were slaughtered at ARC-abattoir, the carcasses were split and the right sides were electrically stimulated for 20 s (400 V peak, 5 ms pulses at 15 pulses per s) and left sides not stimulated. Steaks were sampled from the *M. longissimus lumborum* and two retail procedures were simulated for ageing of the steaks. The steaks were aged till 3 days (d) *post mortem* (pm) on polystyrene plates in a display cabinet at 6 °C and till 9, 14 and 20 d pm in vacuum bags at 1 4 °C in a cold room. The steaks were evaluated by visual analysis for colour, marbling, fiber separation, surface texture and structure integrity using a 10 member trained panel. Colour was also measured by Minolta meter and tenderness by shear force using Instron.

The results showed differences between breeds and ageing periods for L*, a*, b*, chroma, hue, visual colour, marbling, fiber separation, surface texture and structure integrity. Significant differences were observed between breeds for ageing and shear force. Treatment (ES and NS) did not have any significant effect on tenderness or colour measurements. Good correlations were observed between the visual colour and instrumental colour L* (r= 0.809), b* (r= 0.698) and hue (r= 0.797). There were also correlations between shear force and structure integrity (r= -0.410) and fiber separation (r= -0.401). Very low correlations were observed between colour and shear force (r= -0.242). According to the results of the study, electrical stimulation seemed to eliminate the differences in meat colour and tenderness within the breeds and it is evident that consumers have the potential to judge meat colour by visual analysis if offered proper training. It could be more difficult for consumers to predict meat tenderness visually by using surface structural observations (fiber separation and structure integrity) but there is potential for an experienced eye. It is clear from the results that there is no relationship between meat colour and tenderness.

Kgantje Moloto

Kgantjie Moloto was born on 24 February 1985 in Tembisa Gauteng. He matriculated in 2002 from Karabi Senior Secondary School in Moletjie Ga-Phago Limpopo province. He received his BSc and Honours (Biochemistry) degrees from University of Limpopo, 2006 and 2007 respectively and Masters degree from University of Johannesburg,2012. His research interest lie in the Search for protein markers related to tenderness in meat (Proteomics).

PROTEOMICS APPROACH AS A NEW WAY TO PREDICT TENDERNESS AS COMPARED TO CLASSICAL SOUTH AFRICAN BEEF CARCASS CLASSIFICATION SYSTEM

K.W. Moloto

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ABSTRACT

Currently controversy exist between feedlot beef producers and pasture beef producers which includes resource poor farmers because the South African Beef Carcass Classification System (SABCCS) do not accurately judge meat tenderness, but still discriminate against animal age at slaughter as an indication of potential tenderness. Modern technologies such as the use of growth stimulants and electrical stimulation influence tenderness and therefor the SABCCS should be adapted to take these technologies into account. According to a recent survey by API, beef tenderness is one of the most variable and inconsistent quality characteristics as measured from a representable sample of meat products in the retail sector despite the SABCCS. Unfortunately there is currently no single non-invasive method to predict meat tenderness of a carcass or specific at abattoir level in order to grade or classify the carcass or cut according to eating quality. Modern science research have progressed in using different proteome approaches that include two-dimensional gel electrophoresis (2-DE), high pressure liquid chromatography, mass spectroscopy, in combination, to identifying differentially expressed proteins that are associated with meat tenderness (i.e. protein markers) that can be used to develop an online non-invasive technology to judge potential beef tenderness accurately. Such a non-invasive technology will change the dynamics and economics of the beef industry to such an extent that more farmers/producers will move into farming and producing this commodity because remuneration will be fair and profitable for all role players.

Meat scientists at ARC-Animal Production Institute are currently running a proteomics project in order to search for protein markers found in indigenous breeds such as the Nguni or Bonsmare already proven to have tenderness characteristics that could be used as tenderness predictors. *M. longissimus lumborum* samples were collected from five pure beef breeds (Nguni, Bonsmara, Brahman, Angus and Charolais), snap frozen and stored at -80 °C, that can be used in the study. Work was started on samples of the Nguni animals with 0-teeth aged for 0 hours, 3 days and 14 days *post mortem*. The initial results show variation as ageing progresses. Such differentially expressed proteins could be applied as molecular biomarkers for meat quality and might provide understanding into the molecular mechanisms and pathways related to e.g marbling and tenderness. Protein markers/ group of proteins will be identified by comparing with results and identifying associations with other tenderness related data such as calpain system, myofibril fragmentation and shear force. Identified protein markers will be tested on unrelated samples to verify its efficacy as markers for quality. Progress on this project will be reported.

Voster Muchenje

Professor Voster Muchenje is a Research Professor in meat science with additional responsibility to research on food security at the University of Fort Hare (UFH) . He is currently the Co-holder of the Department of Science and Technology/National Research Foundation (DST/NRF) SARChI Chair in Meat Science-Genomics to Nutrinomics, and is an Associate of the DST/NRF Centre of Excellence in Food Security. He is the current of Co-Chair of the South African Young Academy of Science (SAYAS) and is also a Y2 (Young Researcher) NRF-Rated researcher. Voster is an experienced team leader of a 40-member research group which has experience on community-based meat science, agricultural, food security and livestock production systems. His current H-Index is 16. To date, he has successfully supervised 6 post-doctoral fellows, 4 PhD students, 27 MSc students and more than 14 Honours students. He is the 2014 UFH VC's Excellence Awards recipient in the Senior Researcher Category. In 2012 he was awarded the South African Society for Animal Science (SASAS) President's Award for exceptional contribution to animal science and the livestock industry. In 2010 he received the UFH VC's Emerging Researcher Award. Voster is also a founding member of the South African Young Academy of Science (SAYAS), an editor and reviewer of scientific journal articles and to date he has published over 100 scientific articles in national and internationally recognised peer-reviewed journals. Several of his peer-reviewed articles have been highly cited and downloaded. Voster has presented more than 50 papers/posters at conferences, in countries such as Brazil (2006), China (2007), Denmark (2009), Belgium (2011), Germany (2013), Turkey (2013) and Uruguay (2014). He has also has more than 20 articles in farmer journals, including The Farmer's Weekly. He has presented some of his research activities on television, including the SABC's Morning Live Programme. He has presented several keynote addresses at local and international conferences. In addition to this, he is also an editorial board member of the journal Food Research International (published by Elsevier), and an Associate Editor for the South African Journal of Animal Science. In June 2014, he was appointed the Managing Guest Editor for the Food Research International special issue on Food and Nutrition Security. He has partnerships with local and international universities, communal and emerging farmers in the Eastern Cape Province. He serves (or served) on several boards which include: SASAS National Council (where he is also a member of its editorial sub-committee); Academy of Science of South Africa (ASSAf) Agriculture Education and Training (AET) Consensus Study Panel; ASSAf Panel on book and conference evaluations, NRF evaluations panel, IDC-Eastern Cape Nguni Cattle Project (2011-present) and Fort Cox College of Agriculture and Forestry Board of Governors (2012 – Present). He is also a member of the American Meat Science Association (AMSA).

RELEVANCE OF A FORMAL CARCASS CLASSIFICATION SYSTEM TO THE INFORMAL SECTOR

V. Muchenje, Z. Soji, B. Mushonga and I.F. Jaja

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The meat value chain in South Africa can be divided between the commercial and communal farmers which comprise the formal and informal marketing systems, respectively. In 1992 the South African meat industry was deregulated, leading to the promulgation of the Marketing of Agricultural products Act, Act no. 47 of 1996. The Act stipulated new rules which allowed producers to produce and sell animals at their own will to customers at mutually agreed prices. This resulted in an inordinate increase in the number of animals slaughtered in non-designated areas. When animals are slaughtered in the informal sector, quality control directly depends on the owner. Notwithstanding the requirements for all livestock to follow the laws and procedures regulating animal slaughter, the informal sector has its own "rules". Challenges besetting communal farmers such as low levels of literacy, inadequate levels of management, complex ownership of the animals, multi-purpose nature of the animals and limitations to infrastructural development drive communal farmers away from the formal marketing to informal marketing channels. The formal market is characterised by meat inspection and carcass classification. These two quality control systems further scare away communal farmers from the formal market as they are less likely to benefit from them. The classification system in South Africa is based on age, back fat cover, carcass conformation, bruises, and to a lesser degree, sex. It is common that meat from communal farmers is less likely to be less fat due to limited supplementary feeding in this sector. In addition, most communal farmers keep indigenous rather than exotic animals which are routinely handled on a daily basis and thus have a good temperament. Such animals are less likely to panic during transportation and in lairages hence their meat is less likely to be bruised. Although most communal farmers usually keep indigenous livestock, animals like the Nguni are not known to have a great carcass conformation and thus communal farmers are not likely to get a bonus for conformation on their carcasses. As a result farmers would rather opt for the informal sector where such a consideration does not take centre stage. Furthermore, communal farmers would normally not sell young animals which attract premium bonuses. It can therefore be concluded that the formal classification system is not totally friendly to the communal farmers and hence needs to bend over backwards to accommodate them. The formal classification system should also take into cognizance the practices in communal farmers and the habits of consumers and take a critical view of accepted norms of meat classes and quality. This paper seeks to assess the relevance of formal classification to the informal sector, the level of confidence of the rural farmer in the current classification system and make recommendations to relevant stakeholders on ways to ameliorate the undesirable effects of this regulation on the informal sector and communicate vital findings through a feedback system.

Key words: Abattoir, meat classification, meat inspection, red meat, communal areas, South Africa

Hettie Schönfeldt

Professor Hettie Schönfeldt, is a NRF-rated and registered scientist (nutritionist and food scientist) and mentor in the fields of human nutrition and food composition. She is a Professor Extraordinaire in the Faculty of Natural and Agricultural Sciences, Department of Animal and Wildlife Sciences and an Associate of the Institute of Food, Nutrition and Well-being at the University of Pretoria. She attained her PhD with a thesis entitled "Effect of Age on Beef quality".

Under her guidance 25 post graduate students have received their degrees and has published more than 60 contributions in numerous international journals and books, 117 technical reports for industry and more than 130 contributions to conferences.

She has been part of the faculty of international training courses being held worldwide, including participation on the Advisory Board for the Production and use of Food composition data in Nutrition courses. Prof Schönfeldt is Manager: Administration of the Red Meat Research and Development programme and coordinator of consumer and health professional communication under the auspices of Lamb and Mutton South Africa. She was a chief rapporteur for the Food and Agriculture Organization (FAO) of the United Nations Expert Consultation on Protein Requirements for human health, as well as being part of the evaluation team of the FAO's work in Nutrition. Prof Schönfeldt was recently invited by the United Nations Systems Standing Committee on Nutrition (UNSCN) to perform a descriptive review of food and agricultural policies in South Africa to encourage discussion on nutrition-sensitive agriculture.

CHANGES IN THE NUTRIENT CONTENT OF SOUTH AFRICAN RED MEAT

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INTRODUCTION

Globally, red meat industries have responded to the ever escalating obesity epidemic and the increased awareness of the role of food choices on health and nutrition, by reducing the amount of fat of red meat carcasses and subsequently increasing nutrient density. Actions include breed selection, feed manipulation, animal age, and retail and food preparation practices, such as trimming. Since the 1930's the nutrient composition of South African red meat, together with other research, has assisted in guiding the development of the national carcass classification systems over time. Recently, research projects have determined the nutrient content of beef and sheep as currently produced.

METHODOLOGY

Sampling: For lamb (0 incisors) and mutton (>6 incisors), three Mutton Merino carcasses and three Dorper carcasses were pooled in each age group (n = 18 X 2) from three different production regions. Nine Bonsmara carcasses from each of four age groups of beef were included in the study (n = 9 X 4). All animals were slaughtered and dressed using standard commercial procedures. Dissection took place in an environmentally controlled de-boning room (10°C) by an experienced deboning team. Carcasses were sectioned down the vertebral column, and subdivided into the primal carcass cuts. For sheep meat, the shoulder, loin and leg and for beef, the shoulder, prime-rib and rump, were analysed for nutrient content. The cuts were weighed and dissected into muscle, intramuscular fat, subcutaneous fat, and bone. Each fraction was weighted and recorded, in order to calculate carcass composition. Nutrient analysis and carcass composition was used to calculate nutrient content.

Nutrient analysis: Meat and fat fractions from three similar cuts were grouped together as composite samples which were cubed, minced twice (5mm, then 3mm mesh plates), vacuum sealed and frozen. Meat and fat samples were respectively freeze dried and sent for nutritional analysis at the Agricultural Research Council (ARC) Analytical Laboratory and the NutriLab at the University of Pretoria. All analytical procedures were performed on a double-blind base using accredited methods.

Comparison with previous data: The results were compared with data documented on the composition of South African red meat over time (Naudé, 1974, Klingbiel, 1984, Schonfeldt, 1998) and existing national food composition references tables of the Medical Research Council (MRC).

RESULTS

Nutrient content, including total fat and fatty acid profile varied between production systems and age groups. Notable changes have been found related to fat content in particular. Red meat has decreased in fat content over time, with production systems and age influencing nutrient content. Other macro and micronutrients simultaneously increased as fat is dilutes nutrients.

CONCLUSION & RECOMMENDATIONS

Nutrient composition differs significantly between age groups. Notable changes in nutrient composition are also observed in red meat compared to data guiding the original development of the current carcass classification system.





Zimkhitha Soji

Zimkhitha Soji was born and raised by her parents in a rural household in Mount Coke, King William's Town in the Eastern Cape Province. She has three siblings and has always been very family oriented because she knew that her family will always support her as she reaches for the stars. Zimkhitha attended Hector Peterson High School in Zwelitsha where she was one of the top students in the field of Science and proved her intelligence by participating in Miniquiz Science and Maths competitions and being a member of the Science club. Throughout her high school she has won numerous academic awards for Maths, Physical Science, Agricultural Science and Accounting and as a result she passed her Matric outstandingly in 2009. With the outstanding matric results she received a Mayoral Bursary from the Buffalo City Metropolitan Municipality to pursue her studied at the University of Fort Hare in 2010. She is now currently registered as a first year full-time Master (MSc) degree candidate in the department of Livestock and Pasture Science at University of Fort Hare majoring in Animal Science. She is a person that is always found to be extremely pleasant to work with, attentive to detail, disciplined and conscientious of following through with scheduled task. Since her first year as undergraduate, she has been demonstrating high sense of credibility and hard work hence she obtained her BSc degree with Cum Laude and as a result was a recipient of the South African Society for Animal Science (SASAS) merit award in 2014. She has a strong level of knowledge and potential for growth in the field of Animal Science. She has the ability to carry out research, think and write analytically. She is a young energetic, visionary and self-motivated person who believes to carry out research that will provide socio-economic benefits. She is willing to learn and to be taught and has the ability to work above what was required of her. She is very diligent and enthusiastic about the research work especially in the area of Livestock and Pasture Science hence she is planning to register for her Doctor of Philosophy (pHd) degree in 2016.

CARCASS CLASSIFICATION AND MEAT INSPECTION AS QUALITY ASSURANCE SCHEMES USED IN SELECTED ABATTOIRS IN THE EASTERN CAPE PROVINCE, SOUTH AFRICA

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The main objective of the study was to evaluate the effectiveness of the classification system and inspection on meat quality assurance in the Eastern Cape Province abattoirs. Two abattoirs in the Eastern Cape Province were evaluated for carcass classification and meat inspection. The abattoirs used were East London abattoir (ELA) which is a large scale and Adelaide abattoir (AA) which is a small scale abattoir. Active carcass classification and meat inspection were observed and recorded. One hundred cattle, 100 pigs and 100 sheep were used for the evaluation of the carcass classification system in ELA and 30 Pigs, 30 sheep and 30 cattle were evaluated in AA. Short informal personnel interviews and documentation on the classification system and meat inspection were also used in the study. Descriptive statistics was used to analyse the results. The results showed that the classification system is not practised in AA and the meat inspection is not standardised because it is a small scale abattoir and is community based. Nonetheless in ELA classification and meat inspection are indeed practised. The red meat in ELA is classified to 5 different classes comprising of: Age (A (0), AB (1-2), B (3-6) & C (>6); Fatness (0-6), Damage (1-3), conformation (1-5) and Sex (female/male). Classification consideration for pigs is fat thickness and have the classes which are P (1>12), O (12>17), R (17>22), C (22>27), U (27>32), S (<32). Considering the consumers' expectations, the consumers prefer that the meat they consume must be tender, juicy, be of good flavour, colour, and aroma; and generally of good quality and free from food-borne diseases and pathogens. Ante-mortem, post-mortem inspection and the carcass classification system practised in ELA abattoir which are mostly based on visual appraisal, might not respond to the consumer expectations as they might not be able to detect food-borne diseases and measure meat quality attributes preferred by consumers. Furthermore the results showed that meat inspection with adequate carcass classification is compromised in the rural area, consumers from this area continuously buy meat not properly regulated. Moreover, the inadequate meat inspection services indicate major problems concerning safety. The results therefore arouse a conclusion that the existing meat inspection techniques and classification system need to be evaluated and upgraded where necessary for quality assurance because the food safety scares around the world are becoming a major concern in many countries.

Keywords: Abattoir, meat quality, meat classification, consumer expectations, food safety

Phillip Strydom

Phillip Strydom is Research Team Manager for the Meat Science Program of the Animal Production Institute of the ARC at Irene. He obtained his B.Sc. Agric., B.Sc. Agric. (Hons.) and M.Sc. Agric. at the University of Pretoria. His Ph.D. entitled "The characterisation of Indigenous Cattle in relation to Production and Product characteristics" was obtained from the University of the Orange Free State in September 1998.

He is involved with research on meat production concerning various aspects of growth manipulation and pre-and post harvest factors influencing optimal meat production and product quality throughout the whole production chain. He spent a sabbatical year in 2004 at INRA in France where he investigated non-invasive methods to predict meat quality in beef.

THE EFFECT OF A BETA-AGONIST AND ANIMAL AGE ON BEEF QUALITY AND ITS IMPACT ON VARIATION IN QUALITY ON RETAIL LEVEL

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ABSTRACT

Various intrinsic and extrinsic factors affect the different sensory quality attributes of meat of which flavour and tenderness are the most important. The current situation in the beef industry is such that the classification of beef according to age alone to describe tenderness and other quality characteristics is probably not as effective as it was before the introduction of certain metabolic modifiers into the production system and deregulation of the different parts of the value chain.

This presentation will cover investigations on the effects of age combined with feeding regime and the supplementation of the beta agonist, zilpaterol, on different quality characteristics of 3 beef cuts were discussed. The 4 age/feeding regime/zilpaterol groups were grain fed A age, no zilpaterol, AC, grain fed, A age treated with zilpaterol, AZ, pasture fed AB and B age and the 3 muscles tested were the ST or M. semitendinosus (silverside; high connective tissue), LL or M. longissimus lumborum (loin; low connective tissue) and BF or M. biceps femoris (silverside; high connective tissue). In addition we shall report on variation in quality of beef as experienced by the consumer on retail level.

The effects of age and zilpaterol on tenderness were muscle specific. Tenderness of LL cuts was least affected by age but zilpaterol significantly decreased tenderness and aging potential. LL cuts of AZ carcasses were tougher than all other age groups at 3 days post mortem and equal in tenderness to LL cuts of AB and B age carcasses. Prolonged aging combined with no zilpaterol gave the best results for A-age LL cuts. Tenderness of high collagen cuts (BF and ST) were negatively affected by age due to reduced collagen solubility and did not improve significantly when aged for 14 days. The effect of zilpaterol on these cuts was less significant and BF and ST cuts of AZ carcasses were more tender than the same cuts of AB and B carcasses.

A sensory panel clearly distinguished between cuts of grain fed (AZ and AC) and pasture fed carcasses (AB and B) on the grounds of flavour characteristic. AB and B cuts scored higher for Grassy, Animal-like and Rancid flavour overtones and lower for Roasted flavour and Sourness than AZ and AC grain fed cuts

Subcutaneous fat of pasture fed carcasses was yellower than fat of grain fed carcasses. Colour measured as lightness or light reflection (L*) and chroma (vividness) was generally darker and duller (darker red) for cuts of pasture fed animals.

Vacuum-packaging contributed to an overall oxidative stability and little variation occurred among muscles, treatments and ageing times. However, samples from pasture fed animals tended to be more stable than grain fed animals.

We conclude that age is a poor predictor of tenderness of low connective tissue cuts when a beta agonist is used. However, age could be used to distinguish effectively between high connective tissue cuts. Apart from tenderness, typical flavours related to the diet of animals define the expected eating quality of beef of different ages and feeding regimes.

Hester Vermeulen

Mrs Hester Vermeulen (M Sc (Agric) Agricultural Economics) is an agricultural economist specialising in consumer food economics encompassing aspects such socio-economic consumer dynamics, consumer behaviour and food choices, consumer trends, food consumption patterns, food affordability and food security, nutrition economics. She currently works in the Bureau for Food and Agricultural Policy as the coordinator of consumer analyses.

A CONSUMER PERSPECTIVE ON THE SOUTH AFRICAN RED MEAT CLASSIFICATION SYSTEM

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INTRODUCTION

Packaging information is an important tangible resource used by consumers to gauge product quality. Red meat classification information obtained from product labels and/or roller marks on meat could provide consumers with valuable quality indicators. However, South African consumers' views on and usage of the current red meat classification system is largely unknown.

OBJECTIVES

To investigate South African red meat consumers' knowledge and perceptions regarding beef and sheep meat classification and related quality parameters among low-, middle- and high income consumers. These results will be interpreted in conjunction with results from a recent national in-store observational survey of fresh red meat labelling information.

METHODS

Fresh red meat labelling observations were conducted among independent butchers and large retailers across South Africa (n=60). Observations were compared with consumers' perceptions of red meat classification extracted from recent comprehensive consumer surveys among stratified representative samples of SA low-, middle and high income consumers (n=165, n=171 & n=249) conducted in 2012/2013.

RESULTS

Low income consumers had very limited understanding and gave little attention to red meat classification. Even though middle LSM and high LSM consumers also have a limited understanding of red meat classification (up to 90% with no understanding), around half of these consumers check for a classification mark.

Red meat classification was not mentioned by consumers as a major concern regarding red meat. However, many aspects related to classification were mentioned such as concerns regarding quality, fattiness, tenderness, juiciness, taste, freshness, smell and appearance.

Consumers' purchase considerations for beef and mutton/lamb focused largely on safety, appearance, price and eating quality. The attribute 'Grading stamp' was not among the top 20 considerations for consumers even though many aspects related to red meat grading featured in the top 20 such as appearance, quality, tenderness and fat-related attributes.

Labelling information observed at independent butchers focused mainly on price, store name and packaging date. Observations related to fresh red meat classification were insignificant (<5% of butchers). Selected brands offered by large retailers indicated more advanced labelling information, but very limited application of red meat classification info was observed.

CONCLUSION AND RECOMMENDATIONS

- In general the basic nature of fresh red meat labeling information presented to South African consumers is in line with consumers' dominant purchase considerations.
- There is a definite need for consumer education on the red meat classification system and its implications in terms of product quality.
- Even though 'classification' is not a dominant product evaluation attribute, related attributes are important. Thus, the indication of red meat classification information on fresh meat product labels could assist consumers to make more informed product decisions.
- Follow-up research is recommended to test consumers' perceptions regarding red meat classification after presentation with consumer education on the subject.
- There is a definite need for the development and consumer testing of an appropriate front-of-pack labeling system to communicate red meat classification on product labels

Edward Webb

Prof Eddie Webb is Head of the Department of Animal and Wildlife Sciences at the University of Pretoria. A graduate of the University he completed his post-doctoral studies at the University of Gent in Belgium and Nutreco in The Netherlands on aspects of fatty acid synthesis in ruminants and growth modelling. He has been President of the South African Society of Animal Science since 2008 and deputy-editor of the *SA Journal of Animal Science*. He also serves on the editorial board of Small Ruminant Research.

Prof Webb served on the organising committee and as special editor of the International Conference for Meat Science and Technology held in Cape Town in 2008. He is a member of the advisory committee on meat science research for the Agricultural Research Commission and was the chairperson of the scientific committee of the 8th International Congress on Goats.

During his career Prof Webb has published 72 papers in peer-reviewed scientific journals, delivered 85 papers at international conferences and participated as guest lecturer at international symposia and universities.

He holds a C1 rating from the National Research Foundation and has mentored eight PhD and 33 Master's students. Prof Webb is registered, professionally, with the SA Council for Natural and Scientific Professions, the SA Association for Professional Animal Scientists and the SA Society for Animal Science.

DESCRIPTION OF CARCASS CLASSIFICATION GOALS AND CURRENT SITUATION

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Carcass classification is an essential part of efficient animal production, price fixing and meeting consumer demands. Carcass classification (or grading) is based on the description of carcasses by characteristics which are of prime importance to the meat industry and consumers. Significant variation exists in carcass composition and quality due to the effects of species, age, maturity type, gender and interactions with production system. A number of extrinsic and intrinsic factors affect carcass and meat quality and the purpose of carcass classification, is to classify carcasses to ensure more consistent meat quality and consumer satisfaction.

The Meat Safety Act (Act 40 of 2000), provides guidelines for the conversion of livestock to meat, to ensure a safe and wholesome product to consumers, while the Agricultural Product Standards Act (Act 119 of 1990), helps to control and sets specific product standards for local and export purposes by means of inspection, grading (by distinctive marks) and sampling for quality control. Proiducers, retailers and consumers differ in terms of their perceptions and expectations regarding carcass and meat quality, as well as the eating experience.

This paper addresses the purpose and characteristics of the current South African carcass Classification system, grading systems in other countries and the implications for effective marking, price fixing and consumer satisfaction based on the complex cycle from 'farm to fork'.

POSTERS

CHANGES IN THE NUTRIENT CONTENT OF SOUTH AFRICAN RED MEAT

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INTRODUCTION

Red meat today is significantly different to that produced and consumed in the past. The amount of fat found on red meat carcasses and further removal of fat through trimming practices has resulted in a significantly leaner product. Up to date scientific data on the nutrient content of red meat is required to inform professionals, align consumer education projects and assess the role which red meat can play in today's healthy, balanced diet.

The nutrient content of lamb and mutton with and without subcutaneous fat was recently determined as no local data previously existed. The composition of beef with subcutaneous fat removed has never been determined, and a running project aims to determine the effect of trimming on the nutritional profile of beef from four age groups.

The relevant up-to-date composition data on South African red meat enables the extrapolation of the effect which trimming has on composition. Not only will a reduction in fat content result in lower contribution of fat and energy per 100g product, but also increase the amount of other essential nutrients such as protein, iron and B-vitamins per 100g product (nutrient density). This essential information can be used to determine the role of red meat in the diets of South Africans within the context of the prevailing micronutrient deficiencies and rising obesity incidence.

METHODOLOGY

Three recent projects on the composition of South African beef, lamb and mutton were performed in collaboration with the SA red meat industry, the University of Pretoria and the Agricultural Research Council. The sampling plans for each project were developed to ensure that nutrient data generated are representative and accurate, while simultaneously considering financial constraints. All animals were slaughtered and dressed using standard commercial procedures. An experienced deboning team was responsible for the physical dissection of the carcasses. All analytical procedures were performed on a double-blind base in SANAS (South African National Accreditation Services) accredited laboratories.

RESULTS

The studies found that the fat content of SA red meat is significantly less than what was previously reported in the national food composition reference tables. In line with global trends, the fat content of SA red meat has decreased from nearly a third of the carcass composition in the 1950's to 10% of the edible portion of lean meat, and less than 5% when all visible fat is removed.

CONCLUSION AND RECOMMENDATIONS

Red meat plays an important role in the diet of most South Africans as it is often regarded as the central food around which meals are planned. The nutrient content of SA red meat has changed dramatically over time. The fat content of red meat has decreased from more than 30%, to less than 5% if visible fat is removed. This substantial decrease in fat content of red meat not only decreases the amount of total and saturated fat which the product contributes to the human diet, but also impacts on the nutrient density of the food as fat dilutes other essential nutrients, e.g. protein and iron. These nutrients are often in short supply in the diets of many people from developing countries such as SA.

The updated nutrient content data can be used to assess the actual impact which red meat consumption has on the nutrition and health status of the population, and enable realignment of consumer education projects, update food-based dietary guidelines, and formulate policy aimed at combating overweight and obesity while simultaneously aiming to improve the nutritional quality of the populations' diet.

Keywords: beef, fat content, lamb, mutton, nutrient density

THE EFFICIENCY OF ELECTRICAL STIMULATION TO COUNTERACT THE NEGATIVE EFFECTS OF A BETA-AGONIST ON MEAT TENDERNESS OF FEEDLOT CATTLE

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The current classification system classifies carcasses according to age alone. It is however well known that there are many other factors, both pre- and post-slaughter, which affect meat quality. Such factors include the use of growth promoters (such as beta-agonists like zilpaterol) which are widely utilized across most feedlots in South Africa. There are however some post-slaughter practices such as electrical stimulation which can lessen the negative effects these growth promoters have on meat quality. In this study, 20 out of 40 young steers

received no beta-agonist (C), the remaining twenty steers received a beta-agonist (zilpaterol hydrochloride) (Z) for the 30 days prior to slaughter followed by a four day withdrawal period. After slaughter carcasses were split, the left side electrically stimulated (ES) and the right side not stimulated (NES). Samples were aged for 3 or 14 days post mortem. Parameters included Warner Bratzler shear force (WBSF) and calpastatin and calpain enzyme activity. Zilpaterol resulted in increased ($P < 0.001$) WBSF mainly due to an increased ($P < 0.001$) calpastatin activity. ES improved tenderness ($P < 0.001$) in general by early onset of rigor triggering the activity of calpains. ES also reduced the calpastatin activity ($P < 0.001$), which partially countered the effect of high calpastatin activity on the aging potential of Z loins. ES can therefore be implemented to improve meat tenderness in zilpaterol supplemented steers, although steers without zilpaterol will still have an advantage in final tenderness. It is therefore necessary to consider multiple factors when estimating carcass quality.

ADEQUACY OF SOUTH AFRICAN CARCASS CLASSIFICATION SYSTEM TO EMERGING BEEF PRODUCTION SYSTEMS: CURRENT STATUS, CHALLENGES AND OPPORTUNITIES

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South Africa has about 14 million of cattle, with a substantial number (>40%) owned by communal farmers mostly living in the former homelands. Despite having sufficient land and high production potential, South Africa is still a net importer of beef. In the last 10 years, South Africa has been importing around 32 000 tonnes of beef per annum. The possible reason for this under-performance is largely due to the low production levels in the communal production areas of the country. There are a number of historical reasons to this, however, one of the main challenges facing these farmers include (1) poor formal farming education (2) lack of proper cattle management (3) poor farming infrastructure (4) theft (5) poor market access and (6) loss to preventable diseases. A number of interventions were introduced previously by the government and other development agencies to address these challenges, and improve participation of these farmers to the mainstream beef sector. However, the promotion of these farmers came at a time when the red meat industry is demanding lean, fast growing cattle with desirable carcass conformation and good sensory qualities to satisfy the consumers as stipulated by the existing South African carcass classification system. Carcass attributes recorded by this classification system include: carcass weight, age of the animal, fat content of the carcass, carcass conformation, damage to the carcass and the sex of the animal. Well-designed genetic improvement programmes for carcass quality have been an essential tool used by commercial farmers to meet classification system's demands. Commercial famers have been breeding and selecting cattle for good conformation and muscularity for a very long time. On the other hand, the communal and emerging beef farmers do not have such programmes, and are more likely to be penalized by the market. This poses a question on whether the promotion of the communal farmers to mainstream beef production will be economical and sustainable. The objective of this review article, therefore, is to evaluate and summarize the adequacy of the existing carcass classification in relation to the emerging beef farmers. The current status, challenges and opportunities (with their potential implications) of the existing classification system will be reviewed.

AN EVALUATION OF THE SOUTH AFRICAN GOAT CARCASS CLASSIFICATION SYSTEM

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A classification system is an important tool in describing the quality of a carcass for the benefit everyone in the marketing chain. In South Africa, goat carcasses are classified according the South African Red Meat Classification System of 1992. This system predicts meat yield and eating quality of a carcass basing on age, level of fatness, conformation and degree of damage. However, since its establishment, the current carcass classification system has not been updated, despite considerable changes in the production systems and consumer demands. This review will evaluate the relevance of the South African goat carcass classification system and give recommendations, according to the current production systems and consumer expectations.

Age, as estimated by dentition, is used to determine the eating quality of the carcass. The use of dentition is said to be an accurate estimate of age, therefore it is still relevant, especially with goats raised by smallholder farmers, who in most cases do not keep age records. However, the age at which permanent incisors erupt vary with species, breed and plane of nutrition. Therefore, research should focus on the age at which permanent incisors erupt in specific goat breeds, under different management systems. The use of age as an indicator of tenderness in goat carcasses is not very reliable. Various intrinsic and extrinsic factors coupled with ante-mortem and post-mortem handling procedures affect tenderness. Research should focus on the best ante-mortem and post-mortem handling procedures that would ensure chevon of optimum quality. The level of fatness as a determinant of juiciness and flavour of meat, is based on visual assessment of subcutaneous fat cover. However, the use of subcutaneous fat cover as classification criteria is not relevant in goat carcasses. Instead of promoting the leanness of goat carcasses, a criteria based on subcutaneous fat cover downgrades goats, which naturally have very little subcutaneous fat. A conformation score is used to predict meat yield from a carcass. However, goats are late maturing and a good conformation occurs as they get older. Hence, conformation is not relevant for classifying goat carcasses. Instead, carcass weight is the best indicator of meat yield in goats, therefore should be considered in a goat classification system.

In conclusion, although the current goat carcass classification is relevant in some instances, a new classification system which values the uniqueness of goats should be considered. This will ensure fair remuneration of goat farmers as well as meet the expectations of diverse consumers in South Africa.

QUALITY CHARACTERISTICS OF CHEVON FROM BOER AND INDIGENOUS GOATS HANDLED UNDER MINIMUM STRESS

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Goat meat (chevon) is a healthy source of meat, capable of reducing the risks of cardio-vascular diseases. However the acceptability of chevon in South Africa is relatively low because of its unattractive colour and toughness. Research has shown that the quality of chevon can be improved if best ante-mortem and post-mortem handling procedures are practised. Very few studies have focused on improving the quality of chevon from Boer and indigenous goats, the main breeds for commercial chevon production in South Africa. The objective of the study is to determine the effects of breed and muscle type on chevon from Boer and indigenous goats handled under minimum stress. Twenty indigenous and Boer (n = 10/breed), castrated goats were used for the study. They were slaughtered at less than 1 year (no permanent incisors), with a live weight of 36.77 ± 0.56 kg. Meat quality characteristics (pH, colour, tenderness and water holding capacity) were evaluated on M. longissimus dorsi (LD) and M. semimembranous (SM) muscles. pH was measured at 0, 1, 3, 6 and 24 hours post-mortem. Colour (CIE L*, a*, b* chroma and hue), Warner Bratzler Shear Force (WBSF) values and water holding capacity (WHC) were measured on samples collected at 24 hours post-mortem. The results show that muscle type had an effect ($P < 0.05$) on early (0 and 1 hour) post-mortem pH values, WBSF values, colour and WHC while breed had an affect ($P < 0.05$) on WBSF values only. The pH values of the LD muscle were lower than the SM muscle during the early post-mortem period, but no significant differences were observed as post-mortem time progressed (3, 6 and 24 hours). The SM muscle (8.45 ± 1.72 kg) had higher WBSF values than the LD muscle (4.34 ± 1.07 kg). Chevon from indigenous goats (6.66 ± 2.69 kg) had higher WBSF values than from Boer goats (6. 19 ± 2.28 kg). The SM muscle had a lower meat to fluid ratio than the LD muscle, indicating a lower WHC of the SM muscle than the LD muscle. The LD muscle had higher L* (lightness), b* (yellowness), chroma and hue angle while the SM muscle had higher a* (redness) values. In conclusion, quality characteristics such as colour, pH, WHC do not differ much in chevon from Boer and indigenous goats. However chevon from Boer goats is more tender than chevon from indigenous goats. Further, chevon from the LD muscle is more tender, light coloured and has high water holding capacity than chevon from the SM muscle. The research is on-going. Further work will be done to evaluate breed responsiveness to ante-mortem stress, glycolytic potential of post-mortem muscles and the effect of post-mortem electrical stimulation on meat quality characteristics. The findings of the research will help in the commercialization of chevon. This will benefit communal and emerging farmers, the major producers of goats in South Africa.

THE NECESSITY OF A HAEM IRON DATABASE TO DETERMINE DIETARY IRON ABSORPTION

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INTRODUCTION

Dietary studies have led to increased interest in biologically active constituents present in foods. When reporting, no reference is made to the specific type of iron found in food sources. A single reference of total iron intake does not indicate the amount of iron that is absorbed, as the type of iron, inhibitors and enhancers of a meal have an influence on iron absorption.

OBJECTIVE

To illustrate the importance of a heme iron database considering the contribution of South African meat to total iron absorption.

METHODS

Triplicate samples of raw commonly consumed meat (beef, lamb, pork and chicken) were analysed for total iron using atomic absorption spectrophotometry and heme iron using an adapted Hornsey method. Relative iron absorption was calculated using a constant value as well as analysed value for heme iron.

RESULTS

Beef (TFe=2.46±0.41; HFe=1.97±0.19) and lamb (TFe=1.65±0.12; HFe=1.26±0.39) meat have the highest total iron (TFe) and heme iron (HFe) content with chicken (TFe=0.75±0.11; HFe=0.57±0.13) and pork (TFe=0.76±0.09; HFe=0.64±0.08) meat having the lowest values. The percentage heme iron (%HFe) for beef (81%), lamb (75%), chicken (76%) and pork (84%) was higher than the constant value.

CONCLUSION

The meats in this study contain higher percentage heme iron (>75%) than was used in the Monsen model (40%) to estimate iron availability. More detailed food-composition tables are needed. The lack of knowledge of the presence of different factors in foods is even more obvious when the availability of dietary iron is determined in indigenous foods.

Keywords: Food composition, Heme iron, meat

THE PERCEPTION TOWARDS AND UTILIZATION OF ANIMAL PRODUCTS BY DIFFERENT SOCIO-ECONOMIC GROUPS IN SOUTH AFRICA

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Concurrently with urbanization and shifts in class mobility in South Africa, both low and middle income consumers report increased consumption levels of chicken and eggs. White meat consumption is also increasing at the expense of red meat. Chicken is perceived to be healthier and more nutritious and better value for money than red meat by these consumers. The perceptions of low income consumers towards animal protein foods are distinctly different than that of middle income consumers.

Key Words: Animal Protein Food, Nutrition Transition, Red Meat, White Meat

CONTRIBUTION OF SOUTH AFRICAN LAMB AND MUTTON TOWARDS ESSENTIAL FATTY ACID INTAKE

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INTRODUCTION

Essential fatty acids play a part in many metabolic processes, and suggest evidence that low levels of essential fatty acids, or the wrong balance of types of fatty acids, may be a precursor for a number of illnesses such as increased blood cholesterol, heart disease and cancer.

A study was conducted to determine the fat and fatty acid composition of South African sheep meat.

METHODOLOGY

Mutton (n=18) and lamb (n=18) carcasses were selected from two different abattoirs, represented from three different production regions in South Africa. The left side of each carcass was kept raw, while the right sides were cooked prior to analysis. Each cut was cooked whole according to standardised cooking methods to an internal temperature of 70°C. The cuts were dissected into meat (muscle, intermuscular and intramuscular fat), bone and subcutaneous fat (SCF). The fatty acid profile was analysed using a GC method.

RESULTS

Raw lamb contained 6.79g fat, 3.62 SFA, 2.92 MUFA, 0.25 PUFA and 3.37 g omega fatty acids /100g edible portion respectively. Raw mutton contained 7.85g fat, 4.18 SFA, 3.35 MUFA, 0.31 PUFA and 3.78 g omega fatty acids /100g edible portion respectively. Nutrients showing the greatest differences between raw and cooked treatments, were total fat, C16:0 saturated fatty acid (SFA) and C18:1n9c monounsaturated fatty acid (MUFA).

CONCLUSION

Sheep meat contributes consistently to the essential fatty acids, linoleic and α-linolenic acids, as well as C20 and C22 polyunsaturated fatty acids. Although humans have the metabolic capacity to synthesize the latter from the n-6 or n-3 precursors from linoleic and α-linolenic acid respectively, an increase in the consumption of C20 and C22 n-3 PUFA's has the potential to overcome the perceived imbalance in the ratio of n-6:n-3 PUFA's in modern diets.

Keywords: Sheep meat, fatty acids

EFFECT OF AGE ON CARCASS AND CUT COMPOSITION OF SOUTH AFRICAN BEEF CARCASSES

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The physical composition and nutrient content of different age group carcasses and cuts of South African beef from equal fat classes were investigated. Carcasses from three different age groups and various fatness levels within each, were obtained on the commercial market. The physical composition of each right side cut (n=270) was assessed and analysed for raw nutrient content, while each left side cut was cooked prior to analyses.

Physical composition of the carcass and cuts had the greatest effect on the difference between age groups, with meat and bone increasing with an increase in age. Protein increased (including eleven of the amino acids measured) and moisture content decreased with age in the cooked cuts. When physical composition was excluded, lysine and iron were higher and linoleic acid lower in older compared to younger animals, thus meat from older animals which is mostly consumed by people with severe iron-deficiency anaemia in the rural parts of South Africa, is adequate to meet this need. Lysine as one of the nine essential amino acids for adults, was higher in the C-age meat, contrary to belief that it is of inferior quality and can be recommended as part of a balanced diet. Palmitic acid (16:0) increased with age while Linoleic acid (18:2) decreased with age. Significant differences in fat content (subcutaneous and proximate), meat, moisture, various fatty acids (palmitic, stearic and oleic acids) and calcium were found between the different cuts. Hydroxyproline, glycine and some minerals discriminated the most between the different cuts within a carcass.

SENSORY TENDERNESS OF THREE BEEF CUTS FROM CARCASSES OF DIFFERENT AGE CLASSIFICATIONS, DIETS AND AGED OVER TWO AGING PERIODS

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MEATCO export extensively aged loin to South Africa and Europe that originates from cattle of varying ages and kept under different feeding regimes (grain fed vs. pasture) as a single product line. Age, feeding regime and aging can all affect tenderness which is an important part of the consumers eating experience. This study investigates the effect of these factors on eating quality by means of sensory evaluation. Six age groups/feeding scenarios namely, pasture finished AF (0 tooth), ABF (1-2 teeth), B-4 teeth and B-6 teeth and feedlot finished AG (0 tooth), ABG (1-2 teeth) were defined. Within each age/feeding scenario two post-mortem aging groups (36 and 55 days) were specified. The sensory panel clearly distinguished between the 2 grain fed groups (AG and ABG) and the young free range group (AF) on one side and the older free range groups (ABF, B4 and B6) on the other with the first groups scoring higher for tenderness. From this study it can be suggested that even though extreme post-mortem aging results in acceptable tenderness levels for all age groups and feeding regimes, the consumer may still pick up differences between the different age groups and feeding regimes.

Key Words: Animal age, grain fed, pasture, tenderness

COOKING YIELD AND NUTRIENT RETENTION VALUES FOR SOUTH AFRICAN LAMB AND MUTTON

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RATIONALE

With the influences of breed, harvesting, slaughtering and storage conditions, animal composition, production and processing methods including cooking methods (which all may affect both weight and nutrients), it is important to determine country-specific yield and retention values. Currently, yield and retention values used in South Africa are borrowed from the USA. Therefore, South Africa is undertaking activities relating to the compilation of its own food composition data.

OBJECTIVE

To generate South Africa's own cooking yield and nutrient retention values for lamb and mutton.

Materials and Methods. Dorper and Merino lamb and mutton carcasses, representing three main production areas in South Africa were used. The shoulder, loin and leg cuts were used to determine the cooked nutrient composition. Using GenStat for Windows, 2000, the significance of all variables measured for each sample was tested by means of factorial analysis of variance, which tested the main effect of the nutrients, cuts, breed and cooking method as well as the nutrient-by-cut-by-breed-by-cooking method interactions, at the 5%level.

RESULTS

Shoulder and leg cuts cooked according to a moist heat cooking method tended to have a higher cooking yields and nutrient retention than the loin which was cooked with a dry heat cooking method. Mutton loin and shoulder cuts had higher cooking yields and nutrient retention in comparison with the leg.

CONCLUSIONS

Reasons could be attributed to the cooking method and the fat distribution due to the growth phase and body composition of the animals. It is known that the core (approximately at the loin and thick rib) of the carcass is the part that matures last, thus explaining the lower amounts of subcutaneous fat in the thick rib and hence the lower cooking yield. Dorper breeds mature earlier than Merino breeds, explaining their differences in the cooking yield.

Key words: Yield and retention values, South African lamb, mutton, cuts.

THE NUTRITIONAL COMPOSITION OF SOUTH AFRICAN PORK

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BACKGROUND

The most important challenge facing mankind in the future is to provide adequate nutrition and safe food as well as clean water for all in an environmentally safe way. People consumed food in various forms, but their health depends on the combination and quantity of nutrients in the food consumed.

OBJECTIVE

To determine the nutrientional composition of raw and cooked selected wholesale cuts (shoulder, loin and leg) for South African pork.

Materials and methods. Each raw and cooked cut (shoulder, loin and leg) were dissected into meat, bone and subcutaneous fat in order to determine the nutritional composition per cut and for the whole carcass. Nutrient analysis was performed on the raw and cooked meat and fat samples from the leg, loin and shoulder cuts on a double blind basis. The data collected has been statistically analysed using GenStat for Windows, 2007.

RESULTS

Significantly lower fat contents were observed for the leg (5.21 g/100 g) and loin (6.99 g/100 g) compared to the shoulder cut (10.32 g/100 g edible portion). The overall percentage fat for all three cuts is less than 10 % that is recommended by the SA Heart Mark. The loin cut (27.5 g/100 g) had more protein when compared to the leg (25.5 g/100 g) and shoulder cuts (22.8g/100 g). However, the loin cut had significant less vitamin B2 (0.02 mg/100 g) than the shoulder (0.04 mg/100 g) and the leg cut (0.04 mg/100 g).

CONCLUSION

Pork is a nutrient-dense food that naturally contains many essential nutrients such as protein, vitamins and minerals, without supplying too much fat. Therefore, as recommended in healthy eating advice around the world, lean meat especially lean pork, should be promoted as part of a healthy balanced diet.

Key Words: Food composition, pork, cuts (shoulder, loin, leg), raw and cooked

NUTRIENT CONTENT OF SOUTH AFRICAN C_2 BEEF OFFAL

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INTRODUCTION

Nutrient content and food composition tables of offal is relatively scarce however there is a great need for detailed information on food with adequate nutritive value, for the informal - poorer sections of the South African population.

OBJECTIVE

To determine a selected group of nutrients in raw and cooked C-age, fat code 2 (C_2), bovine offal and to evaluate it as a potential source of nutrients such as protein and iron. Methods: The nutrient content of raw and cooked C_2 bovine offal were analysed by accredited laboratories.

RESULTS

Cooking affected nutrients such as moisture, protein, fat, ash and energy as well as the micronutrient values, which were higher in the cooked offal cuts. The biggest difference could be attributed to the difference in fat content between the cuts. The tongue is very high in fat with 23g/100g and therefore has the highest kJ (1157kJ) content of the six cuts. The spleen had the highest iron content (36mg/100g). Significantly lower fat contents were observed in the lungs (3g/100g), heart (7g/100g) and the spleen (3g/100g) cuts when compare to the values in the 1999 version of the South African Medical Research Council's Food Composition Tables. The heart, intestine and spleen are also an important source of Iron and compare favourable to beef. The heart also contained the highest zinc of all the cuts.

CONCLUSION

Offal containing primary food components which have high potential in human nutrition such as high protein content and can therefore is recommended as a good low cost nutritious product.

Key Words: Nutrient composition, South African offal, cooked, raw

THE INFLUENCE OF FAT SCORE AND FAT TRIMMING ON PRIMAL CUT COMPOSITION OF SOUTH AFRICAN LAMB

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INTRODUCTION

The objectives of this study were firstly to determine the physical composition of cuts (meat, bone and subcutaneous fat) of South African lamb carcasses with different fat scores given by visual appraisal of the hot carcass by trained classifiers, and secondly to identify certain cuts suitable for trimming. In South Africa, sheep carcasses are classified according to age and, subjectively, according to fat cover. Certain local meat companies have altered part of their operations to produce boneless retail cuts. This process could include fat trimming to obtain leaner more attractive cuts for the consumer. Trimming of carcasses with high fat scores could be an option for these operations provided that the cost/profit ratio is favourable.

RESEARCH METHODOLOGY

For this study, 66 grain-fed Dorper A2 lambs (males and females of plus minus 8 months) were divided into three groups and slaughtered at 30, 36 and 42 kg. Chilled carcass sides were subdivided into seven wholesale cuts (neck, shoulder with associated shin, breast, rib, loin, leg and shin as well as flank). The cuts were dissected into meat consisted of muscle, intermuscular and intramuscular fat, bone and subcutaneous fat (SCF) consist of visible fat on outside of carcass was removed and all meat removed from bones in order to determine the physical composition per cut (meat, bone and subcutaneous fat), and for the whole carcass. The soft tissue (meat and fat) of the carcass was analysed for % total fat, protein, ash and moisture.

RESULTS

The percentages total fat in the carcass increased with 15.5 % over the five fat classes, with the largest increment between fat class 1 and 2, (visual appraisal of the hot carcass by trained classifiers) reaching a plateau from fat classes 3 up to 5. The % SCF of the loin increased the most (26 % units) as the fat score increased from score 1 to 5, followed by the flank, shoulder and neck cuts. The % meat (lean) of the neck, thick rib and breast showed no significant change between fat score 1 to 5, although the % bone decreased significantly (> 6 % units).

CONCLUSION

Meat and bone proportions decreased significantly with increase in fat score for the loin, flank, leg and shoulder. The composition of the loin cut was most affected by changes in the fat score.

In theory, trimming could reduced the boneless SCF level of the loin, leg and shoulder by 12 %, 6 % and 9 % units, respectively, when trimmed from a fat score 5 down to a fat score 3. Further trimming to fat score 1 will reduce the % SCF by 18 %, 8 % and 5 % units level respectively. The SCF of neck and thick rib could be reduced between 4 and 5 % units from fat score 5 to fat score 3. The neck, thick rib, breast and flank could be trimmed from a fat score 3 to a fat score 1 level by 5 units.

THE IMPLICATION, APPLICATION AND RELEVANCE OF THE RESEARCH

The final decision on implementing trimming procedures would be determined by weighing the cost involved labour and weight loss through trimming against the possible extra profit gained from increased sales of leaner cuts. It is most likely that the shoulder, loin and leg cuts will be used for trimming and production of leaner cuts.

Key words: Fat score, fat trimming, primal cut composition, South African lamb

AN INVESTIGATION ON THE EFFECT OF THE SOUTH AFRICAN CARCASS CLASSIFICATION SYSTEM ON NGUNI CARCASS VALUE

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The classification system is a means of determining the economic- and consumer value of a carcass in the market place. The current system tends to discriminate against the smaller frame, early maturing local cattle breeds. The market is moving towards consumption of naturally produced, grass fed animals. However the current system discriminates against this practice and needs to be amended to allow for the shift in the consumer demand. Grass fed beef production also produce less greenhouse gasses which make it more acceptable as an environmentally friendly production system.

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