# Piglet castration and alternatives to castration

Around 80% of male piglets in the EU are castrated (EFSA, 2004), equating to approximately 100 million piglets each year, mostly without anaesthetics or analgesics (Fedriksen et al., 2009). The primary reason for castrating male piglets is to reduce boar taint (Prunier et al., 2005), although important secondary benefits include reduced aggression and sexual behaviours such as mounting, that increase with the onset of puberty in entire males (Zamaratskaia et al., 2009). Aggression and sexual behaviours increase the risks of injury to pigs, such as fight lesions and lameness (Fabrega et al., 2010; Rydhmer et al., 2010) and thus convey a reduction in welfare (FVE, 2009). There are also associated increased risks to stockpeople.

## Rearing pre-pubertal pigs for slaughter

In the UK and Ireland and to some extent Spain, Portugal and Greece, pigs are reared to slaughter weights of around 110kg, or to an age before sexual maturity is reached (Fredriksen et al., 2009). This renders castration unnecessary as the aggressive sexual behaviours and the chemicals primarily responsible for boar taint do not present themselves in high levels until the peri- and post-pubertal period (Dunshea et al., 2001). Some aggressive and sexual behaviour may still be present in these pigs, but mitigation strategies against such behaviours can be put in place, and are discussed later.

## Rearing large pigs for slaughter

In many countries, preferred cuts of meat require pigs to be reared to greater slaughter weights (120kg+ – post-puberty). For some continental meats such as Parma ham, a higher fat content is required which can only be achieved through rearing males to at least 140kg (Consortium of Parma Ham, 2011). This brings with it problems of increased risk of boar taint and aggressive and sexual behaviours, which pose legitimate welfare concerns; the rearing of these males intact may not always be appropriate and alternatives have to be sought.

## Surgical Castration

Surgical castration is painful (Hay et al., 2003; Prunier et al., 2006; Leidig et al., 2009; von Borell et al., 2009) and the Federation of Veterinarians of Europe (FVE) recommends that '*As soon as possible, the practice of castrating piglets should be phased out*'. Research shows piglets respond to surgical castration with specific vocalisations (Puppe et al., 2005; Leidig et al., 2009; von Borell et al., 2009) and behaviours (Hay et al., 2003) indicative of pain. In the hours following castration, piglets may be more inactive and show reduced activity at the udder, whilst behaviours such as trembling, huddling, scratching at the rump and stiffness may last for days (Hay et al., 2003; Moya et al., 2008). Physiological indicators of stress, such as increased levels of the hormones cortisol, adrenocortiocotropic hormone (ACTH) and lactate, also take place following castration (Prunier et al., 2005).

## Mitigating the pain and stress of castration

Where '*surgical castration cannot be avoided*' (Prunier et al., 2005), the pain and stress experienced during surgical castration can be minimised through the use of analgesics and local or general

anaesthetics (EFSA, 2004; Prunier et al., 2005; Prunier et al., 2006). However, the added cost and time associated with administration means these options are rarely considered (Fredriksen et al., 2009).

There is some debate as to the effectiveness of many anaesthetics as they may add additional stress to the procedure through increased handling (Leidig et al., 2009) as well as pain or unfavourable reaction arising from the anaesthetic itself (von Borell et al., 2009). Carbon dioxide when used as an anaesthetic is known to result in rapid loss of consciousness, yet is highly aversive to piglets; an experience that lasts until loss of consciousness (Rodriguez et al., 2008). Isoflurane is an effective anaesthetic, but does not appear to suppress pain (Giersing et al., 2006).

EFSA in their 2004 report recommended that local anaesthetics plus analgesics should be used for piglet castration. The local anaesthetics lidocaine is considered effective, but needs to be injected directly into the testes, which may cause pain and stress. However, cardiovascular and EEG responses demonstrate that the injection is far less painful than castration without anaesthetic (Haga and Ranheim, 2005). Leidig et al (2009) found that procaine reduced the stress response to castration, but not completely, suggesting that local anaesthetics should be used in combination with analgesics to gain maximal effect.

The analgesics meloxicam and fluxinin have both been shown to reduce the behavioural and physiological indicators of pain and stress when applied pre-operatively (Langhoff et al., 2009; Keita et al., 2010). The benefits of such analgesic treatment are present at 4 hours post-castration (Langhoff et al., 2009; Keita et al., 2010), but have diminished at 24 hours (Keita et al., 2010). Analgesics can therefore mitigate some of the post-operative effects of castration, but only for a limited time and prolonged analgesic treatment should be sought (Prunier et al., 2005).

## Alternatives to Castration

'Alternatives to surgical castration can 'raise animal welfare of piglets significantly' (de Roest et al., 2009)

### Management and feeding strategies to reduce boar taint and aggression in entire males

Boar taint is primarily caused by the compounds androstenone, skatole and, to a lesser extent, indole. Skatole can be controlled to a large extent by keeping pigs clean and through dietary means (Giersing et al., 2006; Lungström and Zamaratskaia, 2006). Feeding raw potato starch reduces skatole levels in the fat and plasma of boars (Zamaratskaia et al, 2005), barrows (Claus et al., 2003) and livers of pigs (Zamaratskaia et al, 2006), and there has been some success with feeding high-fibre diets (Hansen et al., 2008). However, it is important to maintain nutritionally balanced diets that do not compromise the health and welfare of these animals. To keep pigs clean, they should have well drained pens with separate lying and dunging areas and bedding should be kept clean and dry. Giersing et al (2006) recommend providing pigs with showers to prevent them wallowing in excrement which can lead to skatole being absorbed through the skin.

Dominance and aggression are linked to higher levels of androstenone and in turn, high levels of fighting and aggression can increase levels of androstenone (Giersing et al., 2006). Pen design and management system should therefore aim to reduce aggressive encounters. Consideration should

be given to rearing entire males in birth-to-slaughter groups, avoiding mixing (even in transit and lairage) and providing them with greater resource (feed space, enrichment material and space) to reduce aggressive interactions.

## Detecting boar taint on the slaughterline

Estimates of tainted carcasses varies widely, but since the odour is only detected during cooking, the carcass can be used in heat-processed meats (such as cooked hams, luncheon meat and cooked sausages) and meats that are served cold (Squires, 2010) providing it can be isolated and removed off the slaughterline. Several methods exist to detect boar tainted carcasses on the slaughterline including sensory (human) and chemical/biochemical (sometimes automated) sorting methods, although there is currently no universally agreed method in the EU (EFSA, 2004).

A method of detecting skatole in backfat was developed in Denmark and used throughout the 1990s. It gave results in around 20 minutes and resulted in a carcass rejection rate of 4-6% (Stoier et al., 2010). However, some markets will not accept meat sorted only on the basis of skatole (Stoier et al., 2010), requiring a method detecting all three compounds (Schäfer et al., 2011) and at low concentrations (Wäckers et al., 2011). Human nose methods using trained panels can detect several compounds, but there are significant differences between method protocols (Haugen, 2009) and deviations in results (Heres et al, 2011; Haugen, 2009). Chromatographic and immunological methods detect both skatole and androstenone but may show similar inconsistencies to sensory results (Haugen, 2009). Development of the automated 'electronic nose' is promising with results showing good sensitivity and correlation with human sensory panels (Lungstrom and Zamaratskaia, 2006), however, at present, these methods are costly, time consuming and may produce a high level of false negatives (Wäckers et al., 2011; Haugen, 2009). In future, automated detection methods may provide a reliable and efficient method of boar taint detection and may mitigate the need for castration altogether. However, until a reliable method that is acceptable across industries and markets is developed, other alternatives may have to be sought.

## Genetic selection against boar taint

Genetic selection against the two chemicals primarily responsible for boar taint, androstenone and skatole, could, according to Merks et al (2009) '*render castration unnecessary*'. Strong selection against androstenone and skatole has been estimated to result in the elimination of boar taint within only four generations (Merks et al., 2009) and several candidate genes have been identified (Squires and Schenkel, 2010). It is considered unlikely that such selection will affect production traits (Merks et al., 2009; Squires and Schenkel, 2010).

Whilst genetic selection would provide a favourable outcome in terms of meat quality, it is likely to be a longer term solution to the problem (Squires and Schenkel, 2010) estimated to take 5-10 years with today's technology (Backus et al., 2008). Mitigation strategies against aggression amongst males would also need to be employed.

## Rearing female only herds

Rearing only female herds would require ability to reliably sex boar semen in large volumes. Currently, the availability of sorted semen is too low for commercial pork production (von Borell et al., 2009) and whilst boar semen has been effectively sorted, frozen and thawed to give sufficient post-thaw sperm quality, difficulties have arisen when it comes to sustained pregnancy (Rath and

Johnson, 2008). There may also be increased risks of pain and discomfort for female pigs during insemination as a more invasive deep intrauterine insemination technique is required when using sexed semen compared with more traditional AI methods (Giersing et al., 2006).

## Improvac

Improvac is the brand name of the only current provider of a vaccine against the male hormone GnRH, which has recently been licensed in the EU. The vaccine allows heavy boars to be produced without the risk of boar taint (Dunshea et al., 2001) requiring two injections at least 4 weeks apart into the base of the ear to prevent teste development. The advantages of Improvac are similar to raising entire males up to the second injection - better weight gain, feed conversion and leaner carcasses (Morales et al., 2010). After the second injection, benefits are similar to those of rearing castrates - reduced aggression and sexual behaviours and a reduction in the risk of boar taint (Zamaratskaia et al., 2008; Baumgartner et al., 2010).

Research has shown that pigs given Improvac show less aggressive behaviour, mount their penmates less (Fabrega et al., 2010) and are without skin lesions when compared to entire males (Rydhmer et al., 2010), thereby offering a welfare advantage. Baumgartner et al. (2010) concluded in their study that '*From an animal welfare point of view GnRH [treatment] of male pigs is beneficial.....because it avoids pain and stress*' and '*does not increase behavioural problems in the fattening period*'.

The remaining concern for welfare surrounds stress or trauma arising from catching, restraining and injection. Correct handling minimises the stress associated with the procedure (Giersing et al., 2006), and since the Improvac injection is an aqueous preparation it produces little reaction at the site of injection (Dunshea et al., 2001); recent research showed an occurrence of inflammation in only 6% of treated pigs (Einarsson, 2006).

The quality of meat from Improvac pigs is no different to that of meat from either females or castrated males (Gispert et al., 2010; Morales et al., 2010) and there is better consumer acceptance of meat from Improvac than entire males (Font i Furnols et al., 2008). Whilst meat quality may be good, some consumers and producers may be concerned about potential health and safety issues surrounding the use of the injection (Van Beirendonck et al., 2010), although the real risks to human health and safety are minimal because a) the product has almost entirely disappeared from the pig before slaughter, b) it only works when injected into the bloodstream and c) a stockperson would need to accidentally inject themselves twice to render themselves infertile (Backus et al., 2008). A recent survey of Belgian consumers found that Improvac '*did not emerge as a problem in terms of consumer acceptance*' (Vanhonacker et al., 2009).

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