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**The effects of analgesia and local anaesthesia during castration of
male piglets**

DIPLOMA WORK

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1. Introduction

The castration of male pigs reared for meat production has been practiced for centuries. The reason for this is that the castrates develop a bigger fat deposit in their muscles and also a reduction of aggression and mounting behaviors towards fellow pen mates as well as handlers can be seen. Nowadays there is a bigger demand from the consumers for lean meat and this has led to the cessation of castration of male cattle and sheep in most countries. However with pigs the main reason for not keeping them entire is that mature males tend to develop boar-taint, an aversive odor and flavor of the meat as is mostly due to increased levels of skatole and androstenone.

Surgical castration of male pigs is not routinely practiced in some countries, such as Australia and the UK, and has been partially discontinued in Portugal, Ireland and Spain. However, in most countries, all males not kept for breeding are still castrated. Consequently, approximately 100 million pigs are castrated each year in the 25 EU countries, representing more than 80% of the EU male pig population and because of this vast majority the topic of pig welfare is very relevant and puts pressure on the producers to stop castration.

Usually, castration of male pigs is performed surgically by producers without anesthesia or post-operative analgesia. Because the testes and the scrotal skin are innervated with nociceptors, it is highly likely that it is a painful and a stressful event, although this pain can be reduced with the use of anesthetics and analgesics. Furthermore there are new alternatives to surgical castration such as immune-castration and chemical castration and these could possibly inflict less pain.

Castration practices of male piglets is a controversial topic among consumer groups and animal welfare organizations where the question still remains as to which procedure is the most humane and results in least pain and distress for the animal. In order to identify all the advantages and disadvantages of the different methods of castration, it is necessary to evaluate the pain associated with castration, in addition to the physiological, behavioral and health consequences that may result from castration and this is what we have been trying to do in our study. Our study measures blood cortisol levels as a pain response in groups of piglets that have received anesthetics and analgesics compared to a control group without administration of drugs. We also measured their body weight gain to see if this would change and if it this would indicate towards it being a consequence of the pain endured during castration procedure.

2. Survey of literature

2.1. Opinions about castration of consumers and farmers

An internet based study concerning consumers attitude about pig castration and alternatives was performed in Norway in 2011. It concluded that the Norwegian consumers accept the necessity of castration to secure meat quality and are happy with the practice of local anesthesia during surgical castration to reduce pain. Interestingly enough they did not ask for any alternatives and were skeptical about immune-castration, mainly because of risks of unknown residue in the meat and also the lack of research about the long term effects they could have. Castration without an anesthetic on the other hand was thought of as being completely unacceptable (Fredriksen et al. 2011).

When asking the farmers for their opinions, they seemed to differ from that of the consumers. A group of 160 Flemish farmers were asked about their attitude towards surgical castration with and without anesthesia, immune-castration, sperm sexing and the production of entire males. The survey concludes that their opinion was quite homogenous and ranked surgical castration without anesthesia as being the most profitable and effective against boar-taint and on the contrary raising of entire males as the least profitable, most labor costly and least effective. Sperm sexing was also perceived positively (Tuyttens et al. 2012).

It is interesting that these two groups seem to have completely opposite opinions when the farmers should take the opinions of the consumers into consideration to please the them as this would also be more economically beneficial for them. Hopefully shedding some light on the opinions and alternatives present will bring more understanding and better communication between the two groups.

2.2. Benefits of castration

2.2.1. Unwanted breeding

In order to produce good meat-producing offspring, parent animals with the best genetic conformation are mated, either naturally or through artificial insemination. Desirable traits include high growth rate and health and will result in a quickly attained slaughter weight. Up to today both large- and small-scale animal productions practice controlled breeding within the breeding group.

Another problem with keeping pigs for meat production is that they are generally slaughtered around the onset of puberty, being 6 months, and this could lead to unwanted mating within the breeding group. As prevention, all males not marked for further breeding can simply be castrated.

2.2.2. Reduced aggression and behavioral alterations

Aggressive behaviors are displayed more often in intact boars than in barrows (Cronin et al. 2003; Rydhmer et al. 2010) and can result in poorer well-being for fellow pen-mates. This increase in aggressive displays is linked to testosterone levels as similar outcomes were noted when plasma concentrations of testosterone were increased experimentally in prepubertal lambs (Ruiz-de-la-torre & Manteca, 1999). As sexual maturity approaches, an increase in mounting behavior in intact male pigs can also be seen (Cronin et al. 2003), which unfortunately can result in decreased health due to skin and leg injuries and decreased meat quality.

Another important aspect of aggression is that it makes handling of entire male individuals that much harder than castrated males or intact sows. However, newly castrated males can suffer from testosterone withdrawal making them transiently more irritable (Lincoln 2001) and precaution should be practiced when handling such groups of individuals.

2.2.3. Meat quality

One of the reasons that male animals are castrated is that they deposit more fat as a result of reduced testosterone levels (Manning & Serpell 1994) and this is considered to be a desirable trait. Paradoxically today there is a bigger demand from consumers for lean meat. Another and the main issue concerning pig meat is that the meat from entire males tend to develop so called boar-taint, an unpleasant odor which is mostly due to skatole and androstenone (Lundstrom et al. 2009) but this varies in different pig breeds and individuals. Interestingly enough the detection of this unpleasant meat taste was variable when human subjects were tested (Xue & Dial 1997).

However it is worth mentioning that skatole levels can be controlled through hygiene and dietary management (Giersing et al. 2006).

2.3. Castration methods and welfare consequences of surgical castration without analgesia

2.3.1. Methods of surgical castration

Surgical castration is performed on young piglets where they are restrained in different ways such as being suspended by the legs either by a stock person or in a special castration stand, being put in a v-trough or held by a person with one hand in between the legs while holding all four legs and being tilted downwards (Fredriksen et al. 2009). The scrotum is then incised either as most commonly in a vertical way but also horizontally approximately 2 cm in length. The testicles are then freed from surrounding tissues, extracted and then removed by severing of the spermatic cord (funiculus spermaticus). The way the cord is severed varies but is most commonly done by cutting with a sharp object such as a scalpel or pulling the actual testicle until the cord breaks (Fredriksen et al. 2009). Other methods include twisting the cords until they sever, cutting them with scissors or crushing them using instruments such as an emasculator. Pulling the testicles until the cords tear is prohibited in Europe (European Community, 2001 – Council Directive 2001/93/EC). Usually an antiseptic or antibiotic spray is applied in the open wound.

2.3.2. Welfare consequences of surgical castration without analgesia

Most commonly, surgical castration is performed without any analgesics or anesthetics. It is known that the scrotum and testes are innervated with nociceptors and that pain responses to the surgical intervention are decreased when local anesthetics are applied (White et al. 1995). Hence one can safely assume that the act of castration is very likely painful and will cause suffering and distress.

The study of pain and its responses is a very complex field and requires collection of relevant data of both behavioral changes as well as physiological.

When studying pain in pigs, behavior seems to be a more reliable indicator compared to physiological changes (Marchant-Forde et al. 2009). In one experiment five-day-old piglets were either surgically castrated so called sham-castrated or simply left undisturbed.

Behavioral observations were performed during 5 consecutive days and revealed that surgically castrated male piglets not only spent less time at the udder of the sow but also showed clear signs of pain through desynchronized behaviors compared to non castrated groups. Other behaviors in castrated males were huddling, restlessness, stiffness, rump scratching and tail wagging. Concerning tail wagging, this behavior was still increased compared to non castrated individuals even four days post surgery (Hay et al. 2003).

Vocalization appears to be a very useful behavioral indicator of pain and thus special attention to vocal responses of piglets during castration has been paid. Studies have shown that pain is linked to the frequency of the screams and that the higher the frequency is (>1000 hz), the more likely it is that this is an indicator of acute pain. These high pitched screams are produced more often during castration compared to control groups (Marx et al. 2003) and are produced most frequently during pulling and severing of the spermatic cord and also in groups castrated without anesthetics compared to groups given anesthetics (Taylor & Weary 2000; Marx et al. 2003) this again indicating that these two steps of the surgical castration are likely to be most painful.

Physiological measurements have also been proven to be useful as pain indicators where catecholamines, cortisol, heart rate and immune function are most commonly used. The tricky thing about these parameters is that they tend to increase not only to a pain response but also to general arousal and stress and hence can give misleading results. The results seem to vary and be contradictive when it comes to measuring cortisol. In some studies, cortisol release seems to depend on the length of the procedure and handling more than the actual pain inflicted through the castration procedure (Marchant-Forde et al. 2009). In another study (Hay et al. 2003) measured urinary cortisol and found minor differences in the level of castrated and non castrated groups of individuals. On the contrary (Llamas Moya et al. 2008) found an increase of cortisol levels for 2 hours in piglets post castration compared to sham-castrated piglets, even though pro-inflammatory cytokines and other acute phase proteins that were measured in the same study did not seem to correlate with pain. Furthermore (Prunier et al. 2005) found an increase in both plasma cortisol, adrenocorticotrophic hormone and lactate levels in castrated pigs.

2.4. Age and pain

Swine are typically castrated within the first weeks of life and it seems that there is a belief that the younger the piglet is, the less pain it will experience during castration. Within the European Union castration without anesthetics or analgesics must be performed within the first 7 days of life and if done after this day anesthetics and analgesics must be used (European Community, 2001 – Council Directive 2001/93/EC). In other parts of the world such as the United States of America there are no special regulations regarding age, only

recommendations laid down by the American Veterinary Association stating that castration should be performed during the first 14 days of life (AVMA, 2010.)

Interestingly enough studies that have tested this show that the pain experienced during castration does not seem to differ among age groups of younger or older individuals. One example of this is the study by (Taylor et al. (2001) where piglets were either surgically or sham-castrated at 3, 10 or 17 days of age and behavioral and especially vocal responses were measured to see if they would increase with age. The piglets in the groups that were actually castrated produced more high and low frequent screams compared to the sham-castrated ones. During the first few hours the castrated individuals showed behavioral signs of pain such as restlessness and unwillingness to lie down whereas older piglets tended to miss out on more feeding opportunities. However the effects of the induced pain castration inflicts, did not seem to vary in between age groups of castrated individuals in any of the measured aspects.

Additionally measurements of heart rate and also vocalization in the study by (White et al. (1995) at day 1, 2, 4, 8, 12 and 24 days concluded that piglets castrated without anesthetics showed more signs of stress in the age groups of 8 days old and above indicating. It should be noted that the authors discuss their results in terms of stress rather than pain.

In two other studies where body weight, cortisol levels and corticosteroid-binding globulin concentrations were measured, and it was stated that there was no significant difference between the age groups, but also found that there was no difference of cortisol levels in the blood plasma of actually castrated and sham-castrated piglets concluding that the data collected indicates that castration and the handling involved is stressful regardless of age (Carroll et al. 2006).

2.5. Anesthetics and analgesics effectiveness in reducing pain

In order to alleviate pain, castration can be performed under general or local anesthesia and analgesics can be given simultaneously. General anesthesia causes loss of mobility and nociception, whereas analgesics only cause loss of nociception.

General anesthetics present many problems such as the difficulties to practice it at a farm level but also the fact that this would be limited to veterinarian work only. Not only does the pig become hypothermic but also is drowsy for a period of time after the operation which leads to greater risk of getting crushed by the sow. In their study (McGlone & Hellman 1988)

showed that piglet mortality rates were as high as 28% when given a mix of xylazine, ketamine and guaifenesin and that desynchronized feeding behaviors could be observed for a few hours after the castration under sedation making piglets miss feeding bouts.

Gaseous anesthetics have also been tried in studies. Carbon dioxide and isoflurane have been tested in pigs. Carbon dioxide seemed not to alleviate pain and reactions could be seen from the pigs that underwent surgery, but the onset of unconsciousness was very fast which is a good, but the pulse became very slow and even could induce cardiac arrest and death in 25-40% when procedure was longer than 2-3 minutes and this raises concerns about the safety of the anesthetic (Gerritzen et al. 2008). It also did not seem to do much about the level of stress that the pig experienced during the castration plus that it is very aversive to mature pigs and only this causes even more stress and impair the welfare even more (Kohler et al. 1998).

Isoflurane has a smooth and fast induction in less than one minute. (Walker et al. (2004) found that adding nitrous oxide will make isoflurane more effective in induction and also reduce the signs of pain. However they found no difference in cortisol level in the groups tested with and without inhalational isoflurane. Even though inhalational anesthetics are good at alleviating pain, they present legal, safety and economical obstacles.

One alternative could be injecting a local anesthetic directly into the testes and even though the injection itself is probably painful it is not as painful as the castration it seems (Haga & Ranheim 2005). A couple of studies have shown that injecting a local anesthetic like procaine or lidocaine into the testes or into the scrotal skin reduces pain behaviors, mean heart rate as well as vocalization in castrated individuals compared to control groups (White et al. 1995; Leidig et al. 2009). Lidocaine injected either intrafunicularly or intratesticularly also lowered mean arterial pressure and EEG activity during castration (Haga & Ranheim 2005), as well as made piglets return to feeding activity faster after the castration procedure in 2 week old but not 7 week old piglets (McGlone & Hellman 1988). However lidocaine is a short acting anesthetic with duration of action of about 40 minutes and so it will not have an effect on the post operative pain. It should be noted that the use and application of the local anesthetics increases the handling time and hence does increase stress in the piglets.

Non steroidal anti-inflammatory drugs and opioid derivatives can help pain management. Most studies performed unfortunately point to that they have limited effects in alleviating pain during castration procedures of piglets. Examples of this is aspirin administered orally 30 minutes prior to castration was ineffective at decreasing pain induced behaviors, as was the

opioid derivative butorphanol given intravenously 30 minutes prior (McGlone & Hellman 1988). However administering meloxicam another non steroidal anti-inflammatory with a half-life of 20h prior to castration, while not seemingly effective during the procedure seemed to decrease some of the pain-related behaviors up to 4 hours after (Keita et al. 2010).

2.5.1. Implications with usage of anesthetics and analgesics in castration procedures

Several factors are making anesthetics drugs difficult to incorporate in everyday farming life and usage. As mentioned before toxicity imposes a problem example being that the level of lidocaine can easily be reached (6-10 mg/kg in piglets) (Prunier et al. 2006). Another practical problem is that few drugs are licensed for meat producing animals and can therefore not be used, examples are halothane and isoflurane. Furthermore metabolites of anesthetics such as lidocaine can be converted into potentially carcinogenic substances and this raises concerns in Europe as a food residue (Norwegian Scientific Committee for Food Safety 2005). Lastly the drugs used are a costly addition to regular costs involved in the castration procedure.

2.6. Alternatives to surgical castration

There are other options to surgical castration and these include; leaving the males intact, chemical castration or using immune-castration techniques.

2.6.1. Raising intact males

Raising of non-castrated males clearly improves their welfare in their early lives as they are not exposed to the pain inflicted during the act of castration. However the welfare could be impaired in later mature age as testosterone levels are linked to aggression and more fights and mounting behaviors can be observed in entire males compared to castrated ones (Cronin et al. 2003). Some countries such as the United Kingdom choose to raise intact males and solve the bore-taint problem by sending the hogs to slaughter when they have reached a weight of 75 kg, opposed to around 95 kg as done in Europe and North America. The boar-taint can also be reduced through genetic selection and through hygiene and nutrition as skatole is produced by fermentation of tryptophan in the gut (Jensen & Jensen 1995).

2.6.2. Chemical castration

The technique of chemical castration is the intra-testicular injection of a fluid into the testicle that will cause permanent damage (Prunier et al. 2006). Substances used are lactic acid, formaldehyde, silver salt or zinc salt. Obviously injecting any kind of fluid directly into the testicles will cause pain and distress, however if a less painful technique could be developed it would have many advantages. The skin would not have been incised leading to decreased hemorrhage and risk of infection. Up to date there are not enough studies made and therefore no conclusions can be made.

2.6.3. Immuno-castration

Lately scientists have developed a vaccine against reproductive hormones supposedly causing the testicles to shrink due to lack of stimulation of luteinizing hormone. The drug is called Improvac® (Pfizer Animal Health, New York, NY, U.S.A.) and is approved for use in 55 countries. The animal is immunized against gonadotropin releasing hormone just like against bacteria or viruses and the injection regime is two subcutaneous injections at least 4 weeks apart. The first shot only primes the pigs immune system, whereas the second one administered 4-5 weeks before slaughter will stimulate an increase of GnRH antibodies causing neutralization of the endogenous GnRH and subsequently inhibiting testicular function. Many studies (Cronin et al. 2003; Rydhmer et al. 2010) have investigated the effects of Improvac and it seems that in the period between first and last injection there is an increased aggression towards fellow pen mates as well as stock personnel as a result of increased testosterone levels compared to surgically castrated males since the first injection as mentioned above only primes the immune system and has no effect until the second injection is given. After the second injection it seems that there is little difference between the vaccinated pigs compared to surgically castrated males in aspects of curiosity, aggression and social behavior.

3. Materials and methods

3.1. The aim of the study

Our aim was to measure the effects of using analgesia and local anesthesia during castration on the blood cortisol level and body weight (BW) gain in male piglets.

3.2. Animals and treatments

The study was performed on a commercial pig farm in Fejér County.

Four groups of 3-5 day old male piglets were formed as follows:

1. Control group (CO; n = 49)

The control piglets were castrated without anesthesia, according to the law in operation. A worker held the piglets suspended by all four legs on their backs and tilted downwards while the second person performed the vertical scrotal incisions, extracted the testes and cut the funiculus spermaticus with a sharp scalpel blade. A tetracycline spray was applied locally on the open wound.

2. Meloxicam group (ME; n = 50)

The piglets received 0.4 mg/BW kg Meloxicam (Melovem, Dopharma International, The Netherlands) intramuscularly 10 min prior to castration.

3. Meloxicam and Minocaine group (MELI; n = 50)

The piglets were treated with Meloxicam 0.4mg/BW kg, intramuscularly 10 minutes prior to the castration. Additionally, Procaine (0.5 ml 2%, Minocaine 2% inj., Kon-Pharma GmbH, Hannover, Germany) was injected directly into the testes as local anesthesia 2 minutes prior to the castration.

4. Group with two Meloxicam injections (MEME; n = 48)

The piglets received Meloxicam 0.4mg/BW kg, intramuscularly 10 minutes prior to and 6 hours post castration.

3.3. Sampling and analysis

Blood samples were taken from the jugular vein prior to castration or the first shots of Meloxicam and 40 minutes after the castration.

Blood cortisol concentration was measured by RIA method in the Endocrine laboratory of Department and Clinics of Reproduction, according to the method of Csernus (1982).

The body weight of the piglets was measured prior to the castration, and then weekly until weaning (28 days).

I was fortunate enough to be able to be part of the sampling and performing the castrations at two occasions.

3.4. Statistical analysis

The Shapiro-Wilk test was used for test of normality of the variables. Levene's test was used to assess the equality of variances for the variables. In case of normal distribution of the variables, analysis of variance (ANOVA) was used to test the effects, in other cases, when the measurement variable did not met the normality assumption of a one-way anova the Kruskal-Wallis test was used. A Tukey-HSD post hoc test was used for detecting the differences between the groups. The analysis was performed with the statistical software R (R Development Core Group, 2011).



Picture1. Blood sampling (Photo by Dr. Jurkovich)



Picture 2. Surgical castration (photo by Dr. Jurkovich)

5. Results

5.1. Cortisol concentration in the blood samples

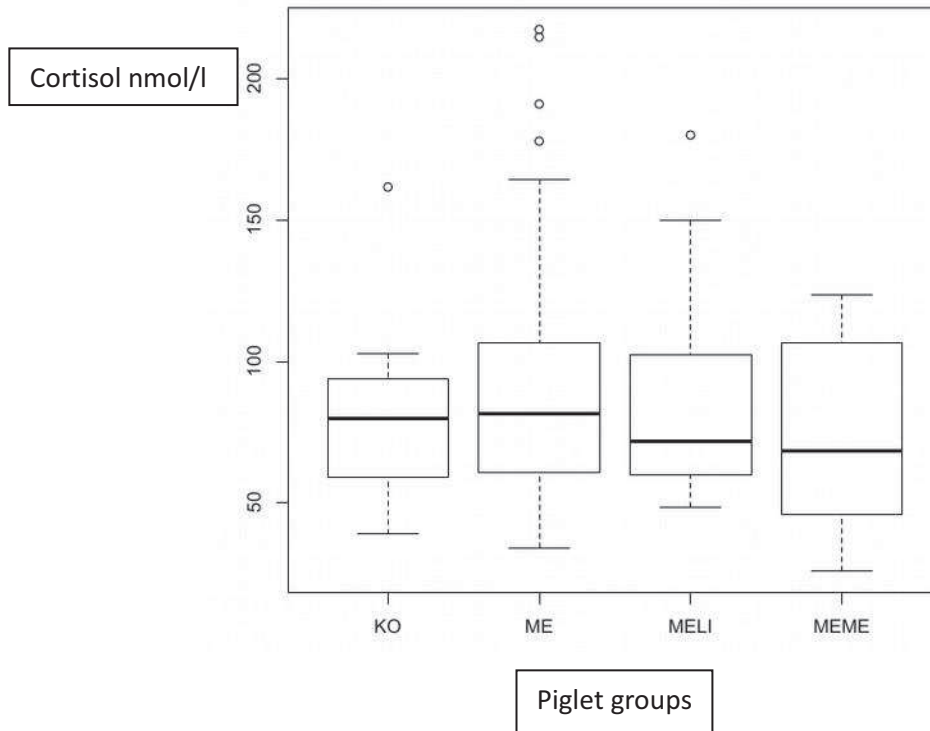


Figure 1. Basal blood cortisol level, pre-castration

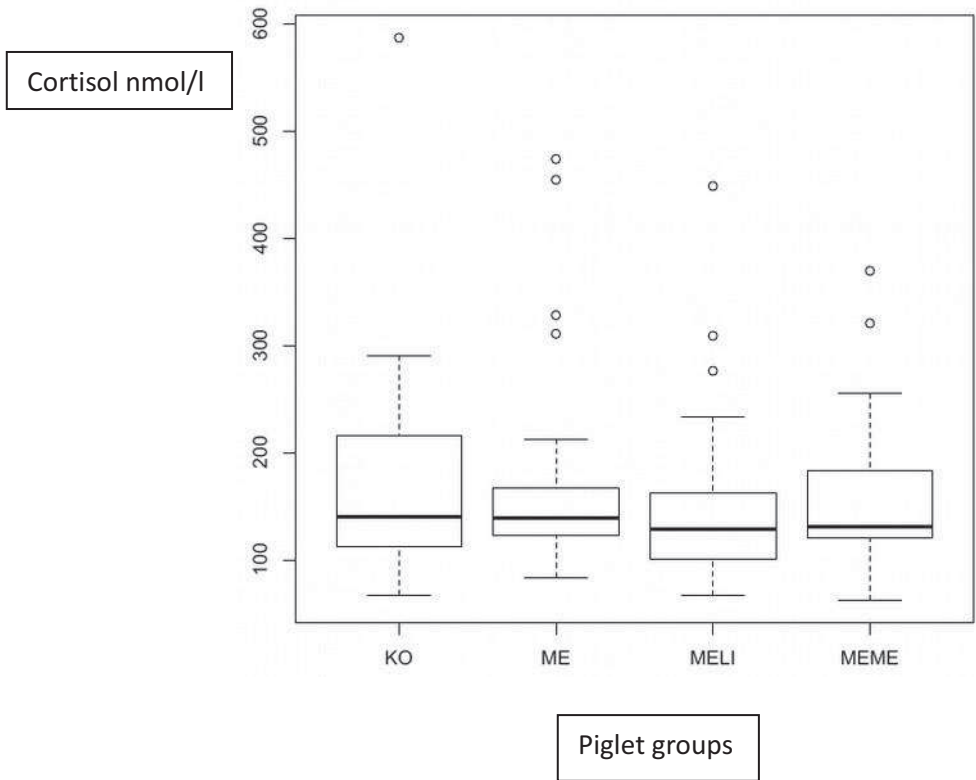


Figure 2. Blood cortisol level, post castration

There was no difference between the blood cortisol concentrations before ($p=0.934$; Figure 1) or after ($p=0.443$; Figure 2) the castration in proportion to each other.

We calculated the ratio of the cortisol concentrations (ratio = cortisol concentration after / cortisol concentration before the castration) to assess the relative changes and to eliminate the bias due to the high variation before castration.

There was no difference in the relative change in cortisol concentration ($p= 0.201$; Figure 3)

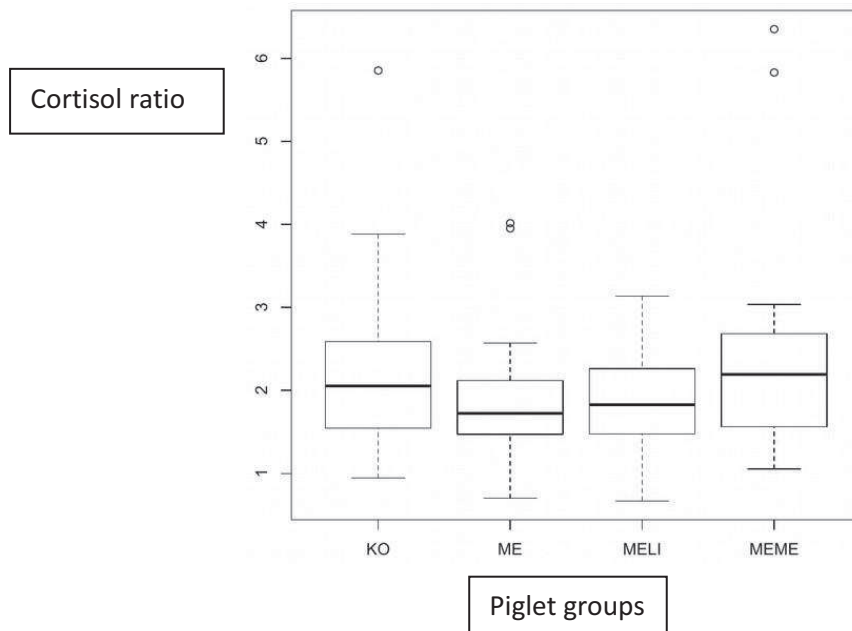


Figure 3. cortisol ratio

5.2. Body weight gain

The initial body weight (BW) differed between the groups. The pigs in the MELI group were significantly ($p=0.0002$) lighter than the pigs in the KO and ME group (Figure 4).

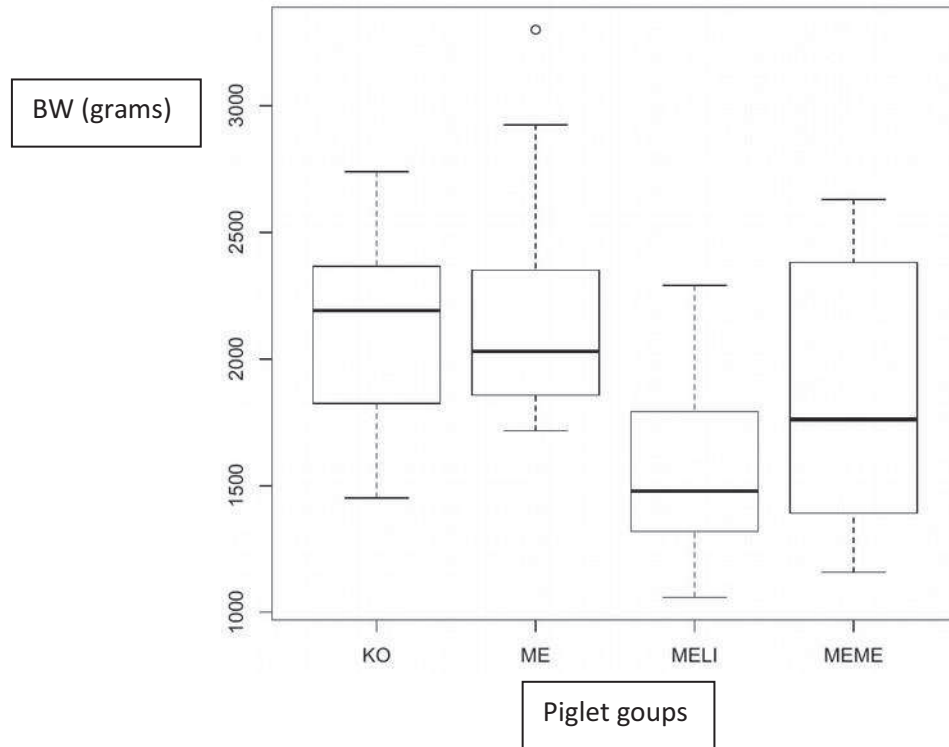


Figure 4. Initial body weight

There was no difference in the final BW at the weaning (28 days after birth).

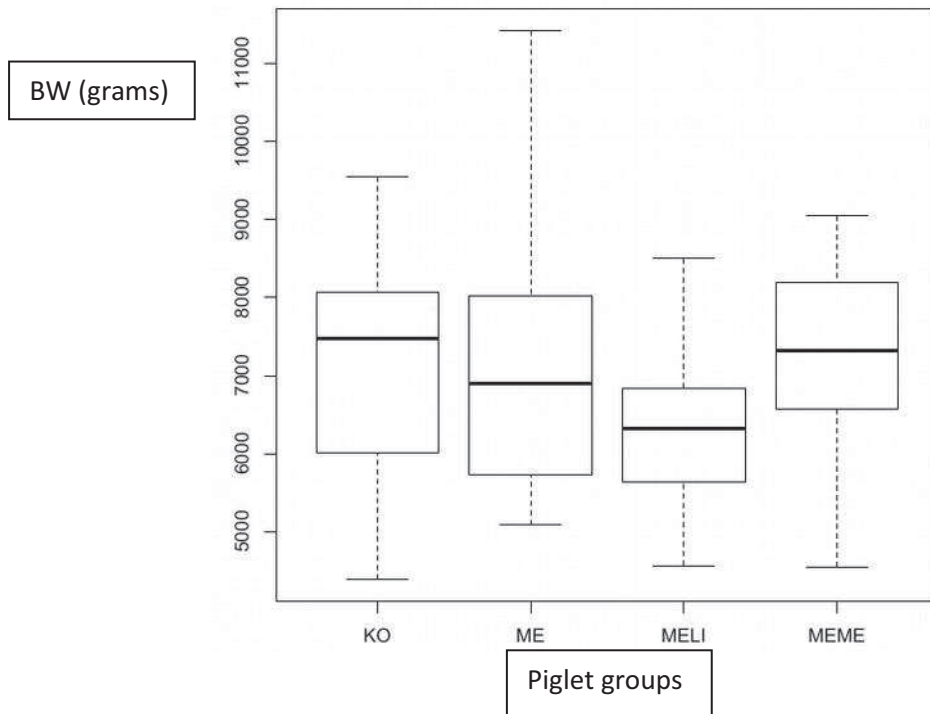


Figure 5. Final body weight at 28 days

Regarding the BW gain (difference between the initial and final BW), there was no difference between the groups.

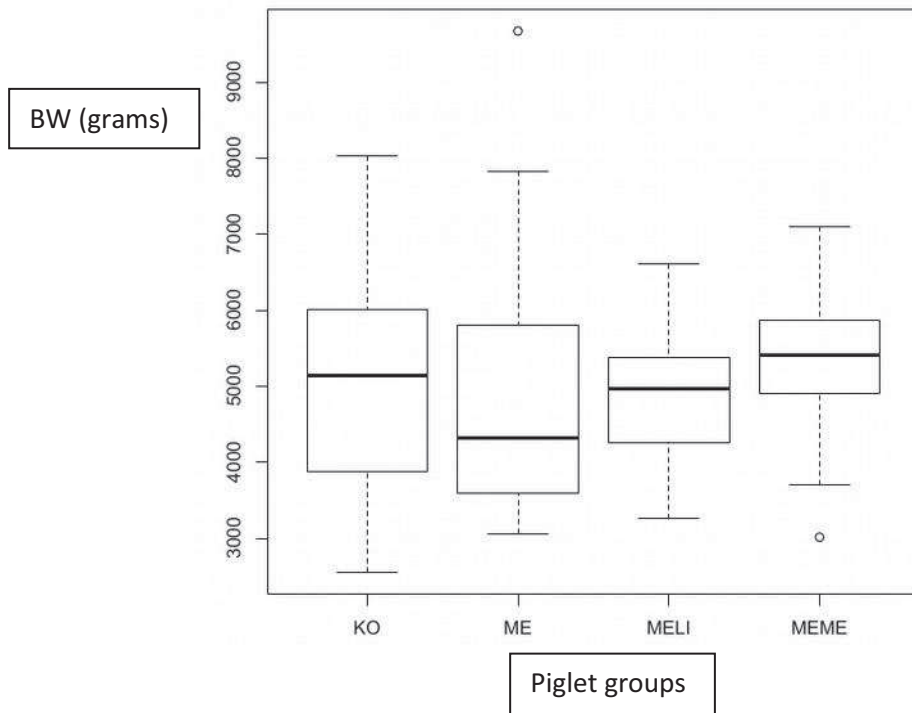


Figure 6. Difference between initial and final body weight

6. Discussion

Summarizing previous articles about studies done on blood cortisol levels as an indicator of pain they concluded that it is a poor parameter to measure as general arousal and most likely stress will induce an increase of cortisol. The results obtained from our study supports this as there was an increase in all of the different piglet group as a response to castration but the increase from pre to post castration was proportional to one another and none of the piglet groups differed much in maximum level of blood cortisol (control group without anesthetics compared to with anesthetics).

Furthermore it is worth mentioning that we did not have a sham-castrated control group of piglets meaning that they should have been picked up and held in the same suspended position but not castrated at all. Fortunately there has been studied done where this is taken into consideration, (Carroll et al. 2006; Kattesh et al. 1996) concluded that cortisole levels did not differ in different age groups of piglets surgically castrated but also not in between castrated and sham-castrated groups which indicates that castration and the handling necessary for performing the procedure is stressful regardless of age.

Regarding pain and weight gain local anesthetics have showed the best results in alleviating castration induced pain through measurement of behavior and vocalization which is considered the best pain indicator in pigs (Marchant-Forde et al. 2009). Analgesics administered, both non-steroidal anti-inflammatory and opioids, have shown to have very little effect in helping with pain reduction during castration (McGlone & Hellman 1988).

Weight gain in our study resulted in that all the groups tested reached proportionally the same increased weight and did not differ between anesthetized and non-anesthetized groups. One other study that got similar results is (Carroll et al. 2006) where not only body weight was measured but also cortisol levels in the blood and likewise found that there was no difference in age groups of the piglets tested. Interestingly enough our group of piglets that were given meloxicam 10 minutes intramuscularly prior to castration and a local anesthetic into the testes had a smaller start weight without no apparent reason. The end weight at weaning (on day 28) had increased the same proportionally to the other groups examined and even caught up with some. Even though meloxicam does not seem to alleviate the acute pain induced by surgical castration, one study mentions that if administered before the procedure does seem to slightly improve pain related behaviors over the subsequent 4 hours (Keita et al. 2010). It is tempting to think that this could be one of the reasons why the MELI group did gain in weight as well as the other groups even after a worse start.

Other aspects and studies worth mentioning and discussing is the lack of studies on both the difference between technique, for example; if twisting the cord until it severs or cutting it with scissors or crushing it with an emasculator would have made a difference for the pain experienced but also the fact that other interventions seem to take place either the same day or a few days prior castration such as tail docking and teeth clipping and whether this has an influence on the pain experience and would have rendered the studies with altered results today if taken into consideration.

7. Conclusions

One can safely assume that surgical castration is a painful and stressful procedure in pigs regardless of age. The amount of pain may be further reduced by the use of local anesthesia combined with analgesia. However, accessibility to drugs remains problematic and proper training of personnel in dosage and delivery, as well as in castration technique, is essential to minimize the impact on the animal, given the additional handling that is required.

Additional techniques for measurements of pain should be found as the ones being considered the best today are correlated with behavior and vocalization and not physiological ones such as blood cortisol levels and heart rate as these are more easily influenced by external circumstances.

Most importantly alternative techniques to surgical castration should be developed as for example vaccination against GnRH offers less discomfort for the pigs during administration and complications involved with the procedure of surgical castration. Also maybe consider raising entire males all together as this is already practiced with success in a few European countries such as the UK and is probably the most humane method plus that the reason for demanding castration, namely boar-taint in meat, has shown that it can be controlled through dietary discretion and increased hygiene as well as breeding away from this trait.

The attitudes of the producers (farmers) and the consumers differ vastly where the consumers seem to think it is unacceptable with castration without any use of anesthetics or analgesics and this could be a good thing as the consumers might have a lot of weight in their opinions if this demand is brought to the attention of the producers, this could influence the economic market and further the decisions of the farmers choice as how to raise or/and castrate their pigs.

8. Summary

Castration of male animals has a long tradition and the reason for this is the propensity of castrates to deposit fat and the easier control of their behavior. Mature male pigs also tend to develop boar-taint, an aversive odor and flavor of the meat contributed mostly by the presence of skatole and androstenone. Surgical castration is performed most commonly without the use of anesthetics or analgesics and since the scrotum and testes are innervated with nociception, it is safe to assume that pain and distress is inflicted on the piglets.

Some countries like the UK have stopped with castration and raise entire males but according to data still the majority of all male pigs in the world are being castrated and the percentage reaches up to 80 %. Paradoxically today consumers demand leaner meat and their attitudes support the welfare of piglets and seem to find that the act of castration is unacceptable.

The study of pain is a complex matter and many parameters should be taken into consideration such as behavioral and physiological changes. The studies that are done up to date all point to that behavioral changes such as vocalization are better indicators of pain than

physiological ones, as these tend to increase in response to arousal and other external stimuli such as stress and not only pain. Other studies also concluded that the pain response is lesser when anesthetics and analgesic are administered before castration, and local anesthetics seemed to give the best results.

Pain management alone with either non-steroidal-anti-inflammatories as well as stronger opioids seemed to have very little effect.

Our study focused on the blood cortisol levels and body weight gain in response to pain. Groups of piglets were surgically castrated, either with administration of anesthetics and analgesics, or without (as a control group). Cortisol does not seem to be a good parameter to measure as it can increase in response to not only pain but general arousal or stress. The study concluded that there was no difference in the cortisol levels pre or post castration regardless to administration of anesthetics and pain relief proportionally in between groups, even though there was an increase in all groups and this could indicate that not only the act of castration but the handling itself can be very stressful for piglets. The body weight gain did not differ either between groups, though the initial weight of one group that received not only meloxicam as pain relief but also a local anesthetic into the testes was smaller, they managed to catch up with the other groups at weaning age 28 days.

Furthermore there have arisen new alternative techniques to surgical castration such as immuno-castration and chemical castration and especially immune-castration seems to be less painful and distressful for the pigs and these could be worth investigating and testing further.



Picture 3. (Photo by Dr. Jurkovich)

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