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The Welfare of Finishing Pigs – Effects of Air quality, Environmental Enrichment, and Management

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Preface

I want to give a huge thank you to my main supervisor Inger Lise Andersen, and co-supervisor Marko Ocepek for good guidance throughout the process of this Master thesis. I also want to say thank you to my “partner-in-crime” through this assignment, Jenny Kristine Runningen, for driving both of us to the many farm visits and for a lot of good discussions about the thesis.

Abstract

It is highly important and necessary to document finishing pigs' welfare, as healthy and happy pigs, with the ability to express their natural behaviour, will give good quality products to the consumers.

A welfare protocol was developed at NMBU in late 2019, and pig producers were recruited to participate in a project named "Griseløftet". Data were collected from a total of 80 farms around Norway, of which 20 farms are included in this thesis. The main objective of this thesis was to investigate the extent of how welfare parameters affect environmental factors, such as pen dirtiness, air quality, amount of litter used in the pens, type, source and frequency of providing environmental enrichment, human-animal interactions and management routines.

High ammonia concentration in the pens resulted in both dirtier floor and pigs. Higher temperature lead to higher prevalence of body lesions, but lower prevalence of tail lesions. Higher prevalence of ear lesions was observed for pigs in pens with lower volume per pig.

Enrichment materials such as long straw, hay, silage, newspaper, and toys were shown to have a significant effect on some of the response variables. An increased fear response was observed for pigs that did not have access to silage, while an increase in ear lesions was observed for the pigs that had access to silage as enrichment material. An increase in body lesions was observed for pigs that did not have access to hay or newspaper, but this increase in body lesions was also observed for pigs that had access to long straw and toys.

Cleaner pigs, with a higher prevalence of body lesions, was observed in pens with small amounts of litter, compared to deep litter pens. Dirty pigs, with a high fear response was observed in deep litter pens. Frequently providing material resulted in cleaner pigs, with decreased prevalence of body-, ear-, and tail lesions, but with an increased fear response.

Cleaner floor and cleaner, more confident pigs, with a higher prevalence of body-, and ear lesions was observed in pens that got more daily contact with the handler. Our results showed that pigs that were sorted in size and age, had a change of pen environment, and was individually selected for slaughter was the cleanest. A higher prevalence of tail lesions was observed for these pigs, except for the pigs that had a change of pen environment. Higher fear response was also observed for pigs that were individually selected for slaughter.

Sammendrag

Det er viktig og nødvendig å dokumentere velferden hos slaktegris, ettersom friske og glade griser som kan uttrykke naturlig atferd vil gi produkter av god kvalitet til forbrukerne.

Høsten 2019 ble det utviklet en velferdsprotokoll av NMBU, og slaktegrisprodusenter ble rekruttert til å være med på prosjektet «Griseløftet». Registeringer ble hentet fra totalt 80 besetninger rundt om i Norge, hvor av 20 er inkludert i denne oppgaven. Formålet med denne oppgaven var å undersøke hvor stor grad velferdsparametere påvirkes av miljøfaktorer sånn som, hygiene i bingene, luftkvalitet, mengde strø i bingene, type, kilde og hyppighet av rotemateriale, menneske-dyr interaksjoner og rutiner i fjøset.

Høyere ammoniakk konsentrasjon i bingene resulterte i både skitnere gulv og griser. Høyere temperatur førte til høyere utbredelse av kroppssår, men lavere utbredelse av halesår. Høyere andel ørebitt ble observert for griser i binger med lavere volum per gris.

Rotemateriale som, langhalm, høy, surfôr, avispapir og leker hadde en signifikant effekt på noen av respons variablene. Økt frykt respons ble observert for griser som ikke hadde surfôr tilgjengelig, mens en høyere andel ørebitt ble observert for griser som hadde tilgang til surfôr som rotemateriale. En økt andel kroppssår ble observert for griser som ikke hadde tilgang til høy og avispapir, men en økt andel av kroppssår ble også observert for griser som hadde tilgang til lang halm og leker.

Renere griser, med høyere andel kroppssår ble observert i binger med lite mengde strø, sammenlignet med talle binger. Skitne griser, med økt frykt respons ble observert i bingene med talle. Ved å gi oftere daglig forsyning av rotemateriale, viste resultatene renere griser, med en lavere andel kroppssår, øre-, og hale-, bitt, men med en høyere frykt respons.

Renere gulv og renere, mer selvsikre griser, men med en høyere andel kroppssår og ørebitt ble observert i binger som fikk mer daglig kontakt med bonden. Våre resultater viste at griser som ble sortert etter størrelse og alder, hadde ett bingemiljø skifte, og ble plukkslaktet var de reneste. En høyere andel halesår ble observert for disse grisene, unntatt for de som hadde ett skifte av bingemiljø. Høyere frykt respons ble observert for griser som ble plukkslaktet.

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1.0 Introduction

1.1. Finishing pig production in Norway and other countries

Pork is a popular meat to eat in Norway and the market is highly regulated. In 2019 there were 132 242 tonnes of pig carcasses approved for human consumption in Norway, which is a decrease of 3.7% from 2018 (SSB, 2020). Pork production is divided into production stages, which all happens in isolated departments. Piglet producers keep the piglets until they are at their weaning age of 9-10 weeks. The piglet producers then either continue to feed some of them up as finishing pigs, also called combined production, or sell some of them on to a finishing pig producer. Finishing pigs are defined as pigs over 10 weeks of age that are primary kept for slaughtering or breeding. The finishing pigs are fed up until they are around 115 kg, in which the pigs are about 5.5-6 months of age.

In Norway, an increase is seen in both the amount of finishing pigs per unit and numbers of herds from 2017 to 2018. It is estimated that there are 326 pig herds in Norway in 2018, in which Rogaland and Tønsberg had the most producers of finishing pigs in 2018 (Løfqvist et al, 2018). In Norway, the majority of the pig herds are kept indoors, because they are dependent on a stabile climate and it gives the farmer more control of their animals (Nortura, n.d). According to Ingris 2018 annual report for finishing pigs in Norway, it shows that the daily gain has increased by 14 grams from 2017, which keeps it at 1032 grams daily gain in 2018. The average slaughter weight is about 80 kg in 2018, which has decreased with 1.5 kg since 2017. The mortality rate has reduced by 0.2 percentage points, to 1.8% in 2018 (Løfqvist et al, 2018).

The UK has around 10.000 pig farms, in which 92% of the production comes from about 1600 farms. Compared to Norway, 40% of the UK pig herd are kept outdoors. The UK had a total of 3.274 thousand finishing pigs, with a daily gain of 866 grams in 2018. The average weight of the pigs at the end of the finishing period was 109.6 kg, with an average finishing mortality of 3.2% in 2018 (AHDB, 2019).

Germany has one of the biggest production of pig meat in the world with 5.342 thousand tonnes pig meat produced in 2018, compared to the UK that had a production of 927 thousand tonnes in 2018, and Norway with a production of 132 thousand tonnes in 2019. Germany together with Spain is EUs biggest pork producers, and there are around 26 million pigs, kept at 22.400 farms. The average daily gain for finishing pigs are around 800 grams. About 65% of the piglets are transferred to a finishing pig producer, while 35% are kept in combined production. Pig meat is the most important meat in Germany, but the consumption has decreased. The downward trend in consumption is mostly because of

animal welfare concerns, environment and health issues and the influx of refugees from Muslim countries (Bittlmayer, 2019).

1.2. Norwegian welfare laws and regulations

The Norwegian Welfare Act has 41 paragraphs which regulates all important aspects of animal husbandry and handling. The law helps to promote good animal welfare and respect for animals (Lovdata, 2009). Through the welfare act, regulations have been made for the different groups of animals, which gives more detailed rules to follow for each species. The regulation for pig husbandry was made in 2003, and there was last made changes in 2012. This law complies with Article 3 of the Council Directive 2008/120/EC in the Official Journal of the European Union, which lays down the minimum standards for the protection of pigs (Council of the European Union, 2001; Lovdata, 2003). The purpose of these regulations is to facilitate conditions for good health and well-being in pigs and to ensure that the pigs natural needs are met. Through pig husbandry the behavioural and physiological needs of the animals must be considered, and they should be protected against the risk of unnecessary stress, pain, and suffering (Lovdata, 2003).

The most important paragraphs related to litter and pen cleanliness in the regulation for pig husbandry is § 7, § 8 and § 20 which states the importance for the pigs to have access to a comfortable, dry, clean and draught-free lying area with proper temperature, proper pen design for use of sufficient amounts of litter to keep the pigs dry and clean, and the avoidance of harmful quantities of fertilizer gas, to ensure good hygiene (Lovdata, 2003). The most important paragraphs related to environmental enrichment is §21, which states the importance that the pigs should always have access to safe and sufficient quantities of material to examine, root and to keep them in activity. Materials that can be used is straw, hay, sawdust, peat, wood (shavings), soil or a mixture of these (Lovdata, 2003).

The most important paragraphs related to human-animal contact and management routines is § 6, § 12, § 13, § *17*, § 18 and § 26, which states the importance of early habituation, daily supervision and proper treatment for sick and injured pigs to ensure calm pigs and avoid unnecessary stress. It also states the importance of inspection of technical devices, proper temperature and air quality and the avoidance of mixing pigs from different groups (Lovdata, 2003).

1.3. Griseløftet

A project named “Griseløftet” was started in 2016 by the company Nortura, which is Norway’s biggest food supplier. With this project they wanted to see if it was possible to

change the consumers perception of the pig meat and industry. In 2018 Nortura launched this project together with Gildes relaunch of the cross-bred pig “Edelgris”. Through this project the pig’s welfare got new standards to ensure a much better welfare than what the regulations already demanded. The goal for this project was to ensure that this new standard will reach all breeds of pigs, not only Edelgris (Nortura, 2019).

The new standards established through Griseløftet was:

- A minimum of 15% more available areal, to give the pigs more room for movement in the pens and improve their well-being (Gilde, 2020).
- The pigs will be given environmental enrichment and activity-stimulating material twice a day, which gives more opportunity for play and exploratory behaviour (Gilde, 2020).
- The pigs will always have enough litter in the sleep area so that every pig can lay in a dry place to prevents injury and illness (Gilde, 2020).
- Pigs that show any signs of trauma to the tail (short tails or lesions) will get removed from the flow of goods at the slaughterhouse (Gilde, 2020).
- All use of antibiotics will be registered and documented for better health, as better welfare gives healthy pigs and thus less needs for antibiotics (Gilde, 2020).
- Pig herds must meet the requirements as veterinary reviews in the documentation system “Helsegris», and the pig herds will also have visits with Norturas advisers and veterinarians at least once a year for security (Gilde, 2020).

1.4. Exploratory behaviour and environmental enrichment

1.4.1. Exploration and play behaviour in young pigs

Pigs (*Sus scrofa domesticus*) are omnivorous, and in natural conditions they will find food sporadically around their environment, by actively searching and exploring their surrounding (Studnitz et al, 2007). Pigs needs to motivate their species-specific behaviours, even in confined housing systems. Distress, stereotypies, and abnormal behaviour are results of not being able to execute their motivated behaviours, which can lead to chronic stress and reduced animal welfare (Van de Weerd & Day, 2009). Domesticated pigs still possess the ability and need for exploratory behaviour; rooting, sniffing, biting and chewing are associated with exploratory behaviour and pigs do this to become familiar with their environment and various resources in their area (Studnitz et al, 2007). Rooting seems to be a high priority, and may represent a behavioural need for pigs, as abnormal behaviour can be observed when this behaviour is not met. The mostly noticeable abnormal behaviour observed when rooting is not met are, redirection of behaviour towards other pigs and objects in the pen (Studnitz et al, 2007).

Pigs have intrinsic exploratory behaviour, which can also be termed curiosity. This keeps the pigs informed about the environment and resources available in it. When pigs are bored, it may motivate this intrinsic exploration, in which they may actively explore and gather information from their environment with their snout and mouth (Studnitz, 2007). Pigs also show appetitive behaviour, which can also be termed hunger. Restricted feeding implies that pigs are only provided with the amount of food needed to obtain a profitable production of meat. Studies have shown that restricted feeding increased the occurrence of rooting behaviour (Day et al, 1995). In contrast, pigs fed ad libitum meet their requirement for energy, but they may lack essential nutrients which again may increase the pig's motivation to perform rooting as a form of appetitive foraging behaviour (Jensen et al, 1993). Both intrinsic exploratory behaviour and appetitive behaviour may increase the level of rooting behaviour in the pig and it may express a need to obtain information from the environment. Pigs are therefore motivated to explore their surroundings, even though their needs are met, and even if they already know their pigpen.

Play behaviour is mostly observed in younger pigs, but can also be observed in older finishing pigs, just not as frequently. Play behaviour is motivationally related to exploratory behaviour and enrichment material is considered important for pigs to fulfil this need (Van de Weerd & Day, 2009). When pigs are exploring a novel object, play behaviour can appear by a stimulation from a sudden change in stimuli or novelty (Wood-Gush & Vestergaard, 1991). This suggest that fear can also be involved with play behaviour. Species-specific behaviours, such as foraging, exploration, positive social interaction and play can be increased if the environment is sufficiently enriched (e.g. Van de Weerd & Day, 2009). Douglas et al (2012) study showed that play behaviour can be less or even absent in barren environment. Play behaviour is also very important in relation to learning and activity in pigs, mostly for piglets and weaners. Pigs that interact with an object, might influence other pigs to also become interested in the object, while if there is an insufficient amount of material it might lead to social competition and agnostic behaviour (Scott et al, 2007). Play behaviour is observed to only be shown when all the pigs' primary needs, such as welfare, health, and access to feed and water are met (Beattie et al, 1996). An absence of play behaviour could therefore be an indicator of insufficient enrichment and may compromise the pigs' welfare.

1.4.2. The effect of litter and pen dirtiness

Pigs prefer to lie in warmer areas with comfortable solid floor and excrete in the coolest part of the pen on slatted floor (Hacker et al, 1994). Pigs have also shown to prefer to excrete as far away as possible from the areas where they spend most of their time, like eating and sleeping (Ocepek & Škorjanc, 2016). However, under warm conditions, pigs tend to eliminate on the lying area in an attempt to create a place to cool themselves (Phillipe et al, 2011) Fouling is a problem observed for finishing pigs, and a significantly higher increase in urination and defecation on solid floor are observed during finishing period compared to the growing period (Larsen et al, 2017; Ocepek & Škorjanc, 2016). One of the reasons for this

fouling behaviour may be because of limited space, due to the increase in body mass, and because they spend less time moving around during the finishing period (Aarnink et al, 2006). Pen fouling will increase the ammonia emissions in the pen, which will result in lower hygiene and air quality in the pens as well as dirtier pigs (Larsen et al, 2017). The use of litter in pens are important to keep the environment pleasant and the pigs clean and dry (Tuyttens, 2005). The amount of litter influences the ammonia production, with usually lower emissions in pens with a lot of litter (Aarnink, 1996).

Studies have shown (e.g. Groenestein et al, 2006; Tuyttens, 2005) that the use of straw-based litter will decrease the ammonia emission, and to increase the amount of straw supply seems like a key factor to minimize emission even further. Deep-litter system are cost effective ways to keep pigs and will reduce the accumulation of slurry in the pen (Corrêa et al, 2008). However, the temperature of the pigs may be negatively affected by heat produced inside this litter (Corrêa et al, 2008). As already mentioned, fluctuating temperatures in buildings may lead the pigs to change their pattern of dunging and urinating, which may lead to more fouling in the lying area, thus an increase in ammonia concentration (Phillipe et al, 2011). This shows that the climate inside the buildings will influence the ammonia emission and is positively correlated with proper temperature and ventilation rate (Phillipe et al, 2011).

The main issue with the use of litter, is unsuccessful management. The litter may become moist and it may stop decomposing, which will lead to decreased hygiene and increased ammonia emission (Corrêa et al, 2008). Philippe et al (2011) study reviewed studies on different manure removal strategies. They observed that fortnightly removal of manure from the pens would reduce the ammonia emission by 20% compared to a system where the slurry was stored for the duration of the finishing period. Also, by removing manure every 2-3 days, emission was reduced by 46% compared to a weekly removal frequency. Hygiene and ammonia emission are clearly correlated with excretory behaviour, ambient temperature, and animal density (Phillipe et al, 2011). Phillipe et al (2011) study showed that a reduction of the animal density in the finishing period, an increase of the ventilation rate or the installation of sprinklers are important measures of avoiding high ammonia emissions.

These studies show the importance of proper management routines for removal of manure, temperature and ventilation control, and the access of litter, to improve hygiene and welfare, and to decrease ammonia emission for finishing pigs.

1.4.3. The effect of environmental enrichment

Pigs need environmental enrichment that can satisfy their need for rooting within the farming system. The EU Directive 2001/93/EC require that pigs must have permanent access to enough quantity of material to facilitate exploration and manipulation. The EU Directive

lists straw, hay, wood, sawdust, mushroom composts, and peat as suitable materials for environmental enrichment for pigs (Council of European Union, 2001). Jordan et al (2008) saw that environmental enrichment significantly increased the proportion of total activity on account of increased occupation with substrate, it also significantly reduced time spent biting pen bars and aggressive encounters.

The different types of material used for environmental enrichment have been studied and reviewed (e.g. Bracke et al, 2006; Studnitz et al, 2007). Most of the studies focus on reduction of abnormal behaviour directed towards other pigs in the pen, but only a few have focussed on the effect on exploratory behaviour directed towards the specific material. The results from a few comparative studies show that material, which is complex, changeable, destructible, manipulatable with edible parts, may stimulate appetitive foraging behaviour and may keep the pigs occupied, to prevent redirection of behaviour towards other pigs or components in the pen (Bracke et al, 2006; Studnitz et al, 2007).

1.4.4. Different types of rooting materials and play objects for pigs

1. Straw

Straw is one of the most studied material when it comes to enrichment for pigs (Studnitz et al, 2007). Straw provide a bulky gut fill when ingested and act as stimulus for rooting and chewing (Van der Weerd & Day, 2009). Studies saw that pigs were more active and had less directed behaviour towards other pigs and object in the pen, when straw was given (Scott et al, 2006). Beattie et al (2000) study compared pigs raised in either barren or enriched environment. The enriched environment contained peat and straw in a rack, plus some extra space for the pigs. Their results showed increased exploratory behaviour among the pigs in the enriched environment, and a reduction in harmful and aggressive behaviour towards other pigs. There were also seen a higher mean daily food intake, growth rate and a lower food conversion ratio in the finishing period for the pigs in the enriched environment.

Straw can be given either as chopped or in full-length. Straw in any length is seen to reduce the occurrence of aggression and tail-biting, compared to when straw was not given (Day et al, 2008). Day et al (2008) study saw that chopped straw increased licking of the straw and decreased picking at it, in growing pigs. This suggest that they were not able to manipulate the straw in the same way as full-length straw. Levels of tail-biting were higher in groups provided with chopped straw, and they concluded that chopped straw should not be used in growing/finishing housing system because of the possibility of directed behaviour towards other pigs or objects may increase (Day et al, 2008). These results correlate with results seen in Lahrmann et al (2014) study, were they saw more aggression in pens with chopped straw, compared to pens with long straw. Study by Van de Weerd et al (2006) tested three different enrichment objects designed for pig-specific requirements. Substrate-, rootable feed-, and liquid dispensers. These were compared to a pen with a full bed of straw and a commercial

enrichment object. The results showed that all the enrichment objects were used by the pigs, but there was difference in frequency and type of object used. The straw and straw rack were used significantly more than the other treatments, which may be because enrichment on the floor could be manipulated from different angles and postures of the pigs. This also applied to the straw rack and rootable feed dispenser. The pigs provided with the liquid dispenser and the commercial enrichment object had the highest frequency of tail biting. Full bed of straw was therefore the most successful in occupying and prevention of severe tail biting.

In contrast to all the benefits observed with the use of straw as enrichment, other material was found to rank above straw in a preference test done with pigs (Studinitz et al, 2007). Studnitz et al (2007) review of enrichment materials saw that materials which rank above straw was peat, compost, sand, wood shavings, branches, beets, and silage. The commonality of all these materials is that they all consist of small pieces that can be chewed and eaten. They also found that material that was ranked below straw were less destructible and less manipulatable material such as ropes and rags, beams, tyres, and chains (Studnitz et al, 2007).

2. Hay

Jordan et al (2008) studied hay as environmental enrichment and compared it to straw. Their results showed that pigs chewed hay for a greater percentage of the observational period compared to straw. Both hay and straw significantly reduced the percentage of time the pigs spent biting bars and aggression towards other pigs in the pen. It was also observed an increased activity among the female pigs, but not among the male castrates. Through this study they observed that the racks with hay were empty earlier compared to the racks with straw. This may indicate that straw might be a better enrichment material, compared to hay, because it lasts longer as chewing material.

3. Peat

Studies have shown that peat as an environmental enrichment for early weaning pig resulted in more belly-nosing and less chewed ears and tails (Horrell & Ness, 1995). In contrast, it was seen that turf was used more for rooting than peat, but the peat-filled tray was used more overall (Horrell & Ness, 1995). Arey (1993) study compared a wide range of enrichment material provided to pigs in a preference test. Their results showed more inactive pigs when peat was used as enrichment, compared to sawdust or straw, but more active compared to mushroom compost. The pigs preferred peat, mushroom compost, and sawdust as enrichment materials. These results are similar to Pedersen et al (2005) study which saw a preference for peat and branches over chopped straw and long straw. Peat, mushroom compost, and sawdust are all similar in texture but varies in moisture content.

Straw and wood bark were the least preferred materials in Arey (1993) study. This suggest that particle size or texture may have played a role in determining the preference of materials for pigs.

4. Wood shavings

Wood shavings are mostly used as substrate in beddings. Caldara et al (2012) found that the pigs with wood shaving as bedding substrate was laying/sleeping longer compared to the pigs on concrete floor, but less than with coffee husks. The behaviour of positive interaction between the pigs was higher in the pen with wood shavings. Presence of bedding increased positive interactions between pigs and reduced the number of agonistic interactions. The time spent on food intake was higher in the pens with concrete floor, followed by the pens with wood shavings and coffee husks, supposedly because of lack of other stimuli in the environment (Caldara et al, 2012). Their results showed a benefit of using wood shavings or coffee husks as enrichment materials for growing pigs as it increased positive interaction between the individuals and reduced stereotypic behaviour such as redirected behaviour towards other pigs or objects in the pen (Caldara et al, 2012). Telkanranta et al (2014) study gave wood shavings and newspaper as enrichment to finishing pigs twice a day. The most important benefit found was that the mean prevalence of severe tail damage was 32.1% for the control pigs without enrichment, and 9.8% for the enriched pigs. Prevalence of tail lesions was lower in the pens which had wood shavings, compared to those who did not have any.

5. Silage

Holinger et al (2018) study showed that pigs with access to grass silage were occupied longer than control pigs without silage. The grass silage did not alter redirected behaviour towards other pigs in the pen and tail and ear manipulation were not affected by this treatment. For the treatment group with grass silage it showed that this material did not reduce the pigs time budget on their occupation with straw, but it increased the overall time for occupation with either straw or silage. This showed a large time budget on foraging, feeding and exploratory behaviour and the material might have satisfied the behavioural needs of the pigs (Holinger et al, 2018). Jensen et al (2007) study showed that the pigs preferred maize-silage the most followed by grass-silage. It may be concluded that silage from either grass or maize is able to increase finishing pigs' welfare, by reducing tail lesions, thus exceeding positive effect from allocation of just straw. Silage can also be regarded as a feed, as it gives positive impact on the digestive system as well as the behaviour of the pigs (Holinger et al, 2018).

6. Newspaper

Telkaranta et al (2014) studied enrichment to prevent tail damage in piglets from birth to weaning. The enriched group had access to newspaper, rope, a plastic ball, and wood shavings, while the control group only had access to a plastic ball and wood shavings. Their results showed that newspaper was observed to create more activity, compared to toys such as a plastic ball. Piglets with access to newspaper from birth to weaning were shown to less target oral-nasal manipulation at other piglets and more at objects compared to control groups without newspaper. Telkaranta et al (2014) also saw a lasting effect on tail biting post-weaning, the pigs with experience of enrichment such as newspaper and ropes inflicted less severe tail damage than those in the control groups who did not have the same experience.

7. Dirt/Compost

Jensen et al (2008) tested 12 pairs of pigs in a preference maze-test. The 12 pairs of pigs were tested in six different enrichment categories: chip (trunk, branches, spruce and bark), toys (plastic toys, rope and wooden beam), rough (maize silage, grass silage and sugar beets), earth (compost, peat and wood shavings), hay (seed grass hay, alfalfa hay and barley straw) and straw (unchopped and chopped barley straw and straw pellets). The results showed a clear preference for the earth category where the highest ranked material was compost and peat. This preference for the earth category corresponds to Arey (1993) study, in which the pigs had a higher preference for peat and mushroom composts. The preference for peat and mushroom compost observed in these studies, may be due to similarity in texture to earth – as pigs in semi-woodland will root in the ground for food, and developed foraging strategies that depend on high levels of exploratory behaviour involving the mouth and snout (Arey, 1993).

8. Toys

Scott et al (2007) studied the influence of different types of enrichment on the behaviour of finishing pigs. They found that with manipulatable toys, the time pigs spent manipulating the toys were <2%, compared to straw which occupied 21% of the pigs' time. It was observed more aggressive behaviour towards other pigs and objects in the pen in the absence of straw. Manipulatable toys therefore failed to provide the same level of occupational activity as observed with straw. Pearce et al (1989) studied if the provision of toys would influence the growth and behaviour of male pigs that were exposed to pleasant and unpleasant handling. The toys provided in this study for the enriched pens were chains, bars, and tyres. They saw that the provision of toys significantly reduced the fear of humans for both handling methods. The pigs housed in the barren environment showed more interaction with the handler and more drinking behaviour. These social interactions in the barren environments may suggest that it is a substitution for the lack of stimulation from the environment (Pearce et al, 1989). This suggest that addition of a few manipulatable objects such as toys may improve the pigs' welfare by reducing the fear of humans and allowing

exploratory behaviour (Pearce et al, 1989).

Mkwanazi et al (2019) explored the existing knowledge available in relation to environmental enrichment. They concluded that enrichment should be manipulatable and long-lasting to have any effect in stimulating the pigs. Mkwanazi et al (2019) saw that toys such as hanging plastic bottles and colourful balls needs to be changed over time to keep the pigs interested. The toys which are kept on the floor needs to be cleaned and disinfected often as they easily can get dirty, which can result to loss of interest for the toys (Mkwanazi et al, 2019) Scott et al (2009) saw that hanging toys were used more than toys on the floor, but the plastic toys provided may not be appropriate for expression of proper rooting behaviour as observed with other enrichment materials such as straw.

9. Wood and branches

Chou et al (2020) compared three wood species and a rubber toy in relation to enrichment in finishing pigs. They saw that the pigs were more attracted and interested to spruce posts and the group who got this wood species was observed to have lower tail biting records, compared to larch and beech wood. It was also observed that the rubber toy was more frequently used than larch and beech wood. This correlates with Jensen et al (2008) study in which pigs preferred spruce and willow in the chip category. Pedersen et al (2005) study also saw a preference for peat and branches over chopped straw and long straw. These studies show that wood and branches appear to be a safe material to use as environmental enrichment for pigs. Softer wood species was preferred by pigs and branches are one of the enrichment materials that rank above straw (Chou et al, 2020; Studnitz et al, 2007). Wood and branches consist of pieces that can be chewed and eaten, but it is important to continually give these material as it may be used up quickly.

10. Other materials

Other materials used for enrichment may be ropes and chains. Open rope ends are easily destructible and are observed to attract more chewing activity among pigs (Guy et al, 2013). More time is also spent with these types of materials, compared to less destructible materials like chains (Studnitz et al, 2007). Pigs were observed to spend more time with chains when it was paired with sawdust, compared to when it was paired with wood shavings (Guy et al, 2013). Pigs are observed to be attracted to perform destructible chewing behaviour. Which is why it is important that the material that are used for enrichment are destructible. Chains are non-destructible materials, and therefore the pigs would prefer ropes over chains. Pigs also get quickly habituated to many of the different enrichment materials, so it is important to either give them continually or find enrichment materials that pigs prefer.

1.5. Handling and management (human impact)

Gonyou et al (1986) conducted a study to examine how different handling methods would affect the behaviour and growth on growing pigs. Four different handling methods was studied: positive, negative, minimal, or aversive. For the positive handling method, the experimenter crouched down, allowing the pigs to approach, and the pigs would get scratched on their head, back and bellies. In the negative handling method, the experimenter would approach the pigs with a gloved hand toward their snout and head area. For the minimal handling method, the pigs would not get any contact with the experimenter and for the aversive handling method, an electric shocker would be used if the pigs failed to avoid the experimenter. The results of this experiment showed that all the groups would approach the experimenter more quickly after the testing period was finished, except for the pigs in the aversive treatment. The negative and aversive treatment groups gained less weight, compared to the other treatments. An increased area of the cortex was observed for the pigs in the aversive treatment which indicate chronic stress among this group (Gonyou et al, 1986). This experiment concluded that frequent, non-aversive handling is necessary to avoid damaging growth response and to avoid chronic stress, thus reduced welfare for the pigs (Gonyou et al, 1986).

Study done by Day et al (2002) showed that when groups of pigs were exposed to pleasant handling such as calm contact with the stockperson and frequent strokes, the pigs would eat more food, but they were more difficult to move during routine husbandry tasks, through a reduced fear of humans. On the other hand, the groups of pigs that were exposed to minimal handling would use less time to exit their pen during routine handling. Pearce et a; (1989) study observed that pigs that were negatively handled during rearing showed more fear towards humans. When putting these pigs in an enriched environment, it reduced the pigs fear of humans, regardless if they were handled positively or negatively (Pearce et al, 1989). Negatively handled pigs spent more time resting, sitting, and standing inactively, and less time interacting with other pigs (Pearce et al, 1989). The pigs in Pearce et al (1989) study showed no chronic stress from the negative handling, but it showed a high fear of humans. In the enriched environment, positively handled pigs showed more exploratory behaviour compared to negatively handled pigs. Hemsworth et al (1987) did a similar experiment as Gonyou et al (1986), but instead of the aversive treatment, it had an inconsistent handling treatment, which was defined as a combination between the pleasant and the unpleasant treatment for this experiment. In this experiment 32 young female pigs were exposed to four handling treatments for a six-week period. The handling treatments were pleasant, inconsistent, minimal, and unpleasant handling. The pleasant treatment consisted of stroking when the pigs approach the experimenter, while the unpleasant treatment consisted of forcing the pig away if it approached the experimenter (Hemsworth et al, 1987). This study agrees with the results from Gonyou et al (1986), in which the pleasant and minimal handling treatments showed higher growth rates and less fear towards humans. The negative and inconsistent handling treatments had adverse effect on growth performance and higher corticosteroid concentrations. These latter groups therefore

showed a chronic stress response and fear towards human interactions (Hemsworth et al, 1987). Goumon & Faucitano (2017) studied the influence of handling management on stress in pigs. While moving pigs, they found that poor handling would impair the pig's movement, which lead to rougher handling and more stressful experiences for the pigs.

All these studies concluded that frequently positive and calm handling of pigs, will reduce their fear of humans and avoid unnecessary stress for the animals.

1.6. Project background

Research in relation to pigs have mostly focussed on weaning pigs and sows, while research on finishing pigs has been lacking. Therefore, this project will focus on finishing pigs and their welfare. A welfare protocol was established in collaboration with NMBU and Nortura, as a tool to objectively assess the welfare of finishing pigs in Norwegian herds. This thesis focuses on twenty selected finishing pig farms, located in three regions of Eastern Norway.

1.7. Thesis statement and predictions

The main objectives for this thesis was to assess the level of welfare in twenty Norwegian finishing pig herds, with the use of a welfare protocol and a questionnaire. More specifically, we wanted to study the effect of pen dirtiness, air quality, amount of litter used in the pens, type, source, and frequency of providing environmental enrichment, human-animal interactions, and management routines on selected welfare parameters.

The following predictions were made:

- We predicted that the floor and pigs would become dirtier with increasing temperature, higher air velocity, and less volume per pig.
- We predicted that material which are manipulatable, such as long straw, hay and silage would be more stimulating to use, compared to newspaper and toys.
- Providing more amounts of litter may lead to decreased ammonia concentration, thus result in cleaner pens, and cleaner pigs.
- We predicted that frequently providing enrichment would make the pigs more confident, and decrease the prevalence of body-, tail-, and ear lesions.
- We predicted that supplying different types/combinations of enrichment materials would decrease fear and the prevalence of body-, tail-, and ear lesions.
- We predicted that providing pleasant and frequent contact with the pigs would lead to less fearful and more confident pigs.

- We predicted that keeping pigs that were the same age and/or size, in stable groups with minimal mixing, would lead to better overall hygiene, more confidence and less prevalence of body-, tail-, and ear lesions.
- We predicted that management routines, such as the use of individually selecting pigs for slaughter and proper moving routines, would lead to less fearful pigs and better overall hygiene.

2.0. Materials and methods

This assignment is a part of a bigger research project called "Griseløftet", which is a collaboration between NMBU and Nortura to strengthen the welfare of finishing pigs. The data collected during the visits will be used as a basis for identifying conditions that can improve the welfare of the pigs and the pig producer's production results, as well as factors that can improve the meat quality. In total, during 2020 there will be collected data from 80 of Norturas pig herds across the country and used in relation to each other to look at differences and similarities.

For this specific assignment data from 20 pig producers were collected from finishing pig producers in three regions in Eastern Norway. Ten pig producers were visited in Vestfold and Telemark county, eight in Viken county and two in Innlandet county. The field survey lasted from December to March, with the first visit on 17th of December 2019 and the last on 5th of March 2020. The contact information for the 20 different pig producers came from Nortura, and because of biosecurity reasons, only one herd could be visited a day.

2.1. Trial venues

The data collection for this project was conducted on 20 different pig herds throughout Eastern Norway. Twenty different ways of keeping finishing pigs were examined, as each farmer had their own barn system, from old barns to newer ones.

Figure 1. An example of a typical pen for keeping finishing pigs.

2.2. Pigs examined

Finishing pigs from 1-3 weeks before slaughter was assessed in this project. From each farm, eight pens were chosen at random and the pigs in those pens were observed. If there were more than one room holding finishing pigs, the observations were divided so that all the rooms could be assessed.

2.3. Equipment and biosecurity

Equipment used:

- Apparatus for measuring temperature and air velocity, called the VelociCalc™ Ventilation Meter (Fig. 1).
- Apparatus for measuring ammonia concentration, called the GIG Micro Ammonia Meter (Fig. 2).
- Pen and protocol

For biosecurity reasons, preventive measures were taken. Protection clothes were used and disposed for each herd that was visited, including disposable white protection overalls with hood, surgical gloves, protection masks and shoe protections or boots usually worn at that specific herd. Precautions were also made so that the observers were tested for MRSA before starting the experiment.

Figure 2. VelociCalc™ Ventilation Meter.

Figure 3. GIG Micro Ammonia Meter.

2.4. Field survey setup

2.4.1. Protocol

A protocol was made for this project to properly examine and register finishing pig's environment, management, and welfare. This protocol was both resource-based (based on what is provided to the animal, resource given, space allowance, etc…) and animal-based (based on evaluation of the welfare status of individual animals). The whole protocol is included in Appendix 1 and will give more elaborate details about the field survey. The protocol consisted of three chapters:

The first chapter is a questionnaire to the farmer about husbandry practices and routines. The questions cover areas such as animal husbandry, feeding, environmental enrichment and human-animal interactions. The questionnaire is divided into 6 parts, and the different parts of the questionnaire will be elaborated here:

1. ***General information about the pig herd and farmer***

This section gets information about the farmers education and amount of years he/she has been working with pig production. This part also asks general questions about the pig herd, such as numbers of inserts, number of pigs delivered for slaughter in the last pool and how many houses and sections this farmer has with finishing pigs (Table 1.).

2. Follow-up of abnormal behaviour as well as sick and injured animals

This section collects information about how many pigs died, were euthanized, and/or got treatments in the last pool of finishing pigs on the farm. The reasons for these circumstances were also registered. The last part of this section asks questions about the farmers routine for the less and more sick pigs and the use of the infirmary pen.

3. Pen environment

This section registers information about the pigs' pen environment. The farmer gets asked questions about how often the pens get cleaned, how the pigs are sorted when they arrive at the farm, and if "yes", how they are sorted. The alternatives of sorting methods are age, sex, or size. Question also include age difference between the pigs in the pens and if the pigs are moved or mixed during their finishing period. The last question of this section is if the farmer selects the pigs individually for slaughter or not.

4. Feeding

This section registers information about the feeding types and strategy used. Questions about type of feeding, such as wet feeding, dry feeding, or alternative feeding agents. Question about the type of feeding strategy, either appetite or restrictive and if the farmer practice gender-based feeding or not.

5. Rooting material

This section asks questions about the pigs' access to rooting material, what types are used and how often the pigs are given rooting material.

6. Human-animal interactions:

This section asks questions about how many times the farmer has contact with the pig herd, what kind of contact, how he/she moves the pigs and if there are any routines before they are transported to the slaughterhouse. It also registers in which condition the farmer would

not send the pigs to slaughter and if the farmer has experience that he/she was denied pigs to be sent to slaughter, and why.

Table 1. General information about the 20 pig herds visited.

Herd number	Visit date	Years in production	People responsible	Production type*	Inserts per year	Number of sections with pigs	Total of pigs in herd
1	18.12.19	2	2	F	3	3	265
2	10.01.20	13	2	F	3	4	384
3	17.01.20	21	3	C	7	2	45
4	24.01.20	11	1	F	3,5	3	165
5	27.01.20	24	1	F	3,5-4	2	163
6	28.01.20	18	1	C	7	1	252
7	29.01.20	14	1	F	7	4	260
8	30.01.20	28	4	C	7	2	168
9	03.02.20	34	3	C	7	2	160
10	07.02.20	28	3	C	7	1	88
11	11.02.20	13	2	F	7	2	323
12	13.02.20	7	3	C	3,25	2	398
13	17.02.20	16	2	C	6-7	2	170
14	18.02.20	22	3	C	7	2	224
15	19.02.20	8	3	F	3-4	3	420
16	20.02.20	8 + 35	4	C	16	2	220
17	21.02.20	7	4	C	8	2	90
18	26.02.20	14	1	F	6-7	2	300
19	05.03.20	10	1	F	4	5	150
20	05.03.20	4	3	F	3-3,5	2	320

*F=Finishing pigs' production, C = Combined production

2.4.2. Quantitative fieldwork

The second and third chapter of the protocol are quantitative fieldwork in which eight different pig pens (per farm) are examined by the observer(s). If there were more than 15

pigs in the pen, then 10 pigs are marked and used as a representative selection. If there are more sections or houses the observer should divide the pens between the sections and houses.

The first part of the quantitative fieldwork was to observe and count the expression of positive and negative behaviour of the pigs, while the observer(s) were standing outside the pen. An ethogram was made to explain the different behaviours observed and the observation time was 10 second. The next part examined the dirtiness of the lying area and of the pigs themselves. The observer should stand outside the pig pen and evaluate the percentage level of solid floor covered by manure. Thereafter, the number of pigs that has the body covered in manure should be counted and divided into percentage categories. Categories for floor dirtiness is defined as level 1-3, where 1 equals if less than 10% of the solid floor is moist and/or covered in manure, 2 equals if less than 40% of the solid floor is moist and/or covered in manure, and 3, equals if more than 40% of the solid floor is moist and/or covered in manure. Categories for pig dirtiness is defined as, less than 10% ($\leq$10%) of the body is covered in manure, and over 10% (>10%) of the body is covered in manure.

Next, the amount of litter in the lying area should be examined, while still standing outside the pig pen. Five different alternatives for litter amount is available, from nothing to deep litter, and the correct amount should be recorded. The next part looks at movement, the shape of the pig, hernias, and ear-, and tail lesions, while standing inside the pen. Every pig should be standing up, and the amount of pigs who have a limp or have severe mobility problems should be recorded. Secondly, the number of pigs with hernia is recorded. Thirdly, the number of pigs with tail lesions and ear lesions should be counted and recorded. Lastly, an evaluation of the body shape of the pigs should be recorded – by examining their spine and hip bones. While also standing inside the pen, the number of pigs with lesions or tears on their body should be recorded. Body lesions are defined as scratches and/or lesions where skin is penetrated.

The last part of the quantitative fieldwork focuses on air quality and volume per pig. Ammonia concentration (ppm), temperature (°C), air velocity (m/s) and volume per pig (m^2) was recorded in the lying area of three different pens at three different locations around the room (front, centre and back).

2.5. Unforeseen events

During the trial period the ammonia meter stopped working. This resulted in that ammonia was not measured in 6 of the 20 pig herds, since the delivery period took longer than expected.

2.6. Observer reliability

To avoid observer drift and ensure inter-observer reliability, the observations was done together and discussed, so that measurements taken were consistent for each pen and farm.

2.7. Ethical evaluation

The welfare of the finishing pigs was not negatively affected in this study. As one part of this study is to look at how the pigs react to humans, their welfare was clearly taken into consideration. The pigs may have experienced stress and fear when the observer went into the pen, but it could be observed that most of the pigs were used to daily interaction with humans. It is likely that the study can give benefits for both animals and industry in the future, as there is a great demand for measures that can improve welfare and reduce behaviour problems in finishing pig production.

2.8. Statistical analysis

Microsoft Excel

The 20 different protocols were put into two different Microsoft Excel spreadsheets. Legends were made for answers like “yes/no” and to questions with many alternative answers, as statistical programmes respond better to numerical values. The first spreadsheet gives information about the 20 different pig herds and answers to the questionnaire. While the second spreadsheet gives information about the welfare and environment of the different pig herds, with the answers from the quantitative fieldwork. Microsoft Excel was also used to make figures and other descriptive statistics.

Statistics

Statistical analysis was done by the Glimmix procedure in the programme SAS 9.4 (SAS Inst. Inc., Cary, NC). This procedure was used because the data in this paper is a mixture of fixed and random effects and are not normally distributed.

Floor dirtiness was analysed through a multinomial distribution in five different models. Floor dirtiness is not graphically shown in this thesis, as the differences were very small. Pig dirtiness, $\leq$10%, pig dirtiness, >10%, confidence, fear, no body-, body-, tail-, and ear lesions was analysed with binomial distribution in five different models. Farm was specified as a random effect.

Model 1 includes the averages for the fixed effects; ammonia concentration, temperature, air velocity and volume per pig, which are all continuous variables.

Model 2 includes the different types of enrichment materials as different classes of fixed effects. The types of enrichment materials included in this model was chopped straw, long straw, hay, silage, newspaper, and toys. Each class had two levels, in which 0 equals that the material is not available, and 1 which equals that the material is available.

Model 3 includes the fixed effects: litter amount, material provision and material variability. Litter amount is defined as the amount of litter the pigs are given, with the class variables: small, moderate, large, and deep. Material provision is defined as how many times daily the pigs get enrichment material, with the class variables: daily, two times daily, and more than two times daily. Material variability is defined as the variation of material combinations the pigs are given, with the class variables: one type, two types, three types, four types and six types.

Model 4 includes the fixed effects: type of contact and daily contact. Type of contact is defined as what kind of contact the pigs get from the handler, with the class variables: no contact, verbally, physical contact, or both verbally and physical contact. Daily contact is defined as how many times daily the pigs are in contact with the handler, with the class variables: once daily, two times daily, and more than two times daily.

Model 5 includes the fixed effects: mixing strategy, sorting strategy, changing pen environment, individual selection of pigs for slaughter and moving routines. Mixing strategy is defined as how many times the pigs are mixed on the farm, with the class variables: zero, one and two. Sorting strategy is defined as in which way the pigs are sorted on the farm, with the class variables: age, sex, and size. Some farms use different feeding systems depending on the finishing pigs age. Therefore, as the pigs grow, they may be moved from one pen environment to a different one. Changing pen environment is defined as if the pigs are changed from one pen environment to another on the farm, with the class variables: not changed and changed. Individually selection of pigs for slaughter is defined as if the pigs are individually selected for slaughter or not, with the class variables: yes and no. Moving routines is defined as how many different methods are used for moving the pigs, with the class variables: one method, two methods and three methods.

The data is presented as either, mean with standard error, or P-values in an F-test with 5% significance level.

3.0. Results

The mean, standard error, and range (minimum-maximum) for the different response variables given as percentages of observation per pen is shown in Table 2. Floor dirtiness are not included in Table 2, as it is different levels and not percentages.

It was observed a high mean percentage for the response variables; Pig dirtiness $\leq$10% (89.4 ± 1.4), confidence (62.7 ± 2.1) and no body lesions (74.1 ± 1.7). The lowest mean percentages was observed for the response variables; pig dirtiness, >10% (10.7 ± 1.4), fear (7.1 ± 1.8) and tail lesions (4.1 ± 0.8). It was observed a high percentage of pigs with ear lesions (49.7 ± 1.8), compared to tail lesions (4.1 ± 0.8).

Table 2. Average prevalence (mean ± SE) and range (min-max) for the response variables.

Response variables	Mean ± SE	Minimum	Maximum
Pig dirtiness, ≤10%	89.4 ± 1.4	18.2	100.0
Pig dirtiness, >10%	10.7 ± 1.4	0.0	81.8
Fear, %	7.1 ± 1.8	0.0	100.0
Confidence, %	62.7 ± 2.1	0.0	100.0
No body lesions, %	74.1 ± 1.7	0.0	100.0
Body lesions, %	25.5 ± 1.6	0.0	100.0
Ear lesions, %	49.7 ± 1.8	0.0	100.0
Tail lesions, %	4.14 ± 0.8	0.0	70.0

3.1. Air quality and volume per pig

The effect of ammonia concentration, temperature, air velocity and volume per pig on the different response variables are presented in Table 3. It was observed dirtier floor, in pens with high ammonia concentration, and a cleaner floor, in pens with low ammonia concentration (Fig. 4A). Similarly, pigs kept in pens with low ammonia concentration were cleaner, than pigs kept in pens with high ammonia concentration (Fig. 4B-C). No significant effect between ammonia concentration and the remaining response variables could be observed.

In pens with higher temperature, pigs had more body lesions, compared to pens with lower temperature. However, a higher prevalence of tail lesions was observed in pens with lower temperature, compared to pens with higher temperature (Fig. 4B-C). Air velocity did not

have a significant effect on any of the response variables (Table 3.). A higher prevalence of ear lesions was observed for pigs in pens with lower volume per pig (Fig. 4D).

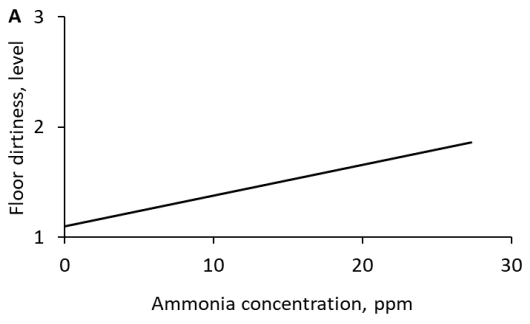
Table 3. Effect of average ammonia concentration (ppm), temperature (°C), air velocity (m/s) and volume per pig (m^2) on the response variables.

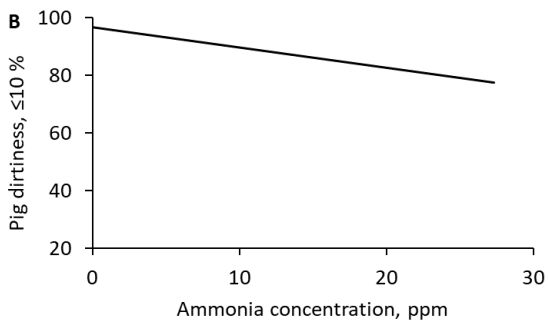
Response variables	**Ammonia, ppm**		**Temperature, °C**		**Air velocity, m/s**		**Volume per pig[1], m²**	
	F value	P value	F value	P value	F value	P value	F value	P value
Floor dirtiness, %	4.5	**0.037**	1.4	NS	1.4	NS	0.2	NS
Pig dirtiness, ≤10%	6.2	**0.016**	0.6	NS	0.6	NS	1.2	NS
Pig dirtiness, >10%	6.2	**0.016**	0.2	NS	0.6	NS	1.2	NS
Confidence, %	0.1	NS	0.0	NS	0.8	NS	2.3	NS
Fear, %	1.2	NS	1.5	NS	2.8	NS	2.2	NS
No body lesions, %	0.1	NS	4.4	**0.041**	0.3	NS	1.1	NS
Body lesions, %	0.1	NS	4.4	**0.041**	0.3	NS	1.1	NS
Ear lesions, %	0.1	NS	0.0	NS	2.9	NS	5.3	**0.025**
Tail lesions, %	1.1	NS	22.4	**<.0001**	0.2	NS	2.2	NS

Bold – Significant, P≤0.05.

NS – Non-significant, P>0.05.

[1:] Overall volume of the room, divided on the amount of pigs in the room.





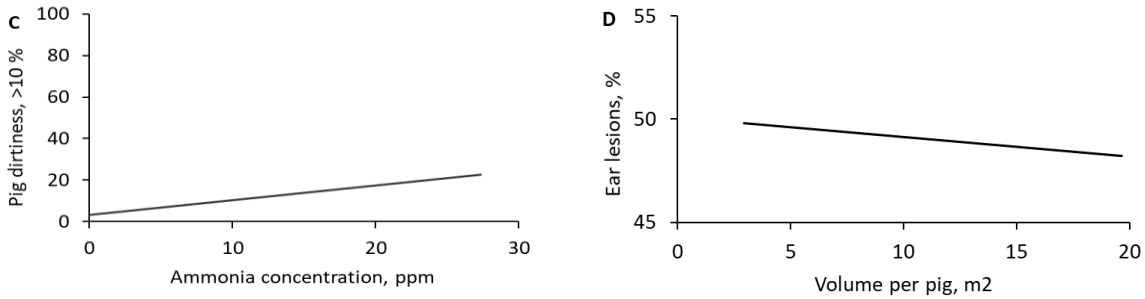


Figure 4. Significant effect of **(A)** floor dirtiness on ammonia concentration, **(B)** pig dirtiness, ≤10% on ammonia concentration, **(C)** pig dirtiness, >10% on ammonia concentration, **(D)** tail lesions on volume per pig.

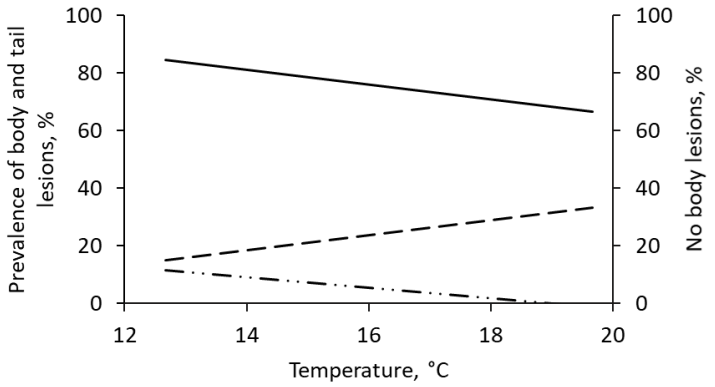


Figure 5. Significant effects of no body lesions (——), body lesions (– –) and tail lesions (— · ·) on temperature.

3.2. Litter and environmental enrichment

3.2.1. Effect of type of material

Chopped straw and Other, did not show any significant effect on any of the response variables (Table 4.). The significant effect between floor dirtiness and long straw showed that pens with long straw had cleaner floor (1.2 ± 0.05), compared to pens that did not have long straw (1.4 ± 0.06). Higher prevalence of body lesions was observed for pigs in pens that had long straw available, and for those pens that did not have hay available (Fig. 6B-C). Increased fear response was observed in pens that did not have silage available, but a higher prevalence of ear lesions was observed for the pens with silage available (Fig. 6A & 6D). Pigs without access to newspaper had significantly higher prevalence of body lesions, compared

to pigs that had access to newspaper (Fig. 6B-C). Higher prevalence of body lesions was also observed for pigs in pens that had toy available, compared to pigs that did not have toys available (Fig. 6C).

It was not observed any significant effect between enrichment materials and pig dirtiness, confidence, or tail lesions from our results.

Table 4. The effect on different types of enrichment materials on the response variables.

Response variables	Enrichment material													
	Chopped straw		**Long straw**		**Hay**		**Silage**		**Newspaper**		**Other***		**Toy****	
	F value	P value	F value	P value	F value	P value	F value	P value	F value	P value	F value	P value	F value	P value
Floor dirtiness, %	0.4	NS	4.0	**0.047**	1.5	NS	0.5	NS	2.3	NS	0.4	NS	2.4	NS
Pig dirtiness, ≤10%	2.4	NS	0.0	NS	0.2	NS	1.4	NS	0.0	NS	0.3	NS	1.4	NS
Pig dirtiness, >10%	2.5	NS	0.0	NS	0.2	NS	1.4	NS	0.0	NS	0.3	NS	1.4	NS
Confidence, %	0.7	NS	3.0	NS	1.0	NS	1.1	NS	0.3	NS	1.8	NS	0.2	NS
Fear, %	1.0	NS	1.1	NS	2.7	NS	4.2	**0.043**	2.6	NS	1.1	NS	2.2	NS
No body lesions, %	0.1	NS	2.7	NS	5.6	**0.019**	0.5	NS	4.8	**0.030**	0.2	NS	2.2	NS
Body lesions, %	1.1	NS	5.6	**0.02**	4.9	**0.028**	0.6	NS	7.5	**0.007**	0.9	NS	5.4	**0.022**
Ear lesions, %	0.0	NS	0.1	NS	0.3	NS	4.5	**0.035**	1.1	NS	1.9	NS	0.5	NS
Tail lesions, %	2.0	NS	1.1	NS	0.2	NS	3.2	NS	0.9	NS	1.0	NS	0.3	NS

Bold – Significant, P≤0.05.

NS – Non-significant, P>0.05.

*Other = wood shavings, branches, cardboard, and pellets.

**Toy = chains, tyres, ball, plastic bottles, ropes, etc…

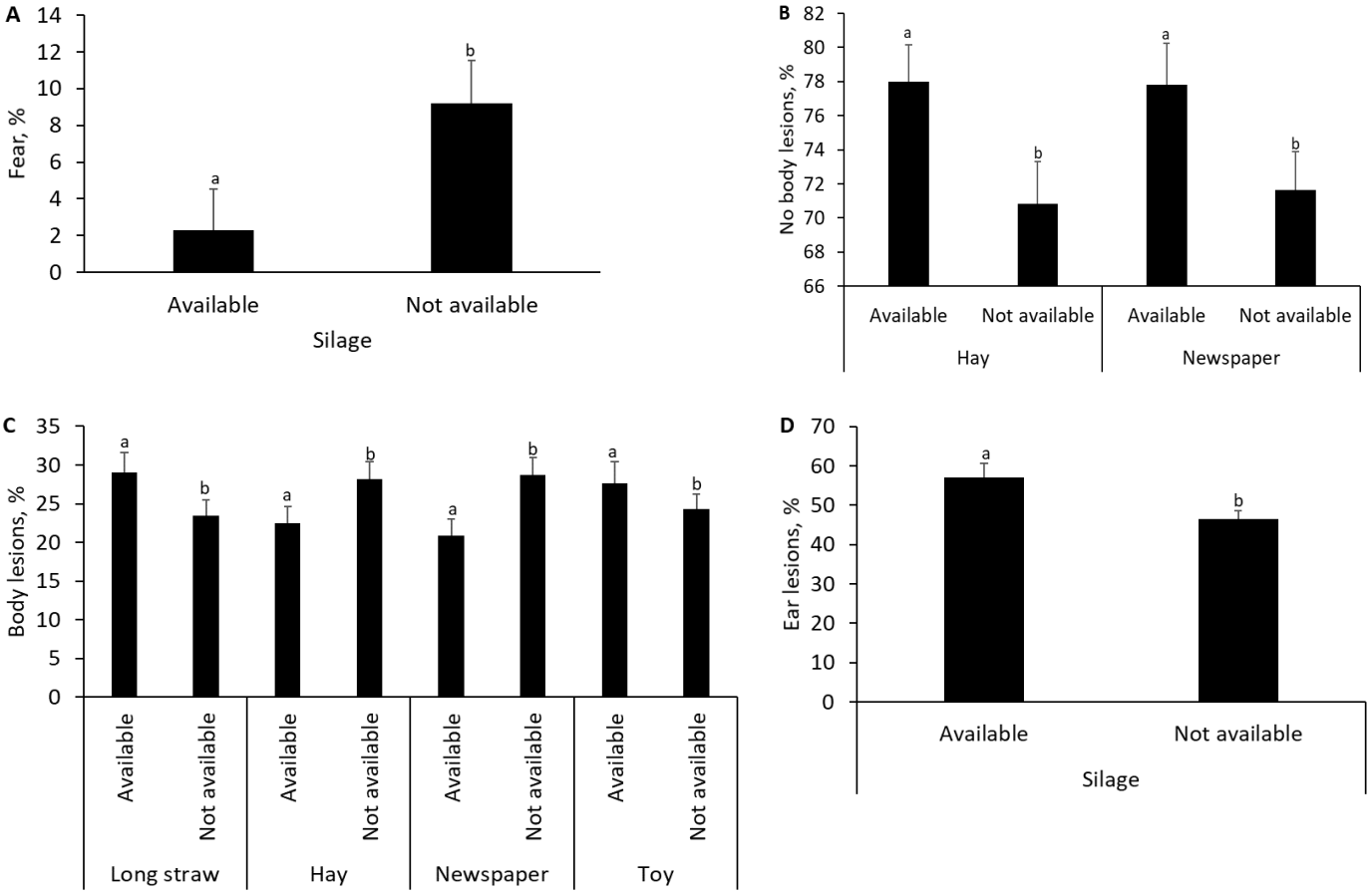


Figure 6. Enrichment materials. Significant effect of **(A)** fear on silage, **(B)** No body lesions on hay and newspaper, **(C)** Body lesions on long straw, hay, newspaper and toy, **(D)** Ear lesions on silage.

3.2.2. Effect of litter amount, material provision and material variability

The effect of litter amount, material provision and material variability on the different response variables are presented in Table 5.

It was not observed any significant effect for litter amount, material provision and material variability on floor dirtiness. Litter amounts had a significant effect on pig dirtiness, fear, no body lesions, and body lesions. Material provision had a significant effect on all response variables, except for floor dirtiness. Material variability had a significant effect on fear, no body lesions and ear lesions (Table 5.).

Table 5. Effect of litter amount, material provision (how much material given daily) and material variability (how many combinations of the different material types are given) on the response variables.

Response variables	Litter amount		Material provision, n		Material variability	
	F value	P value	F value	P value	F value	P value
Floor dirtiness, %	0.6	NS	0.0	NS	0.2	NS
Pig dirtiness, ≤10%	76.8	**<.0001**	48.4	**<.0001**	2.3	NS
Pig dirtiness, >10%	90.3	**<.0001**	57.5	**<.0001**	2.3	NS
Confidence, %	2.0	NS	3.6	**0.029**	2.2	NS
Fear, %	62.0	**<.0001**	71.7	**<.0001**	204.0	**<.0001**
No body lesions, %	281.6	**<.0001**	324.0	**<.0001**	5.3	**0.002**
Body lesions, %	179.3	**<.0001**	207.4	**<.0001**	2.4	NS
Ear lesions, %	1.8	NS	4.7	**0.010**	2.7	**0.034**
Tail lesions, %	1.4	NS	1923.1	**<.0001**	0.9	NS

Bold – Significant, P≤0.05.
NS – Non-significant, P>0.05.

3.2.2.1. Effect of litter amount

The cleanest pigs (pig dirtiness ≤10%) was observed for the pigs with small amounts of litter, while the dirtiest pigs (pig dirtiness >10%) was observed for the pigs with deep litter (Fig. 7A-B). A high fear percentage could be observed for the pigs with deep litter, compared to the pigs with the other quantities of litter (Fig. 7C). Small, moderate, and large amounts of litter did all show a significant difference with deep litter for both pig dirtiness and fear.

The highest percentage of body lesions was be observed for the pigs with small amounts of litter, and the lowest for pigs with deep litter (Fig. 7D-E). Similarly, to pig dirtiness and fear, did small, moderate, and large amounts of litter show a significant difference with deep litter for “body lesions” and “no body lesions”. A significant difference was also observed between all the different litter amounts for “body lesions” and “no body lesions”.

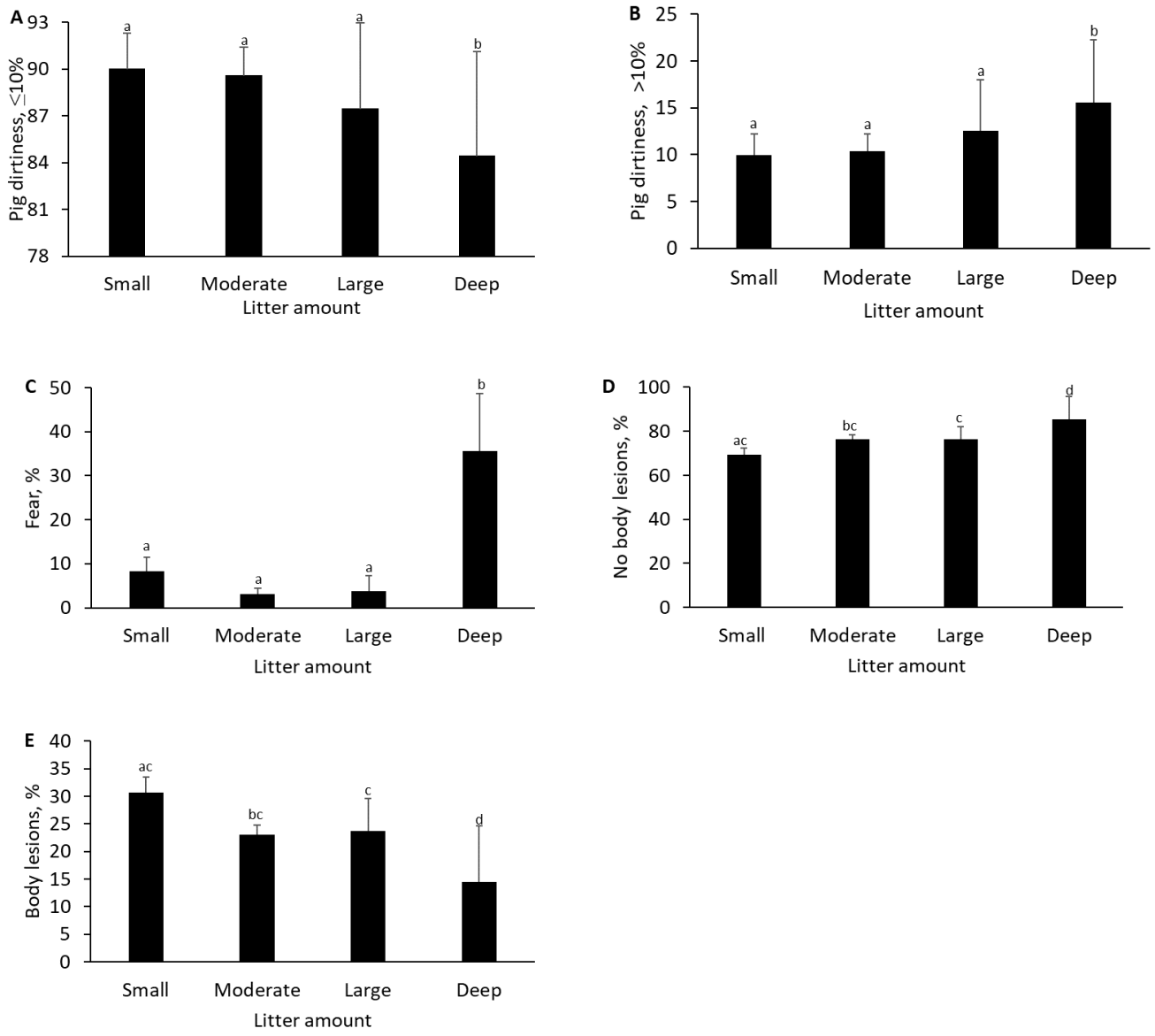


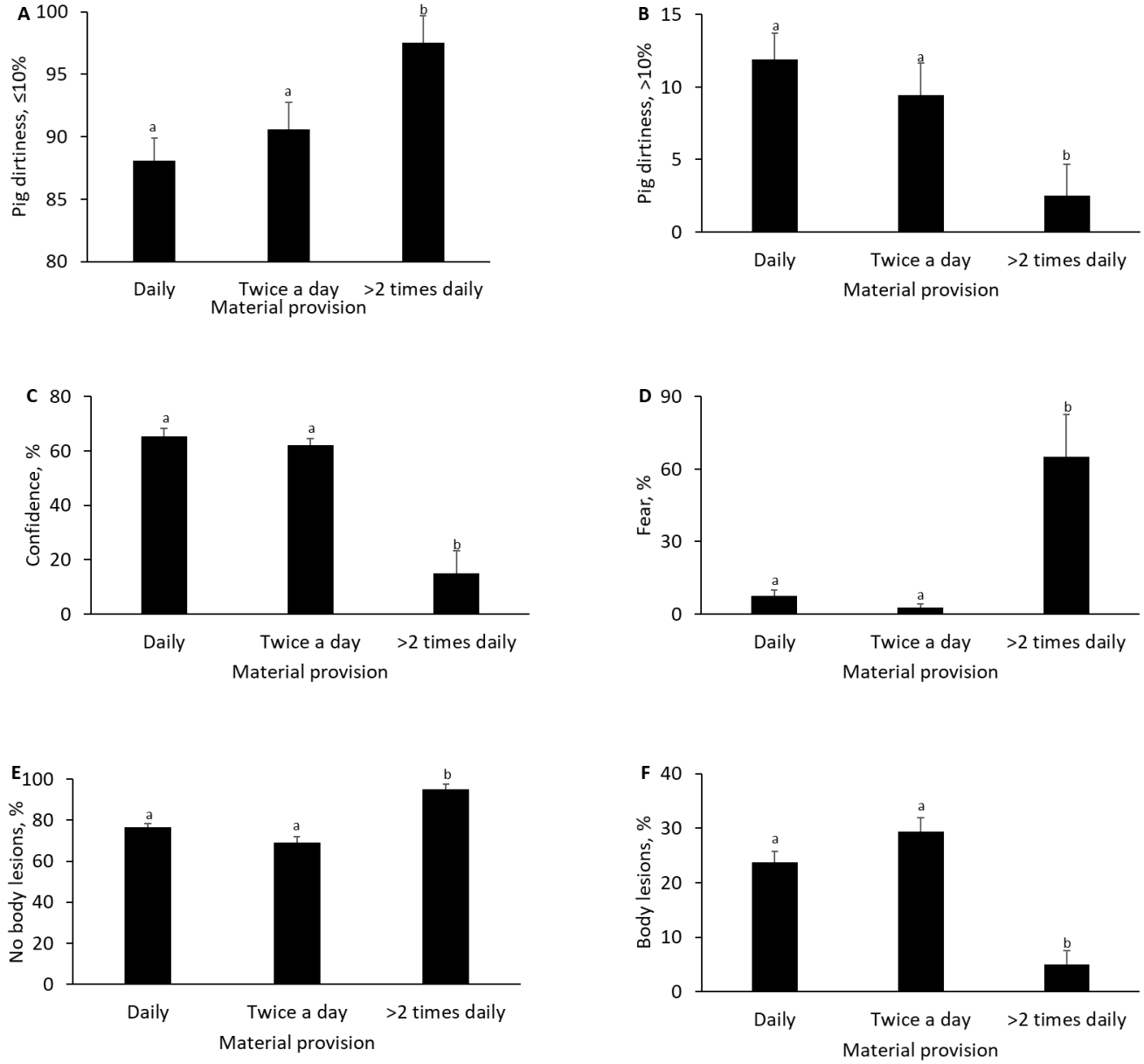
Figure 7. Litter amount. Significant effect of **(A)** pig dirtiness, ≤10% on litter amount, **(B)** pig dirtiness, >10% on litter amount, **(C)** fear on litter amount, **(D)** no body lesions on litter amount, **(E)** body lesions on litter amount. $^{a-d}$: unequal squared letter marks significant difference between the different amounts of litter.

3.2.2.2. Effect of material provision

Cleaner pigs (pig dirtiness, ≤10%) was observed for the pigs that got material more than two times daily, and dirtier pigs (pig dirtiness, >10%) was observed for the pigs that only got material once daily (Fig. 8A-B). A higher confidence response was observed for pigs that got material one and two times daily, compared to a higher fear response for the pigs that got material more than two times daily (Fig. 8C-D).

It could be observed a higher percentage of body lesions for the pigs that were given material once and twice a day, compared to the pigs that were given material more than two times daily (Fig. 8E-F).

For ear lesions it was observed a higher percentage for pigs that were given materials one and two times daily, and for tail lesions the highest percentage was observed for pigs that were given material just once daily (Fig. 8G-H). The categories, “daily” and “twice a day” were significant different from “>2 times daily” for all variables.



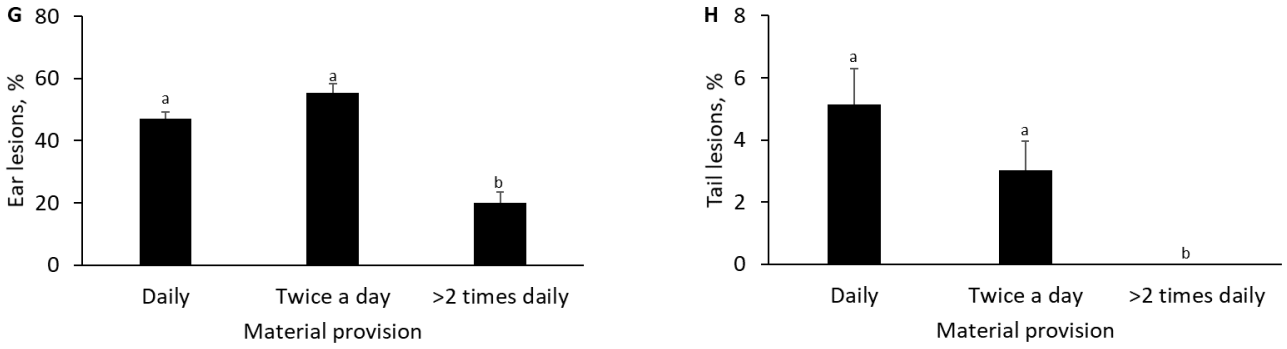


Figure 8. Material provision. Significant effect of **(A)** Pig dirtiness, ≤10% on material provision, **(B)** pig dirtiness, >10% on material provision, **(C)** confidence on material provision, **(D)** fear on material provision. **(E)** No body lesions on material provision. **(F)** Body lesions on material provision, **(G)** ear lesions on material provision, **(H)** tail lesions on material provision. $^{a-b}$: unequal squared letter marks significant difference between the different frequencies of material provision.

3.2.2.3. Effect of material variability

The highest fear response was observed for the pigs with four types of materials, while the lowest fear response was observed for six and three types of material. One, two and three types of materials were significantly different from four and six types of material. Four types and six types were also significantly different from each other (Fig. 9A).

For the pigs with one type, two types, three types and six types of material, it was observed less body lesions, compared to the pigs with four types of material. One type of material was significantly different from four types of materials, and two types was significantly different from three, four and six types. Three and six types were also significantly different from four and two types of material variations (Fig. 9B).

The lowest prevalence of ear lesions was observed for the pigs with four types of material, and the highest prevalence of ear lesions for pigs with three types of material. All the different material variations were significantly different from four types of material for this variable (Fig. 9C).

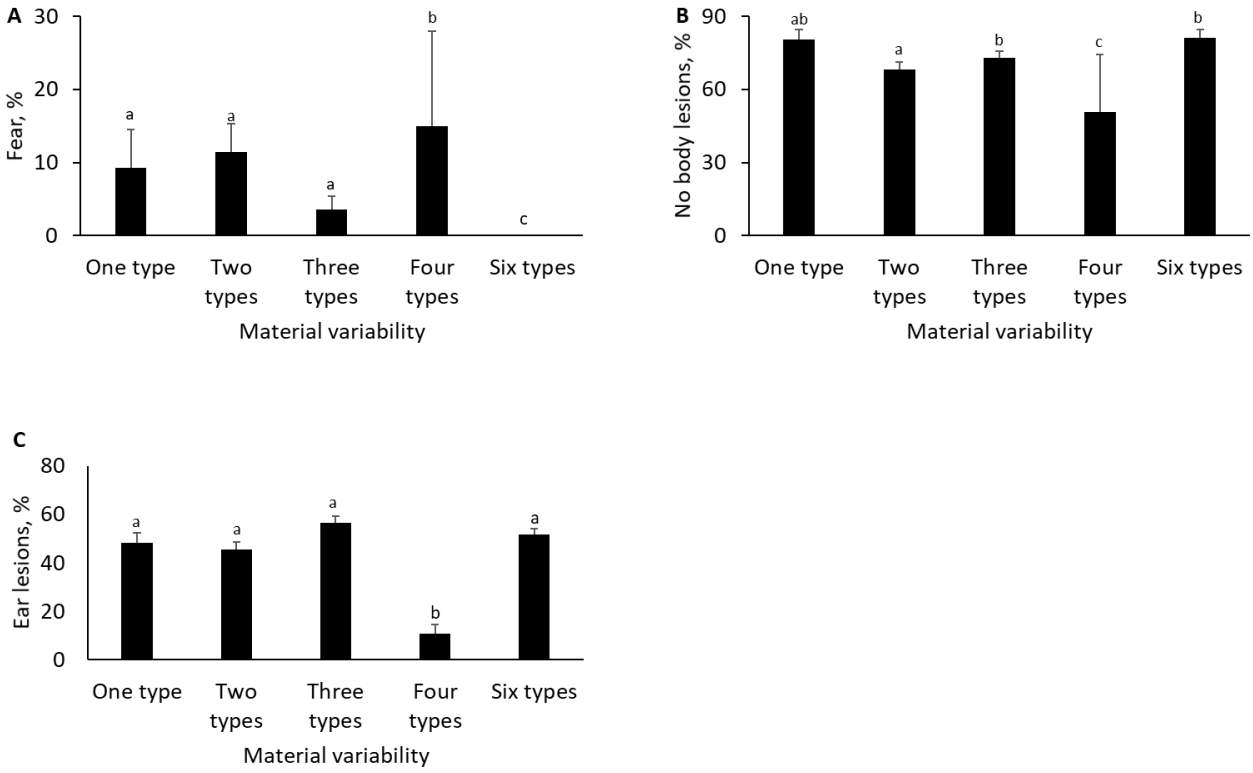


Figure 9. Material variability. Significant effect of **(A)** Fear on material variability, **(B)** No body lesions on material variability, **(C)** Ear lesions on material variability. [a-c]: unequal squared letter marks significant difference between the different variations of material.

3.3. Human-animal contact and management

The effect of type of contact, daily contact, mixing strategy, sorting strategy, changed pen environment, selective slaughter and moving routines on the different response variables are presented in Table 6.

Type of contact did not have any observed significant effect on any variables. Daily contact had a significant effect on all the variables, except for body lesions and confidence. Mixing strategy had a significant effect on floor dirtiness and tail lesions. Sorting strategy had a significant effect on pig dirtiness. Changing pen environment had a significant effect on floor dirtiness, pig dirtiness and tail lesions. Individual selection of pigs for slaughter had a significant effect on floor dirtiness, pig dirtiness, fear, and tail lesions. Moving routines only had a significant effect on floor dirtiness.

Table 6. Effect of type of contact, frequency of daily contact, mixing strategy (how many times the pigs are mixed), sorting strategy (in what way the pigs are sorted), changed pen environment (if pigs are changed from one pen to another, depending on feeding strategy), individual selection of pigs for slaughter (if the pigs are individually selected for slaughter or not) and moving routines (how many methods are used for moving the pigs) on the response variables.

Response variables	**Type of contact**		**Daily contact, n**		**Mixing strategy**		**Sorting strategy**		**Changing pen environment**		**Individual selection of pig for slaughter**		**Moving routines, n**	
	F value	P value	F value	P value	F value	P value	F value	P value	F value	P value	F value	P value	F value	P value
Floor dirtiness, %	1.3	NS	245.5	**<.0001**	345.5	**<.0001**	2.6	NS	17.7	**<.0001**	11.2	**0.001**	8.5	**0.0004**
Pig dirtiness, ≤10%	1.9	NS	284.9	**<.0001**	2.5	NS	5.0	**0.008**	infty	**<.0001**	11.8	**0.001**	1.6	NS
Pig dirtiness, >10%	1.9	NS	284.9	**<.0001**	2.5	NS	5.0	**0.008**	infty	**<.0001**	11.8	**0.001**	1.6	NS
Confidence, %	0.8	NS	0.9	NS	0.6	NS	0.3	NS	0.03	NS	0.2	NS	0.4	NS
Fear, %	0.1	NS	76.7	**<.0001**	3.7	NS	0.5	NS	0.2	NS	infty	**<.0001**	0.3	NS
No body lesions, %	1.6	NS	3.3	**0.041**	1.1	NS	0.4	NS	2.6	NS	1.6	NS	1.8	NS
Body lesions, %	1.52	NS	3.0	NS	0.7	NS	0.4	NS	1.97	NS	1.5	NS	1.1	NS
Ear lesions, %	0.4	NS	3.7	**0.029**	3.1	NS	0.1	NS	0.7	NS	0.0	NS	0.3	NS
Tail lesions, %	2.3	NS	336.6	**<.0001**	2608	**<.0001**	0.9	NS	infty	**<.0001**	Infty	**<.0001**	0.1	NS

Bold – Significant, P≤0.05.

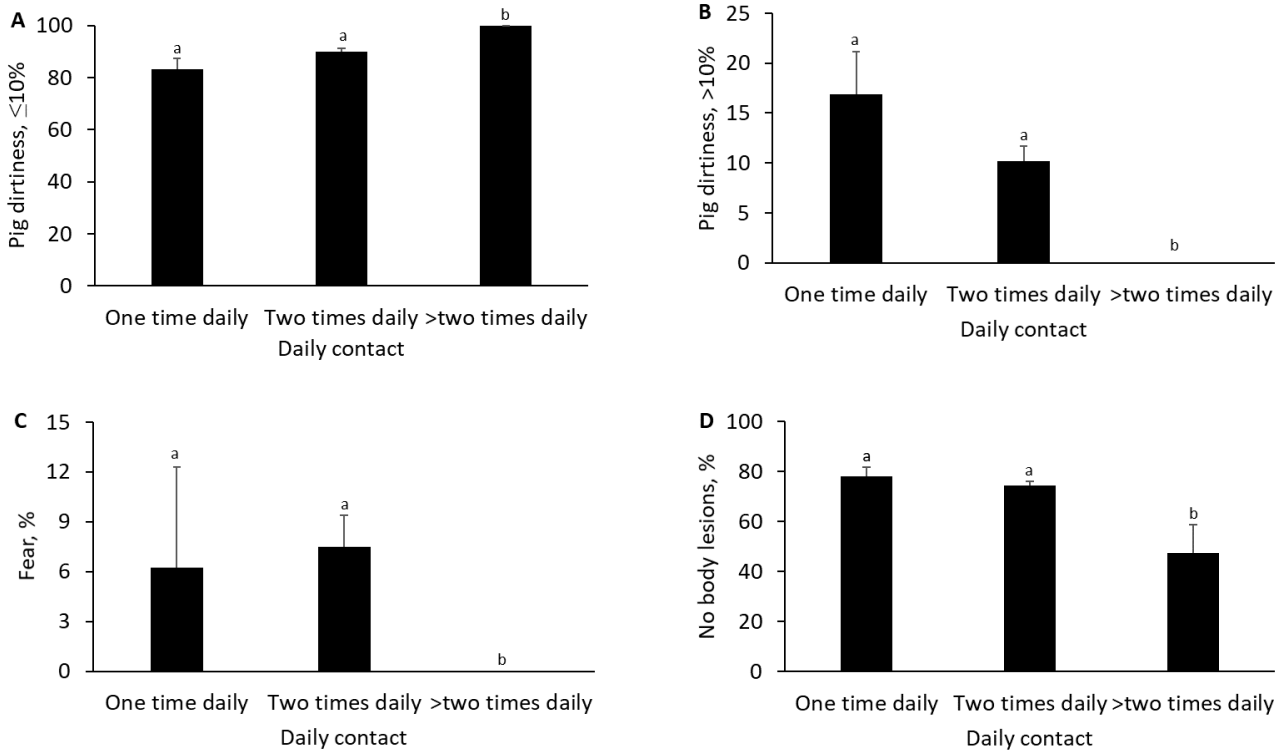
NS – Non-significant, P>0.05.

3.3.1. Effect of daily contact

The significant effect between floor dirtiness and daily contact showed an dirtier floor with less daily contact (Table 6, Mean ± SE for the different categories, once daily, 1.7 ± 0.12, two times daily, 1.3 ± 0.04, more than two times daily, 1.0 ± 0.00). It was observed a higher percentage of clean pigs (pig dirtiness, ≤10%) with more times daily contact, and a higher percentage of dirtier pigs (pig dirtiness, >10%) with less daily contact (Fig. 10A-B).

The highest fear response was observed for pigs with two times daily contact, while no fear response was observed for the pigs with more than two times daily contact (Fig. 10C).

The highest percentage of “no body lesions” was observed for the pigs with one- and two-times daily contact (Fig. 10D). The highest percentage of ear lesions was observed for the pigs with more than two times daily contact, while the highest percentage of tail lesions was observed for pigs with two times daily contact (Fig. 10E-F). For the significant variables, one- and two-times daily contact was significantly different from more than two times daily contact.



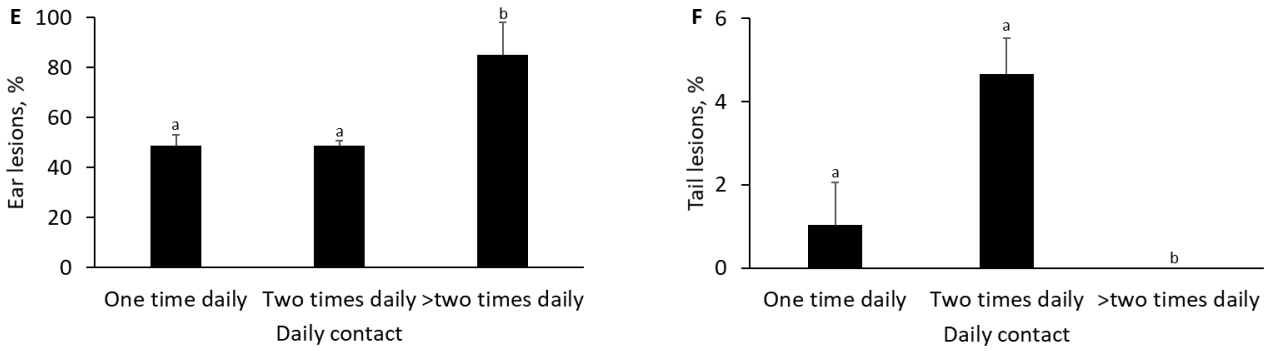


Figure 10. Daily contact. Significant effect of **(A)** pig dirtiness, ≤10% on daily contact, **(B)** pig dirtiness, >10% on daily contact, **(C)** fear on daily contact, **(D)** no body lesions on daily contact, **(E)** ear lesions on daily contact, **(F)** tail lesions on daily contact. [a-b]: unequal squared letter marks significant difference between the different frequencies of daily contact.

3.3.2. Effect of mixing strategy

The significant effect between floor dirtiness and mixing strategy showed the dirtiest floor for pigs in pens that got mixed one time (1.4 ± 0.10), followed by the pigs in pens that got mixed zero times (1.3 ± 0.05). The cleanest floor was observed for the pigs in pens that got mixed two times (1.0 ± 0.00). It was observed a higher prevalence of tail lesions for the pigs that had zero mixing, compared to the pigs that was mixed one or two times (Fig. 11).

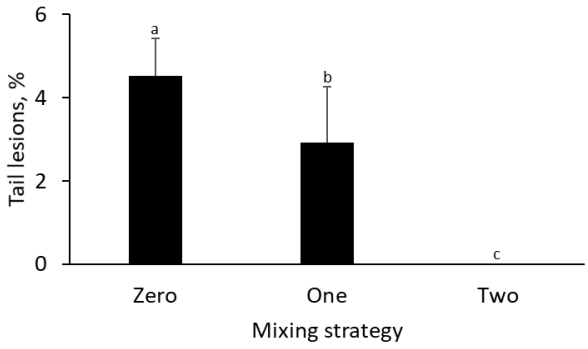


Figure 11. How many times the pigs are mixed. Significant effect of tail lesions on mixing strategy. [a-c]: unequal squared letter marks significant difference between the different mixing strategies.

3.3.3. Effect of sorting strategy

A higher percentage of clean pigs (pig dirtiness ≤10%) was observed for pigs that were sorted in size, while a higher percentage of dirty pigs (pig dirtiness >10%) was observed for pigs that was sorted in different sex (Fig. 12A-B). All the class variables were significantly different from each other for both response variables.

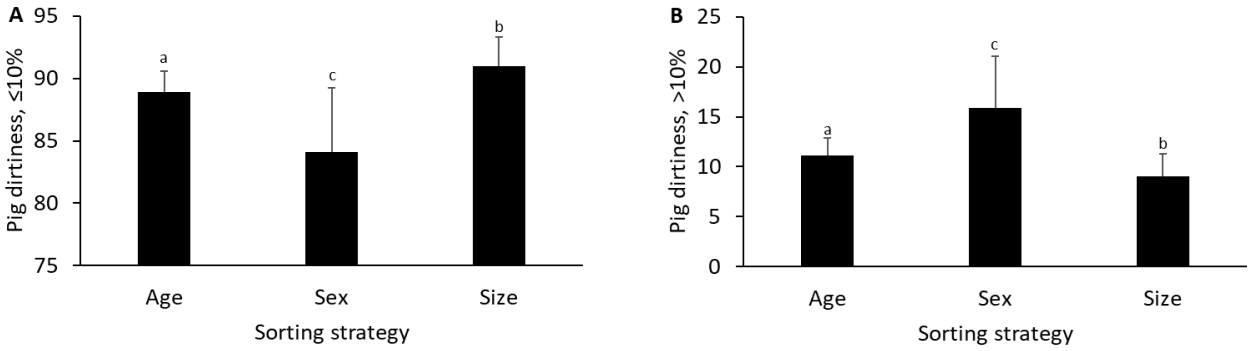
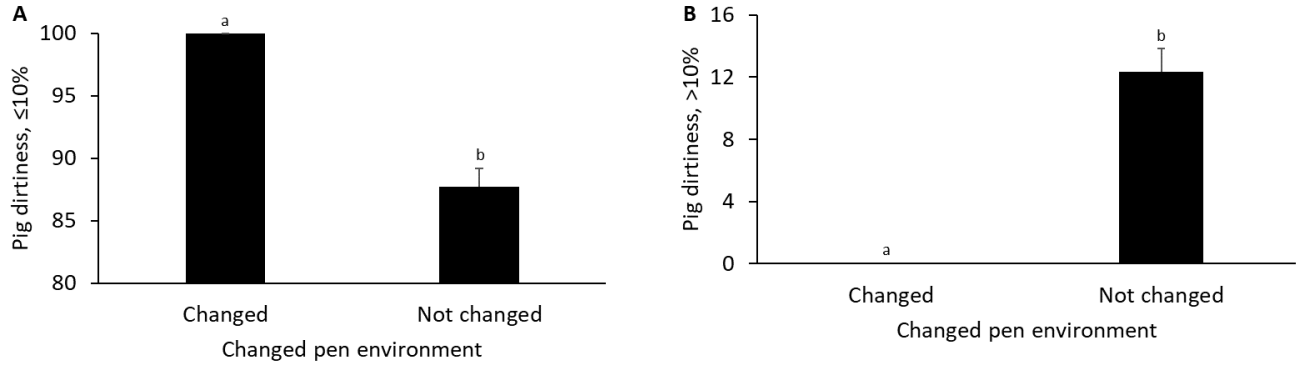


Figure 12. Sorting strategy. Significant effect of **(A)** pig dirtiness, ≤10% on sorting strategy, **(B)** pig dirtiness, >10% on sorting strategy. $^{a\text{-}c}$: unequal squared letter marks significant difference between the different sorting strategies.

3.3.4. Effect of changing the pen environment

The significant effect between floor dirtiness and changing pen environment showed dirtier floor for the pigs that did not have a change of pen environment (1.4 ± 0.05), compared to the pigs that did have a change of pen environment (1.2 ± 0.08). A higher percentage of clean pigs (pig dirtiness, ≤10%) was observed for the pigs that had a change of pen environment, compared to the pigs that did not have a change of pen environment (Fig. 13A-B). A higher percentage of tail lesions was observed for the pigs that did not have a change of pen environment, compared to the pigs that did (Fig. 13C). A significant difference was observed between not changed and changed for all the significant variables.



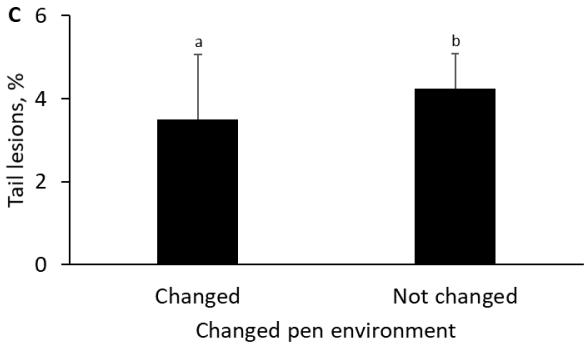
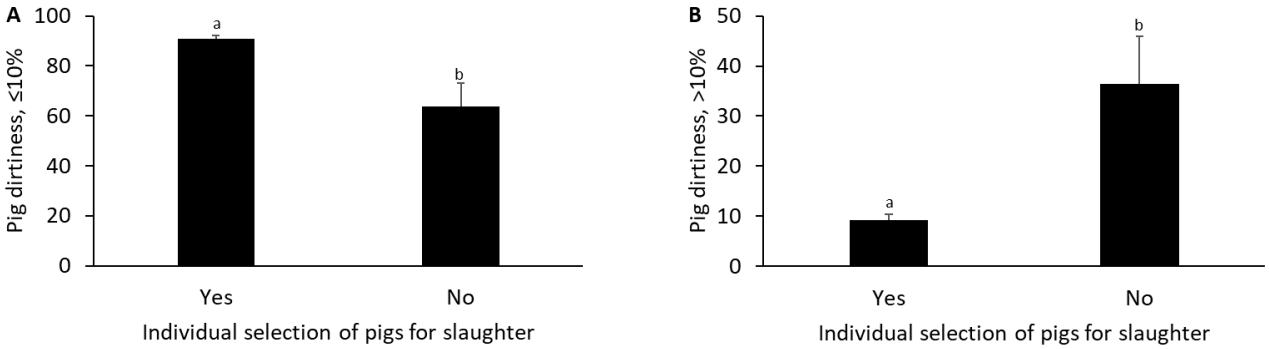


Figure 13. Changing the pen environment. Significant effect of **(A)** pig dirtiness, ≤10% on changed pen environment, **(B)** pig dirtiness, >10% on changed pen environment, **(C)** tail lesions on changed pen environment. [a-b]: unequal squared letter marks significant difference between not changed and changed pen environment.

3.3.5. Effect of individual selection of pigs slaughtered

The significant effect between floor dirtiness and individual selection of pigs for slaughter selective slaughter showed dirtier floor for the group that did not get selectively picked for slaughter (1.5 ± 0.19), compared to the group that got selectively picked for slaughter (1.3 ± 0.04). The cleanest pigs (pig dirtiness, ≤10%) was observed for the pigs that was selectively picked for slaughter, compared to the ones that were not (Fig. 14A-B). A higher percentage of fear and tail lesions were also observed for the pigs that were selective picked for slaughter (Fig. 14C-D).



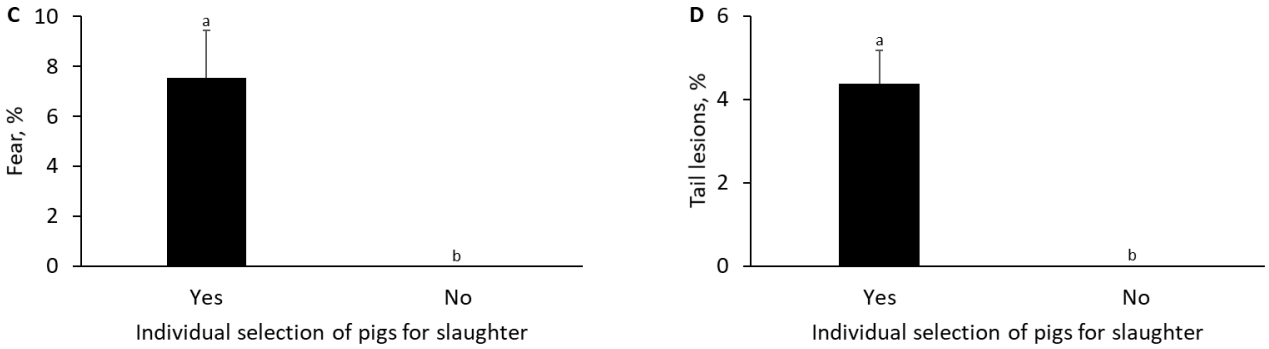


Figure 14. Individual selection of pigs for slaughter. Significant effect of **(A)** pig dirtiness, ≤10% on individual selection of pigs for slaughter, **(B)** pig dirtiness, >10% on individual selection of pigs for slaughter, **(C)** fear on individual selection of pigs for slaughter, **(D)** tail lesions on individual selection of pigs for slaughter. $^{a\text{-}b}$: unequal squared letter marks significant difference between if the pigs are individually selected for slaughter or not.

3.3.6. Effect of moving routines

The significant effect between floor dirtiness and moving routines showed dirtier floor with an increase in methods of moving pigs (Table 6, Mean ± SE for the different categories: 1 method, 1.2 ± 0.05, 2 methods, 1.4 ± 0.06, 3 methods, 1.4 ± 0.16).

4.0. Discussion

The main objective of this thesis was to assess pigs (n=1352) welfare at 20 finishing pig producers in East Norway. We investigated the effect of pen dirtiness, air quality, amount of litter used in the pens, type-, source-, and frequency of providing environmental enrichment, human-animal interactions, and management routines on selected welfare parameters.

As predicted the results showed that temperature in the pens influenced body and tail lesions. An increase in temperature resulted in an increase in body lesions, but a decrease in tail lesions. As the temperature increased, the pigs might prefer to lay down on the cold floor to reduce the body temperature. Under such conditions, they prefer slatted floor over solid floor (Aarnink et al, 2006). Our data indicate, that while having more body lesions, pigs are prepared to fight to defend the cold, slatted lying area. Furthermore, as they are not near each other while laying down, less tail biting can be observed. As already mentioned, in hot conditions, pigs tend to foul in the laying area (Phillipe et al, 2011). The temperature in this incidence did not influence either floor or pig dirtiness. This may be because the

temperature is not uncomfortable warm enough for the pigs to express fouling behaviour, or because they had other cooling methods available, such as sprinklers.

As predicted ammonia concentration influenced both floor dirtiness and pig dirtiness. With increased dirtiness on floor and pigs, the ammonia concentration also increased. These results are therefore in accordance with other studied (e.g. Larsen et al, 2017; Phillipe et al, 2011) which concludes that hygiene and ammonia emission are correlated with excretory behaviour and ambient temperature.

Our results showed an increase in prevalence of body lesions with the use of long straw and with the use of toys. As already mentioned, the use of long straw shown to decrease the aggressive behaviour in pens, compared to the use of chopped straw (Lahrmann et al, 2014). However, as an increased prevalence of body lesions are observed in our results, other factors, such as amount and frequency of material provided might be influencing the prevalence of body lesions, as more competition for resources will occur if the amount of enrichment is not sufficient. The pens which had toy available did also show an increased prevalence of body lesions. This may indicate that the toy used was not manipulatable or long-lasting enough to stimulate the pigs needs. Other factors may have influenced these results as well, such as frequency of daily material provision and/or material combination. The results showed an increase in prevalence of body lesions for the pigs in pens were hay and newspaper were unavailable. This may indicate that the use of these types of material are crucial to keep the pigs occupied, as studies have shown (e.g. Jordan et al, 2008; Telkaranta et al, 2014) the use of hay and newspaper as enrichment material will stimulate the pigs and give an increase in activity with these kinds of materials. An increased fear response was observed for pigs in pens with no silage available, but it was also observed an increased prevalence of ear lesions for these pigs. Holinger et al (2018) study concluded that the use of grass silage did not alter redirected behaviour towards other pigs in the pen, and this may be the reason why we observed these effects on ear lesions. As silage was shown by Studnitz et al (2007) to rank above other material such as straw in a preference test, it may indicate that a provision of silage as enrichment may help reduce the pigs fear of humans because they prefer this material. The other enrichment materials included in this thesis was not observed to have any significant effect on the response variables, and some were not used by the farmers, such as peat and dirt. These results may be in accordance with the Studnitz et al (2007) review study which concluded that material which are complex, manipulative, and destructible are the best types to fulfil the rooting behaviour of the pigs.

We predicted that an increase in the amount of litter would lead to cleaner pens. Our results showed that pens with small amount of litter had the cleanliest pigs, and pens with deep litter had the dirtiest pigs. Corrêa et al (2008) study concluded that if deep litter pens were unsuccessfully managed, it would lead to decrease hygiene, this may therefore be the

reason for the higher prevalence of dirtier pigs in these types of pens. It was also observed fearful pigs in the pens with deep litter, compared to the other litter amounts. The reason for the increased fear response may be due to less frequent contact with humans, as they might not get a new supply of litter every day, and because of the high animal density in these pens.

We predicted that pigs would become more confident if they were provided with an increased amount of enrichment materials. Despite our predictions, the results showed a higher occurrence of fearful pigs in pens were material was given more frequently. This may be due to competition for material, and it may also suggest that the amount of material provided was not enough. As predicted, the pigs that were given less frequent material provision showed a higher incidence of body-, ear-, and tail lesions. This would indicate that more aggression and boredom occur if pigs do not get enough material. This is in accordance with Studnitz et al (2007) review study, reporting that a lack of stimuli in the environment, will cause more redirected behaviour towards other pigs in the pen. For material variability, the results showed that the most fearful pigs, with a high prevalence of body lesions, had four different combinations of material. In contrast, less prevalence of ear lesions was observed for the pigs with a combination of four types of material, and more for the pigs with the combination of three and six. These results might depend more on the specific type of material used for the combinations, and not as much on the amount of combinations available.

We predicted that providing pleasant (e.g. calm contact, frequent strokes, etc..) types of contact would increase the confidence of the pigs and decrease the fear response. In contrast, our results showed that type of contact had no effect on the response variables. This may indicate that frequency of daily contact may be more important than type of contact for the pigs' welfare. This study did not record negative interactions between pig and handler, as the questionnaires alternatives ranged from "no contact" to "both verbal and physical contact" and did not elaborate if the type of contact was negative or positive. Bias answers from the farmers on the questionnaire about type of contact with the pigs, might also be a reason for why type of contact did not influence the response variables in this thesis. The frequency of daily contact had a significant effect on floor and pig dirtiness. As predicted, the results showed that an increased contact between the farmer and the pigs resulted in both cleaner floor and pigs and vice versa. It was also predicted that more contact would lead to more confident pigs. The results agree with this prediction, as more confident pigs were observed with more daily contact. Our results are in accordance with Gonyou et al (1986) and Day et al (2002) which concluded that frequent handling of pigs is necessary to avoid fearful pigs, which may decrease their welfare. Despite our predictions, a higher percentage of body wounds and a higher prevalence of ear lesions was observed for the pigs that got the most daily contact. The reason for this may be due to other factors, such as lack of stimuli and more competition between the pigs.

We predicted that keeping pigs with the same age and/or size, in stabile groups with minimal mixing would have a positive effect on hygiene, confidence and body-, ear-, and tail lesions. As predicted, the pigs sorted in equal size were the cleanest, while pigs that were sorted in the different sex were the dirtiest. We do not know the reason for this difference between sexes, but Newberry & Wood-Gush (1986) study noticed that young intact males showed more aggressive behaviour than females, when sorted in single-sex groups. This may indicate more aggressive behaviour within groups sorted in same-sex groups, which may also result in dirtier pigs. In contrast to our prediction, our results showed that the floor became cleaner when the pigs was mixed several times, and for pigs that changed pens. Even more, pigs were cleaner if changing pen, compared to the pigs that did not. When pigs get mixed and/or change their environment they will use energy on exploration and to try creating a stabile hierarchy (Rhim et al, 2015). Our results are surprising, and it was not found any logic explanation for this result. A higher prevalence of tail lesions was observed for the pigs that did not get mixed and did not have a change of pen environment. As these pigs would already have a stabile group, the reason for the increased prevalence of tail lesions may be due to boredom, and lack of stimuli in the pen.

We predicted that use of proper management routines, such as individually selecting pigs for slaughter and moving routines, would lead to less fearful pigs and better overall hygiene. Cleaner floor and pigs were observed for the pigs that was individually selected for slaughter, which may be due to decreased animal density in the pen, as this method for slaughter is performed. This would therefore lead to better space in the pens, which might again lead to better overall hygiene. The pigs that was individually selective slaughtered showed an increased fear response and an increased prevalence of tail lesions, the reason for this may be due to the creation of unstable groups, when pigs are removed from the pens. The pigs may need to stabilize their hierarchy again, and this might lead to increased fear. Other factors may also influence these results, as lack of stimuli in the pens would result in more tail lesions. It was observed dirtier floor with the use of more methods/equipment for moving the pigs. This may indicate that with the use of more methods, the pigs may get more stressed during moving and more manure will end up on the floor, or that the methods/equipment will leave the floor dirtier.

5.0. Conclusion

Finishing pigs need welfare friendly environment to avoid increased prevalence of body-, and tail lesions and to prevent dirty pens, thus an increased ammonia emission. Frequently provision of enrichment material, such as hay and newspaper, occupied finishers by focusing on manipulating the material, rather than redirect their behaviour towards other pigs in the pen. It was also observed that providing silage increased the confidence of the pigs. To supply litter is crucial for pigs' comfort and cleanliness, and proper management with the use of deep litter is essential, as our results observed an increased fear and dirtiness for these pens. Frequent human-animal contacts are important to ensure increased confidence and an overall increased hygiene. The use of proper management routines, such as use of individual selection for slaughter, mixing-, and sorting strategies is necessary to increase the pigs' comfort and welfare, but it is also important to acknowledge the many factors which may affect the results of the routines used. Therefore, more research should be executed to enhance the welfare of finishing pigs even further.

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Appendix 1.

REGISTRERINGSSKJEMA DYREVELFERD SLAKTEGRIS

KAPITTEL 1: SPØRSMÅL TIL SLAKTEGRISBESETNINGEN

Nortura rådgiver (navn og etternavn): _____

Slaktegrisbesetningen (ID): _____ Dato for besøk: _____

Dato for neste slakt: _____ Det er viktig at det skal brukes tydelig skift

1.0OM BESETNINGEN

1.1 Dyreeier og besetning	Svar	
Antall år ansvarlig dyreeier har drevet med svineproduksjon?		
Har dyreeier landbruk- eller husdyrfaglig bakgrunn/utdanning?	Ja ☐ Nei ☐	
Antall og fast ansatte personer involvert i det daglige stellet av grisene i denne puljen?	Antall, n	Fast, n
Er det en ren slaktegrisbesetning eller en kombibesetning?		
Antall innsett per år?		
Antall slaktegris levert i siste pulje?		
Er besetningen med i Griseløftet?	Ja ☐ Nei ☐	
Antall hus med slaktegris?		
Antall avdelinger med slaktegris?		
1.2 Oppfølging av unormal atferd samt syke og skadde dyr		
Antall døde og avlivede slaktegris, til sammen i siste pulje?		
Antall slaktegris som fikk behandling for sykdom og skader i siste pulje?		
Årsaker til sykdom hos slaktegris i siste pulje?		
Hva gjør du ved oppdagelse av lettere skader/haltheter?	Merker dyret Isolerer dyret Avventer Ingenting	

	Sykebinge Behandling Annet:
Hva gjør du ved oppdagelse av mer alvorlig sykdom eller skade?	Merker dyret Isolerer dyret Avventer Sykebinge Veterinær Behandler Avliver
Isoleres gris som biter?	Ja ☐ Nei ☐
Flyttes halebitt gris til sykebinge?	Ja ☐ Nei ☐
Avlives gris med alvorlig skader eller halebitt?	Ja ☐ Nei ☐
1.3 Bingemiljø	
Hvor ofte blir bingene rengjort?	Daglig To ganger daglig Sjelden Annet
Sorteres grisen ved mottak?	Ja ☐ Nei ☐
Hvis ja på spørsmålet over, hvordan sorteres det?	Alder Kjønn Størrelse
Er det stor aldersforskjell innad i bingene?	Ja ☐ Nei ☐
Antall blandinger/flyttinger per pulje?	
Blir grisen flyttet til et annet bingemiljø? (Tilvekst – sluttfôring) samme binge	Ja ☐ Nei ☐
Praktiseres plukkslakting?	Ja ☐ Nei ☐
Hvilke(t) ventilasjonssystem benyttes?	
Hvilke(t) gjødselsystem benyttes?	Vakuum utgjødsling Wire-trekk Tau-trekk Hydraulisk gjødseltrekk

	Kjetting trekk Annet: _____
Forårsaker rotematerialet problemer for gjødselsystemet?	
1.4 Fôring	
Type fôring? (Våtfôring, Tørrfôring, Alternative fôring midler)?	
Type fôringsstrategi? (Appetitt eller restriktivt)	
Praktiseres det kjønnsdelt framfôring?	Ja ☐ Nei ☐
Hvor ofte sjekker du at vannipler, vannkar og fôringautomater fungerer?	Daglig 1 gang i uka Sjeldent Aldri
1.5 Rotemateriale	
Har grisentilgang på rotemateriale?	Ja ☐ Nei ☐
Type rotemateriale som brukes i bingene (Kryss av de som benyttes)	Kuttet halm ☐ Longhalm ☐ Høy ☐ Torv ☐ Trespon ☐ Surfôr ☐ Avispapir ☐ Jord/Torv ☐ Greiner ☐ Andre ☐ Leker ☐ Hvis andre, hvilke: _____
Hvor ofte får grisene rotemateriale? (aldri, sjeldent, månedlig, ukentlig, daglig, to ganger daglig, flere ganger daglig)	
1.6 Dyr og menneske interaksjon	
Hvor mange ganger har du eller andre kontakt med grisene? (en gang daglig, to ganger daglig, mer enn to ganger daglig)	
Type kontakt med grisene?	

(ingen kontakt, verbalt, klapp/berøring, både verbal og klapp/berøring)	
Hva gjør du når du flytter/driver grisen? (Kryss av dem som benyttes)	Drivgang ☐ Transportlem ☐ Stemmebruk ☐ Lokking med fôr ☐ Lett berøring ☐ Går selv ved at bonden stiller seg bak ☐ Rasle padle ☐
Hvis grisen ikke vil flytte seg, hva gjør du da?	
Hvilke rutiner har du for grisen, den siste timen før de transporteres til slakteriet?	De blir blandet i gangen. ☐ De blir blandet i eget transportrom. ☐ De blir satt i eget transportrom. Ikke blandet med andre griser. ☐ De blir fastet i mer enn 24 timer. ☐ De blir fastet i mindre enn 24 timer. ☐ Ingen fasting ☐ De har tilgang til vann ☐ De har ikke tilgang til vann ☐ ☐ Andre kommentarer? Se nederst på siden. ☐
I hvilken tilstand ville du ikke sendt gris på slaktebilen?	
Har du opplevd at slaktebilen ikke vil ta med gris fra deg?	Ja ☐ Nei ☐
Hvis ja på spørsmål over, hvorfor?	

Hva gjør du med gris som ikke egner seg for transport?	
Er du, eller andre, tilstede når slaktebilen henter gris og eventuelt hjelper du til med å flytte grisen om nødvendig?	Ja ☐ Nei ☐
Har Mattilsynet kontaktet deg pga. avvik på innsendt slaktegris, i siste leverte pulje?	Ja ☐ Nei ☐

Andre kommentarer:

KAPITTEL 2: GRISEVELFERD

Forberedelser observatøren:

Velg deg ut 8 tilfeldig binger, helst ikke nabo-binger hvis det er mulig, for å evaluere velferd (kapittel 2), og oppstallingsforhold (kapittel 3). Gjør deg ferdig med alle målingene i en binge før du går videre til neste. Hvis det er flere avdelinger eller flere hus, skal du fordele bingene mellom hus/avdelingene. Hvis det er flere enn 15 griser i bingen, marker 10 griser som skal være et representativt utvalg og undersøkes på individnivå.

2.1 Uttrykk for positiv/negativ adferd FØR observatøren går inn i bingen.

Stå utenfor inngangen til bingen

Observasjonstid: 10 sekunder – tell antall (n) griser som uttrykker en av fem adferder.

Adferd- forklaring

1 Flykter umiddelbart bort med hele kroppen og søker stor avstand fra observatør

2 Beveger hodet/overkropp og/eller beveger seg et par skritt vekk fra observatør

3 Viser tilsynelatende ingen respons/blir stående eller fortsetter som før

4 Viser tilsynelatende ingen respons/blir stående men tar kontakt etter noe nøling

5 Søker kontakt umiddelbart

Binge	Flykter umiddelbart	Beveger seg rolig vekk	Ingen respons	Tar kontakt etter en stund	Søker kontakt umiddelbart
	n	n	n	n	n
1					
2					
3					
4					
5					
6					
7					

8					

2.2 Renhet på tett gulv og renhet på gris

Stå utenfor inngangen til bingen.

1. Kryss av for prosentandel av området med tett gulv som er dekket av møkk eller bløtt underlag
2. Tell antall gris som har kroppen dekket av møkk på mindre enn 10%, mindre enn 40% eller mer enn 40%.

Binge/Griser	0 ≤ 10, %	> 10 ≤ 40, %	> 40, %	
Binge 1				Kategorier binge: 0 ≥ 10 – Mindre enn 10% av området med tett gulv er bløtt og/eller dekken av møkk. > 10 ≥ 40 av området med tett gulv er bløtt og/eller dekken av møkk. > 40 av området med tett gulv er bløtt og/eller dekken av møkk. Kategorier griser: 0 ≥ 10 – Mindre enn 10% av kroppen er dekken av møkk. > 10 ≤ 40 % av kroppen er dekket av møkk > 40 % av kroppen er dekket av møkk
Griser 1, n				
Binge 2				
Griser 2, n				
Binge 3				
Griser 3, n				
Binge 4				
Griser 4, n				
Binge 5				
Griser 5, n				
Binge 6				
Griser 6, n				
Binge 7				
Griser 7, n				
Binge 8				
Griser 8, n				

2.3 Mengde strø på liggeplass:

Stå utenfor inngangen til bingen.

Kryss av for riktig mengde strø på liggeplass. Beskrivelse er vist i bilder under.

Binge	1	2	3	4	5
	Ingenting	Små mengder	Moderate mengder	Store mengder/ heldekkende	Djupstrø/talle
1					
2					
3					
4					
5					
6					
7					
8					




2.4 Bevegelighet, hold, brokk og øre/halebiting

Gå inn i bingen og få alle grisene på beina, hvis mulig.

1. Tell antall gris som halter og/eller har alvorlige problemer med bevegelighet. Se beskrivelse under tabellen.
2. Tell antall griser med brokk i hver binge. Brokk er en utposning under huden i navlestrengen.
3. Tell antall gris med halebitt og sår på ørene.
4. Gjør en holdvurdering av grisene i bingen. Se på ryggraden og hoftebeina og vurder synligheten av disse. Hvis det er tydelig utstikkende ryggrad og hoftebein blir grisen klassifisert som tynn (Hold ≤ 2).

Binge	Bevegelighet		Hold	Brokk (minst tennisballstørrelse)	Bittskader Øre	Bittskader Hale
	Mindre alvorlig, n[a]	Alvorlig problem, n[b]	Tynne griser, n	Grisene med brokk, n	n	n
1						
2						
3						
4						
5						
6						
7						
8						

[a] – Gris beveger seg noe stivt og/eller er noe halt; [b] – Gris har problemer med å reise seg og/eller bevege seg

Bilde av gris med brokk:

2.5 Kroppssår og skader

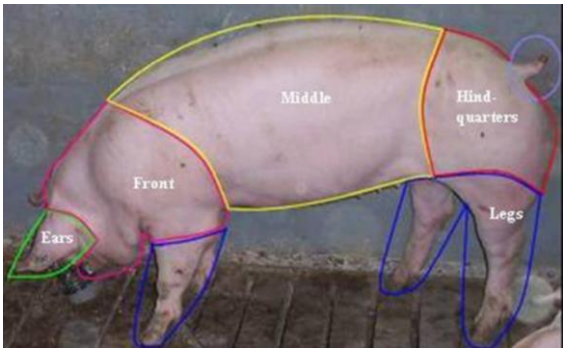
Gå inn i bingen.

Tell antall gris som har sår eller rifter på kroppen i henhold til inndelingen i tabellen nedenfor.

Sår bør evalueres i 4 deler; frampart, midtdel, bakpart og bein. Se bilde for beskrivelse hvis tvil.
Kroppssår blir definert som skrubbsår og/eller sår hvor hud og/eller muskelvev er penetrert.

Binge	Ingen sår/rifter	Noen få sår/rifter	Sår/rifter på flere steder	Sår/rifter på mesteparten av kroppen
	n	N	n	n
1				
2				
3				
4				
5				
6				
7				
8				

Bilde av inndelingen:



Kapittel 3: MILJØ

3.1 Fysisk miljø

Gå inn i bingen og gjør oppmålingene.

Binge	Rom	Antall gris	Drikke plasser[a]	Fôringsteder[b]	Langtro	Binge	Liggeplass (tett golv)	Tilgang til uteareal
	1 eller 2	n	n	n	Lengde, m	Lengde × bredde, m	Lengde × bredde, m	Lengde × bredde, m
1								
2								
3								
4								
5								
6								
7								
8								

Drikkeplasser[a] - Hvor mange gris kan drikke samtidig?

Fôringsteder[b] – Hvor mange griser kan spise samtidig?

3.2 Luftkvalitet

Gå inn i bingen

Bruk egnet måleutstyr og mål temperatur, lufthastighet og ammoniakkonsentrasjon i tre ulike binger spredt i rommet (front, midt og bak).

Gjør målingene på liggeplassen i bingen i «grisehøyde».

	Rom 1			(eventuelt, hvis ulike) Rom 2		
	Front	Midt	Bak	Front	Midt	Bak

Lufttemperatur, ˚C						
Lufthastighet, m/s						
Gasskonsentrasjon (NH_3, ppm)						
Volum av rommet (Lengde × bredde × høyde, m)						
Antall griser, n						

3.3 Ta bildene av binge og rom

- Ta bilde av bingen slik det er beskrevet under punkt 3.1 Fysisk miljø. Få med hele bingen og skillevegger på bildet.
- Dersom binge 1-8 er ulikt utformet skal det tas bilder av de forskjellige bingene, og bildene skal merkes med bingenummeret.
- Ta bilde av rommet der grisen oppholder seg slik at ventilasjonssystemet vises og merk bilde med rom 1 og rom 2.

3.4 Sykebinge (kryss av alternativ)

			Optimalt
Er sykebinge tilgjengelig?	Ja	Nei	
Blir sykebingen tatt i bruk til syke dyr?	Ja	Nei	
Er det trekkfritt i sykebingen?	Ja	Nei	Lavere enn 0.2 m/s
Temperatur i sykebingen (˚C)?			15 – 20 ˚C
Areal (lengde × bredde, m)			
Er det rikelig med strø sykebingen (minst nr 3 i tabellen 2.3)?	Ja	Nei	

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