Effect of breed and previous social experience on the response of Swedish and Dutch Yorkshire gilts in a challenging feed test

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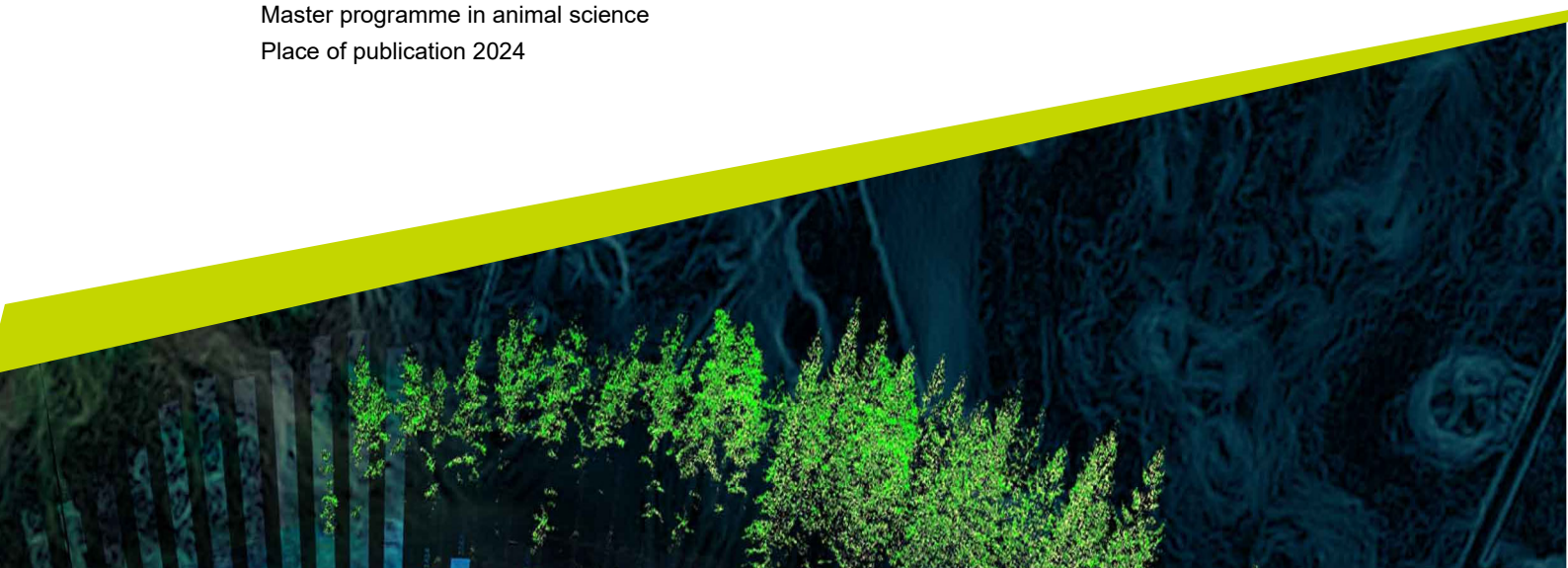

Effect of breed and previous social experience on the responce of Swedish and Duch Yorkshire gilts in a challangeing feed test

Effekt av ras och tidigare social erfarenhet på responsen hos Svenska och Holländska Yorkshiregyltor i ett utfodringsstresstest

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Abstract

This master's thesis aimed to examine the differences between breeds of gilts and the effect of their previous social experience on their response in a feed challenge test (challenged by not giving access to the feed provided in the feed stall promptly). The test was performed in their home group pen approximately 2 weeks before they gave birth to their first litter (at 8-9 months of age). The 65 gilts to be determined were between the two gilt breeds, and they were also exposed to two different social experiences (Early and Late social experiences). The results show that Swedish Yorkshire gilts were more exploratory and engaged more socially during the feed challenges test than Dutch Yorkshire gilts, suggesting that breed-specific tendencies, shaped by their historical breeding practices, affected their behaviour. Moreover, this research also emphasizes the impact of previous social experiences of gilts on their future behaviours. The gilts introduced to additional social mixing at 10 weeks of age exhibited aggressive behaviours of either a competitive or dominant nature compared to the gilts without that additional social mixing experience. This indicates the possibility that the previous social experiences will not only shape each gilts' behaviours but also affect their welfare and group interactions. The results of this thesis suggest that a deeper understanding of breed-specific behaviours and the impact of previous social environments can guide more welfare-oriented breeding, housing, and management strategies.

Keywords: Swedish Yorkshire, Dutch Yorkshire, behaviour, social experience, social environment, swine, pig

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Abbreviations

AP	Access Pen
CP	Control Pen
DY	Dutch Yorkshire
IG	Intact Group
MG	Mixed Group
SY	Swedish Yorkshire

1. Background

Group housing of sows has been recognised for its welfare benefits, notably allowing sows to exhibit essential species-specific behaviours and move freely. As commercial pig production evolves, group housing has become a significant welfare consideration. Despite these advantages, challenges such as the occurrence of excessive aggression and injury rates have raised concerns. These behavioural issues are fundamental in establishing social hierarchies. However, they can lead to severe consequences, including injuries, death, or the premature culling of animals, thereby negatively influencing animal welfare and economic strains on farmers (Anil et al., 2003; Brajon et al., 2021; Verdon et al., 2016).

The complexity of sow behaviour in group housing is further compounded by environment, breed, and previous social experiences. These elements influence sows' abilities to cope with group dynamics, impacting their feeding and foraging behaviour and response to stressors (Hannius, 2019; Huynh et al.,2005; Rushen, 2000). Stress-induced changes in feeding patterns are responses to environmental and social pressures, with stress hormones like cortisol playing a significant role in modifying appetite and eating behaviours. Research into the genetic basis of aggression and social behaviours in pigs indicates a heritable component to these traits. Studies have shown variations in aggression linked to breed, with implications for stress and frustration responses under restrictive conditions (Lund & Simonsen, 1995; Avital & Jablonka, 2000; D'Eath et al., 2009). These findings emphasise the influence of genetics on the development and expression of aggressive behaviours, suggesting that breeding could potentially mitigate some unwanted outcomes associated with group housing, such as injurious aggressive behaviour.

The interaction between genetics and environment is also evident in the stress responses of different breeds. For instance, Swedish Yorkshires, potentially due to indirect breeding for traits favourable in loose-housed systems, may exhibit less aggressive and more exploratory behaviours in stressful situations, which could suggest a capacity for more adaptive coping mechanisms (Held et al., 2002; Spoolder et al., 2000). Loose-housed systems contrast with breeds optimised for intensive production settings with stalled sows, which may demonstrate a higher propensity for competitive and aggressive behaviours.

1.1 Evolutionary background of pigs

The domestic pig (Sus scrofa) is a testament to the intricate relationship between genetics and domestication. The works of Larson et al. (2005) and Frantz et al. (2015) reveal that pig domestication was not a singular event but a multifaceted process occurring at several centres across Eurasia. Larson et al. (2005) outlined a phylogeographic history that shows a rich, multi-regional domestication journey deeply influenced by the interactions between humans and different wild boar populations. Frantz et al. (2015) expanded on this by demonstrating the dynamic gene flow and selective forces at play throughout the domestication process, emphasizing the role of both natural and artificial selection in shaping the traits of domestic pigs. This comprehensive genetic legacy continues to shape pig behaviour and management practices, offering insights into the development of sustainable and welfare-oriented livestock production.

1.2 Genetic influence and breed differences

Genetic contributions to pig behaviour, mainly those relevant to aggression, social experience, and feed efficiency, are crucial for informed breeding and management. Camerlink et al. (2022) discovered that certain aggression-related behavioural traits have moderate heritability and are strongly genetically correlated, implying a significant genetic component that could be targeted in breeding programs for enhanced welfare.

Swedish Yorkshires (SY) and Dutch Yorkshires (DY) represent breeds shaped under divergent selection pressures and breeding practices. The SY breed, developed under Sweden's welfare-oriented systems, could be more socially tolerant and adaptable to group living (Andersson, 2019). Conversely, the DY breed has been selected for traits optimizing production within production systems with crated sows, potentially resulting in different behavioural responses to human interaction and nursing behaviour (Anderberg, 2017; Lundahl, 2019). Acknowledging these breed-specific characteristics is vital in a comprehensive welfare assessment. Such evaluation should thoroughly investigate the SY and DY's behavioural adaptations, mental well-being, and physical health under various farming conditions. It is, therefore, essential to dissect and understand the various welfare responses these SY and DY exhibit to ensure that the animals' intrinsic needs are met and their inherent behaviours are suitably accommodated.

The temperamental and behavioural variations between SY and DY gilts can be attributed to genetic and environmental factors. Research by Kavlak et al. (2021) and Do et al. (2013) discusses how genetic differences can be seen in feeding behaviours and social hierarchy dynamics, potentially impacting how gilts respond to environmental stresses such as feed challenges. In addition to exploring the

genetic background of behavioural responses, the research by Kavlak and Uimari (2024) was particularly informative. They delved into the genetic basis of feed intake-based resilience, uncovering genetic markers associated with behaviours influencing how gilts respond to environmental stressors, such as competitive situations during feed challenges. Their findings are crucial for understanding the role of genetics in behavioural expressions related to aggressiveness and persistence. This knowledge is essential for developing management strategies that align with the welfare needs of pigs, acknowledging the importance of genetics in shaping these behaviours.

1.3 Social Environment and Behavioral Development

In addition to genetic factors, social aspects significantly influence pig behaviour and welfare. Social interactions within group housing systems can lead to positive and negative outcomes. Well-socialized pigs exhibit less aggressive and more cooperative behaviours, enhancing group stability and overall animal welfare. While, inadequate socialization can result in increased aggression, stress, and injury. The key to improving pig welfare lies in understanding these social dynamics. This knowledge helps to develop effective management strategies that promote harmonious interactions and reduce conflicts (Brajon et al., 2021; D'Eath et al., 2009).

1.4 Frustration in Pigs

Frustration is a critical factor in animal welfare, often arising from unmet needs or restrictive environments. In pigs, frustration can manifest through increased aggression, stereotypic behaviours, or reduced exploratory actions. Previous studies have identified behaviours associated with frustration, such as biting, tail-biting, and excessive vocalizations (Day et al., 1995; D'Eath, 2002). These behaviours are often observed when pigs face obstacles in accessing resources, such as during a challenging feed test. Understanding these behaviours allows better interpretation of the pigs' welfare status and developing interventions to mitigate frustration (Rushen, 2000; Spoolder et al., 2000).

1.5 Aim

This master's project assesses breed differences and the impact of previous social experiences on gilts' responses in a challenging feed test. The research is about understanding pig behaviour and providing crucial insights that can

significantly improve animal welfare and enhance livestock production. The aim is not just a goal but a key to unlocking a comprehensive understanding of pig behaviour and its implications for livestock production.

Following the overall aim, this study addresses the following specific research questions:

I. How do Swedish and Dutch Yorkshire gilts differ in their exploratory and social behaviours during a challenging feed test?

II. How do early social experiences affect gilts' aggression levels and social interactions in a feed-restricted environment?

2. Material and methods

This project was performed at a pig facility at the Swedish Livestock Research Centre Lövsta outside Uppsala. The facility is a Specific Pathogen Free (SPF) herd with ISO 14001 environmental standard certification where herds are controlled from bringing in new animals and are regularly controlled for common pig diseases, leading to thorough infection control routines (The Swedish Livestock Research Centre, 2017). The study was approved by the National Ethics Committee for Animal Experiments in Uppsala (ID: 5.8.18-16279/2017).

2.1 Animals

This master thesis project included 65 gilts. They were followed from when their mother sow was inseminated until a feeding challenge test (254.5 ±19.83 days of age, mean ± standard deviation) two weeks before the birth of their first litter. The gilts originated from 28 litters, and half of the litters were sired by Swedish Yorkshire (SY) and half by Dutch Yorkshire (DY) boars. The test was carried out in the pen that the gilts lived, and besides the differences in their breeds, the gilts were exposed to different social experiences early in life in a balanced study design (Tables 1, 2 and 3).

2.2 Housing and management

The gilts included in the feed challenge test two weeks before they gave birth to their first litter were followed by when their mother was inseminated. The housing and management of the gilts through rearing is hereafter described in chronological order.

After birth, the gilts were housed with their mother sow and litter siblings in loose-housed farrowing pens. The pens consisted of a lying area with a concrete floor, a dunging area of the slatted floor, a heat lamp, and an area to which only the piglets had access, known as the piglet corner. The lying area was 2.00 m x 2.05 m, and the slatted area was 2.00 m x 1.20 m, meaning that the total area of the pens was 6.50 m^2. The staff manually cleaned the pens at the stable during the morning, and a straw was provided after cleaning. The cleaning was done at least an hour

before the observation began. The sows were fed automatically with dry feed and were given feed two or three times a day. Dry feed adapted for piglets is provided through a feed dispenser from approximately 3 weeks of age, and water was available ad libitum from drinking nipples. The gilts were weaned from their mother sow at 5 weeks of age and were, after that, kept with their litter siblings in the farrowing pen until 10 weeks of age.

At 10 weeks of age (27.6±4.11 days, mean ± standard deviation), the gilts were moved to a finishing pig stable where they were housed in groups of 4 per pen. The pen consisted of a dunging area with a slatted floor, which is one-third of the pen area, and a lying area in concrete to which only the piglets had access. The lying and feeding areas were 3.6 m x 2.2 m, and the slatted area was 3.6 m x 1.0 m, meaning that the total area of the pens was 11.5 m^2. Cleaning of the pen was done manually by the staff in the morning, and chopped straw was provided automatically after cleaning, and this was done at least an hour before the observation began. Pigs received either dry or wet feed, which was given automatically thrice daily. Water was available ad libitum from drinking nipples.

From 20 weeks of age (141.3±1.67 days of age, mean ± standard deviation), the gilt groups of 4 per group were moved to a pen in the dry sow stable. The pen total area for dry sows was 32.5 m^2 and consisted of deep straw bedding, a row of seven feeding stalls, and one water station. The gilts were kept loose and housed in groups. Each sow received individual feeding with dry feed and was fed manually by staff two times a day, with the first feed allowance around 8:00 in the morning and 1:00 p.m. Water was available ad libitum from drinking nipples.

2.3 Feed challenge test

The gilts included in the study were subjected to a challenging feeding trial in their home pen in the dry sow stable in late pregnancy, approximately 2 weeks before they gave birth to their first litter (254.5 ±19.83 days of age, mean ± standard deviation). The gilt behavioural response to the challenging feeding trial was video-recorded in each pen during the 15-minute test. The feed was placed in the feeding trough, but the gates to the feed stalls were shut so that the sows could not access the feed throughout the 15-minute test. The behavioural response of the gilts during the challenge test was recorded with a video camera placed over the pen. The video camera used was a Garmin VIRB Ultra 30.

The home pen where the test was carried out had a total area for dry sows of 32.5 m^2, and it consisted of deep straw bedding, a row of seven feeding stalls, and one water station for the gilt group of 4 gilts per group. The gilts were kept loose and housed in groups. Each sow received individual feeding with dry feed and was fed manually by staff two times a day, with the first feed allowance around

8:00 in the morning and 1:00 p.m. Water was available ad libitum from drinking nipples.

2.4 Study design

The gilts included in this study were of two different lines of Yorkshire, Swedish Yorkshire (SY) and Dutch Yorkshire (DY) and were provided with two different early social housing environments (AP and CP, described in detail below) and two different late social housing environments, intact group, and a mixed group (IG and MG, described in detail below).

The distribution of gilts over breed and early and late social treatments are presented in Tables 1, 2 and 3.

Table 1: Distribution between breeds and treatment during early socialisation of Swedish Yorkshire sires and Dutch Yorkshire

	SY	**DY**	**Total**
Access pen	13	21	34
Control pen	16	15	31
Total	29	36	65

Table 2: Distribution of gilts over breeds and treatment during late socialisation of Swedish Yorkshire sires and Dutch Yorkshire

	SY	**DY**	**Total**
Intact Group	8	24	32
Mixed Group	17	16	33
Total	25	40	65

Table 3: Distribution over early and late socialisation of Swedish Yorkshire sires and Dutch Yorkshire

	Access pen	Control pen	Total
Intact Group	16	19	35
Mixed Group	17	13	30
Total	33	32	65

2.4.1 Breed

The gilt sires used were 100 % SY or DY, and the gilt dams used to produce gilts were 100 % SY or at least 50 % DY, which means that the gilts investigated in this study are 100 % SY or at least 75 % DY. The two breeds have a similar breeding objective but have historically been selected in different social environments. The SY breed has been evaluated and selected based on performance

in a group-housed environment and has thus been indirectly selected for behaviours favourable in group housing. The DY sows have historically been evaluated and selected based on performance in sow stalls and thus been indirectly selected for behaviours favourable in individual housing. However, in the past decade, DY has been chosen in group housing as group housing is now compulsory in the EU (EU Council Directive 2008/120/EC). Thus, individuals not coping in a group housing system (SY) or individual housing (DY) would not be parents for the next generation, even though behaviour traits were not included in the breeding goal. Additionally, Lundeheim (2017) reported that as Swedish pig breeding stopped in 2005, the existence of the SY breed stopped after that. In this study, the SY dams were purebred SY sows still in production, and the SY sires were from frozen semen samples saved from when breeding for the SY gilts was still going on in Sweden; thus, both sires and dams were 100 % SY.

2.4.2 Early and late social experience treatments

Between week 2 and week 5 of age in the farrowing pen, half of the litters had the opportunity to move freely between their pen and the neighbouring pen, which was done with the help of a pop-hole of about 35 cm high and 30 cm wide in the pen, which makes it possible for two litters of piglets to mingle and meet with the other sow in the neighbouring pen, as seen from the master thesis of Andersson (2019). This pop hole allowed piglets, not sows, to move between the two pens, creating the extended social mixing environment for the gilts in the access pen (AP) treatment. The other half of the litter was controlled and housed in standard conventional loose house farrowing pens and control pens (CP), where piglets and the sow in one litter were kept individually without additional opportunities for socialisation. The reason for this was to create two different social environments in the early life of the gilt. Moreover, at 10 weeks of age, half of the gilts were mixed with unfamiliar gilts in mixed groups (MG) (4 gilts per pen, 2 pairs from 2 litters). Half of the gilts were only moved to the gilt-rearing pen with 4 gilts from their birth litter, without mixing with unfamiliar pigs, intact groups (IG).

2.5 Behaviour video analysis

The videos from the feed challenge test were analysed using BORIS (Behavioural Observation Research Interactive Software), a video analytical software used to observe the gilts' behaviours. To easily recognise the individual gilts in each pen, they all had different-coloured ear tags and colour markings on their backs. The continuous observations lasted for fifteen minutes in the group,

and for each gilt, social experience and interactions with pen fitting were recorded for each minute of the test (1-15).

The ethogram in Table 4 was first developed based on Hannius (2019), who studied paired interaction tests with gilts at five weeks of age. The ethogram was tested in a pilot study of the feeding test included in this study and modified to suit the purpose of this thesis project.

Data on the live events observed by the gilts were recorded in video recordings. The recorded events were extracted using BORIS. The number of events was recorded per minute per behaviour of gilts. Data from the BORIS program was then extracted and entered into Excel. Based on the primary information, the data was edited so that the analysed data included the following variables related to social behaviour: Biting, Climbing or riding, Fighting, Head knock, Initiator, Nosing, Receiver, Chasing, Belly nosing and the rest of the following variables related to pen exploration: Pen exploration (feed stall), Pen exploration (wall) and Pen exploration (floor).

Table 4: Ethogram of behaviours recorded in gilt in the 15-minute feed test.

Behaviour	Definition
Social interactions	
Biting	A gilt bites another gilt with its teeth in contact with another gilt's skin.
Head knocks	A rapid thrust upwards or sideways with the head or snout
Climbing/riding	At least one hoof/leg on the top of another gilt/mounting another gilt
Levering	The gilt puts its snout under the body of another gilt and lifts it in the air; you can see that the body is pushed upwards, but all legs can still be on the ground.
Nosing	The snout is touching or is within sniffing distance of other gilts.
Mounting	Placing hooves on the back of another pig with or without pelvic movement
Tail directed	Tail in the mouth of another gilt: ranges from tail being gently manipulated to tail being chewed/bitten.
Ear directed	Ear in the mouth of another gilt: ranges from ear being gently manipulated to being chewed/bitten.
Flank directed	Oral/nasal attention, including bites directed toward the flank of another gilt
Fighting	The gilt uses vigorous side-to-side movements of its head to hit any part of the head or body of another gilt.
Abnormal ending of a fight	Chasing and biting the hindquarters of the opponent
Chasing	One gilt follows another gilt at an approximate of>=s per 3s, with an adverse reaction from the receiver.
Initiator–aggressive interaction	A gilt that first addresses the aggressive behaviour toward the other gilt
Receiver–aggressive interaction	A gilt which is the recipient of the first agonistic action
Pen exploration	
Pen exploration (feed stall)	Sniffing, touching, sucking, or chewing any object that is around the feed stall
Pen exploration (wall)	Sniffing, touching, sucking, or chewing any object that is part of the wall
Pen exploration (floor)	Sniffing, touching, sucking, or chewing any object that is on the floor of the pen

2.6 Statistical analysis

The descriptive statistics (total frequencies performed per behaviour) were calculated in SAS using PROC FREQ. Due to the low frequency of performance

and deviation from a normal distribution, the social and exploration behaviours were thereafter transformed into binary variables (performed during each minute of the test or not, 0/1). Thereafter, the procedure FREQ was used to assess differences between breeds and social experience treatments (early and late) with chi-square tests.

3. Results

The frequency of performing behaviours (total frequency throughout the entire 15 minutes of challenging feeding trial) behaviours is presented descriptively per breed, early social experience treatment and late social experience treatment in tables 5, 6 and 7, respectively.

Table 5: Total frequency of events performed per behaviour by the 65 gilts during the 15-minute challenging feeding trial by Breed.

	Frequency of events		
Behaviour	**SY** (N=29)	**DY** (N=36)	**Total**
Belly nosing	1	2	3
Biting	12	15	27
Chasing	1	0	1
Climbing/riding	3	2	5
Feed stall exploration	327	306	633
Fighting	82	76	158
Flank directed	0	2	2
Floor exploration	31	46	77
Head knock	14	20	34
Initiator	38	38	76
Nosing	26	15	41
Receiver	44	32	76
Wall exploration	149	225	374

Table 6: Total frequency of events performed per behaviour by the 65 gilts during the 15-minute challenging feeding trial by Early social experience treatments.

	Frequency of events		
Behaviour	**AP** (N=34)	**CP** (N=34)	**Total**
Belly nosing	2	1	3
Biting	15	12	27
Chasing	0	1	1
Climbing/riding	4	1	5
Feed stall exploration	320	313	633
Fighting	76	82	158
Flank directed	1	1	2
Floor exploration	39	38	77
Head knock	21	13	34
Initiator	37	39	76

Nosing	19	22	41
Receiver	37	39	76
Wall exploration	210	164	374

Table 7: Total frequency of events performed per behaviour by the 65 gilts during the 15-minute challenging feeding trial by Late social experience treatments.

	Number of sows Treatment		
Behaviour	**MG** (N = 33)	**IG** (N = 32)	**Total**
Belly nosing	0	3	3
Biting	11	16	27
Chasing	0	1	1
Climbing/riding	2	3	5
Feed stall exploration	300	333	633
Fighting	77	81	158
Flank directed	1	1	2
Floor exploration	52	25	77
Head knock	21	13	34
Initiator	39	37	76
Nosing	28	13	41
Receiver	36	40	76
Wall exploration	222	152	374

3.1 Breed

SY gilts were involved in fights, nosed and received social experience in a higher proportion of the observed test minutes compared to DY gilts (table 8). Moreover, SY gilts explored the feed stall in a higher proportion of the observation minutes than DY gilts (table 8).

Table 8: Differences in the percentage of minutes of the test that the behaviour was performed between breeds. Percentage and Chi-square P-value for the difference.

	SY N=420 sow minutes	**DY** N=420 sow minutes	**P value (chi-square)**
Social interaction			
Biting	2.62	1.98	0.5071
Climbing/riding	0.71	0.36	0.4436
Fighting	12.62	7.39	0.0061
Head knock	1.67	2.70	0.2807
Initiator	6.19	4.50	0.2417
Nosing	3.57	1.44	0.0300
Receiver	7.14	3.42	0.0085
Chasing	0.00	0.24	0.2501
Belly nosing	.	.	.
Pen exploration			
Feed stall exploration	46.19	32.25	<.0001

Floor exploration	3.10	2.34	0.4699
Wall exploration	21.9	21.44	0.8619

3.2 Early social experience treatments

There were no major or significant differences in behaviour response to the challenging feed trial between early social experience treatments AP and CP (table 9).

Table 9: Differences in the percentage of minutes of the test that the behaviour was performed between early social experience treatments. Chi-square P-value for the difference.

	AP N=495 sow minutes	**CP** N=480 sow minutes	**P value (chi-square)**
Social interaction			
Biting	2.22	2.29	0.9418
Climbing/riding	0.81	0.21	0.1899
Fighting	8.89	10.42	0.4191
Head knock	3.03	1.46	0.0985
Initiator	4.85	5.63	0.5861
Nosing	2.22	2.50	0.7751
Receiver	4.44	5.63	0.3989
Chasing	0.00	0.21	0.3096
Belly nosing	.	.	.
Pen exploration			
Feed stall exploration	39.8	36.67	0.3145
Floor exploration	2.63	2.71	0.9366
Wall exploration	23.64	19.58	0.1244

3.3 Late social experience treatments

The MG gilts were involved in fighting, and both initiated and received social experience in a higher percentage of test minutes than IG gilts (table 9). Moreover, MG gilts explored the feed stall in a higher proportion of the minutes of the test compared to the IG gilts (table 9).

Table 10: Differences in the percentage of minutes of the test that the behaviour was performed between early social experience treatments. Chi-square P-value for the difference.

	IG N=525 sow minutes	**MG** N=450 sow minutes	**P value (chi-square)**
Social interaction			

Biting	1.52	3.11	0.0962
Climbing/riding	0.38	0.67	0.5335
Fighting	6.29	13.56	0.0001
Head knock	3.24	1.11	0.0258
Initiator	3.62	7.11	0.0146
Nosing	2.86	1.78	0.2683
Receiver	3.24	7.11	0.0058
Chasing	0.00	0.22	0.2798
Belly nosing	.	.	.
Pen exploration			
Feed stall exploration	35.05	42.0	0.0260
Floor exploration	2.10	3.33	0.2316
Wall exploration	21.33	22.0	0.8010

4. Discussion

4.1 Exploratory behavior

The results of the present study reveal breed-specific tendencies, with Swedish Yorkshire (SY) gilts interacting more with their environment in the pen during the feed-challenging test compared to Dutch Yorkshire (DY) gilts. The higher activity level with the closed feeding stalls during the feed challenging test suggests they were more affected by the limitation than DY sows. It could also be speculated that this is related to an inherent curiosity, a trait that Day et al. (1995) suggest may drive pigs to engage more deeply with their surroundings. Exploration behaviour is not merely a product of the environment but has roots in genetics, as reported in earlier studies (Avital et al., 2000). However, exploration of the closed feed stalls was one of the most common behaviours performed during the feed challenge test by both SY (performed on average 46 % of the observed minutes) and DY (performed on average 32 % of the observed minutes). This indicates that gilts of both breeds noticed and reacted to the challenge of feed being entered into the feed stalls, but the feed stalls not being opened and giving them access to the feed. These findings align with Machado et al. (2017), who indicated that space availability and environmental interaction opportunities significantly influence exploratory behaviours. The observation that gilts with additional social experience earlier in life (10 weeks of age), offered mixed group (MG), displayed more exploratory behaviour than gilts with less social experience, kept in an intact group at 10 weeks of age (IG) might suggest that a dynamic social environment, one that mimics the natural complexity of social experiences in the wild, could stimulate a richer behavioural repertoire later in life. However, this study did not show significant differences in behavioural responses to the challenging feed test between early social experience treatments AP and CP. This result could indicate that while early experiences shape certain aspects of pig behaviour, they may not affect how pigs handle specific environmental challenges. Understanding the interplay of genetics, environmental conditions, and social experiences is crucial for tailoring management practices in pig production. Enriching environments to match the pigs' species-specific needs can improve welfare outcomes. This notion is supported by Studnitz et al. (2007), who emphasised that pigs retain their intrinsic behavioural

needs despite domestication. The practical implications of these findings suggest that producers can enhance pig welfare by incorporating more varied and stimulating environments that cater to the pigs' exploratory nature. Such environments encourage positive behavioural expressions and facilitate better adaptation to changing conditions within the production setting.

4.2 Social behaviour

The results of the present study highlight breed-specific social behaviours, with Swedish Yorkshire (SY) gilts showing more social interactions such as fighting and nosing compared to Dutch Yorkshire (DY) gilts. These behaviours, crucial for establishing social bonds and hierarchies, are essential for the well-being of group-housed pigs. The increased social activity among SY gilts, aligning with their genetic predispositions, underscores the practical implications of this study for animal welfare and sustainable farming practices. These findings are consistent with the literature, which suggests that social hierarchies and aggressive behaviours have a genetic component (D'Eath et al., 2009; Lund & Simonsen, 1995).

The study's findings on early social experiences' impact on gilts' social behaviours are significant. Gilts with additional social experience earlier in life (mixed group at 10 weeks of age) showed increased social activity compared to those without such experience. This raises the question of the potential impact of early socialization on social dynamics in challenging situations later in life. These results suggest that early socialization plays a crucial role in fostering the establishment of stable dominance hierarchies and improved social skills, thereby reducing stress and improving welfare (D'Eath, 2005).

The social dynamics observed in this study underscore the importance of understanding and managing social structures within pig groups. Effective management strategies that consider the social needs and behaviours identified in this study, such as early socialization, can significantly enhance the well-being of pigs. For instance, providing opportunities for social interactions and minimizing aggression through selective breeding can improve the overall welfare of group-housed pigs (Brajon et al., 2021; Verdon et al., 2016). This highlights the practical implications of the study for pig management.

Conducting this research adhered to strict ethical guidelines to ensure the welfare of the gilts. The study's design, including the feed challenge test, was approved by the National Ethics Committee for Animal Experiments and aimed to minimize distress and harm. Ethical practices, such as those employed in this study, not only improve animal welfare but also enhance the reliability of scientific findings by ensuring that the animals are treated with care and respect (Nakagawa & Cuthill, 2007; Fraser et al., 1997).

This research also contributes to sustainable animal production practices. By highlighting the behavioural differences between breeds and the impact of social experiences, the study provides insights into more sustainable breeding and housing practices. For example, the increased exploratory behaviour and social engagement in SY gilts suggest that they may benefit from more dynamic and enriched environments, which can reduce stress and improve welfare. Sustainable practices

benefit the animals and ensure long-term viability and ethical responsibility in pig farming (Camerlink et al., 2022; Turner, 2011; Rushen, 2000).

Pigs' behaviour is dynamic, and the experiment sheds light on the complexity of social interactions among gilts. The pronounced social engagement aligns with the observed genotypic predispositions towards activity and interaction. This result aligns with the findings of D'Eath et al. (2009), who show that social hierarchy, including aggressiveness, is a heritable trait. Lund and Simonsen (1995) also observed that breed differences contribute to variations in aggressive behaviour, a finding echoed by Turner et al. (2008) and Grandison et al. (2003) regarding social ranking in pigs.

The experiment did not reveal behavioural differences in response to a challenging feed test between gilts exposed to early social experiences at 2-5 weeks (AP and CP). This result prompts a re-evaluation of the emphasis on early social conditioning in predicting future behavioural outcomes in challenging environments. Turner (2011) highlights the profound implications of severe social behaviours on animal welfare and profitability for the producer, identifying aggressive behaviours like biting and fighting as detrimental.

The additional social experience of mixing with unknown individuals at 10 weeks of age in the experiment demonstrated a significant increase in fighting behaviours. This experience may reflect a valuation of pen access and a willingness to defend resources against unfamiliar animals, echoing findings by D'Eath (2002). This higher level of aggression could indicate inflexible behaviour patterns or an underdeveloped social acumen, as aggressive individuals may struggle to recognize submission cues from others (Mendl & Erhard, 1997). Moreover, the provision of early socialization experiences, as seen in AP gilts, while not significantly altering the occurrence of social behaviours, suggests a trend towards a quicker establishment of social hierarchies, which, according to D'Eath (2005), could mitigate stress and injuries in future interactions with unfamiliar pigs.

Overall, this study highlights the importance of considering both breed and environmental factors when managing pigs. The impact of additional early social experience on late social experience patterns suggests potential benefits for pig welfare if producers facilitate opportunities for piglets to socialize with unfamiliar peers before weaning. This approach could foster the establishment of stable dominance hierarchies and improved social skills that may result in reduced stress and improved welfare for pigs.

4.3 Methods

The methodology of this project sought to investigate exploration behaviour and social dynamics between breeds and previous social experiences of gilts. The results indicated only marginal differences between breeds and effects of social experience treatments.

This project used video analysis to observe and record gilt behaviours during the feed challenge test. This approach corroborates the recommendations for reducing observer bias and disturbance, thereby ensuring more authentic behavioural observations (Meagher, 2009). Also, using the detailed ethogram informed by

previous research (Hannius, 2019), this study adopted a more consistent and comprehensive behaviour ethogram, which shows the importance of such tools in behavioural science (Martin & Bateson, 2007).

However, the methodology adopted for the gilts also had its limitations. The observation period was limited to 15 minutes, mindful of gilts welfare considerations. This duration, though practical, only partially captures all of the gilt's social experiences and post-challenge behaviours, potentially omitting significant behavioural dynamics (Fraser et al., 1991). Although the gilt sample size was suitable for this research objective, increasing the number of observed gilts per group or included in the experiment will also enhance the statistical power, thereby strengthening the confidence in detecting some potentially significant differences between the gilt groups (Festing & Altman, 2002). Moreover, despite its thoroughness, manual analysis of the extracted video data is still prone to human error as it is time-consuming (Burghardt et al., 2012). The addition of an automated behaviour recognition technology could offer a more efficient and more accurate alternative for data collection (Weary et al., 2009).

Furthermore, methodological refinements could increase the research outcomes. Employing logistic regression for statistical analysis, as suggested by Dobson (2002), could provide deep insights into the complex interactions between factors like breed and social experience on behavioural outcomes of the gilts. This approach will improve the robustness and accuracy of results by adjusting for multiple variables simultaneously. Also, extending observation periods or employing multiple observation points throughout the gilt's developmental stages will provide a more detailed view of behaviour persistence and its evolution over time (D'Eath et al., 2009). Additionally, the absence of significant differences between the gilt groups in this research shows the importance of negative results, as they are just as valuable as positive findings in scientific research. The negative findings show the boundaries of current knowledge, the assumptions of current challenges, and the refining of research questions (Altman & Bland, 1995). They highlight the complexity of animal behaviour, driven by a group of interrelated factors. Understanding these results' importance will help design a more refined approach to the research questions and methodologies in future studies, thereby enriching the scientific debate (Kuhn, 1997).

The study's reliance on visual video observations ensured that the welfare concerns associated with more invasive sampling methods were mitigated. However, introducing new individuals into the experimental groups posed ethical considerations due to the potential escalation of aggressive interactions. Such risks were carefully managed, with continuous monitoring to prevent harm, aligning with ethical standards for animal welfare research (Nakagawa & Cuthill, 2007).

Before the study, ethical implications were rigorously planned and evaluated as described in the application for and approval of an ethical permit to conduct this

animal experiment (Approved by the National Ethics Committee for Animal Experiments in Uppsala (ID: 5.8.18-16279/2017).

5. Conclusion

From the results, it can be concluded that SY gilts explored the closed feed stalls and their pen mated (nosing) more than DY gilts.Gilts of the SY breed also performed agonistic social behaviours (fighting) more than gilts of the DY breed.This result could be from an indirect selection of behaviours beneficial in different environments in the two breeds (group housed for SY and individually for DY).The results show that gilts with additional social experience earlier in life (additional mixing with unknown individuals at 10 weeks of age (MG)) performed more fighting behaviour and explored the closed feed stalls more during the 15-minute feed challenging test.However, overall, no clear patterns of differences between breeds or social experiences in gilt behaviour in the challenging feed test could be seen.This research highlights the complexity of pig behaviour, influenced by both breed and their previous social experiences.

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Popular science summary

There is a shift in Europe from individual housing of sows and gilts to group housing. These two housing systems meet some of the sow's needs but not others. Individual housing systems limit the opportunities for aggressive behaviour in animals while denying them social interaction and adequate space. Gilts in group housing systems, on the other hand, show more aggressive behaviour but have more space and opportunities to socialize with other gilts.

In 2012, Sweden stopped breeding the Swedish Yorkshire (SY) and replaced it with Dutch Yorkshire (DY) breeds. These two breeds were selected in different environments (group housing versus individual housing), which may have resulted in behavioural differences that may be important for group housing systems. This master's thesis aimed to examine the differences between breeds of gilts and the effect of their previous social experience on their response in a feed challenge test. The gilts to be determined were between the two gilt breeds (SY and DY), and they were also exposed to two different social experiences (Early and Late social experiences). The first purpose was to find out if behavioural differences between the groups introduced to the previous social experience test depended on whether the gilts had opportunities to interact with other unfamiliar gilts during the nursing period (access boxes (AP)) or only with their littermates (Control pen (CP)). Another purpose was to examine whether the gilts could socialize with their group (IG) or mixed group (MG). An ethogram was then developed to record the behaviour of 65 sows for 15 minutes.

This practical study was conducted at the Swedish Agricultural University's (SLU) research centre in Lovsta, Uppsala, and was then carefully observed through video recordings. These practical studies showed that SY gilts were more exploratory and engaged more socially during the feed challenges test than DY gilts, suggesting that breed-specific tendencies, shaped by their historical breeding practices, affected their behaviour. Moreover, this research also emphasizes the impact of previous social experiences of gilts on their future behaviours. The gilts introduced to late social experience (MG) exhibited aggressive behaviours of either a competitive or dominant nature than the IG gilts, pointing to the possibility that the previous social experiences will not only shape each gilts' behaviours but also affect their welfare and group interactions.

The results of this thesis suggests that a deeper understanding of breed-specific behaviours and the impact of previous social environments can guide more welfare-oriented breeding, housing, and management strategies.

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