COMPARISON OF SLAUGHTER CHARACTERISTICS OF "S" AND "E" CLASS SLAUGHTER BULLS OF THE DOUBLE-MUSCLED BELGIAN BLUE BEEF BREED USING A COMMERCIAL CUTTING METHOD

Vergelijking van de slachtkarakteristieken van "S" en "E" geklasseerde Belgisch Witblauwe dikbilstieren versneden op een commerciële manier

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ABSTRACT

According to the SEUROP carcass classification system, double-muscled slaughter bulls of the Belgian Blue beef breed (DM-BBB) are usually classified either as "E" or as "S" carcasses. The large differences in price paid on the market for these two types cannot be explained on the basis of differences in carcass lean meat content resulting from standard dissection methods. In this study, commercial dissection was applied to evaluate the differences between "S" and "E" carcasses. It was concluded that the differences in the proportion of high and low quality meat could not explain the large price differentials. Other factors than carcass composition (size and shape of cuts, meat quality traits) are thus involved.

SAMENVATTING

Het overgrote deel van de karkassen van Belgisch Witblauwe dikbilstieren krijgt de graad "S" of "E" (SEUROP – classificatie) toebedeeld. Afhankelijk van de classificatie worden er verschillende verkoopprijzen voor deze twee typen gehanteerd. Het mager vlees aandeel, bepaald met behulp van een standaard versnijding, kan het prijsverschil tussen deze twee klassen niet verklaren. De commerciële versnijdingsmethode die in deze studie werd toegepast, biedt evenmin een verklaring voor deze verschillen. Blijkbaar spelen bijkomende factoren, zoals de grootte en de vorm van de commerciële stukken en een verschil in vleeskwaliteit, een rol in de prijsvorming.

INTRODUCTION

Because of the large demand for high quality carcasses, the double-muscled (DM) Belgian Blue Beef breed (BBB) is by far the most successful beef breed in Belgium (Hanset, 1984). According to the SEUROP classification system for conformation (Anonymous, 1991), DM-BBB carcasses are usually classified either as "E" or as "S". An "S" carcass is an exceptionally double-muscled carcass. This class has been included in the European bovine carcass classification system, chiefly to allow proper classification and differentiation of the typical DM-BBB carcasses. "E" carcasses are also considered to be double-muscled, but not extremely. There is little doubt that both types of carcasses are the result of homozygosity for the muscular hypertrophy (mh) mutation at the myostatin locus (Van de Voorde *et al.*, 1999).

Within the DM-BBB, there is genetic variance in the degree of meatiness. This may be due to independent loci and modifier genes (both minor genes) of the mh/mh (major gene) genotype (Hanset and Michaux, 1985). Because homozygosity for the major gene already exists, selection for improved muscular conformation is done by focusing on the minor genes (Georges *et al.*, 1990; Hanset, 1996). It is reported that muscularity in the breed is still increasing (Hanset *et al.*, 2001).

Different methods involving different dissection or cutting procedures exist to estimate the amount of muscle, fat and bone in a carcass. Purchas *et al.* (2002), Michaux *et al.* (1983) and Shahin (1995) dissected carcasses anatomically. Approximation of whole carcass dissection for estimating carcass composition has been done using a one rib cut (Uytterhaegen *et al.*, 1994; Van de Voorde *et al.*, 1999), a three rib cut (Arthur *et al.*, 1989) or a wholesale rib cut dissection (Casas *et al.*, 2000). Commercial cutting procedures can also be used (Herring *et al.*, 1994). Estimation of carcass composition is done in a large number of studies to evaluate the effects of various genetic or environmental (e.g. dietary) factors, e.g. to compare double-muscled cattle with conventional types (Uytterhaegen *et al.*, 1994; Purchas *et al.*, 2002) or to examine sex differences for muscle size and shape (Shahin, 1995).

The prices paid for “S” animals in December 2003 were 2.63 to 3.30 euros/ kg live weight, while 2.26 to 2.80 euros/kg live weight were paid for “E” animals (Boer en Tuinder, 2003). For a live weight of 650 kg, this makes a price difference ranging from 240.50 to 325 euros between an “S” and an “E” animal.

Using a standard dissection procedure, De Smet *et al.* (1999) could not establish why there is such a difference in price/kg. Cutting carcasses commercially and comparing the relative amounts of retail cuts, lean meat content and slaughter offal between “S” and “E” carcasses may provide more information. In this study, a commercial cutting on “S” and “E” carcasses was done. The aim of this article is to see whether this commercial cutting could be used as a tool to find significant differences between “S” and “E” carcasses that could explain the large price differentials.

MATERIALS AND METHODS

Animals

All the bulls (20) involved in this study were of the DM-BBB breed. They had a full DM-BBB pedigree and were therefore assumed to be homozygous for the mh allele. All had been raised and fattened on the same farm and were separately slaughtered over a one-year period.

Collection of raw data

All the bulls were weighed using a balance (live weight (LW)), and four body dimensions were recorded using a measuring rod and tape: withers height (WH); shoulder width (SW), which is the distance between the broadest points of the shoulder; the width of the hind quarters (BcW), which is the distance between the broadest points of the hind quarters; and the heart girth (HG), which is measured right behind the shoulders and is half of the heart girth following the muscles on the thorax and then multiplying by two. The weighing and measuring was done the moment the bulls were fattened and left the farm for slaughtering. All the bulls were transported to the same EU approved slaughterhouse after a 12-hour period of food deprivation. Transportation time was approximately 30 minutes. The bulls were immediately killed following arrival. Age at slaughter was exactly known.

After slaughter, all carcasses were weighed (warm carcass weight; WCW) and classified within a time lapse of 30 minutes. The visual appraisal of muscular conformation and fat cover of the carcasses was done by the experienced inspector of the abattoir according to the SEUROP classification. The seurop classification regulations are described in the legislation of the European Community EEG – regulations (Anonymous, 1991; conformation class S = extreme muscularity to P = poor; fat class 1 = low fat covering to 5 = extreme fat). Fifteen bulls were classified “S” and five were classified “E”. Two “S” and two “E” carcasses belonged to fat cover class 1, while all the others were classified in fat cover class 2. All the carcasses were conventionally cooled in the same refrigerator. Seven days after slaughter, the cold carcass weight (CCW) was recorded.

The carcasses were transported to a commercial butchery and separated into lean meat, fat and connective tissue (= not fat; not lean meat and not bones), and bones. The lean meat portions were allocated to high quality meat (HQM = Σ retail cuts (RC) and low quality meat (LQM). The twelve retail cuts of premium meat quality that were retained are listed in Table 1 with their name and corresponding code. They were weighed separately. The low quality meat, being the amount of meat that is not of a high standard, mostly because of lower tenderness, was weighed together. The total amount of bones (B) was weighed, as was the amount of fat and connective tissue (F&C).

Calculated data

The dressing-out percentage (% retained) was calculated as WCW/LW * 100. The carcass weight loss following seven days of cooled storage equals 100 –

Table 1. Selection of the twelve premium quality retail cuts (according to Michaux *et al.* (1983), Hanset and Michaux (1985) and Van Hoof *(personal communication, 1998).*

Name of retail cut	Code	Anatomic Name
Striploin, Sirloin and Rib eye	1	Mm. spinalis et semispinalis dorsi/ M. Ilicostalis/ M. longissimus dorsi
Shoulder clod	2	Mm. triceps brachii caput longum et laterale
Chuck tender	3	M. supraspinatus
Blade cover	4	M. subscapularis
Blade	5	M. infraspinatus/ M. deltoideus/ M. teres minor
Tenderloin	6	M. psoas minor/ M. psoas major/ M. Iliacus
Rump	7	M. gluteus medius/ M. gluteus profundus
Goose skirt	8	M. tensor fasciae latae
Inside round	9	M. sartorius/ M. gracilis/ M. adductor femoris/ M. semimembranosus/ M. pectineus
Thick flank	10	M. vastus lateralis/ M. vastus medialis/ M. rectus femoris
Eye of round	11	M. semitendinosus
Outside round	12	M. biceps femoris

(CCW/WCW * 100). The weights of all retail cuts together equal the weight of the high quality meat (HQM). The total lean meat content (LMC) is the sum of HQM + LQM. The weight of the retail cuts separately (RC) and together (HQM), the weight of the LQM, LMC, bones (B), fat and connective tissue (F&C) were divided by the warm carcass weight (WCW) to express them as relative carcass proportions (%). The warm carcass weight was used because it is more standardized than the cold carcass weight.

Statistical analysis

SPSS 11.0 for Windows was used to explore and analyze the raw data (LW, age, WH, SW, BcW, HG, WCW, CCW) and the calculated data (% retained, B%, F&C%, WL%, RC1% → RC12%, LQM%, HQM%, LMC%). An independent sample t-test was used to compare the mean values of the “S” and the “E” groups. No age or weight correction was done because the mean values did not differ significantly between the two groups.

RESULTS AND DISCUSSION

In Table 2 minimum, maximum and mean values of all traits are listed for both groups. The mean weight, age and body measurements are highest for the “S” group. All the means of the calculated parameters except RC1% → RC6% are in favor of the “S” bulls. However, none of the differences in mean values were significant, probably because of the large variability within the groups and the relatively low number of animals in this study.

The aim of this limited study was to find out whether the findings from a commercial cutting method would provide an explanation for the large differences in price paid per kg of carcass weight between “S” and “E” carcasses. For the commercial cutting method, as presented here, some non-significant differences were found between “S” and “E” carcasses (in favor of the “S” bulls) for lean meat content percentage, low and high quality meat content, dressing-out percentage, some retail cut percentages, and bone, fat and connective tissue percentages. The small mean differences in low (+ 1.6 %) and high (+ 0.2) quality meat content justify a price difference on average of 0.113 (selling price of 5.5 (low) to 12.89 (high) euros per kg; [((0,2 * 12,89) + (1,6 * 5,5))/100]) euros per kg live weight in favor of the “S” bulls, but this cannot explain the large price differences per kg LW (0.37 to 0.50 euro per kg live weight) that exist in commercial practice between

Table 2. Characteristics of the fifteen "S" and five "E" double-muscled Belgian Blue Beef slaughter bulls.

Trait	"S" (15)				"E" (5)			
	Min.	Max.	Mean	s.e.	Min.	Max.	Mean	s.e.
Age (days)	435	820	597	27.9	426	584	497	27.3
LW (kg)	492	880	671	30.3	405	720	571	51.1
WH (cm)	106	137	126	1.9	106	133	120	4.3
SW (cm)	62	75	69.9	1.0	61	73	67	2.0
BcW (cm)	60	71	66	0.8	61	67	63.8	1.0
HG (cm)	202	270	228	5.0	190	232	213.6	6.9
WCW (kg)	339	630	469.8	22.5	277	494	395.2	35.4
CCW (kg)	330	614	458	21.9	270	479	383.5	33.9
% Retained	68.4	73.5	69.8	0.3	68.4	69.6	69.1	0.2
WL%	1.3	2.9	2.4	0.1	2.3	3.0	2.8	0.1
B%	9.3	13.7	12.0	0.3	11.4	14.0	12.7	0.4
F&C%	3.3	8.8	6.0	0.4	4.5	8.1	6.7	0.6
RC1%	4.9	7.8	6.3	0.2	5.6	7.3	6.4	0.3
RC2%	1.3	2.7	2.2	0.1	2.1	2.5	2.3	0.1
RC3%	0.8	1.2	0.9	0.02	0.7	1.1	0.9	0.06
RC4%	0.7	1.2	0.9	0.02	0.8	1.0	0.9	0.04
RC5%	0.5	1.5	1.0	0.05	0.8	1.3	1.0	0.08
RC6%	1.6	2.4	1.9	0.05	1.8	2.4	2.0	0.09
RC7%	2.0	2.9	2.4	0.06	2.4	2.9	2.6	0.08
RC8%	0.8	1.3	1.0	0.03	0.9	1.3	1.1	0.06
RC9%	5.0	7.2	6.0	0.1	5.2	6.2	5.8	0.1
RC10%	3.0	4.2	3.6	0.1	3.2	3.8	3.5	0.1
RC11%	2.1	3.0	2.5	0.1	2.1	2.6	2.5	0.1
RC12%	4.4	5.8	4.9	0.1	3.5	5.0	4.4	0.2
HQM%	30.5	37.8	33.9	0.5	30.8	35.1	33.7	0.7
LQM%	42.1	50.7	45.6	0.7	42.4	45.6	44.0	0.6
LMC%	76	85.6	79.5	0.7	76.3	79.9	77.7	0.6

s.e. = standard error; LW = live weight; WH = withers height; SW = shoulder width; BcW = width of the hind quarters; HG = hearth girth; WCW = warm carcass weight; CCW = cold carcass weight; % retained = dressing out-percentage = ratio of warm carcass weight to live weight; WL% = ratio of weight loss to warm carcass weight over a period of seven days; B% = ratio of carcass bone weight to warm carcass weight; F&C% = ratio of fat and connective tissue weight to warm carcass weight; RC% = ratio of carcass retail cut weight to warm carcass weight; HQM% = ratio of high quality meat weight (Σ (1-12)) to warm carcass weight; LQM% = ratio of low quality meat weight to warm carcass weight; LMC% = ratio of carcass lean meat (= HQM + LQM = CCW – weight of (bone + fat & connective tissue)) to warm carcass weight.

these two classes. Hence, other factors than carcass lean meat and fat content must be involved, resulting in a higher value of the commercial cuts. This is probably related to the size and shape of the retail cuts. Measuring and describing the size and shape of the retail cuts or a more detailed, standardized commercial cutting, whereby steaks of premium, second and third quality and low quality meat sorted according to different price classes, are weighed together with bones, fat and connective tissue, may therefore be considered. When planning such detailed commercial cutting, standardization may prove to be very difficult, but it will be necessary. A butcher adapts his refined cutting in accordance with the requests of his customers. Another factor involved may be the time budget and ease of cutting carcasses. Therefore, additional measures of dissection efficiency are needed.

The results indicate that the variation for lean meat content in the "S" group is quite high compared to the variation within the "E" group. Although not enough animals are present in this study to allow a correct estimate of the variability, the variation in the "S" group is sufficiently high to consider additional classes in this group. This may justify classification of carcasses using subclasses such as S^-, S^0 and S^+ in forthcoming studies, as is already being done in some abattoirs and as provided in the SEUROP classification method (Anonymous, 1991).

CONCLUSION

The large differences that exist in price per kg between "S" and "E" carcasses cannot be explained on the basis either of the commercial cutting method presented in this study or of the standard dissection procedure of De Smet *et al.* (1999).

Future studies that undertake to explain why large differences in price per kg exist between "S" and "E" carcasses in the Belgian Blue breed must take cutting efficiency into consideration and must evaluate the shape and size of the retail cuts using measurements or using a detailed commercial cutting method. Future studies should also use more animals and subclasses, and they should strive for equal distribution over all subclasses. Because of the need for standardization, the possibility of using only slaughter bulls with the same fat coverage and of doing the commercial cutting under research conditions rather than in a commercial environment should be considered.

REFERENCES

Anonymous (1991). Council regulation (EEC) N° 1026/91 of 22 April 1991 amending Regulation (EEC) N° 1208/81 determining the Community scale for the classification of carcasses of adult bovine animals. *Community legislation in force, Document 391R1026*, pp. 1-2.

Arthur, P.F., Makarechian, M., Price, M.A., Berg R.T. (1989). Carcass characteristics of yearling normal and double muscle cross bulls. *Canadian Journal of Animal Science 69*, 897-903.

Boer en Tuinder. (2003). Markten. *Boer en Tuinder 19 dec. 03,* p. 15.

Casas, E., Schakelford, S.D., Keele, J.W., Stone, R.T., Kappes, S.M., Koohmaraie, T. (2000). Quantitative trait loci affecting growth and carcass composition of cattle segregating alternate forms of myostatin. *Journal of Animal Science 78*, 560-569.

De Smet, S., Van de Voorde, G., Seynaeve, M. (1999). Practical experience of carcass classification in Belgium. Proceedings of the European Experts Colloquium on Grading & Classification, pp. 18-22. Ed. K. Khodabandehloo. AFTS, England.

Georges, M., Lathrop, M., Hilbert, P., Marcotte, A., Schwers, A., Swillens, S., Roupain J., Bouquet, Y., Vassart, G., Hanset, R. (1990). Etude du gène "mh" (muscular hypertrophy) par génétique inverse. *Nouvelles de la Science et des Technologies 8*, 47.

Hanset, R. (1984). Selection Animale et Civilisation. *In Génétique et Production Animale,* I 1-I 24, *Belgische Franqui-leerstoel, Rijksuniversiteit Gent, Faculteit Diergeneeskunde (editor).*

Hanset, R., Michaux, C. (1985). On the genetic determinism of muscular hypertrophy in the Belgian White and Blue cattle breed. I. experimental data. *Genetics, Selection, Evolution 17*, 359-368.

Hanset, R. (1996). Le Blanc – Blue Belge face à la nouvelle donnée économique. *Agribex 1996, Journée sectorielle, Bovins à viande,* pp. 1-25.

Hanset, R. , de Tillesse, S. , André, E., Marchand, E. (2001). Genetic parameters and trends in the Belgian Blue cattle breed. *In. Van der Honing, Y., Hofer, A., Crovetto, G.M., Madec, F., Kemp, B., Lazzaroni, C., Bodin, L., Fernandez, J.A. and Bruns, E.W. (editors). Book of Abstracts of the 52nd Annual Meeting of the European Association for Animal Production, Budapest 26-29 August 2001,* p 39 (abstr.).

Herring, W.O., Williams, S.E., Bertrand, J.K., Benyshek, L.L., Miller, D.C. (1994). Comparison of Live and Carcass Equations Predicting Percentage of Cutability, Retail Product Weight, and Trimmable Fat in Beef Cattle. *Journal of Animal Science 71*, 1107-1118.

Michaux, C., Stasse, A., Sonnet, R., Leroy, P., Hanset, R. (1983). La composition de la carcasse de taureaux culards blanc-blue belge. *Annales de Médecine Vétérinaire 127*, 349-375.

Purchas, R.W., Fisher, A.V., Price, M.A., Berg, R.T. (2002). Relationship between beef carcass shape and muscle to bone ratio. *Meat Science 61*, 329-337.

Shahin, K.A. (1995). Sex differences in muscle topography and its relationship to muscularity in Double Muscled cattle. *Livestock Production Science 43*, 1-13.
Uytterhaegen, L., Claeys, E., Demeyer, D., Lippens, M., Fiems, LO., Boucqué, CY, Van De Voorde, G., Bastiaens, A. (1994). Effects of double muscling on carcass quality, beef tenderness and myofibrillar protein degradation in Belgian Blue White Bulls. *Meat Science 38*, 255-267.
Van de Voorde, G., De Smet, S., Seynaeve, M., Demeyer, D. (1999). Relationship between SEUROP conformation and fat grade and composition of carcasses of Belgian Blue slaughter bulls. *50th Meeting European Association of Animal Production, Zürich*, pp. 1-5.

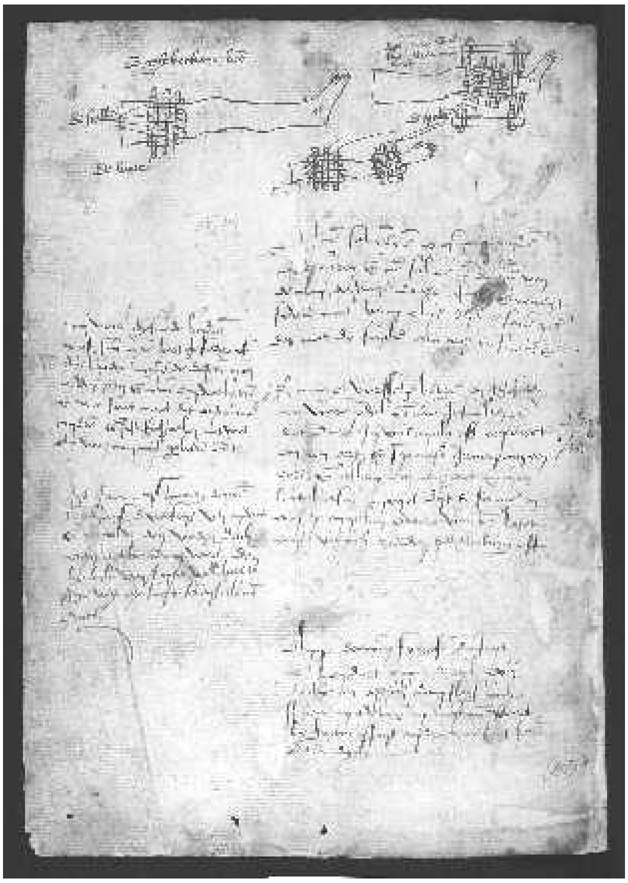
Uit het verleden

JEHAN YPERMAN

Omstreeks 1850 zijn handschriften ontdekt van Jan Yperman. Zijn geboortedatum is niet bekend, maar men neemt wel aan dat hij getrouwd is in 1285 en gestorven in 1351. Hij was werkzaam in Ieper, onder andere in het Belle godshuis (heden een intiem museum in de Rijselsestraat).

Ypermans "*Cyrurgie*" werd geschreven in het Vlaams ten behoeve van zijn zoon, hoewel Yperman zelf goed Latijn kende: "*en dair om maecte hi diet in vlaemscher talen om dat hij begeerde dat syn soen profiteerde dair mede ende hem bleve van syne leerling"*. Zijn handschrift blijkt het eerste boek te zijn in de Nederlandse taal over geneeskunde in het Nederlandse taalgebied.

Het handschrift bevindt zich in de universiteitsbibliotheek van Gent onder het catalogusnummer 1273 van de oude manuscripten. Het bestaat uit 328 bladzijden met telkens twee handgeschreven kolommen. Het geschrift oogt mooi, maar is moeilijk of niet te lezen voor de leek. Hier en daar zijn enkele tekeningetjes aangebracht (zie Figuur: splintverbanden voor fracturen). De tekst wordt verder wat levendiger gemaakt met rode letters voor titels of accenten.



In zijn chirurgische methodes, waarvan enkele volledig origineel, onder andere de arterieligatuur, toont Yperman zich een ware meester in het vak. Hij blijkt zich zelfs te hebben gewaagd aan schedelchirurgie. Yperman was veel meer dan enkel een compilator of een slaafse pronker met andermans veren. Hij bezat een uitgebreide kennis, kritische zin en vooral een nuchter oordeel. Hij vond ook dat de chirurg niet roekeloos mocht te werk gaan op de kap van de patiënt. Hij streefde ernaar om een heelkundige kunstenaar te zijn: *"pint u altoes om een cleine lixeme (litteken) te maken"*. De veredeling van het beroep ging hem zeer ter harte: kwakzalverij en bijgeloof konden gebrek aan kennis niet goedmaken.

Mocht Jan Yperman hebben geschreven in het Latijn (het hedendaagse Engels), dan had hij vanzelfsprekend een belangrijkere impact gehad op de toenmalige heelkundige praktijken. Toch werd zijn werk in de loop der eeuwen verscheidene keren gekopieerd en mag hij terecht de vader van de Vlaamse heelkunde genoemd worden.

F. Verschooten

BRONNEN

Elaut L. (1941). Jehan Yperman. Uit:100 Grote Vlamingen, Standaard Boekhandel, Antwerpen, 47-49.
Tricot J.P. (1990). Jehan Yperman. Vader der Vlaamse Heelkunde. Uit: Van Hee, R. (Ed.). *In de voetsporen van Yperman*. Heelkunde in Vlaanderen, Gemeentekrediet, Brussel, 78-85, 295-298 etc.