Characteristics and challenges of the modern Belgian veal industry

Kenmerken en uitdagingen van de moderne Belgische vleeskalversector

[1]B. Pardon, [2]B. Catry, [3]R. Boone, [4]H. Theys, [5]K. De Bleecker, [6]J. Dewulf, [1]P. Deprez

[1] Department of Large Animal Internal Medicine, Faculty of Veterinary Medicine, Ghent University, Salisburylaan 133, 9820 Merelbeke, Belgium
[2] Healthcare Associated Infections and Antimicrobial Resistance, Scientific Institute of Public Health, J. Wytsmanstraat 14, 1050 Brussels, Belgium
[3] Dierenkliniek Venhei, Geelsebaan 95-97, 2460 Kasterlee, Belgium
[4] Vilatca N.V., Kalverstraat 1, 2440 Geel, Belgium
[5] Animal Health Service-Flanders, Industrielaan 29, 8820 Torhout, Belgium
[6] Veterinary Epidemiology Unit, Department of Reproduction, Obstetrics and Herd Health, Faculty of Veterinary Medicine, Ghent University, Salisburylaan 133, 9820 Merelbeke, Belgium

bart.pardon@UGent.be

ABSTRACT

In this paper, the modern Belgian veal industry is situated in a European context, and an overview is provided of the major past, present and future challenges for veal production. The production of white veal requires a specific diet and housing conditions to assure a controlled iron anemic state resulting in pale carcasses. In response to the increasing public concern about animal welfare, legal limits for hemoglobin (in 1990), the provision of a minimum quality of solid feed to assure ruminal health and group housing from the age of eight weeks on (in 2007), have been implemented sector-wide. The integrated structure of the sector likely made it possible to realize these radical changes at relatively short notice. Despite the pioneers role the veal industry played in the development of quality labels for food safety and all efforts made towards improved nutrition and housing, the veal production remains highly liable to public criticism on welfare issues. Nowadays, especially the intensive antimicrobial use in relation to high levels of antimicrobial resistance in commensal, pathogenic and zoonotic bacteria in veal calves is strongly criticized. The future challenge lies in the development of veal production systems, which require only few antibiotics, but safeguard animal welfare and revenue.

SAMENVATTING

In dit artikel wordt de Belgische vleeskalversector gesitueerd binnen Europa en wordt een overzicht gegeven van de belangrijkste vroegere, hedendaagse en toekomstige uitdagingen voor de sector. Om blank kalfsvlees te produceren, dienen de dieren in een gecontroleerde anemische toestand gehouden te worden, hetgeen een specifieke voeding en huisvesting vraagt. Als reactie op de toegenomen maatschappelijke bezorgdheid inzake het welzijn van vleeskalveren werden een wettelijk minimumgehalte voor hemoglobine (in 1990), een minimum hoeveelheid vast voedsel om een betere pensontwikkeling te stimuleren en groepshuisvesting vanaf de leeftijd van acht weken (in 2007) geïmplementeerd. De geïntegreerde structuur van de sector heeft er vermoedelijk mede voor gezorgd dat al deze doorgedreven wijzigingen in een relatief beperkte periode konden doorgevoerd worden. Ondanks de voortrekkersrol die de vleeskalversector heeft gespeeld met betrekking tot het oprichten van kwaliteitslabels en ondanks alle inspanningen voor een betere huisvesting en voeding, blijft de sector onderhevig aan maatschappelijke kritiek. Tegenwoordig worden vooral het intensieve antibioticumgebruik en de hiermee geassocieerde hoge resistentieniveaus van commensale, pathogene en zoönotische bacteriën bij vleeskalveren sterk bekritiseerd. De toekomstige uitdaging ligt dan ook in de ontwikkeling van een vleeskalversector die slechts een beperkte hoeveelheid antibiotica nodig heeft en terzelfdertijd dierenwelzijn en inkomen veilig stelt.

INTRODUCTION

The veal industry is mainly an important side market of the dairy industry. Because its basic resources are (male) calves and milk replacer, it plays a major regulating role in the dairy and meat industries worldwide (Sans and De Fontguyon, 2009). Despite this economic importance, only a minority is familiar with this type of cattle production due to the closed structure of this industry. Contemporary veal production has specific characteristics, highly different from dairy or traditional beef production. Partly because of the low employment rate in this industry and partly because of the rather negative public opinion of the past decades, the present public perception of the veal industry still does not match reality. For example, it is often still believed that veal calves are housed in small wooden crates and are only fed milk, causing severe anemia in these animals. In the last decades however, substantial changes to the management of veal calves have been made, all driven by an urge to improve animal welfare. At present, the veal industry, together with other intensive livestock farming systems, is strongly criticized for its intensive antimicrobial use. A realistic image of the contemporary veal industry seems absolutely necessary for all persons involved in this ongoing discussion about responsible antimicrobial use in livestock, in order to develop a more sustainable veal production in Belgium in the near future.

Therefore, in this article, background information is provided on the veal production in Belgium and in Europe, and an overview of the main challenges of contemporary veal production is given.

THE VEAL INDUSTRY

The veal industry worldwide

In the industrialized world, veal meat is a high quality product, which has highly appreciated nutritional values, such as a favorable amino acid profile, low fat content and tenderness. It is marketed worldwide and is generally more expensive than beef, pork or poultry. In 2008, the European veal consumption stood at 1.6 kg per capita per year with the largest consumer being France (4.1 kg per capita per year) and Italy (3.5 kg year) (Sans and De Fontguyon, 2009). In the European Union (EU), veal is defined as meat from calves aged between 0 and 8 months of age. Since 2008, three distinct 'veal definitions' are applicable in Europe (Regulation EC 566/2008). 1. White veal (milk-fed or special fed veal) is white in color (1-10 points on the European color scale) and must be younger than eight months old at slaughter. White veal is the traditional form of veal production and still holds the largest proportion of the European veal industry. 2. Rosé veal (red, grain-fed or non-formula-fed) also originates from calves younger than eight months old, but is slightly more red (11-14 points) due to a different diet. 3. Meat from bovines aged between 8 and 12 months is locally marketed under different denominations, such as beef (United Kingdom), older rosé veal (Ireland, the Netherlands), ternera (Spain) or 'jeune bovin' (France) (Brown and Claxton, 2011).

Of the global veal production in 2010, 82% was produced in Europe. In 2008, the European veal production stood at 5.8 million calves, or 806-000 tons of carcass weight (Sans and De Fontguyon, 2009). The main producing countries were France (27%), the Netherlands (25%) and Italy (16%) (Brown and Claxton, 2011). The Belgian veal industry nowadays accounts for 6% of the global production, similarly to Germany (5%) (Brown and Claxton, 2011). The veal production in other European countries is limited, as in Switzerland (Bähler et al., 2010), or restricted for welfare concerns in Scandinavian countries. Outside the EU, veal is also produced in the United States (Indiana, Michigan, New York, Ohio, Pennsylvania and Wisconsin) (6% of the global production), Canada (4%), Australia (4%) and New Zealand (3%) (Brown and Claxton, 2011). In these countries, also bobby calves, which are slaughtered within a week after birth, are produced. In Australia and New Zealand, it is the main form of veal production (Cave et al., 2005). In Europe, bobby veal production is presently at low scale in Bulgaria and Romania (Sans and De Fontguyon, 2009).

Worldwide, the white veal industry is characterized by a high degree of integration, whereas the rosé industry is still privately owned (Derks et al., 2005). In order to provide all these veal herds with calves within a limited time frame, in an all-in/all-out production system, there is a complex network of calf purchase, transport and sorting within each country and often expands internationally. Calves originating from multiple herds, are collected by a local tradesman (mostly only a few calves per herd at once) and transported to a sorting center, owned by an integration or a larger tradesman. Here, the calves are sorted according to breed, bodyweight and conformation, after which they are transported to the fattening herd. The typical diet of white veal is an all-liquid diet of milk powder. Skimmed milk powder is used, but the protein (casein) component is frequently replaced by cheaper whey or vegetable (soy, pea, etc.) proteins. The latter product without any animal proteins is referred to as 'nil product'. The milk powder composition can highly differ over time, and the milk diet is often adapted to the breed that is used within a certain production system. In most farms, milk is initially distributed to the calves by bucket and by drinking trough in the group housing phase. Alternatively, automatic milk distributors are used in calves housed in pens of 15 to 70 animals (Sans and De Fontguyon, 2009). In addition to the milk diet, concentrates and roughage are provided.

The Belgian veal industry

Around the year 1900, male calves were traditionally slaughtered as bobby calves shortly after birth. The veal industry in Belgium started in the regions around Antwerp in close contact with the Dutch veal industry. In these regions, the soil consists predominantly out of sand, which is of minor agricultural quality, directing agriculture towards livestock farming. Together with a growing dairy industry, an excess of male calves became available. Soon, many producers fattened a number of calves in individual boxes with exclusively excess of cow's milk, producing white veal, which was already in those days expensive meat reserved for special occasions. With the invention of skimmed milk powder in the Netherlands in 1955, the Belgian sector experienced a revolutionary change in the trace of the Dutch sector towards a more industrialized veal production system (Derks et al., 2005). By 1960, veal production had already become the main activity of several farms in the Netherlands (Derks et al., 2005).

Belgium has approximately 2,4 million cattle and 36,666 cattle farms (LARA, 2010; SANITEL, 2012). Of these, 154,098 are veal calves (Truyen, 2011). The exact number of veal herds in Belgium has only recently been determined at 286, of which 96.4% is situated in Flanders (Truyen, 2011). Over 70% of the Flemish veal industry is situated in the province of Antwerp (Figure 1). Limburg, West-Flanders, Flemish Brabant and East-Flanders account for 13, 10, 5 and 2% of the herds in Flanders, respectively (SANITEL, 2012). The mean herd size is 569 calves, and 92% of the herds hold more than 200 calves (SANITEL, 2012; Truyen, 2011). Belgium produces almost exclusively white veal in three production types, which are based on breed. In most herds, dairy calves (red and black Holstein-Friesian (HF) (60%)) are raised, but also purebred double muscled Belgian blue (BB (15%)) calves and crossbreds (predominantly HF x BB (25%)) are raised. Raising BB veal calves is more difficult given the significantly higher mortality rate in this breed than in HF and crossbreds (Pardon et al., 2012a). As in the whole of Europe, the sector is highly integrated in Belgium. There are three main integrators in Belgium with their own milk powder plants and slaughterhouses. Additionally, there are another five smaller integrators, predominantly specialized in the BB segment. In 2006, 300,036 Belgian veal calves were slaughtered, which accounted for 36.6% of the

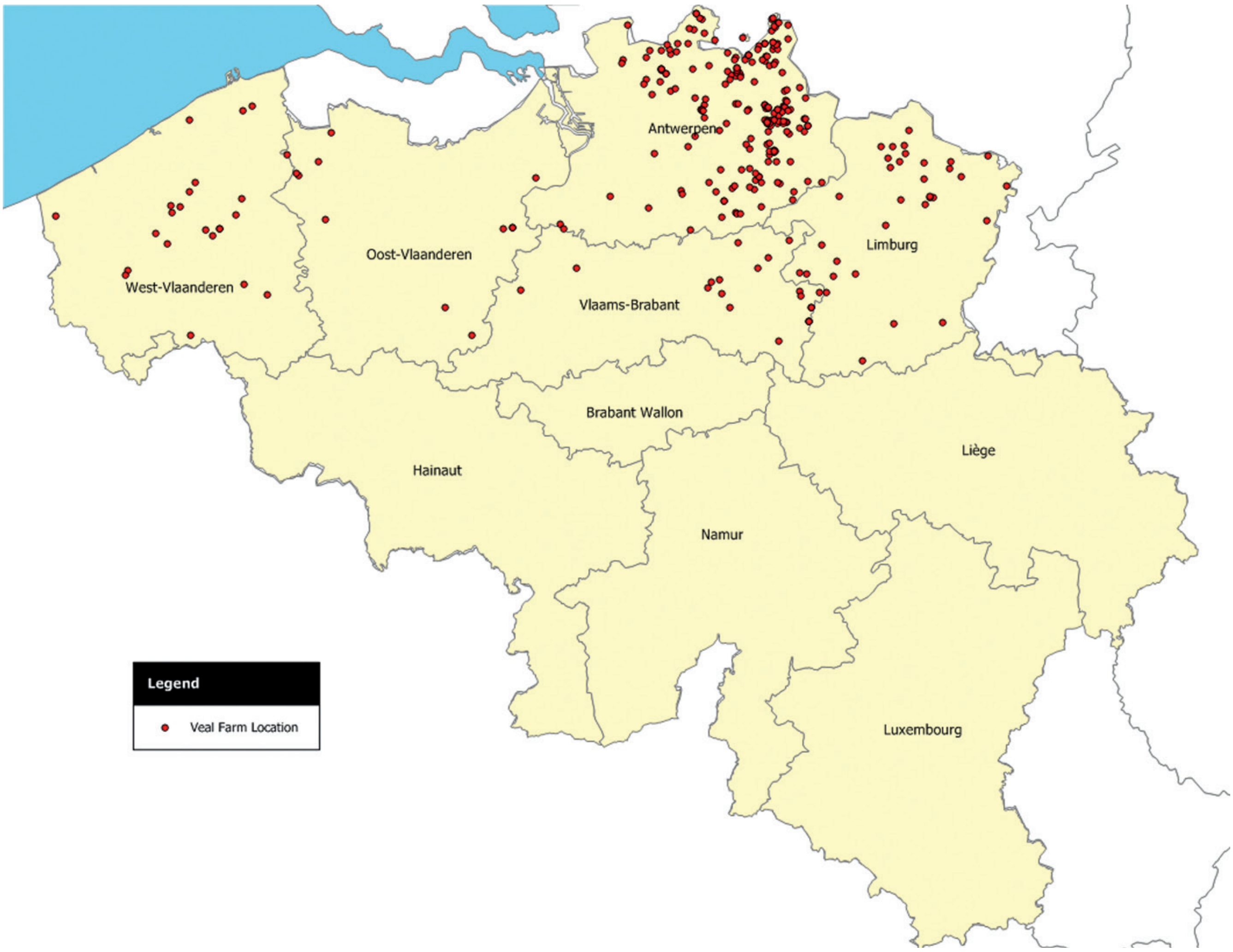

Figure 1. Distribution of veal herds in Flanders in 2009 (SANITEL-2009) (Figure design: E. Ducheyne).

total number of cattle slaughtered in Belgium in that year (Campers et al., 2008). This number gradually increased and reached 321,882 calves in 2010. The heavier BB calves are destined to the domestic market, whereas the lighter calves are exported. In recent years, the Belgian veal consumption has been on the decrease, and stood at 4.1% of the meat consumption per inhabitant in 2010 (VLAM, 2010). In 2010, 39.456 tons of carcass weight were exported, predominantly to Italy (38.8%), France (22.9%) and Germany (14.7%) (Truyen, 2011). The turnover of the Belgian veal industry is estimated at 600 million euro annually (Truyen, 2011). The Belgian veal industry provides approximately 500 jobs in the veal herds, 400 in milk powder factories and slaughter houses and another 1.500 as indirect services (transport, veterinarians and retail) (Truyen, 2011). The three main Belgian integrators are united in the Belgian Society for Veal Producers (BVK- beroepsvereniging voor de kalfsvleessector), which introduced the Belgian Controlled Veal Label (BCV-1996) as a horizontal quality assurance system. At present, 98.9% of the Belgian veal production is produced under the BCV label (Truyen, 2011). Compliance with the label is certified and controlled by an independent external agency.

Past, present and future challenges of the veal industry

The primary consumer demand for white veal is the pale color of the meat. As a consequence, meat color is one of the principal price setters for white veal carcasses. To obtain white meat, veal calves are maintained under specific housing conditions (no access to soil or conventional roughage) and are fed specific milk diets to ensure low iron intake. Besides these challenges for veal production, the public opinion criticizes white veal management and is concerned about the influence that low iron (Fe) levels might have on behavior, welfare and drug use (Wilson et al., 1995). Consequently, the veal industry has been subjected to constant changes in its attempt to maintain the production of high quality veal under changing consumer demands. The next paragraphs provide an overview of the evolution of nutrition and housing in the veal industry in regard to animal welfare. Additionally, the issue of antimicrobial consumption and resistance, which is nowadays the main challenge for the veal industry as is the case in other intensive livestock farming systems, is briefly touched upon.

Animal welfare and the all-liquid diet

The first public remarks on animal welfare in the veal industry date from the 1960's (Derks et al., 2005). The lack of freedom to move, the iron deficiency anemia and the all-liquid diet without any provision of solid feed, which prevents calves from ruminating, were the main issues addressed. Signs of decreased animal welfare are high levels of abnormal behavior (stereotypy), such as tongue playing, cross-sucking (urine drinking), sucking on the feed trough or coat licking (Bokkers and Koene, 2001). In veal calves, the high incidence of abomasal ulcerations at slaughter has also been regarded as a sign of reduced animal welfare, since abomasal ulcers are associated with acute and chronic stress or unsuitable feeding strategies (Welchman and Baust, 1987; Wiepkema, 1987; Bähler et al., 2010; Brscic et al., 2011).

A large portion of the animal welfare issues on white veal, as perceived by the public, has been blamed on the artificial iron anemic state under which the animals are raised. Both the diet and housing conditions necessary to obtain this iron anemia and the potential health consequences are criticized. The red color of meat and blood is caused by the Fe containing proteins myoglobin and hemoglobin (Hb), respectively. By reducing Fe in feed, Hb reduces and carcasses become paler, without affecting other veal performance and carcass traits (Wilson et al., 1995). However, meat color is affected by much more factors, since Hb only accounts for one third of the variation in visual color score, which makes obtaining the correct meat color a constant challenge for veal producers (Wilson et al., 1995). Hb has been shown to be a better indicator of carcass color than plasma Fe (Wensing et al., 1986; Miltenburg et al., 1992a). Normal Hb levels for calves range from 4.9 to 9.3 mmol/L, whereas levels between 4.3 and 4.9 mmol/L are considered marginally anemic (Schwartz, 1990; Wilson et al., 1995). In Belgium, the objectives are 7.7-8.0 mmol/L in the first weeks of production and 4.9-6.0 mmol/L shortly before slaughter (Personal communication, R. Boone). The principal physiological effect of iron deficiency anemia is reduced appetite, occurring when dietary levels drop below 15 ppm (Webster et al., 1975). A further decrease in iron levels is associated with an impaired immune function, resulting in more severe consequences of infection (pneumonia), decreased growth performance and an increased feed/gain ratio (Gygax et al., 1993). To meet the European public opinion, dietary Fe intake in veal calves has been increased and bound to legal prescriptions (minimum of 4.5 mmol Hb/L (EC Directives 91/629/EC and 97/2/EC)). In fact, feed efficiency even increases without affecting carcass quality when extra iron is supplemented from week 6 on (Miltenburg et al., 1992b). Nowadays, most integrations monitor the Hb status several times per production cycle to assure correct carcass color and compliance with European regulations.

Additionally, a minimum daily uptake of solid feed of 250 grams starting from the age of 8 weeks is now compulsory (Council directives 91/629/EC and 97/2/EC). It was speculated that the provision of solid feed would reduce the quantity of milk powder uptake, hereby reducing growth and carcass quality, but this did not occur. Several solid feeds have been tested for their suitability for veal calves. Carcass color is not affected by wheat straw, despite its high Fe content, due to low bioavailability, whereas for example dried beet pulp evokes too red carcasses (Cozzi et al., 2002). Additionally, wheat straw reduces the number of hairballs in the rumen, which is a proxy for abnormal licking behavior (Cozzi et al., 2002). Also abnormal behavior and the time in contact with the feeding trough are decreased in calves provided wheat straw, whereas cross sucking and cortisol curves are not influenced (Mattiello et al., 2002). Unfortunately, the provision of wheat straw increases the number of abomasal erosions at slaughter. Recently, it has been shown that especially large amounts of cereal grain are associated with hyperkeratinization and plaque formation in the rumen and abomasal ulceration (Brscic et al., 2011; Prevedello et al., 2012). The creation of a solid feed that improves calves' behavior while maintaining performance and reducing gastro-intestinal damage, remains a challenge (Mattiello et al., 2002). Reducing the volume of milk provided and increasing the concentration have historically been associated with a reduction in the number of abomasal ulcerations, but this needs confirmation under contemporary diet conditions (Welchman and Baust, 1987). Recent work, which evaluated the partial replacement of milk powder by solid feed (mixtures of maize, barley straw and concentrates), showed that providing more solid feed not only resulted in early rumen development and better feed utilization, but also in less abomasal scars (Berends et al., 2012). Another study also showed that the partial replacement of milk powder by low-protein solid feed improved N retention for protein gain, especially in the last weeks of fattening (Berends et al., 2013). These benefits of the generally cheaper solid feed diets and the ability to keep the carcasses pale on these diets, substantially increased their use in the veal industry at present, making that the European recommendations on solid feed provision are easily met and exceeded. Providing drinking water next to the milk diet is not necessary for health reasons, but plays a role in environmental enrichment. Calves consume almost all of the water provided and non-nutritive oral behavior is reduced during production (Gottardo et al., 2002). However, provision of ad libitum water is not advisable as it leads to compulsive drinking (Gottardo et al., 2002). Nowadays, on several veal farms in Flanders, drinking nipples are available especially in hospital pens.

Animal welfare and housing

The historical rearing system of white veal calves in individual wooden boxes (crates) has been strongly criticized because of poor welfare (Van Putten, 1982; Broom, 1991). In response, several European directives have been implemented, guaranteeing minimum space requirements (European directives 91/629/EC and 97/2/EC; KB 23 January 1998). Since 2007, group housing for veal calves have become obligatory in the European Union. In the United States, individual housing is still allowed, but also criticized. Five states already have bans, and a complete ban has been advised since 2017 (Brown and Claxton, 2011). In Europe, calves can still be housed in individual boxes in the first 8 weeks of life (Figure 2). These so-called 'babyboxes' are installed in the group housing pen and have fenced lateral partitions allowing social contact with neighboring calves. They have proven to reduce the risk of respiratory disease by 52% in the first 3 weeks after arrival (Brscic et al., 2012).

At the age of 8 weeks and for the remaining of the production cycle, group housing is obligatory with a minimum surface area of 1.8 m^2 per calf (Figure 3). The most common group housing system applied in Europe is housing on slatted floors in small pens of 4-8 animals. Predominantly in France, calves are raised in larger groups (30-60 calves) and fed by automatic milk delivery devices. In addition, there are several systems, which implement additional animal welfare standards, in the Netherlands (Peter's farm) and Switzerland (naturafarm) (Bokkers and Koene, 2001; Bähler, 2009a, b). The additional welfare claimed in the Peter's farm system is the fact that calves are housed in larger groups (35 to 60 calves)

Figure 2. Individually housed veal calves in 'babyboxes' on slatted floors during the first six weeks of production.

Figure 3. Group housing of 26-weeks-old Holstein Friesian veal calves in a one compartment stable.

with automatic feed delivery devices, which allows them to move and eat as they desire. Additional environmental enrichment devices, such as toy balls, are provided (Bokkers and Koene, 2001). The floor type, the surface area per calf, the purchase policy and the stable climate are not different from traditional veal housing. In Switzerland, driven by a consumer demand for more animal-friendly production, the retailer Coop initiated a veal farming program (naturafarm), which meets standards exceeding current animal welfare regulations (Bähler et al., 2009a,b, 2010). This includes minimizing transportation time to a maximum of 6 hours, a minimum arrival age of 21 days, at least 3,5 m^2 surface area per calf, permanent free access to an outdoor pen and to fresh water and roughage ad libitum.

From a welfare perspective, group housing turns out to be preferable over individual housing allowing social interaction, explorative behavior and more comfortable resting positions (Le Neindre, 1993; Stull and McDonough, 1994; Andrighetto et al., 1999; Bokkers and Koene, 2001; Babu et al., 2004). However, tongue rolling is only significantly reduced in group housing compared with the smallest individual housing system (0.55 m x 1.50 m) and not when compared with larger boxes (1.10 m x 1.50 m) (Le Neindre, 1993). Licking behavior is even increased in group housing compared with the smallest crates (Le Neindre, 1993). Especially the problems of cross sucking (prepuce (urine drinkers), ears, skin, …) and licking of the environment are more pronounced in group housing systems (Le Neindre, 1993; Babu et al., 2004). In group housing, cross sucking accounts for 1% of the observed time in a period of 24 hours, whereas abnormal oral behavior in total accounts for 21% (Plath et al., 1998). Production results (average daily gain, feed efficiency and dressing percentage) are similar in individual and group housed calves (Andrighetto et al., 1999; Bokkers and Koene, 2001). Calves in group housing under Peter's farm conditions show less oral behavior, less self-grooming, lie down more, and have less hair balls in the rumen than in individual or conventional group housing, all of which point towards a somewhat improved welfare in the first 6 weeks of production (Bokkers and Koene, 2001). Also the naturafarm system likely creates better animal welfare conditions, since the odds for fundic ulcers is 4.8 times higher in conventional veal farming than in the naturafarm (Bähler et al., 2010). In that study, automatic feeding systems reduced the risk of fundic ulcers (Bähler et al., 2010). Contradictory, other researchers found the highest amount of abnormal sucking activities in herds with automatic delivery devices (Plath et al., 1998). Moreover, in other production systems, the use of automatic feeder delivery devices is associated with an increased morbidity risk (Maatje et al., 1993; Lundborg et al., 2003; Svensson et al., 2003; Svensson and Liberg, 2006). It is clear that the ideal veal calf housing system, compromising between performance and animal welfare, still needs to be determined.

Antimicrobial consumption and resistance

In recent years, the occurrence of high levels of (multi)resistance, compared to conventional cattle, in pathogenic (*Pasteurellaceae*), commensal indicator bacteria (*Escherichia coli*) and zoonotic agents in samples from veal calves has been worrying the general public (Catry et al., 2005; Cook et al., 2011; Di Labio et al., 2007; MARAN-2012). The detection of livestock-associated methicillin resistant *Staphylococcus aureus* (LA-MRSA) in 88% of the Dutch veal farms and in 72% and 33% of the Dutch and Belgian veal farmers, respectively, has initiated a public discussion in Western Europe, because of zoonotic concerns (Graveland et al., 2010; Vandendriessche et al., 2013). The probability of being a persistent LA-MRSA carrier highly depends on livestock animal contact, and a study showed that 17% (34/199) of veal farm visits resulted in (transient) MRSA acquisition (Graveland et al., 2011; van Cleef et al., 2011; Vandendriessche et al., 2013). Next to LA-MRSA, especially extended spectrum beta lactamases (ESBL's), enzymes, which render *Enterobacteriaceae* resistant to the critically important third and fourth generation cephalosporins, are off concern (Smet et al., 2010). ESBL's were initially a poultry issue, but recent work has shown a marked increase of ESBL genes in fecal samples from Dutch (4 to 39% between 1998 and 2011) and French (29.4% in 2012) veal calves (Hordijk et al., 2013; Haenni et al., 2014). ESBL spread is particularly hard to control, since the corresponding genes are located on plasmids, which facilitates spread to other bacterial species, including zoonotic bacteria (Smet et al., 2010). The same ESBL carrying plasmids have been found in fecal samples from humans and veal calves (Madec et al., 2012). Also, in other important zoonotic agents, such as enterohemorrhagic and verotoxigenic *Escherichia coli*, *Salmonella spp.* and *Clostridium difficile*, multiresistance has been demonstrated in veal isolates (McDonough et al., 1999; Carlson et al., 2002; Bardiau et al., 2010; Zidaric et al., 2012).

With the systematic collection of national antimicrobial consumption data in recent years, the abundant antimicrobial use in the veal industry has become clear (Pardon et al., 2012b; Bos et al., 2013). In the Netherlands (2011) and Belgium (2008-2010), the average veal calf has been treated with, respectively, 28.6 and 61.0 defined daily doses (DDD_{veal}) of antimicrobials per year, compared to 5.8 DDD_{cattle} per year in dairy cattle (MARAN-2009, 2011; Pardon et al., 2012b). For years, practitioners have relied on the empiric installment of oral group antimicrobial treatments in milk and seemed reasonably able to keep mortality rates acceptably low (Pardon et al., 2012b; MARAN-2012, 2013). Today, the emergence and importance of antimicrobial resistance are of a never seen greater concern from an animal and public health point of view. Given the current organization of the industry, which implies commingling of neonatal, recently transported calves at high stocking densities, reduction of antimicrobial use forms a huge challenge. Recent experiences in the Netherlands have shown that it is possible even in the high risk situation of veal calves, to drastically reduce antimicrobial use within a few years (MARAN-2012, 2013).The main reason is most likely that antimicrobial use is more driven by socio-economic factors, merely habits, than by diagnostic evidence (van der Fels-Klerx et al., 2011). However, attention should be paid to the technical and ethical limits of this reduction, since both the economic benefit of veal production and animal welfare need to be safeguarded. Details on how a rational reduction in antimicrobial use can be achieved are not within the scope of the present article, but can be found in another publication (Pardon, 2012).

CONCLUSION

The veal industry still holds a central position in the expanding European markets for male calves and milk powders. Thanks to the high degree of integration, the industry has played a pioneers role in assuring optimal food safety, as documented by the early installment of a quality label. Nowadays, the increasing distance between the life of the European consumer and the reality of farming practices, creates a constant societal concern on animal welfare and a demand for sustainable and environmentally friendly production. Despite a swift adaptation to several new laws on feeding and housing and despite extra efforts by the sector, contemporary veal production remains vulnerable to public criticism. To ensure their market, the veal industry will have to keep on addressing these consumers issues. Nowadays, especially the urgently wanted reduction in antimicrobial use forms a huge challenge to the industry.

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REFERENCES

Andrighetto I., Gottardo F., Andreoli D., Cozzi G. (1999). Effect of type of housing on veal calf growth performance, behaviour and meat quality. *Livestock Production Science 57*, 137-145.

Babu L.K., Pandey H.N., Sahoo A. (2004). Effect of individual versus group rearing on ethological and physiological responses of crossbred calves. *Applied Animal Behaviour Science 87*, 177-191.

Bähler C. (2009a). COOP Naturafarm calf - approach, antibiotic use, feeding, market conditions. *Praktischer Tierarzt 90*, 768-769.

Bähler C. (2009b). Coop Naturafarm calf - transport and stalling of fattening calves in Switzerland. *Praktischer Tierarzt 90*, 576-+.

Bähler C., Regula G., Stoffel M.H., Steiner A., von Rotz A. (2010). Effects of the two production programs 'Naturafarm' and 'conventional' on the prevalence of non-perforating abomasal lesions in Swiss veal calves at slaughter. *Research in Veterinary Science 88*, 352-360.

Bardiau M., Muylaert A., Duprez J.N., Labrozzo S., Mainil J.G. (2010). Prevalence, molecular typing, and antibiotic sensitivity of enteropathogenic, enterohaemorrhagic, and verotoxigenic *Escherichia coli* isolated from veal calves. *Tijdschrift voor Diergeneeskunde 135*, 554-558.

Berends H., van Reenen C.G., Stockhofe-Zurwieden N., Gerrits W.J. (2012a). Effects of early rumen development and solid feed composition on growth performance and abomasal health in veal calves. *Journal of Dairy Science 95*, 3190-3199.

Berends H., van den Borne J.J., Alferink S.J., van Reenen C.G., Bokkers E.A., Gerrits W.J. (2012b). Low-protein solid feed improves the utilization of milk replacer for protein gain in veal calves. *Journal of Dairy Science 95*, 6654-6664.

Bokkers E.A.M., Koene P. (2001). Activity, oral behaviour and slaughter data as welfare indicators in veal calves: a comparison of three housing systems. *Applied Animal Behaviour Science 75*, 1-15.

Broom D.M. (1991). Needs and welfare of housed calves. EAAP, Lelystadt, the Netherlands.

Brown R., Claxton R. (2011). Global veal market overview presentation. In: *Proceedings of the 5th International Veal Conference*. 19-20 May, Noordwijk aan Zee, the Netherlands.

Brscic M., Heutinck L.F., Wolthuis-Fillerup M., Stockhofe N., Engel B., Visser E.K., Gottardo F., Bokkers E.A., Lensink B.J., Cozzi G., Van Reenen C.G. (2011). Prevalence of gastrointestinal disorders recorded at postmortem inspection in white veal calves and associated risk factors. *Journal of Dairy Science 94*, 853-863.

Brscic M., Leruste H., Heutinck L.F., Bokkers E.A., Wolthuis-Fillerup M., Stockhofe N., Gottardo F., Lensink B.J., Cozzi G., Van Reenen C.G. (2012). Prevalence of respiratory disorders in veal calves and potential risk factors. *Journal of Dairy Science 95*, 2753-2764.

Campers V., Van Gijseghem D., Van Bogaert T. (2008). Sectoranalyse van de vleesveehouderij in Vlaanderen. Departement Landbouw en Visserij, afdeling Monitoring en Studie, Brussels, Belgium. *http://lv.vlaanderen.be/nlapps/data/docattachments/rundveesector.pdf.* Accessed 5 April 2012.

Carlson S.A., Stoffregen W.C., Bolin S.R. (2002). Abomasitis associated with multiple antibiotic resistant *Salmonella enterica* serotype *Typhimurium* phagetype DT104. *Veterinary Microbiology 85*, 233-240.

Catry B., Haesebrouck F., Vliegher S, Feyen B., Vanrobaeys M., Opsomer G., Schwarz S., Kruif A. (2005). Variability in acquired resistance of *Pasteurella* and *Mannheimia* isolates from the nasopharynx of calves, with particular reference to different herd types. *Microbial Drug Resistance 11*, 387-394.

Cave J.G., Callinan A.P., Woonton W.K. (2005). Mortalities in bobby calves associated with long distance transport. *Australian Veterinary Journal 83*, 82-84.

Cook A., Reid-Smith R.J., Irwin R.J., McEwen S.A., Young V., Butt K., Ribble C. (2011). Antimicrobial resistance in *Escherichia coli* isolated from retail milk-fed veal meat from Southern Ontario, Canada. *Journal of Food Protection 74*, 1328-1333.

Cozzi G., Gottardo F., Mattiello S., Canali E., Scanziani E., Verga M., Andrighetto I. (2002). The provision of solid feeds to veal calves. I. Growth performance, forestomach development, and carcass and meat quality. *Journal of Animal Science 80*, 357-366.

Derks T., Kramer S., Loseman B., Ottink-Orriëns A. (2005). Nuchtere noodzaak. 25 jaar belangenbehartiging met hart voor de sector. Giethoorn ten Brink, Meppel, the Netherlands.

Di Labio E., Regula G., Steiner A., Miserez R., Thomann A., Ledergerber U. (2007). Antimicrobial resistance in bacteria from Swiss veal calves at slaughter. *Zoonoses and Public Health 54*, 344-352.

Gottardo F., Mattiello S., Cozzi G., Canali E., Scanziani E., Ravarotto L., Ferrante V., Verga M., Andrighetto I. (2002). The provision of drinking water to veal calves for welfare purposes. *Journal of Animal Science 80*, 2362-2372.

Graveland H., Wagenaar J.A., Heesterbeek H., Mevius D., van Duijkeren E., Heederik D. (2010). Methicillin resistant *Staphylococcus aureus* ST398 in veal calf farming: human MRSA carriage related with animal antimicrobial usage and farm hygiene. *PloS One 5*, e10990.

Gygax M., Hirni H., Zwahlen R., Lazary S., Blum J.W. (1993). Immune functions of veal calves fed low amounts of iron. *Zentralblatt für Veterinarmedizin. Reihe A 40*, 345-358.

Haenni M., Chätre P., Métayer V., Bour M., Signol E., Madec J.Y., Gay E. (2014). Comparative prevalence and characterisation of ESBL-producing Enterobacteriaceae in dominant versus subdominant enteric flora in veal calves at slaughterhouse, France. *Veterinary Microbiology*, *http://dx.doi.org/10.1016/j.vetmic.2014.02.023*

Hordijk J., Wagenaar J.A., van de Giessen A., Dierikx C., van Essen-Zandbergen A., Veldman K., Kant A., Mevius D. (2013). Increasing prevalence and diversity of ESBL/AmpC-type beta-lactamase genes in *Escherichia coli* isolated from veal calves from 1997 to 2010. *Journal of Antimicrobial Chemotherapy 68*, 1970-1973.

LARA (2010). *Landbouwrapport 2010*. Brussels, Belgium, pp. 209-234.

Le Neindre P. (1993). Evaluating housing systems for veal calves. *Journal of Animal Science 71*, 1345-1354.

Lundborg G.K., Oltenacu P.A., Maizon D.O., Svensson E.C., Liberg P.G.A. (2003). Dam-related effects on heart girth at birth, morbidity and growth rate from birth to 90 days of age in Swedish dairy calves. *Preventive Veterinary Medicine 60*, 175-190.

Maatje K., Verhoeff J., Kremer W.D., Cruijsen A.L., van den Ingh T.S. (1993). Automated feeding of milk replacer and health control of group-housed veal calves. *The Veterinary Record 133*, 266-270.

Madec J.Y., Poirel L., Saras E., Gourguechon A., Girlich D., Nordmann P., Haenni M. (2012). Non-ST131 *Escherichia coli* from cattle harbouring human-like bla(CTX-M-15)-carrying plasmids. *Journal of Antimicrobial Chemotherapy 67*, 578-581.

MARAN (2012, 2013). *Monitoring of Antimicrobial Resistance and Antibiotic Usage in Animals in the Netherlands*. Mevius, D.J., Koene M.G.J., Wit B., van Pelt, W., Bondt N. (Editors), Lelystad, the Netherlands. *http://www.wageningenur.nl/nl/Publicatie-details.htm?publicationId=publication-way-343330383332* Accessed 4 February 2014.

Mattiello S., Canali E., Ferrante V., Caniatti M., Gottardo F., Cozzi G., Andrighetto I., Verga M. (2002). The provision of solid feeds to veal calves. II. Behavior, physiology, and abomasal damage. *Journal of Animal Science 80*, 367-375.

McDonough P.L., Fogelman D., Shin S.J., Brunner M.A., Lein D.H. (1999). *Salmonella enterica* serotype *Dublin* infection: an emerging infectious disease for the northeastern United States. *Journal of Clinical Microbiology 37*, 2418-2427.

Miltenburg G.A.J., Wensing T., Smulders F.J.M., Breukink H.J. (1992a). Relationship between blood hemoglobin, plasma and tissue iron, muscle heme pigment, and carcass color of veal. *Journal of Animal Science 70*, 2766-2772.

Miltenburg G.A.J., Wensing T., Vandebroek J., Mevius D.J., Breukink H.J. (1992b). Effects of different iron contents in the milk replacer on the development of iron-deficiency anemia in veal calves. *Veterinary Quarterly 14*, 18-21.

Overdevest I., Willemsen I., Rijnsburger M., Eustace A., Xu L., Hawkey P., Heck M., Savelkoul P., Vandenbroucke-Grauls C., van der Zwaluw K., Huijsdens X., Kluytmans J. (2011). Extended-spectrum beta-lactamase genes of *Escherichia coli* in chicken meat and humans, the Netherlands. *Emerging Infectious Diseases 17*, 1216-1222.

Pardon B. (2012). Morbidity, mortality and drug use in white veal calves with emphasis on respiratory disease. *PhD. Thesis*, Ghent University, pp. 316.

Pardon B., De Bleecker K., Hostens M., Callens J., Dewulf J., Deprez P. (2012a). Longitudinal study on morbidity and mortality in white veal calves in Belgium. *BMC Veterinary Research 8*, 26.

Pardon B., Catry B., Dewulf J., Persoons D., Hostens M., De Bleecker K., Deprez P. (2012b). Prospective study on quantitative and qualitative antimicrobial and anti-inflammatory drug use in white veal calves. *Journal of Antimicrobial Chemotherapy 67*, 1027-1038.

Plath U., Knierim U., Schmidt T., Buchenauer D., Hartung J. (1998). Group housing for two to eight week old fattening calves. *Deutsche Tierärztliche Wochenschrift 105*, 100-104.

Prevedello P., Brscic M., Schiavon E., Cozzi G., Gottardo F. (2012). Effects of the provision of large amounts of solid feeds to veal calves on growth and slaughter performance and infra-vitam and post-mortem welfare indicators. *Journal of Animal Science*, Doi: 10.2527/jas.2011-4666.

Sans P., De Fontguyon G. (2009). Veal calf industry economics. *Revue De Médecine Vétérinaire 160*, 420-424.

Schwartz A. (1990). The politics of formula-fed veal calf production. *Journal of the American Veterinary Medical Association 196*, 1578-1586.

Smet A., Martel A., Persoons D., Dewulf J., Heyndrickx M., Herman L., Haesebrouck F., Butaye P. (2010). Broad-spectrum beta-lactamases among *Enterobacteriaceae* of animal origin: molecular aspects, mobility and impact on public health. *Fems Microbiology Reviews 34*, 295-316.

Stull C.L., McDonough S.P. (1994). Multidisciplinary approach to evaluating welfare of veal calves in commercial facilities. *Journal of Animal Science 72*, 2518-2524.

Svensson C., Lundborg K., Emanuelson U., Olsson S.O. (2003). Morbidity in Swedish dairy calves from birth to 90 days of age and individual calf-level risk factors for infectious diseases. *Preventive Veterinary Medicine 58*, 179-197.

Svensson C., Liberg P. (2006). The effect of group size on

health and growth rate of Swedish dairy calves housed in pens with automatic milk-feeders. *Preventive Veterinary Medicine 73*, 43-53.
Truyen A. (2011). *Jaarrapport 2011*. Belgische Vereniging van de Kalverhouders.
van Cleef B.A., Graveland H., Haenen A.P., van de Giessen A.W., Heederik D., Wagenaar J.A., Kluytmans J.A. (2011). Persistence of livestock-associated methicillin-resistant *Staphylococcus aureus* in field workers after short-term occupational exposure to pigs and veal calves. *Journal of Clinical Microbiology 49*, 1030-1033.
Vandendriessche S., Vanderhaeghen W., Soares F.V., Hallin M., Catry B., Hermans K., Butaye P., Haesebrouck F., Struelens M.J., Denis O. (2013). Prevalence, risk factors and genetic diversity of methicillin-resistant *Staphylococcus aureus* carried by humans and animals across livestock production sectors. *Journal of Antimicrobial Chemotherapy 68*, 1510-1516.
van der Fels-Klerx H.J., Puister-Jansen L.F., van Asselt E.D., Burgers S.L. (2011). Farm factors associated with the use of antibiotics in pig production. *Journal of Animal Science. 89*, 1922-1929.
Van Putten G. (1982). Welfare in veal calf units. *The Veterinary Record 111*, 437-440.
Vlaams Centrum voor Agro- en Visserijmarketting (VLAM), 2010. Thuisverbruik 2010. *http://www.vlam.be/marketinformationdocument/files/Thuisverbruik2010.pdf*. Accessed 5 April 2012.
Webster A.J.F., Donnelly H., Brockway J.M., Smith J.S. (1975). Energy exchanges of veal calves fed a high-fat milk replacer diet containing different amounts of iron. *Animal Production 20*, 69-75.
Welchman D.D., Baust G.N. (1987). A survey of abomasal ulceration in veal calves. *The Veterinary Record 121*, 586-590.
Wensing T., Abdelrahim A.I., Schotman A.J.H. (1986). Some aspects of extra iron supply in veal calf fattening. *Veterinary Research Communications 10*, 283-296.
Wiepkema P.R. (1987). Developmental aspects of motivated behavior in domestic animals. *Journal of Animal Science 65*, 1220-1227.
Wilson L.L., Egan C.L., Henning W.R., Mills E.W., Drake T.R. (1995). Effects of live animal performance and hemoglobin level on special-fed veal carcass characteristics. *Meat Science 41*, 89-96.
Zidaric V., Pardon B., Dos Vultos T., Deprez P., Brouwer M.S., Roberts A.P., Henriques A.O., Rupnik M. (2012). Different antibiotic resistance and sporulation properties within multiclonal *Clostridium difficile* PCR ribotypes 078, 126, and 033 in a single calf farm. *Applied and Environmental Microbiology 78*, 8515-8522.

Uit het verleden

Waar ooit de facultaire mesthoop lag en nadien een moderne runderstal in hangarvorm verrees: nu nieuwbouw van de KTA (Koninklijk Techrnisch Atheneum) Lindenlei. De oude kliniekgebouwen werden gerestaureerd en zijn in gebruik door deze school. De oudere gebouwen aan het Casinoplein en aan de Coupure dichter bij de Rozemarijnbrug wachten nog op restauratie en herbestemming.

Luc Devriese

Gent - aan de Coupure, hoek Theresianenstraat - anno 2012.