How does different production systems affect the welfare status of pigs from farm to abattoir?

Developing and evaluating animal welfare protocols

Julia Carlsson

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Hur påverkar olika produktionssystem grisars djurvälfärd från gård till slakteri? Utvecklande och utvärderande av djurvälfärdsprotokoll

Julia Carlsson

Supervisor:	**Josefine Jerlström, Swedish University of Agricultural Science, Department of Animal Environment and Health**
Assistant supervisor:	Torun Wallgren, Swedish University of Agricultural Science, Department of Animal Environment and Health
Assistant supervisor:	Matilda Nyman
Examiner:	Anna Wallenbeck, Swedish University of Agricultural Science, Department of Animal Environment and Health

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Swedish University of Agricultural Sciences
Faculty of Veterinary Medicine and Animal Science
Department of Animal Environment and Health

Abstract

The welfare of livestock animals is of great importance among Swedish citizens and has economical importance for the profitability of the pig production. On the day of slaughter, pigs are exposed to new environments and interactions that may compromise their welfare. There are different pig production systems in Sweden e.g., conventional, EU-organic, and KRAV-certified production, with different regulations and requirements related to slaughter. The overall aim of this master thesis was to develop protocols based on animal welfare indicators to investigate how different production systems affect the pigs' welfare in connection to loading, transport, unloading and lairage at the abattoir. Three protocols were developed, consisting of pig behaviour, skin damages, lameness and human-animal interactions. The protocols were tested during direct observations on growing-finishing pigs from a conventional batch and a KRAV-certified batch at loading on-farm, unloading, lairage and in the driving race to stunning at the abattoir. Scan sampling was used to observe pig behaviour on pigs in lairage at the abattoir. The protocols for observing pigs at loading on-farm, unloading at the abattoir and in driving race consisted of annotating the number of pigs displaying a certain behaviour, having skin damage and being lame. The human-animal interaction protocol consisted of annotating the frequency of different interactions. In addition to the protocols, interviews were performed with farmers, haulers and personnel from the abattoir to identify their experience of pig behaviour and their motivation to use a potential protocol.

In general, the results showed that pigs from the conventional batch displayed a larger variation and repertoar of behaviours and that more pigs in that batch had skin damage compared to pigs from the KRAV-certified batch. In addition, pigs from the conventional batch were involved in a larger number and types of human-animal interactions compared to pigs from the KRAV-certified batch. The conclusion of this study is that pigs from both conventional and KRAV-certified batches displayed behaviours indicating fear and stress during loading on-farm, unloading at the abattoir and during the driving race to stunning. A larger variation of fear and stress behaviours was displayed by pigs from the conventional batch compared to pigs from the KRAV-certified batch. However, due to the low number of animals and batches, the results are descriptive and are not necessarily representative for the different production systems in general. The animal welfare indicators that were tested and considered feasible to use are skin damage, turning back, reluctance to move, backing up, slipping and thermoregulatory behaviour. However, the developed protocol for investing the pig behaviours, skin damages and lameness during loading on-farm, unloading at the abattoir and in the driving race to stunning was not feasible to perform, as the measured variables may overtax the observer when observing groups of 15 pigs. On the other hand, the protocol for human-animal interaction and pig behaviour in lairage was feasible to perform, as only one handler was observed at each area and the protocol for lairage contained relevant behaviours. Farmers, haulers and personnel from the abattoir experienced turning back and reluctance to move as unwanted behaviours during loading on-farm and unloading at the abattoir, which was supported by the result from this study. However, the motivation to implement a protocol varied among the respondents, but a recurring message was that the protocol must make improvements to be implemented. Other factors that were emphasised were financial compensation for implementing a protocol and a clear protocol easy to understand.

Keywords: behaviour, direct observation, human-animal interaction, loading, unloading, lairage, driving race, slaughter

Sammanfattning

Djurvälfärden för lantbruksdjuren är av stor betydelse bland svenska medborgare och har en ekonomisk betydelse för lönsamheten inom grisproduktionen. På dagen när grisar ska lämnas till slakt utsätts de för nya miljöer och interaktioner som kan påverka djurvälfärden negativt. I Sverige finns olika grisproduktionssystem, exempelvis konventionell, EU-ekologisk och KRAV-certifierad produktion vilka delvis har olika regelverk och krav relaterade till slakt. Det övergripande syftet med detta examensarbete var att utveckla protokoll baserade på djurvälfärdsindikatorer för att undersöka hur olika produktionssystem påverkar grisarnas välfärd i samband med lastning, transport, avlastning och inhysning på slakteriet samt utvärdera protokollens användbarhet. Tre protokoll utvecklades, två för att observera grisars beteende, hudskador och hälta samt ett för människa-djurinteraktion. Protokollen testades med direkta observationer på slaktgrisar från en konventionell omgång och en KRAV-certifierad omgång grisar vid lastning på gården, avlastning, inhysning och drivning till bedövning på slakteriet. Scan sampling användes för att observera grisarnas beteende vid inhysning på slakteriet. Protokollen för att observera grisar vid lastning på gården, avlastning på slakteriet och drivgång till bedövning bestod av att kontinuerligt notera antalet grisar som uppvisade beteenden, hade sårskador på huden och var halta. Protokollet för interaktionen mellan människa och djur bestod av att notera frekvensen av olika interaktioner. Utöver protokollen genomfördes intervjuer med lantbrukare, transportörer och slakteripersonal för att identifiera hur de upplever grisarnas beteende och deras motivation till att använda ett potentiellt protokoll.

Resultaten visade generellt att grisar från den konventionella omgången uppvisade en större variation och repertoar av beteenden och fler grisar från den omgången hade hudskador jämfört med grisar från den KRAV-certifierade omgången. Grisar från den konventionella omgången var involverade i ett större antal och olika typer av människa-djurinteraktioner jämfört med grisar från den KRAV-certifierade omgången. Slutsatsen från denna studie blev att grisar från både den konventionella och KRAV-certifierade omgången uppvisade beteende kopplat till rädsla och stress vid lastning på gården, avlastning på slakteriet och drivning till bedövning. En större variation av beteenden kopplade till rädsla och stress uppvisades av grisar från den konventionella omgången jämfört med grisar från KRAV-certifierade omgången. På grund av lågt antal observerade djur och omgångar är resultaten i denna uppsats beskrivande och kan inte antas representativa för produktionssätten i stort. Djurvälfärdsindikatorer som är relevanta att inkludera i ett protokoll är skador på huden, vända, vägra gå fram, backa, halka och temperaturreglerande beteenden. Det befintliga protokollet för grisbeteenden under lastning på gården, avlastning på slakteriet och drivning till bedövning visade sig inte vara optimal för praktisk tillämpning eftersom variablerna som mättes kan ha överskattat observatören vid observationer av grupper med 15 grisar. Protokollet för interaktion mellan människa och djur samt grisars beteende i inhysningen var däremot praktisk genomförbara eftersom en människa var observerad åt gången och protokollet för inhysningen inkluderade relevanta beteenden. Lantbrukare, transportörer och slakteripersonal upplevde att oönskade beteenden som grisar utförde vid lastning på gården och avlastning på slakteriet var att grisarna vände eller vägrade gå fram, vilket styrktes av resultaten från denna studie. Motivationen att använda ett protokoll varierade dock mellan respondenterna, men faktorer som lyftes var ekonomisk ersättning och ett tydligt och lättförståeligt protokoll.

Keywords: beteende, direkt observation, människa-djurinteraktion, lastning, avlastning, inhysning, drivgång, slakt

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HPV	High-pitched-vocalisation

Introduction

On the day of slaughter, pigs are exposed to several new environments and interactions that may compromise their welfare (Brandt & Aaslyng 2015). The pigs are moved from their home pens to several new situations with unfamiliar pigs and unfamiliar environments, which can impose stress, thus compromising their welfare (Barton Gade 2004). Pigs experiencing stress before slaughter can lead to meat quality defects and reduced yield, thus resulting in losses of carcass value for the farmer (Faucitano 2018). In 2020, about 2,6 million pigs were slaughtered in Sweden for human consumption (Swedish Board of Agriculture 2022a), of which about 3 % were from organic production (Swedish Board of Agriculture 2020). In Sweden, organic production consists of EU-organic and KRAV-certified production. KRAV-certified production is characterised by outdoor access and promoting natural behaviour (KRAV 2021). The welfare of livestock animals is of great importance among Swedish citizens and the majority of the respondents think it can be improved by being better protected (European Commission 2016). Furthermore, animal welfare is a broad term that includes an individual's natural life, affective state, and biological functioning (Fraser et al. 1997), which is important to consider when evaluating animals welfare (Brambell & Barbour 1965). Studies assessed animal welfare by observing pigs at loading on-farm, unloading, lairage and driving race to stunning at the abattoir with protocols (Brandt et al. 2015; Brandt et al. 2017). The Welfare Quality® project developed a protocol to assess the overall animal welfare of growing-finishing pigs on-farm and at the abattoir (Welfare Quality® 2009). However, this protocol is time-consuming, which is not optimal to applicate in low-scale abattoirs (Dalmau et al. 2009). Limitations regarding aggregate information about animal welfare can require comprehensive assessment or numerous observers to receive information, which emphasises a feasible and reliable protocol (Dalmau et al. 2010). This master thesis is a pilot study for a future research project. It aims to develop and evaluate protocols based on animal welfare indicators to investigate how different production systems affect the pigs' welfare in connection with loading, unloading, transport, and lairage at the abattoir.

The question to be answered are:

1. How does different production systems affect pigs' animal welfare during loading on-farm, transport and time spent at the abattoir?

2. Which animal welfare indicators are relevant, and are the protocols feasible?
3. How do farmers, haulers, and personnel from the abattoir experience pig behaviour during loading on-farm to stunning at the abattoir and their motivation to use a potential protocol?

Literature review

2.1 Regulations

There are different production systems in Sweden: conventional, EU- organic, and KRAV-certified organic. Depending on the production systems, different regulations should be followed, and additional requirements be fulfilled (Table 1).

Table 1. Comparison between conventional, EU-organic, and KRAV-certified organic regulations regarding slaughter. ✗ *= no requirement/not allowed* ✓ *= requirement/allowed*

Fulfilled criteria	Conventional	EU	KRAV
Transport			
Transport time maximum 8 h	✓	✓	✓
20 pigs/compartment	✓	✓	✓
Drive carefully	✗	✗	✓
Possible inspection of animals	✓	✓	✓
Abattoir			
Mixed groups at the abattoir	✓	✓	✗
Overnight lairage	✓	✓	✓*
Daily space requirement 0,75 m^2 (<120 kg)	✗	✗	✓
Ad libitum water in the pen	✓	✓	✓
Access to bedding material in pen	✗	✗	✓
Access to enrichment other than bedding material	✗	✗	✗
Certificate of competence	✓	✓	✓
Animal welfare responsible	✓	✓	✓
Handling			
The use of electric prod	✓	✗**	✗

* Should be avoided **Not allowed during loading and unloading

In Sweden, transporters, farmers, and abattoirs are controlled by different regulations. Slaughter of animals in the European Union, including Sweden, is regulated by the Council Regulation EC 1099/2009. This is complemented by the Swedish Animal Welfare Act (SFS 2018:1192) and the Animal Welfare Ordinance (SFS 2019:66). In addition to these, there is a specific regulation regarding slaughter, the Board of Agriculture's regulations and standard procedures for the slaughter and euthanasia of animals (SJVFS 2020:22), which covers handling, lairage, and care for the animals before slaughter. The Swedish regulation sets the minimum requirements for all pigs and is complemented with additional requirements to be fulfilled for EU-organic and KRAV-certification.

2.1.1 Conventional regulation

The recommendation is to avoid mixing established groups of animals during lairage, driving, and overnight lairage. The animals must be driven calmly and if moving tools are used, a paddle or board is recommended (SJVFS 2020:22). The use of electric prods is allowed but should be avoided (EC 1099/2009). The holding pen must be in accordance with SJVFS 2019:20, and all equipment, and enclosures need to be easy to clean (SJVFS 2020:22). Animals can be housed in lairage for one night but must have access to water and feed if the time for transport combined with lairage exceeds 12 hours (SJVFS 2020:22). The employees in the abattoir should be educated in animal protection, handling, and killing procedures. In addition to educated personnel, a responsible person for animal protection should be selected in larger abattoirs that slaughter more than 1000 animals per year (EC 1099/2009), which currently include most of the abattoirs in Sweden (Swedish Board of Agriculture 2021). The responsible person should ensure that the plant follows the regulation (EC 1099/2009).

2.1.2 EU-organic regulation

EU-organic production has additional regulations to the Swedish regulations, known as Council Regulation (EG 834/2007) and Commission regulation (EC 889/2008). One factor that characterises EU-organic production is the outdoor access to a paddock or pasture (EC 889/2008). EU-organic regulation contains requirements that suffering of animals should be minimised in connection to slaughter. Additionally, the transport time should be minimised. However, no detailed information regarding handling or transport time is given, meaning no further regulation in addition to the Swedish regulation sets the minimum requirements to be followed (EG 834/2007). The use of electric prod shall not be used during loading and unloading of animals, however, there is no detailed regulation regarding the use in combination with slaughter (EC 889/2008).

2.1.3 KRAV-certified organic regulation

KRAV-certified production has additional regulations to Swedish national legislation and EU-organic regulation. One factor that characterises KRAV-certified production is the coherent four-month on pasture during the summer months. Therefore, pigs about to be slaughtered in July must graze no later than 1 June. During the time of the year when the pigs are not kept on pasture, they must have access to an outdoor paddock (KRAV 2022). Pigs that are to be delivered to the abattoir can be collected from the pasture maximum two weeks before planned delivery. According to KRAV's regulation, the producer has the responsibility to group the animals so that the abattoir does not mix established animal groups. During loading, transport, and unloading, animals should be exposed to minimal

physical and physiological stress. The handler must also be able to describe how minimal stress is achieved. To achieve easy handling of the animals, the abattoir should have sufficient lighting, non-slip surface and avoid sharp turns. Furthermore, KRAV-certified pigs should not exceed 15 minutes in the driving races. The space allowance on the abattoir is higher for KRAV-certified pigs compared to conventional pigs (Table 2). Overnight lairage is allowed for KRAV-certified pigs but should be avoided (KRAV 2022).

Table 2. Space requirements and overnight lairage at the abattoir (SJVFS 2020:22; KRAV 2022)

Weight (kg)	KRAV-certified day/ overnight lairage (m^2)	Conventional day (m^2)
<120	0.75	0.55
>120	1.5	1

KRAV-certified abattoirs must always have an animal welfare officer regardless of the number of slaughtered animal units. The role of the animal welfare officer involves documenting deficiencies in animal welfare (EC 1099/2009) and working continuously to improve the handling of animals at the abattoir. In addition to the animal welfare officer, KRAV-certified abattoirs must, if necessary, enlist the help of an external adviser with a focus on animal welfare. The advisor evaluates the animals from unloading to killing and compiles a report to provide suggestions for improving the animal environment and animal welfare (KRAV 2022).

2.2 Animal welfare indicators

Animal welfare is defined by Broom (1986:524) as "the welfare of an individual is its state as regards its attempts to cope with its environment". This definition includes three main concerns, an individual's natural life, affective state, and biological functioning. An animal's natural life relies on the ability to perform natural behaviours in its environment. The affective state includes emotions, e.g. comfort and pleasure, as a positive state, whereas a negative state can involve fear, pain, or hunger. Finally, biological functioning is connected to an animal's fitness and health (Fraser et al. 1997).

2.2.1 Physiological recordings

Welfare measurements on the day of slaughter are important to optimise and record animal welfare (Brandt & Aaslyng 2015). Before and after slaughter measurements have potential to document animal welfare (Brandt et al. 2013). Meat quality after slaughter is one method of measuring stress by evaluating the incidence of pale, soft, exudative (PSE) and dark, firm, dry (DFD) meat (Barton Gade 2004). PSE can also be caused by other factors than pre-slaughter stress, such as chilling processes

and genetics (Barton Gade 2004). However, several studies have measured pH to evaluate the meat quality (Van de Perre et al. 2010; Brandt et al. 2013). In addition to pH, other physiological recordings such as blood temperature, lactate, glucose, and creatine kinase activity can be used as welfare indicators (Brandt et al. 2013). However, the blood measurements can be influenced by several factors such as pre-slaughter handling, fasting period, and physical activity. Thus, there is a demand for several measures to determine the underlying causes of physiological changes (Brandt et al. 2013).

2.2.2 Behavioural recordings

As mentioned previously, animal welfare is connected to an animal's emotional state. Indicators of positive and negative emotions have been investigated. Indicators such as play, tail movement, and barks are behaviours that can indicate positive emotions in pigs (Reimert et al. 2013). On the other hand, high-pitched-vocalisation (HPV), such as squealing and screaming, could display negative emotions (Reimert et al. 2013). In addition, excretion, freeze, and escape attempt may also indicate negative emotions in pigs (Reimert et al. 2013). A behaviour that pigs have motivation to perform is explorative behaviour, which may have various purpose such as appetite or collect information from its environment (Studnitz et al. 2007). Pigs that experience fear has been measured as turning back and reluctance to move forward and thermoregulation has been assessed with the behaviours: huddling, shivering, and panting (Dalmau et al. 2009; Dalmau et al. 2016). Ease of movement has been measured as slipping and falling (Dalmau et al. 2009; Dalmau et al. 2016).

2.3 Assessment of animal welfare

2.3.1 Welfare Quality® protocol

A project called Welfare Quality® developed detailed protocols to measure and assess the overall animal welfare of pigs (Welfare Quality® 2009). Protocols can be based on different areas, animals, resources, and management (Welfare Quality® 2009). Animal-based, meaning that the measurements are focused on the animals for example, the animal's health and behaviour. Resource-based measures are environmental factors such as water supply and space availability. Management-based measures include how the animal unit manager handles strategies and plans regarding the animals in the production (Welfare Quality® 2009). When animal-based measurements are limited, resource and management measures are alternatives (Welfare Quality® 2009). The Welfare Quality® protocol is based on four welfare principles, comprised of different criteria (Welfare

Quality® 2009). The criteria consist of good feeding, housing, health, and appropriate behaviour. The collection of data on the abattoir includes different recordings for each criteria. Good feeding consists of food and water supply. Good housing includes animals showing shivering, panting, huddling, slipping, and falling. Good health is measured by recording lameness, wounds on the body, sick animals, dead animals, and stunning effectiveness. Appropriate behaviour includes measurements such as HPV, reluctance to move, and turning back. In addition, on-farm measurements include behaviours such as aggressive- or exploratory behaviour. The Welfare Quality® protocol has been tested in studies to evaluate how the protocol could be adapted to assess animal welfare among abattoirs (Dalmau et al. 2009; Dalmau et al. 2016). Both studies applied the protocol from the unloading area to the post-stunning area. According to Dalmau et al. (2009) the mean time required for the complete protocol was five hours and 28 minutes, which is considered time-consuming. As a result, the authors suggest removing lameness from the protocol since lameness was assessed with a three-point scale that took about one hour to record per measure occasion. However, lameness has been discovered during unloading in other studies (Dalmau et al. 2010; Dalmau et al. 2016). Dalmau et al. (2010) used a two-point scale to assess lameness, including abnormal or normal gait. Dalmau et al. (2009) found that the correlation between slipping and falling was high, making the authors suggest that only one of these two could be enough to assess animal welfare during unloading.

Overall animal welfare assessment

An overall animal welfare assessment could be aggregated to a score, illustrating the animal welfare level. However, aggregating measurements to a score of animal welfare requires several aspects of consideration (Dalmau et al. 2010). It may require comprehensive assessment or numerous observers to receive sufficient information (Dalmau et al. 2010). The Welfare Quality® protocol included a three-point scale, reflecting good, acceptable, and poor welfare. Several measurements are included in the three-point scale such as behaviour, lameness, and wounds on the body. Behaviours included in the three-point scale are, shivering, panting, and huddling. Lameness was classified for severity of lame, while wounds on the body were classified based on the numbers of lesions (Welfare Quality® 2009). A more recent study by Brandt et al. (2017) developed an animal welfare index for each area from pick-up pen on-farm to driving race at the abattoir. The animal welfare index was based on the Welfare Quality® protocol and an expert panel to score both behaviours and variables from loading on the farm to driving race at the abattoir. The expert panel consisted of personnel from Danish abattoirs, government authorities, and universities with expert knowledge of health and animal welfare that complemented the Welfare Quality® protocol with additional factors such as driving, mixing with unfamiliar pigs and duration of each area. The

animal welfare index included measurements such as duration in each area, time lying down in lairage, driving score, pig behaviours and skin damage. The measurements were classified to illustrate the animal welfare from 0, acceptable to 2, non-acceptable (Table 3) (Brandt et al. 2017).

Table 3. Animal welfare categorisation for the durations in each area, according to (Brandt et al. 2017)

Three-point scale	Loading time, min	Unloading time, min	Lairage time, h
0	0-29	0-14	0-3
1	30-59	15-29	3-12
2	≥ 60	≥ 30	>12

2.4 The pigs way from the farm to the abattoir

When pigs are transported from the farm to abattoir, they are put in several new situations; loading, transport, unloading at the abattoir, time spent in lairage, and finally driven to stunning and debleeding (Figure 1). This means that they encounter several different and for them new persons and environments.

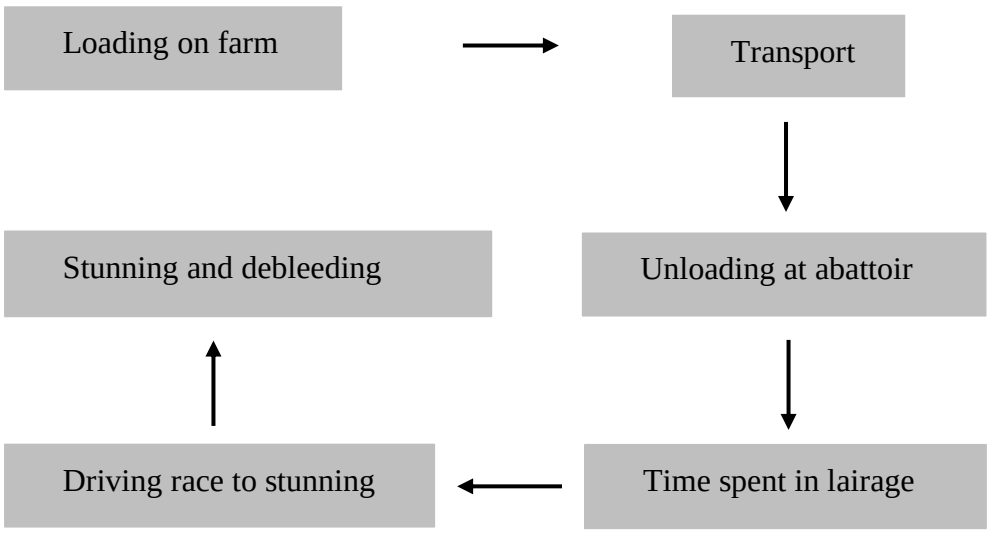

Figure 1. The process of delivering pigs from the farm to abattoir.

2.4.1 Loading on-farm and unloading at the abattoir

Loading and unloading are elements that can be stressful for the pigs as they are moved from a known to an unknown environment. The design of the pick-up facility and the handling of the animals are of great importance regarding loading and thus affect the stress of the pigs (Goumon & Faucitano 2017). Other factors to

be considered are lighting, which should be evenly distributed to not create shadows (Barton Gade 2004). Additionally, there should be a non-slip surface without reflective water pools (Barton Gade 2004). The slope and length of the lorries ramp can facilitate the handling of pigs (Goumon et al. 2013b). According to Barton Gade (2004), the slope should not exceed 20°, unlike SJVFS 2019:7 which recommends a slope less than 15°. Goumon et al. (2013b), found no difference in handling when unloading with a ramp slope of 16° compared to 21° and 26°, respectively. Instead, the authors suggest that other factors, such as the length of the ramp, can have an impact on the ease of handling. Pigs observed at loading displayed overlapping, turning back, reluctance to move, falling (Brandt et al. 2017) and slipping (Brandt et al. 2015). According to Zappaterra et al. (2022) frequently performed behaviours during unloading are turn around, HPV, overlapping, huddling, panting, and slipping. Less frequently performed behaviours are falling, jumping and elimination (Zappaterra et al. 2022).

2.4.2 Transport to abattoir

Animal welfare during transport is related to roads, driving techniques, and the design of the lorry. According to Broom & Fraser (2015) a calm driving technique can prevent injuries and motion sickness. In addition to this, the design of the lorry is important and includes factors such as compartments, ventilation, and ramp (Broom & Fraser 2015). The time allowed for pigs to be transported in Sweden is eight hours; if the transport is longer, seven criteria must be fulfilled (SJVFS 2019:7). For instance, the pigs need to be inspected, have access to bedding material, have the possibility to lay down, appropriate ventilation, and water availability. However, the maximum transport time is 24 hours if the pigs have access to water (SJVFS 2019:7). Roads, transport time, and water access are linked to the planning of routes (Broom & Fraser 2015). To keep control of the routes, haulers have transport documents that show which farm the animals come from, where and when the transport starts, the expected transport time, and the final destination (Swedish Board of Agriculture 2022b).

2.4.3 Lairage at abattoir

Lairage at the abattoir establishes a flow of animals at the abattoir and allows pigs to recover from the transport (Barton Gade 2004). Studies performed in Danish abattoirs demonstrated that lairage duration varied between 24-120 minutes, depending on the number of animals and the abattoir routines (Brandt et al. 2013; Brandt et al. 2015; Brandt et al. 2017). Brandt et al. (2013) demonstrated that up to 80 % of the pigs laid down after 10-15 minutes in lairage at the abattoir. Brandt et al. (2015) found similar results: 76 % of the pigs laid down after 11 minutes in lairage. However, Brandt et al. (2013) emphasise that the reason why pigs lie down

may be due to several reasons, either for comfort or exhaustion. Pigs become exhausted because of stress from transport, moving and mixing with unfamiliar pigs (Brandt et al. 2013). In addition to exhaustion, mixed pigs can exhibit aggressive behaviour and thereby cause skin damage (Aaslyng et al. 2013). Behaviours that studies have investigated in lairage are the postures (sitting, standing, lying) (Brandt et al. 2017), aggressive behaviour (Brandt et al. 2013; Brandt et al. 2015), huddling, shivering and panting (Dalmau et al. 2009). A study by Čobanović et al. (2020a) investigated the variation of behaviours in different seasons during unloading and in lairage. The highest percentage of pigs shivering, huddling, slipping, and falling was observed during the winter, with an average temperature of -2.5 °C during unloading and 5.6 °C in lairage. Panting had the highest occurrence in summer, with an average temperature of 33 °C during unloading and 32.25 °C in lairage (Čobanović et al. 2020a).

2.4.4 Driving race from lairage to stun box

After lairage, pigs are moved to stunning through the driving race. Driving races can be designed differently; pigs can either be moved with automatic gates or manually by a handler with driving devices. In a driving race, when pigs were moved by the handler, pigs displayed turning back, vocalisation, reluctance to move, jumping, pushing, huddling, slipping, elimination, panting, and falling (Zappaterra et al. 2022). On the other hand, Brandt et al. (2015) investigated pig behaviour in a driving race with automatic gates and found that a high percentage of pigs were touched by the gate, followed by falling, overlapping, and slipping. These findings are similar to Brandt et al. (2013), who also found that a high percentage of pigs touched by the gate, followed by overlapping, falling and slipping. However, there are differences between the studies that make it difficult to compare; Zappaterra (et al. 2022) measure more type of behaviours and the frequency of behaviours compared to Brandt et al. (2015), who observed fewer types of behaviours and recorded the percentage of pigs performing a behaviour rather than frequencies.

2.4.5 Human-animal interaction

Handling of animals is of great importance for the animals' behaviour and welfare (Goumon et al. 2013a). Handling before slaughter includes preparation on the farm to stunning, which involves personnel at the farm, hauler, and abattoir personnel (Barton Gade 2004). According to SJVFS 2019:7, animals should, as far as possible, be allowed to move at their own pace and, if necessary, be driven calmly with the help of a board or other driving tools. In addition to this, KRAV-certified regulation has that animals' natural behaviour should be utilised to maintain gentle handling (KRAV 2022). If tools must be used, the recommendation is to use a board

(SJVFS 2019:7), which has shown to be the most effective moving tool for finishing pigs compared to a paddle, flag, or electric prod (McGlone et al. 2004). According to SJVFS 2019:7, electric prods are allowed to be used as a last resort on adult pigs that refuse to move. However, McGlone et al. (2004) suggest avoiding the use of electric prod since other moving devices are equally effective. According to McGlone et al. (2004), the electric prod and paddle caused similar levels of vocalisation and time required to move pigs. In addition, pigs turned more often and vocalised more when using a paddle than when the handler used a board. Thus, the authors concluded that both tools might be ineffective compared to the board (McGlone et al. 2004). Human-animal interactions that have been investigated included events such as shout, poke with an electric prod, and being hit with a stick, plastic tube, and rubber stick, respectively (Zappaterra et al. 2022). The study results show that handlers used plastic tubes, rubber sticks, and shouting more frequently compared to other devices. When comparing unloading and driving race, handlers used plastic tubes and shout more frequently during driving to stunning compared to unloading (Zappaterra et al. 2022). Gentle handling has shown not to cause high stress for animals or adversely affect meat quality, based on stress metabolites and pH and temperature, respectively (Čobanović et al. 2020b). The authors in the study defined gentle as using a board and rattle paddle calmly. The board was used carefully with gentle pressure on the hindquarters and flank (Čobanović et al. 2020b). According to KRAV (2022), rough handling is defined as using electric prod, twisting the tail, careless driving with a gate, as well as hard and/or repetitive slaps or beats with tools. Brandt et al. (2013) recorded handling during unloading with four-point scale ranging from pigs moved voluntarily to handler used hand, rattle stick or board with repetitive strokes (Table 4).

Table 4. Four-point scale for human-animal interaction according to Brandt et al. (2013)

Score	Human-animal interaction
0	Pig moves voluntarily
1	Touch with board or rattle stick
2	Single stroke with a hand, rattle stick or board
3	Repetitive strokes with a hand, rattle stick or board

The study results show that most pigs moved voluntarily with scores 0 followed by scores 2, 1, and 3. The animal behaviour recordings show that the pigs both slipped and fell during unloading (Brandt et al. 2013).

Previous handling

Previous handling has been shown to enhance loading for both pigs and handlers. In a study by Goumon et al. (2013a), growing-finishing pigs were exposed to three

different training strategies for 2,5 weeks before slaughter. One consisted of physical training, by walking pigs in a hallway, the other was psychological training, by placing a 21° ramp in the pen for the pigs to explore. The third training strategy included both the physical and physiological training. A control group was included in the study, which was not exposed to any of the previously mentioned training strategies. However, pigs in both control and ramp treatment were moved once a day from the home pen to reach the same quantity of handling as the other pigs. After the treatments, pigs were tested on a ramp that simulating the one on commercial lorries. The result shows that physical training required less handling, such as fewer slaps/touches and pushes, compared to the other treatments. However, the loading time did not differ between treatments (Goumon et al. 2013a). On the contrary, other studies have reported shorter loading times with trained pigs than non-trained pigs (Geverink et al. 1998; Krebs & McGlone 2009). In the study by Krebs & McGlone (2009) pigs were trained to be moved out of the home pen and loaded on a ramp with a reward for ten minutes per day for ten days. The result showed that trained pigs were faster to unload and move to stunning compared to non-trained pigs. However, more frequent taps/touches with a paddle were performed on trained pigs (Krebs & McGlone 2009). Furthermore, allowing pigs to move out of the home pen for eight minutes twice a week for a period of five weeks resulted in shorter time for loading (Geverink et al. 1998).

2.4.6 Skin damages

Skin damage can be caused by aggressive behaviour and is used as an indicator to assess animal welfare. Skin damage can be evaluated by aggregating the lesions on the body, which are defined as scratches on the skin (Bottacini et al. 2018). Skin damage can cause different economic losses depending on the region of the carcass, for example, severe damage in the hind part causes more trimming (Zappaterra et al. 2022). Factors associated with the severe carcass lesions are longer waiting time until unloading, improper handling, and more space allowance per pig (Zappaterra et al. 2022). According to the Welfare Quality® protocol, the assessment of lesions on the body is divided into a three-point scoring system with three different levels (Welfare Quality® 2009). However, this may be time-consuming (Aaslyng et al. 2013). Therefore, a study assessed lesions on the carcass with a three-point scoring system to achieve a more efficient system (Bottacini et al. 2018). The three-point scoring system consisted of; none or one lesion, more than one up to five lesions and more than five lesions (Bottacini et al. 2018). The body was divided into two areas, posterior and anterior. The posterior area covers the hindlegs and tail, while the anterior area covers the front limbs to the head and ears (Bottacini et al. 2018). Pigs that required overnight lairage at the abattoir had more lesions compared to pigs that were slaughtered the same day as arrival. According to Bottacini et al. (2018) anterior area had the most severe lesions and lesions on the ear an

appropriate indicator for feedback on animal welfare. This is supported by Aaslyng et al. (2013), that predicate that the ears and front are the regions that pigs attack during the fighting. Aaslyng et al. (2013) assessed the severity of the skin damage on both live animals and carcasses. Four regions on the body were assessed with a four-point scale. The scale ranged from none or superficial damage, to deep damage. According to Aaslyng et al. (2013) assessment of deep damage was rare and suggest that less specific, three-point scale, could be sufficient. In that case, the scale would have been translated into animal welfare as good to not acceptable in three steps. Zappaterra et al. (2022) found that pigs who waited longer than 17 min in the lorry before being unloaded had more severe lesions in the hind part compared to the front part. Lower animal density in lairage, 183 kg/m^2 or lower, showed to increase the severity of shoulder lesions compared to higher animal density. This was explained by the ability of the animals to move around and the ability to perform aggressive behaviour despite non-mixing with unfamiliar pigs (Zappaterra et al. 2022).

Material and methods

3.1 Study animals

The study was conducted during winter in Sweden, from February to March 2022. The study was limited to growing-finishing pigs, crossbreeds of Landrace x Yorkshire sows, and Duroc or Hampshire boars. The pigs were slaughtered at about six months of age at a live weight of about 120 kg. Two farms located in Sweden were included, one conventional and one KRAV-certified farm: a farrow-to-finish farm and a specialised finishing pig farm, respectively. To keep the farms anonymous, they will henceforth be mentioned as conventional and KRAV-certified. As this study was carried out during the winter, the pigs from the KRAV-certified batch were housed indoors on straw bedding with an outdoor paddock of a concrete floor. The average group size for pigs from the KRAV-certified batch was 50 pigs per straw bed and paddock. In contrast to the conventional batch where, the average group size was 11 pigs per pen, housed indoors on concrete floor with a slatted floor. Before the study, the pigs from the KRAV-certified batch had been loaded once in a lorry and moved out of the home pen more than twice. Pigs from the conventional batch had been transported in a wagon between stables and moved out of the pen once when weighing prior to the study. The pick-up pen was designed differently in the conventional and KRAV-certified farms. Both farms had a pick-up pen before being driven on to the lorry, which consisted of either concrete floor or soil (Table 5). The conventional farm had a covered gate while the KRAV-certified farm had a foldable metal gate in the pick-up pen (Table 5). The KRAV-certified farm had a 90° turn out from the pick-up pen up to the ramp, unlike the conventional that had a straight path to the lorry (Table 5). On the day of slaughter, pigs from the conventional batch received feed 1,5 h while pigs from the KRAV-certified batch received feed 2,5 h before being transported.

Table 5. Difference between the production system and pick-up pen

Conventional	KRAV-certified organic
Production system	
Pens with slatted floor	Straw bedding with outdoor paddock
11 pigs/pen	50 pigs/pen
Transported in a wagon	Transported in a lorry
Pick-up pen	
Covered gate	Foldable metal gate
Concrete floor	Soil

3.2 Study area: abattoir

The pigs were slaughtered at the same abattoir in Sweden. The abattoir slaughters around 120 pigs per day. The abattoir had nine lairage pens specific for pigs located in between the unloading area and driving race to stunning. The stocking density in the lairage pens varied depending on weight and whether it was conventional or KRAV-certified pigs (Figure 2). The pens and corridors consisted of grooved concrete floors and all pens had two water nipples providing pigs with ad libitum water. Pigs from the KRAV-certified batch and conventional batch that were slaughtered the same day did not or received sawdust for enrichment, and the groups within the batches were mixed during unloading at the abattoir. Pigs that were destined for overnight lairage received sawdust as bedding material. The same transport company transported all pigs in the study. However, the hauler and vehicle differed between the farms. Sawdust was spread out as bedding in the lorries and on the ramps. The lorries had side openings and regulated mechanical ventilation depending on the temperature and season. Each compartment was loaded with maximum of 15 pigs during the observation occasions.

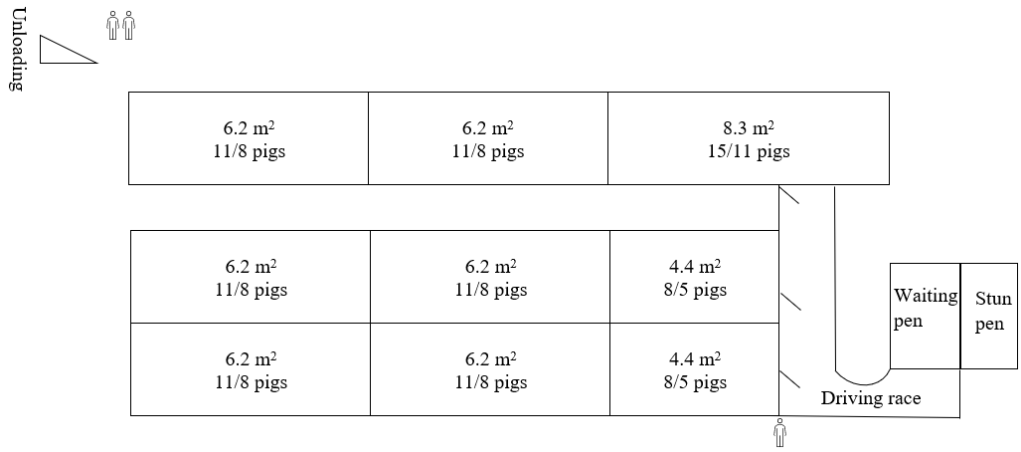

Figure 2. Illustration over lairage pens, driving race, waiting pen, stun pen, observer position and stocking density (conventional/KRAV-certified and overnight for conventionally reared pigs).

3.3 Study design

The study consisted of observing behaviour, skin damage and lameness of pigs and human-animal interactions with developed protocols from loading at farm to stunning at the abattoir (Appendix 1, 2 & 3). In addition, interviews were performed

with farmers, haulers, and abattoir personnel (Appendix 4, 5 & 6). The observations included annotations of pig behaviours and human-animal interactions during loading, unloading, lairage and driving to stunning at the abattoir. A total of 87 growing-finishing pigs were observed on two separate occasions since the KRAV-certified farm sent a batch with 15 pigs to slaughter while the conventional farm sent a batch with 72 pigs. Before data was collected from the different farms, a pilot study was conducted on a conventional farm with the purpose to test and improve developed protocols. Furthermore, the pigs' total time in each area was recorded with a timer and the conditions at the transport and at the abattoir were annotated. A summarisation of all measured variables in each area is presented in Table 6.

Table 6. Overview of the measured variables during the observation inspired by Van de Perre et al. (2010). Animal behaviour, human-animal interaction, animals per pen and time duration was measured with protocols

Loading	Transport	Unloading	Lairage	Driving race
Animal behaviour	Animals per pen	Animal behaviour	Animal behaviour	Animal behaviour
Human-animal interaction	Transport time	Human-animal interaction	Animals per pen	Human-animal interaction
Loading time	Waiting time before unloaded	Unloading time	Lairage time	Driving time

3.3.1 Pilot study

The pilot study aimed to test and improve developed protocols and interview guides. This was performed on 50 growing-finishing pigs from a conventional farm. One observer annotated pig behaviour, skin damages and lameness while the other observer annotated human-animal interaction in each area. The observation on-farm started when the pen door opened at the pick-up pen and ended when all pigs had entered the lorry and the lorry door was closed. When observing human-animal interaction, both hauler and farm personnel were included in the observation. Pig behaviour, skin damages, lameness and human-animal interaction were recorded during unloading from the end of the ramp to the lairage pen. When the lorry arrived at the abattoir, most of the pigs were unloaded and put in lairage pens or driven to stunning. Pig behaviour observation during lairage at the abattoir was performed for 40 minutes. After the pilot study, modifications were done regarding ethogram, observation, and interview guides (Appendix 1,2, 3, 4, 5 & 6).

3.3.2 Behavioural observations

The behaviour observation was recorded through direct observations by two observers (observer 1 and observer 2), who annotated pig behaviour and human-animal interaction during loading, unloading, and driving race. The pig behaviour and human-animal interactions were recorded according to an ethogram established by literature and the pilot study (Table 7 & 8). The protocols that were developed and used during the observations are presented in Appendix 1, 2, and 3.

Pig behaviour

Animal behaviour was measured by counting the number of pigs performing a behaviour, similar to the layout of Welfare Quality® (2009) and Van de Perre et al. (2010) (Table 7). A group of pigs was defined as the number of pigs driven together by the handler. During lairage, pig behaviour was annotated every 10 minutes by one observer using the scan sampling method (Martin & Bateson 2007; Brandt et al. 2013).

Human-animal interaction

Human-animal interaction was carried out using continuous recording by measuring the frequency of human behaviour (Martin & Bateson 2007; Zappaterra et al. 2022) (Table 8). The interactions, speaking, shouting, paddle, board, hand touching, hand slapping and use of electric prod was measured in this study developed from previous studies by Krebs & McGlone (2009), Hultgren et al. (2014) and Zappaterra et al. (2022).

Table 7. Ethogram for pig behaviour in different areas based on (Welfare Quality® 2009; Brandt et al. 2013; Brandt et al. 2017)

Area	Animal behaviour	Definition
Loading, unloading and driving to stunning		
	Turning back	Turns around
	Reluctance to move	Unwilling to move, freeze for at least two seconds
	Backing up	Moving backwards at least two steps
	Slipping	Slips without hitting the ground with a body part
	Falling	Slips and hits the ground with a body part

	Shivering	A body part or whole body is shaking
	Panting	Rapid breathing with open mouth
	Exploring	Sniffing, chewing, or licking environment in the pen
	HPV	Pig is screaming or squealing
Lairage		
	Aggressive	Threatening interaction with another pig by head knocks or bite
	Exploring	Sniffing, chewing, or licking environment in the pen
	Laying	The body has contact with the floor
	Sitting	The pig is sitting with bent thighs and straight front legs
	Standing	All four legs have contact with the floor
	Shivering	A body part or whole body is shaking
	Panting	Rapid breathing with open mouth
	Huddling	Lying down with more than 50 % of the body area on top of another pig

Table 8. Ethogram with human-animal interaction inspired by (Krebs & McGlone 2009; Hultgren et al. 2014; Zappaterra et al. 2022)

Area	Human behaviour	Definition
Loading, unloading, and driving to stunning		
	Speaking	Human speaks or whistles softly
	Shouting	Human shouts or speaks loudly
	Paddle	Paddle touches the pig
	Board	Board touches pig
	Hand touching	Hand touches pig gently

	Hand slapping	Hand slapping pig, arm raised to elbow
	Electric prod	Electric prod touches the pig

3.3.3 Skin damages and lameness

Skin damages were assessed using Aaslyng et al. (2013) definition of score 1, superficial damage on the skin (Table 9). The body was divided into regions according to Bottacini et al. (2018), front and hind (Table 9). The front body was defined as head, ear and shoulder, while hind body was defined as hind-quarters. During the observation, the observer annotated the number of animals with wounds front and hind and choose the side that was most beneficial or visible for the observation of lesions (Welfare Quality® 2009). The assessment of lameness was inspired by Dalmau et al. (2010), normal gait or abnormal gait. If a pig had an abnormal gait, it was annotated in the protocol, otherwise it was not recorded (Table 9). The assessments were included in the same protocol as the pig behaviours (Appendix 1) and were performed during loading, unloading, and driving to stunning.

Table 9. Definition of skin damage and lameness based on (Dalmau et al. 2010; Aaslyng et al. 2013; Bottacini et al. 2018)

Area	Variable	Definition
Loading, unloading, and driving to stunning		
	Wounds front	Pigs that have superficial skin damage on head, ears, or shoulders. The damage has a reddish colour and is longer than 2 cm.
	Wounds hind	Pigs that have superficial damage on the skin on the hind body. The damage has a reddish colour and is longer than 2 cm.
	Lameness	Abnormal gait, short stride, and uneven load on the legs

3.3.4 Loading on-farm

Loading time was recorded, starting when pigs were driven towards the lorry and ended as the lorry door was closed behind the last pig.

Pig behaviour

Pig behaviours were observed when the hauler started driving all pigs from the pick-up pen and ended when all pigs had entered the lorry and the lorry door was closed (Table 7). The behaviours were observed by observer 1.

Human-animal interaction

Human-animal interactions were carried out by observer 2 that annotated the haulers behaviour (Table 8). This observation started and ended at the same time as pig behaviour. A board and gate were used to drive pigs from pick-up pen to the lorry for pigs from the conventional batch. Pigs from the KRAV-certified batch were driven with a board, one of the personnel from the farm helped gather pigs in the pick-up pen.

3.3.5 Transport and unloading at the abattoir

Data collection during transport was limited to the duration of the transport, starting when doors closed on the lorry until arriving at abattoir. When the lorry arrived at the abattoir, the waiting time before being unloaded was noted.

Pig behaviour

During unloading, pig behaviours were annotated by observer 1 starting when the first pig walked down the ramp and ended when the last pig entered the unloading bay (Table 7). The position of the observers differed between the farms. The observers were positioned either inside stable or outside the stable where the ramp was visual (Figure 2). During both observation occasions, a stool was used to stand on to get a better overview and thereby improve the observation.

Human-animal interaction

Observations of human-animal interactions were performed simultaneously as pig behaviour by observer 2. The human behaviours were annotated of the hauler (Table 8). Tools that were used during unloading was a plastic paddle to drive pigs out of the compartment and a board to drive pigs down the ramp for pigs from the KRAV-certified batch. A board was used to drive pigs from the conventional batch out of the compartment and down the ramp.

3.3.6 Abattoir

Pig behaviour

Behavioural observations of pigs during lairage were conducted by observer 2 (Table 7). The behaviour was scanned every 10 minutes until all pigs in the pen were moved to stunning. The behaviours observed in lairage were the posture of

the pigs, thermoregulation, and whether they performed aggressive or explorative behaviour (Table 7). While observer 2 annotated pig behaviour in lairage, the observer 1 annotated pig behaviour in driving race. The observation started when the first pig entered the driving race and ended when the pigs entered the stunning pen (Butina). Before entering the Butina, the pigs were kept in a waiting pen (Figure 2). A stool was used to stand on to improve the observation in the waiting pen.

Human-animal interaction

Human-animal interaction was recorded during driving to stunning by observer 1 who annotated pig behaviour simultaneously (Table 8). The observation started when the first pig entered the driving race and ended when the pigs entered the stun pen. The position of the observer is illustrated in Figure 2. A board was used as driving tool to drive pigs from both conventional and KRAV-certified batches out of the lairage pens and in driving race to stunning.

Resource-based measurements

Apart from the behaviour recordings, a resource-based measurement inspired by Van de Perre et al. (2010) was annotated at the abattoir: the number of pigs per pen (Table 6).

3.4 Interviews with animal workers

Separate semi-structured interviews were performed with the farmer, hauler, and abattoir personnel to collect the perception of the use of the potential protocol and identify important factors that should be included. An interview guide with questions and possible answers was formulated to achieve a structure for the interview (Appendix 4, 5 & 6). The questions were about pig behaviour, handling techniques, and whether the production system affects pig behaviour. Additionally, some questions included potential content for a protocol and attitudes regarding implementation of a protocol. The interview was performed by the author through personal meetings or phone calls. All interviewees are anonymous and will henceforth be referred to as:

Farmer pilot study, hauler pilot study, abattoir personnel pilot study, conventional farmer, KRAV-certified farmer, KRAV hauler, KRAV abattoir personnel and conventional abattoir personnel.

3.5 Descriptive statistics

Descriptive statistics such as mean, standard deviation, maximum and minimum values were calculated in Minitab and Excel for annotated events, skin damage, and

duration of each loading, unloading, transport and driving to stunning. All Figures describing the results were developed using Excel.

Results

4.1.1 Pilot study

The pilot study aimed to test the protocols and the feasibility of the data collection. The result from the pilot study was used to improve ethogram, interview guide and the observer's position. The positioning of observers did not make it possible to see the whole ramp on the lorry during loading and unloading. Henceforth, the positioning was adapted to the most beneficial position according to the conditions of the farms. During the observations, pigs explored and panted, which was added to the ethogram (Table 7). Hand touch and slap were annotated as behaviours that handlers performed and therefore added to the ethogram (Table 8). During lairage at the abattoir, the total observation time was changed from 40 minutes to when all pigs were driven to stunning. During the interviews, respondents thought it was difficult to answer questions containing the word animal welfare. Thus, the word animal welfare was removed from the questions in the interview guide.

4.1.2 Loading on-farm

Pig behaviour

The conventional batch of pigs displayed the following behaviours: explore, turning back, reluctance to move, backing up, slipping, and shivering. KRAV-certified pigs displayed explore, reluctance to move, and HPV during loading. Both batches performed explorative behaviour by 100 % (conventional) and 80 % (KRAV-certified) of the pigs, respectively (Figure 3). A higher percentage of pigs from the KRAV-certified batch displayed reluctance to move compared to pigs from the conventional batch (Figure 3).

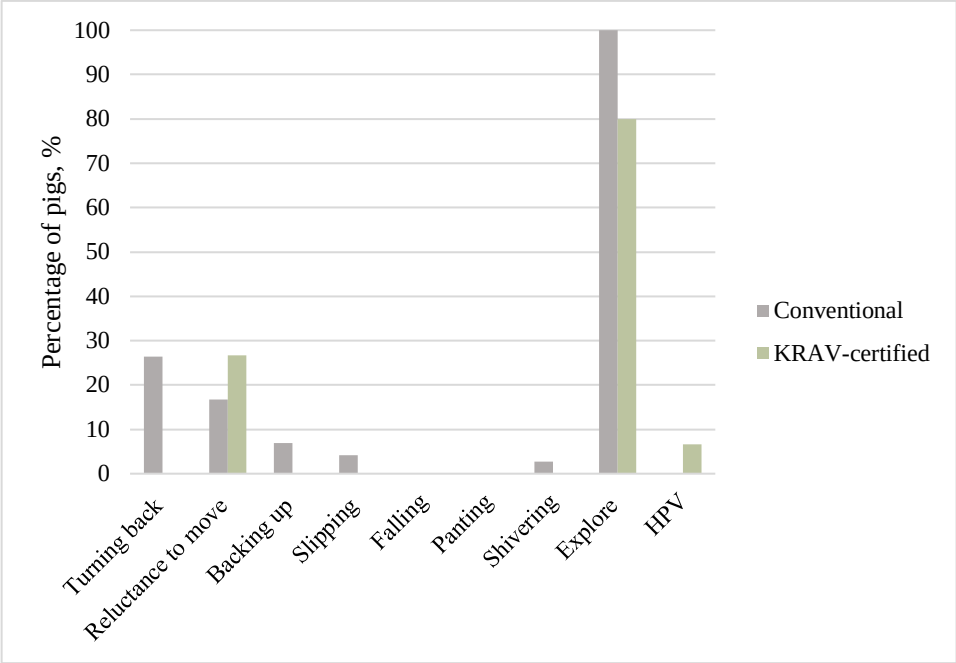

Figure 3. Percentage of pigs performing behaviours during loading from the conventional batch; n=72 and the KRAV-certified batch; n=15. Each bar represents the total percentage of animals from each batch. HPV=high-pitched-vocalisation.

Skin damages and lameness

Pigs from the conventional batch had wounds hind and front, in contrast to pigs from the KRAV-certified batch who had no visible wounds (Figure 4). In the conventional batch, a higher percentage had wounds front compared to the hind (Figure 4). No pigs were lame in the conventional or KRAV-certified batch (Figure 4).

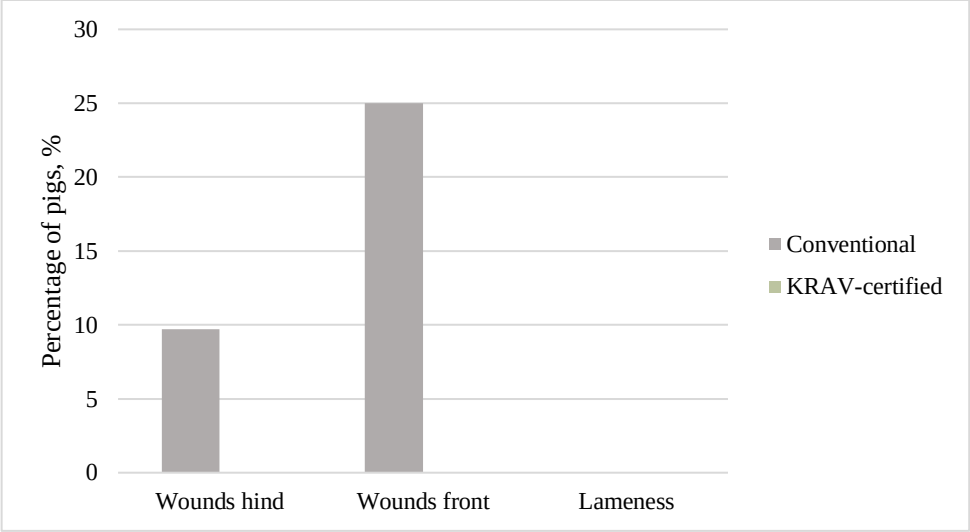

Figure 4. The percentage of pigs with skin damage from the conventional batch; n=72 and KRAV-certified batch; n=15 during loading. The figure also shows the percentage of pigs being lame in the conventional and KRAV-certified batches.

Human-animal interaction

The results from human-animal interaction show that speaking was most common interaction, followed by touch with board and hand for pigs from the conventional batch (Table 10 & Figure 5). For pigs from the KRAV-certified batch, speaking, touch with board and hand occurred once (Table 10). The mean values per group and batch for all performed interactions were higher for pigs from the conventional batch compared to the KRAV-certified batch (Table 10 & Figure 5). A larger number of human-animal interactions were performed for pigs from the conventional batch, compared to pigs from the KRAV-certified batch (Table 10).

Table 10. Descriptive statistics for the frequency of human-animal interactions during loading per group of animals for conventional; n=5 and KRAV-certified; n=2. $Mean_{group}$=mean values per group of pigs and $mean_{batch}$=mean values representing all pigs from the conventional and KRAV-certified batch

	Conventional[1]					KRAV-certified[2]				
Variable	Mean group	Mean batch	S.D.	Min	Max	Mean group	Mean batch	S.D.	Min	Max
Speak-ing	**10.4**	**0.7**	3.78	7.00	15.00	**0.5**	**0.1**	0.71	0.00	1.00
Shouting	**0.0**	**0.0**	0.00	0.00	0.00	**0.0**	**0.0**	0.00	0.00	0.00
Paddle	**0.0**	**0.0**	0.00	0.00	0.00	**0.0**	**0.0**	0.00	0.00	0.00
Board	**8.0**	**0.6**	2.55	4.00	11.00	**0.5**	**0.1**	0.71	0.00	1.00
Hand touching	**6.0**	**0.4**	2.24	3.00	9.00	**0.5**	**0.1**	0.71	0.00	1.00
Hand slapping	**0.0**	**0.0**	0.00	0.00	0.00	**0.0**	**0.0**	0.00	0.00	0.00
Electric prod	**0.0**	**0.0**	0.00	0.00	0.00	**0.0**	**0.0**	0.00	0.00	0.00
Total	**24.4**	**1.7**	5.77	18.0	33.0	**1.5**	**0.2**	2.12	0.00	3.00

[1]Group sizes conventional batch: 15, 15, 15, 12, 15

[2]Group sizes KRAV-certified batch: 13, 2

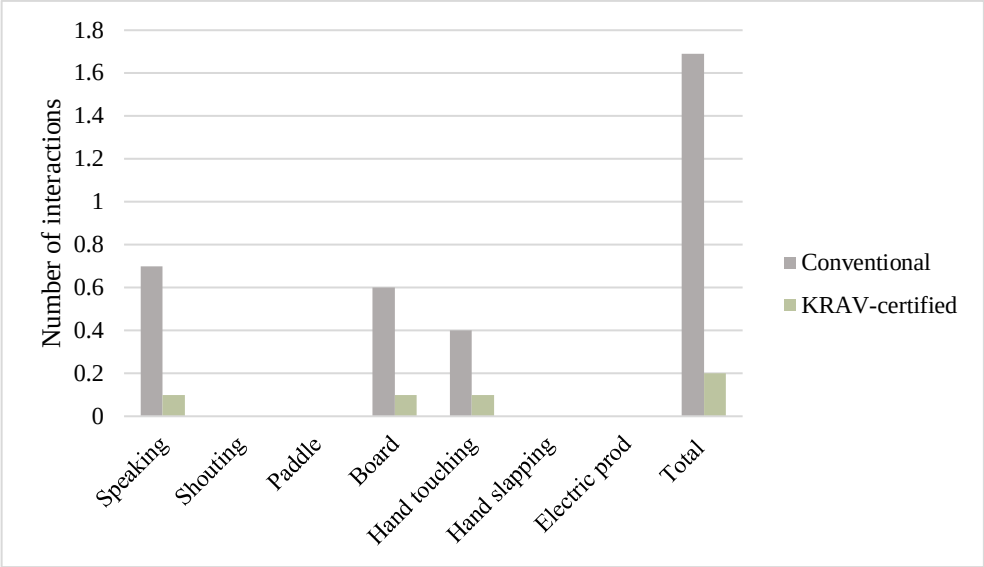

Figure 5. Mean values for human-animal interactions per batch during loading, conventional; n=72 and KRAV-certified; n=15.

Human-animal interactions varied between the groups within and between the production systems (Figure 6). The results show that speaking, touch with board and touch with hand was observed in all groups of pigs from the conventional batch (Figure 6). In contrast, the human-animal interactions were performed on pigs in group 1 and none was observed on pigs in group 2 from the KRAV-certified batch (Figure 6).

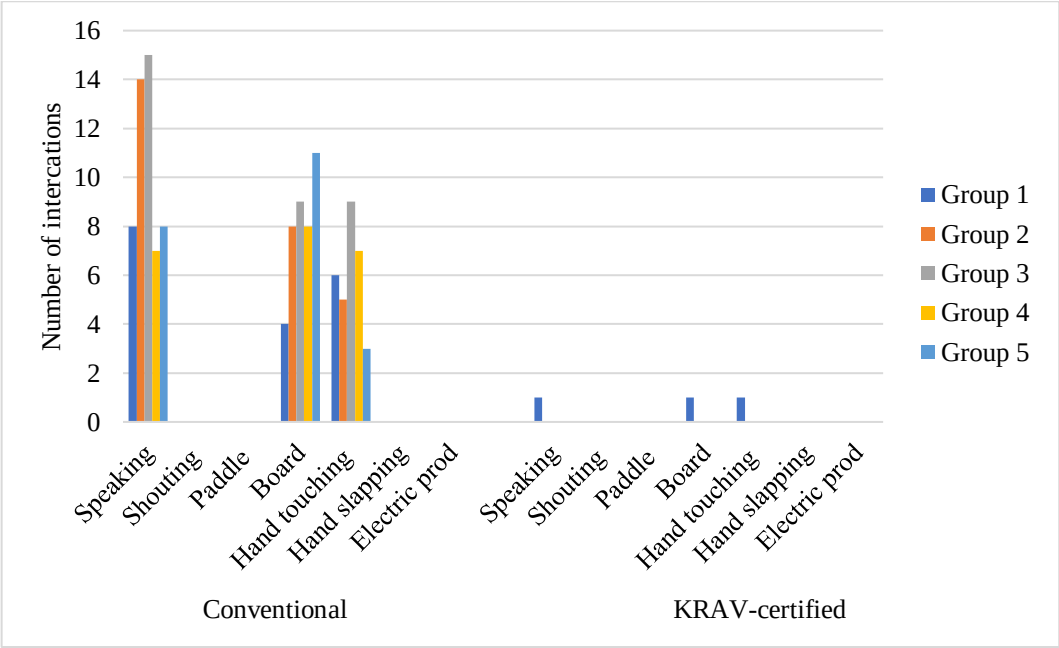

Figure 6. Numbers of human-animal interactions per group of animals during loading for the conventional batch; n=5 and KRAV-certified batch; n=2.

4.1.3 Transport and unloading at abattoir

Pig behaviour

During unloading, the behavioural observations show that the highest percentage of pigs performed explorative behaviour in both conventional and KRAV-certified batches, 88 % and 93 %, respectively (Figure 7). Pigs from the conventional batch performed a larger variation of behaviours than pigs from the KRAV-certified batch. In addition, 7 % of the pigs turned back, 4 % slipped, and 3 % of the pigs shivered (Figure 7). However, reluctance to move occurred more frequently in conventional and KRAV-certified batches (Figure 7).

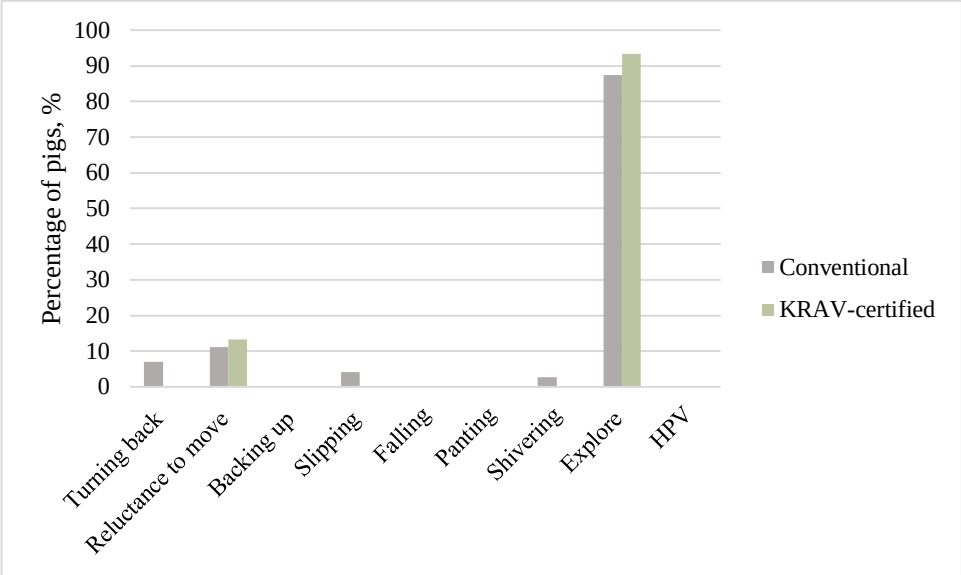

Figure 7. Percentage of pigs performing behaviours during unloading within the batch from conventional; n=72 and KRAV-certified; n=15. Each bar represents the total percentage of pigs from each batch. HPV=high-pitched-vocalisation.

Skin damages and lameness

The result shows that about 14 % of the pigs from the conventional batch had wounds on the front body, in contrast to pigs from the KRAV-certified batch who had no visible wounds (Figure 8). No pigs were annotated having wounds on the hind body or being lame of pigs from the conventional and KRAV-certified batches (Figure 8).

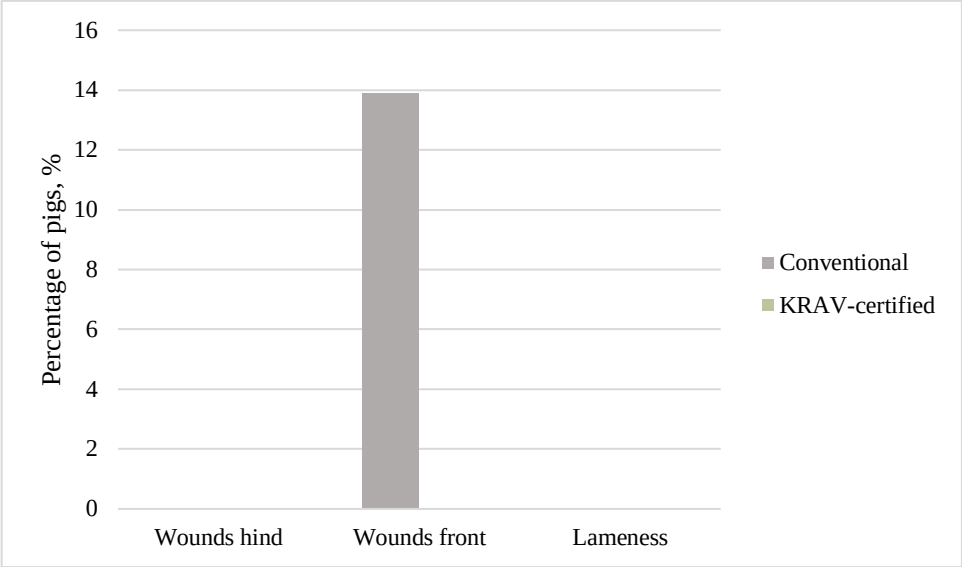

Figure 8. Percentage of pigs with skin damages within the conventional batch; n=72 and KRAV-certified batch; n=15 during unloading. The figure also shows the percentage of pigs being lame within the conventional and KRAV-certified batch.

Human-animal interaction

The most frequent human-animal interaction among the groups of pigs from the conventional batch was speaking, followed by touch with board, hand, and shouting (Table 11). In contrast, the most frequent human-animal interaction for the group of pigs from the KRAV-certified batch were speaking, touch with hand and touch with the board (Table 11). The mean values per group for speaking were higher for pigs from the KRAV-certified batch compared to pigs from the conventional batch (Table 11). The mean value per batch for speaking was also higher for pigs from the KRAV-certified batch than for pigs from the conventional batch (Table 11 & Figure 9). Shouting was performed on pigs from the conventional batch and not on the KRAV-certified batch. Compared to the other mean values per batch, touch with board and touch with hand had higher values for pigs from the conventional compared to pigs from the KRAV-certified batch (Table 11 & Figure 9). These results indicate that speaking was the most common human-animal interaction in conventional and KRAV-certified batches (Table 11).

Table 11. Descriptive statistics for the frequency of human-animal interactions during unloading per group of animals for conventional; n=7 and KRAV-certified; n=1. Mean$_{group}$=mean values per group of pigs and mean$_{batch}$=mean values representing all pigs from the conventional and KRAV-certified batch

Variable	Conventional[1]					KRAV-certified[2]				
	Mean goup	Mean batch	S.D.	Min	Max	Mean group	Mean batch	S.D.	Min	Max
Speak-ing	**3.4**	**0.3**	1.90	1.00	7.00	**8.0**	**0.5**	*	8.00	8.00

Shouting	**0.1**	**0.0**	0.38	0.00	1.00	**0.0**	**0.0**	*	0.00	0.00
Paddle	**0.0**	**0.0**	0.00	0.00	0.00	**0.0**	**0.0**	*	0.00	0.00
Board	**3.0**	**0.3**	1.29	1.00	5.00	**1.0**	**0.1**	*	1.00	1.00
Hand touching	**2.1**	**0.2**	2.79	0.00	8.00	**2.0**	**0.1**	*	2.00	2.00
Hand slapping	**0.0**	**0.0**	0.00	0.00	0.00	**0.0**	**0.0**	*	0.00	0.00
Electric prod	**0.0**	**0.0**	0.00	0.00	0.00	**0.0**	**0.0**	*	0.00	0.00
Total	**8.7**	**0.8**	4.92	2.00	18.00	**11.0**	**0.7**	*	11.0	11.0

*Missing value due to only one group

[1]Group sizes conventional batch: 15, 14, 14, 5, 8, 8, 8

[2] Group sizes KRAV-certified batch: 15

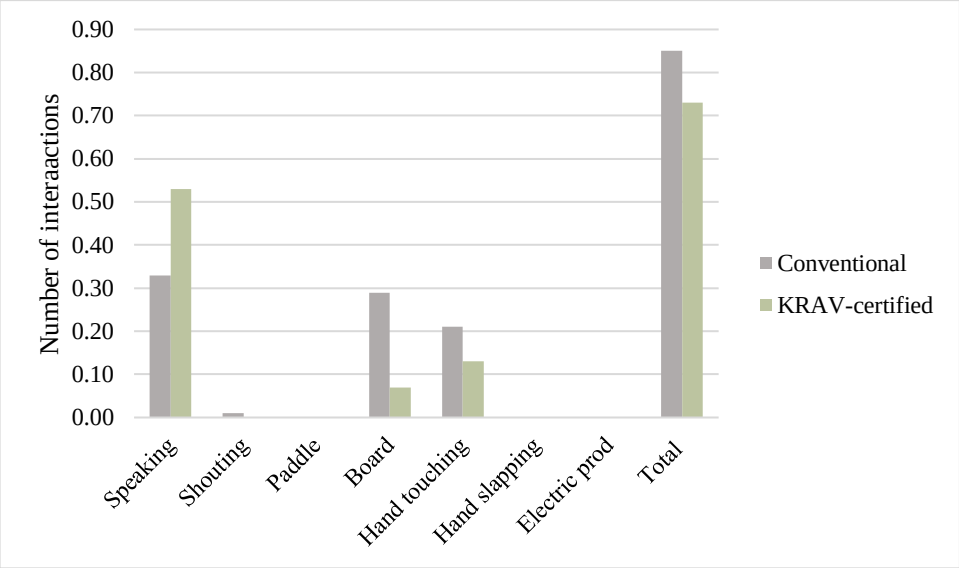

Figure 9. Mean values for the number of interactions per batch during unloading, conventional; n=72 and KRAV-certified; n=15.

Pigs in group 3 from the conventional batch, received the highest number of human-animal interaction, with hand touching (Figure 10). In contrast, pigs in group 1 from the KRAV-certified batch received the highest number of human-animal interactions, with speaking (Figure 10). Pigs in group 6 were involved in a larger number of types of interactions compared to the other groups from the conventional batch (Figure 10).

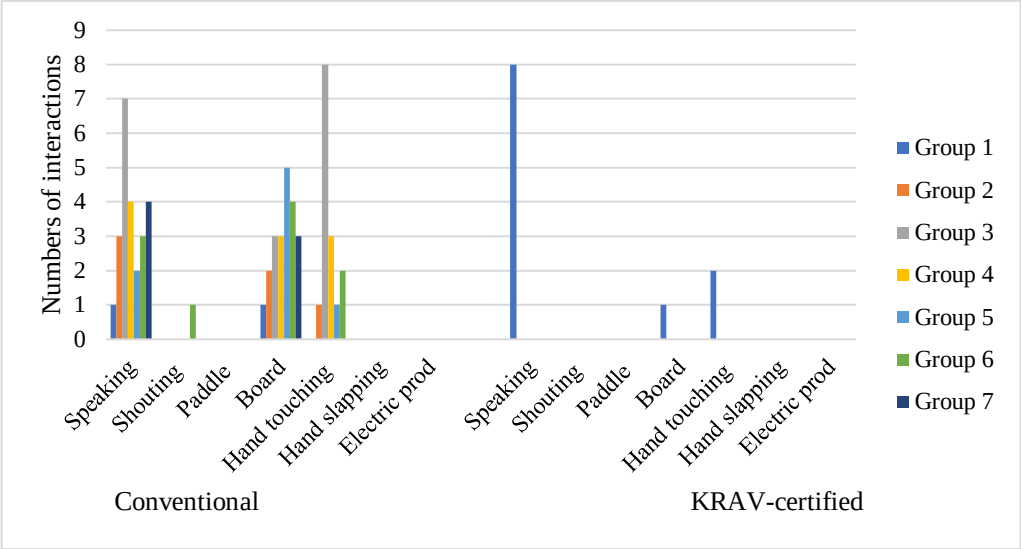

Figure 10. Numbers of human-animal interactions per group of animals during unloading for the conventional batch; n=7 and KRAV-certified batch; n=1.

4.1.4 Abattoir

All data collection from unloading was finished before observing lairage and driving race to stunning, which resulted in missing observations for animals driven directly to stunning from transport. Pigs were driven two to four pigs at a time, which resulted in eleven groups of pigs for the conventional batch and six groups from the KRAV-certified batch.

Pig behaviour

The number of performed behaviours in lairage varied between the observation intervals for pigs from the KRAV-certified batch (Figure 11). Since the observation continued until all pigs were driven to stunning, the number of animals differed between the intervals. All pigs from the KRAV-certified batch were placed in the same lairage pen. The result shows that pigs displayed explorative followed by standing and aggressive behaviour at the first observation (Figure 11). The highest number of observations was the behaviour standing, followed by explorative and resting behaviour for pigs from the KRAV-certified batch (Figure 11). Two pigs from the KRAV-certified batch displayed aggressive behaviour during the first observation and after 70 minutes, one pig expressed thermoregulating behaviour (Figure 11).

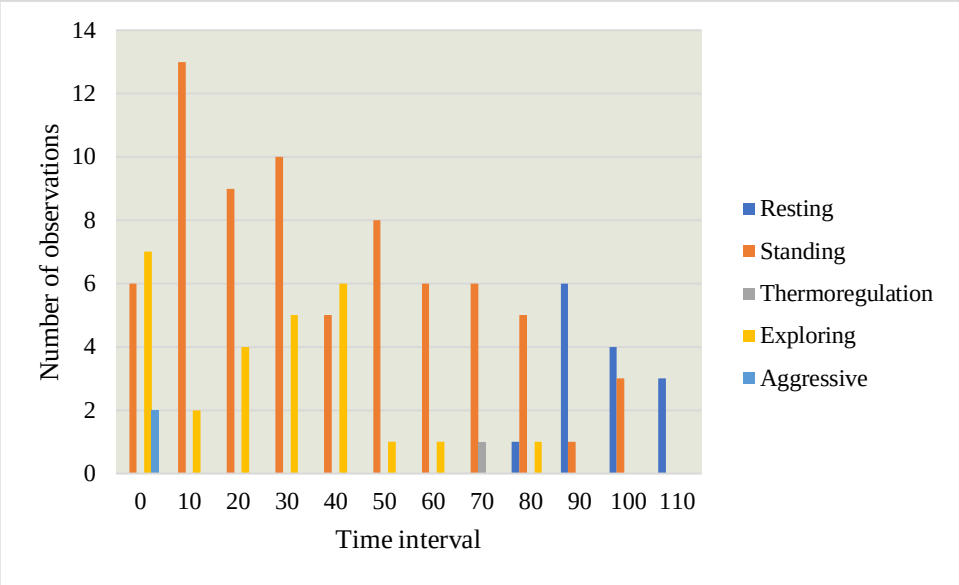

Figure 11. Summary of scan sampling, showing the numbers of observations in lairage on pigs from during lairage for the KRAV-certified batch; n=15. Resting (laying, sitting) and thermoregulation (panting, shivering, huddling). Number of pigs at each time interval: 0=15, 10=15, 20=13, 30=15, 40=11, 50=9, 60=7, 70=7, 80=7, 90=7, 100=7, 110=3.

Pigs from the conventional batch were placed in several different lairage pens at the abattoir. The number of pigs that were destined for overnight lairage was 34. The result shows that the most displayed behaviours were resting, followed by standing and explorative behaviour (Figure 12). The amount of resting behaviour increased from start to 40 minutes and decreased thereafter. One observation of thermoregulatory behaviour was annotated during the last observation at 70 minutes (Figure 12).

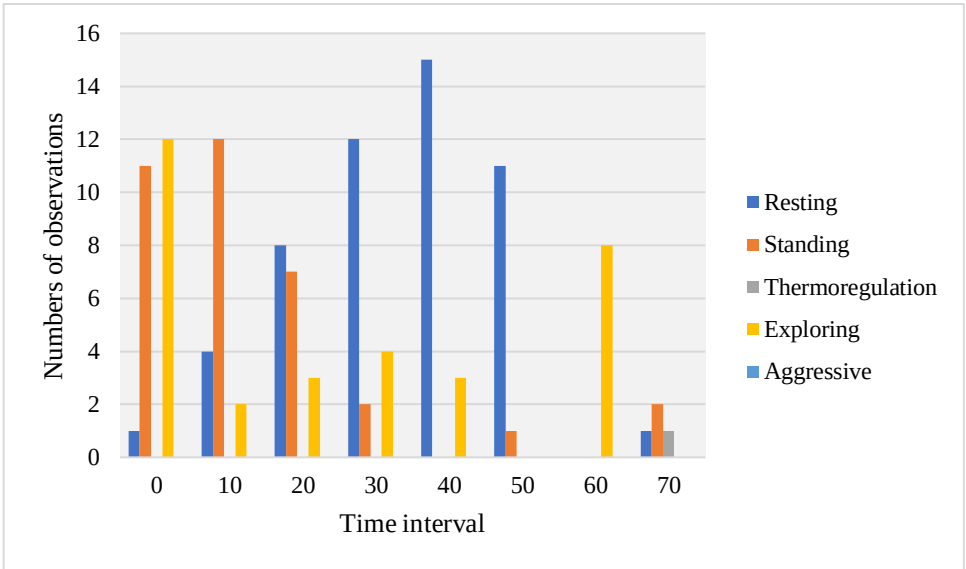

Figure 12. Summary of scan sampling, showing the numbers of observations in lairage on pigs from the conventional batch driven to stunning. Resting (laying, sitting) and thermoregulation (panting, shivering, huddling). Number of pigs at each time interval: 0=24, 10=18, 20=18, 30=18, 40= 18, 50=12, 60=8, 70=4.

The results show that most pigs from the conventional batch displayed explorative behaviours during the first observation (Figure 13). The number of explorative behaviour observations decreases with the time intervals (Figure 13). In contrast, resting behaviour increases with the time intervals (Figure 13). After the first two observations, pigs started displaying aggressive behaviour at 20, 30, 40, and 50 minutes (Figure 13). Pigs expressed thermoregulated behaviour at 50, 60, and 70 minutes (Figure 13).

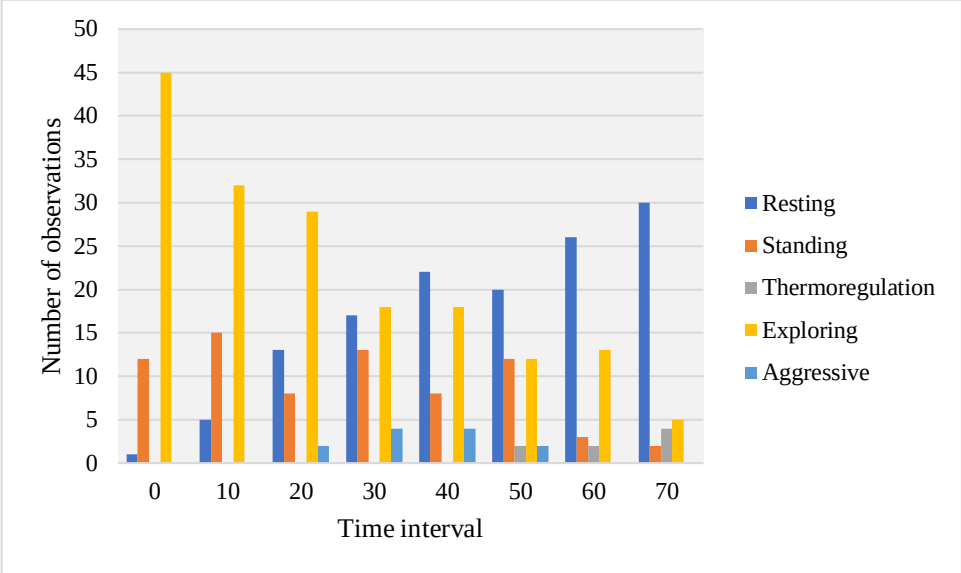

Figure 13. Summary of scan sampling, showing the numbers of observations for all pigs in lairage from the conventional batch; n=72. Resting (laying, sitting) and thermoregulation (panting, shivering, huddling). Number of pigs per time interval: 0=58, 10=52, 20=52, 30=52, 40=52, 50=48, 60=44, 70=41.

The result from the behavioural observations from the driving race shows that all pigs from the conventional and KRAV-certified batches displayed explorative behaviour (Figure 14). Pigs from the conventional batch displayed reluctance to move, backing up, and panting (Figure 14). In contrast, pigs from the KRAV-certified batch did not display reluctance to move, backing up, or panting (Figure 14). On the other hand, pigs from the KRAV-certified batch displayed slipping in the driving race (Figure 14).

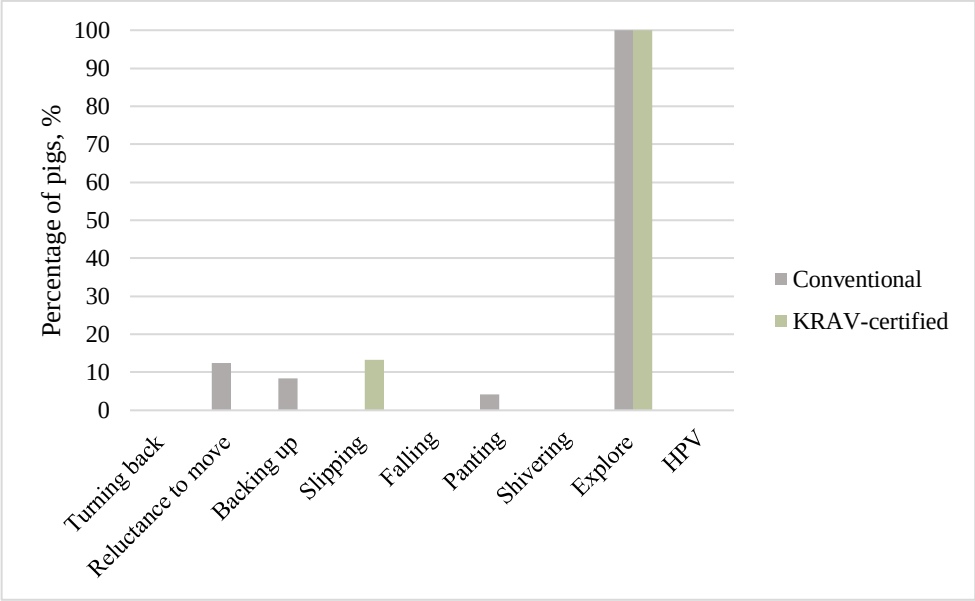

Figure 14. Percentage of pigs performing behaviours during driving race within the batch from conventional; n=24 and KRAV-certified; n=15. Each bar represents the total percentage of pigs from each batch. HPV=high-pitched-vocalisation.

Skin damages and lameness

The result shows that a higher percentage of pigs from the conventional batch had wounds on the front and hind body than pigs from the KRAV-certified batch (Figure 15). A higher percentage of pigs from the conventional batch had wounds on the front body compared to the hind body (Figure 15). No pig from either batches displayed lameness in the driving race to stunning (Figure 15).

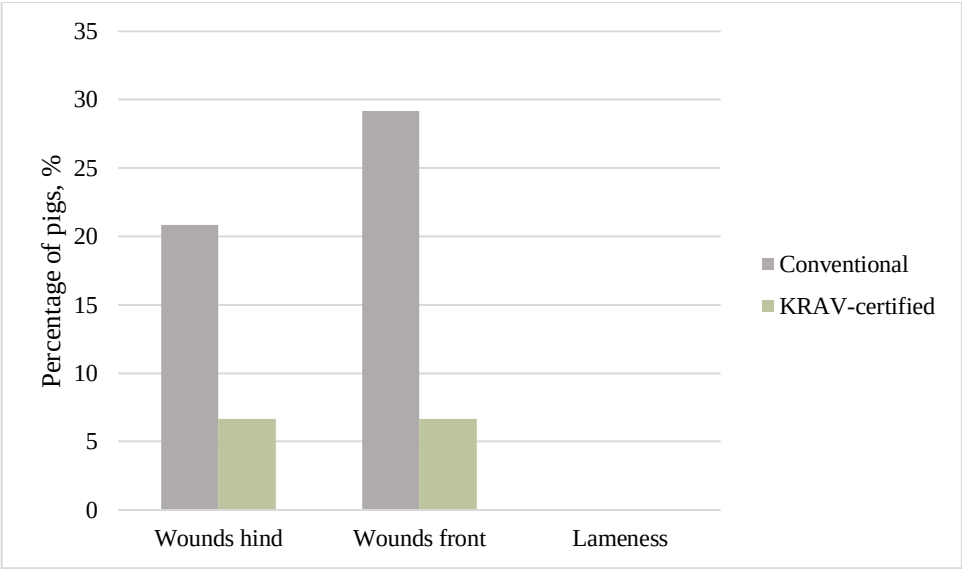

Figure 15. Percentage of pigs with skin damages within the conventional batch; n=24 and KRAV-certified batch; n=15 during the driving race. The figure also shows the percentage of pigs being lame within the conventional and KRAV-certified batch.

Human-animal interaction

Based on the mean values for both the group and the batch, the most occurring human-animal interaction on pigs from the conventional and KRAV-certified batches was touch with the board, followed by speaking (Table 12). The result shows that pigs from the conventional batch received the interaction with hand touching, in contrast to pigs from the KRAV-certified batch who did not receive the interaction with hand touching (Table 12). Mean values per group and batch were higher for all performed human-animal interactions on pigs from the conventional batch than those from the KRAV-certified batch (Table 12 & Figure 16). However, the mean values per group and batch for speaking were similar between the conventional and KRAV-certified batches; 1.1, 0.5 and 1.0, 0.4, respectively (Table 12 & Figure 16). The standard deviation for touch with the board was higher for the conventional batch compared to the KRAV-certified batch (Table 12). In contrast, the standard deviation of speaking was higher for pigs from the KRAV-certified batch than for pigs from the conventional batch (Table 12). The total human-animal interactions were numerically higher for pigs from the conventional batch both per group and batch than pigs from the KRAV-certified batch (Table 12).

Table 12. Descriptive statistics for the frequency of human-animal interactions during driving race per group of animals for conventional; n=11 and KRAV-certified; n=6. $Mean_{group}$=mean values per group of pigs and $mean_{batch}$=mean values representing all pigs from the conventional and KRAV-certified batch

	Conventional[1]					KRAV-certified[2]				
Variable	Mean group	Mean batch	S.D.	Min	Max	Mean group	Mean batch	S.D.	Min	Max
Speaking	**1.1**	**0.5**	0.70	0.00	2.00	**1.0**	**0.4**	1.10	0.00	2.00
Shouting	**0.0**	**0.0**	0.00	0.00	0.00	**0.0**	**0.0**	0.00	0.00	0.00
Paddle	**0.0**	**0.0**	0.00	0.00	0.00	**0.0**	**0.0**	0.00	0.00	0.00
Board	**2.8**	**1.3**	0.98	2.00	5.00	**1.3**	**0.5**	0.52	1.00	2.00
Hand touching	**0.5**	**0.3**	0.82	0.00	2.00	**0.0**	**0.0**	0.00	0.00	0.00
Hand slapping	**0.0**	**0.0**	0.00	0.00	0.00	**0.0**	**0.0**	0.00	0.00	0.00
Electric prod	**0.0**	**0.0**	0.00	0.00	0.00	**0.0**	**0.0**	0.00	0.00	0.00
Total	**4.5**	**2.0**	1.51	2.00	6.00	**2.3**	**0.9**	1.51	1.00	4.00

[1]Group sizes conventional batch: 2,2,2,3,3,2,2,2,2,2,2

[2]Group sizes KRAV-certified batch: 2,2,2,2,4,3

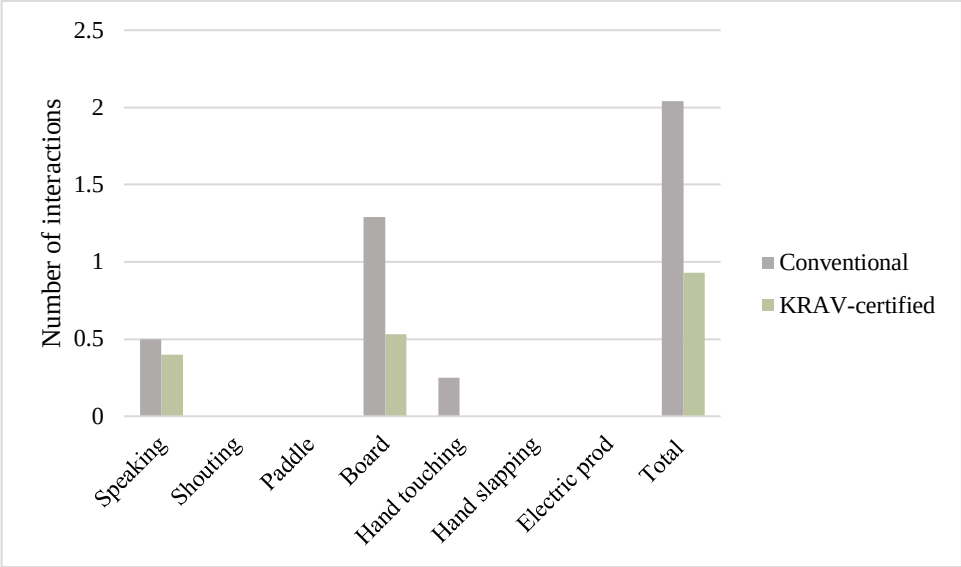

Figure 16. Mean values for the number of interactions per batch during driving race, conventional; n=24 and KRAV-certified; n=15.

The result shows that all groups of pigs received at least one touch with the board from the conventional and KRAV-certified batches (Figure 17). Pigs in group 6 and 7 from the conventional batch had highest number of touches with the board, while pigs in group 5 from the conventional batch had lowest number of touches with the board (Figure 17). Pigs in group 4 from the conventional and KRAV-certified batches received speaking and touch with board twice in the driving race (Figure 17).

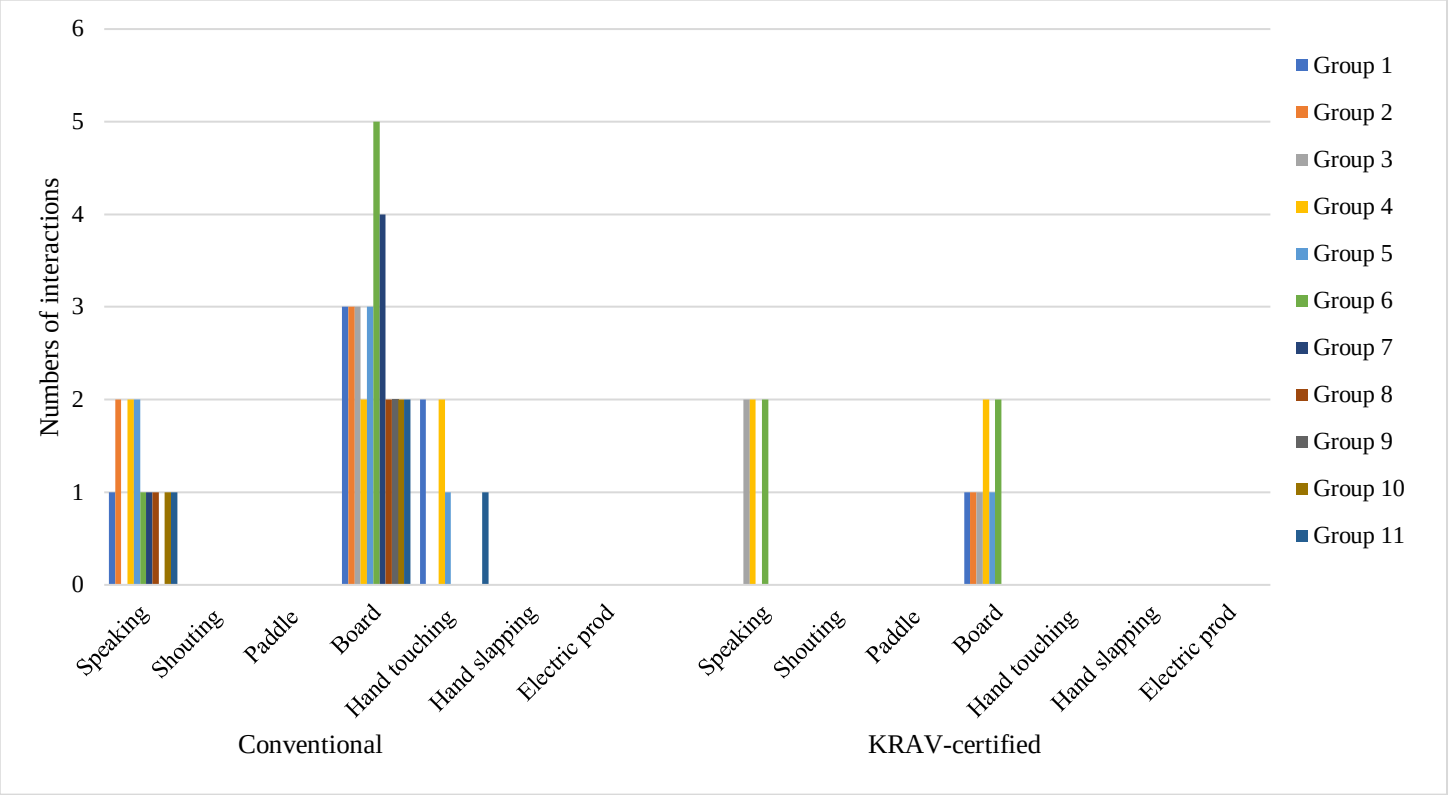

Figure 17. Numbers of human-animal interactions per group of animals for the conventional batch; n= 11 and KRAV-certified batch; n=6 in the driving race.

4.1.5 Duration in each area

The total time in each area is presented as duration at loading, unloading, transport, waiting time, lairage and driving race (Figure 18 & Figure 19). The mean time at loading and unloading was longer for pigs from the conventional batch than the KRAV-certified batch (Figure 18). The transport time was longest for pigs from the conventional batch, while lairage was longest for pigs from the KRAV-certified batch (Figure 19). The waiting time before being unloaded from the lorry was longer for pigs from the KRAV-certified batch compared to the conventional batch (Figure 18). The mean duration in the driving race for pigs from the KRAV-certified batch was longer compared to pigs from the conventional batch (Figure 19).

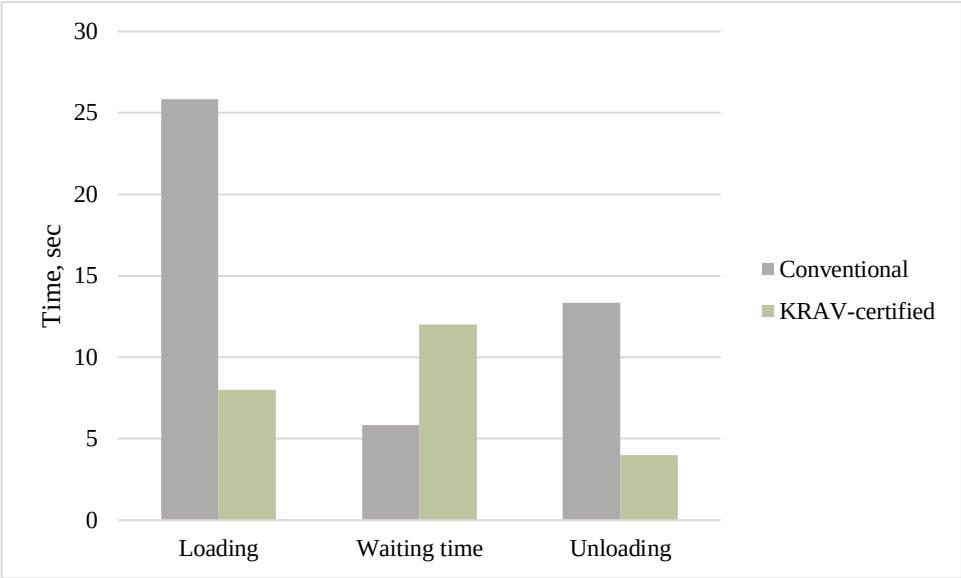

Figure 18. Mean duration per batch presented in seconds during loading, waiting time and unloading, conventional batch; n=72 and KRAV-certified batch; n=15.

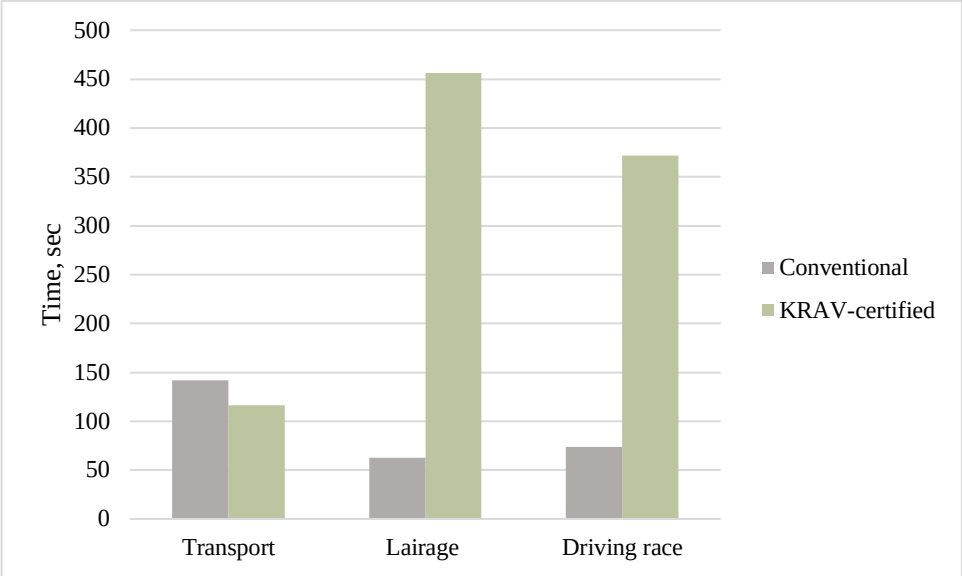

Figure 19. Mean duration per batch presented in seconds during transport, lairage and driving race, conventional batch; n=72 in all areas except for the driving race n=24, and KRAV-certified batch; n=15.

4.1.6 Interviews - pilot study

Farmer

According to the conventional farmer, skin damage can occur caused by water nipples. The pig behaviour differs depending on the weather; if it is cold, several pigs show reluctance to move. In addition to this, the respondent mentioned that if one pig turns back, several other pigs also turn back. Besides these aspects, the respondent mentioned that the restrictive feed before slaughter makes moving pigs out of their home pen more difficult. The respondent considered overnight lairage, long transport, and stunning as stressful factors. When asked about what part from farm to abattoir that has potential for improvement for animal welfare, more time during loading, unloading, and driving race was brought up. Another aspect brought up as improvements by the respondent was the design of small pick-up pens to avoid mixing unfamiliar pigs and a mobile slaughter. The questions regarding a potential protocol, mixing with unfamiliar pigs, and the pick-up facility's design were considered essential factors to include. The respondent added that the protocol should be applicable at a group level due to difficulties assessing all pigs at an individual level. Regarding attitudes toward implementing a protocol, the respondent did not mind implementing a protocol.

Hauler

The respondent did not have an answer to the question regarding commonly noted pig behaviour during loading. The respondent claimed that animal welfare is

connected to the production system and not during transport. However, the respondent believed that if growing-finishing pigs were moved out of their home pen once during the rearing period would ease the handling and loading. Furthermore, the respondent has not experienced any difficulties or time pressure during the transportation of pigs. During the interview, the respondent mentioned that the experience of KRAV-certified pigs was that they are more curious and not as stressed as conventional pigs. An aspect highlighted regarding loading was the importance of the pick-up pen design. Furthermore, at the time of this pilot study, no additional information besides the transport documentation was used during transport. The respondent did not have an answer to the question regarding essential factors to include in a potential protocol. However, if a protocol was about to be used, lack of time and resources would be limiting factors, and the respondent emphasised that a reliable communication between haulers and veterinarians should be priority.

Personnel at abattoir

The respondent described reluctance to move and turning back as pig behaviours performed during unloading. According to the respondent, pigs show reluctance to move during cold weather. However, the respondent thought that pigs should be more handled at the farm. To the question regarding potential improvements at the abattoir, the respondent highlighted enrichment in lairage pens such as chains. The respondent has not experienced time pressure during unloading and driving race, nor has the respondent experienced variation in pig behaviour between different production systems such as conventional and KRAV-certified. When asking about important factors to include in a potential protocol, the respondent did not have any suggestions. However, if a protocol was about to be used, difficulties brought up were lack of time and resources such as it would require additional personnel. In addition to this, the respondent highlighted that a protocol must make improvements in order to be implemented.

4.1.7 Interviews- study

Conventional farmer

According to the conventional farmer, damage on the skin can occur caused by water nipples in the dunging passage when the pigs are moved to transport. According to the respondent, unwanted pig behaviours during loading are turning back and reluctance to move. Factors that are crucial for easy loading are previous handling, weather, and the pick-up facility's design. Regarding weather, the respondent refers to cold and windy weather. Besides these aspects, the respondent mentioned that the restrictive feed before slaughter affects the pigs during loading. When asking about which part from farm to stunning at abattoir affects pigs more,

the answer was overnight lairage. Aside from overnight lairage, mixing with unfamiliar pigs was an aspect that the respondent emphasised, which also was considered to have potential for improvement. If a future protocol was about to be used to document animal welfare from farm to abattoir, the respondent considered including how pick-up facilities should be designed to enhance the loading. Difficulties in using a protocol could be that it is time-consuming. In addition to this, the respondent highlighted that the difficulties may vary among farms. However, the motivation to implement a protocol was an easy to understand and clear protocol.

KRAV-certified farmer

According to the KRAV-certified farmer, there is no equipment on the farm that could cause damage to the pigs. Unwanted pig behaviour that is commonly performed during loading is turning back. Factors that impact the ease of handling are the previous handling of pigs and if the sun is blazing or creating shadows which make it difficult to move the pigs. When asked about which part from farm to stunning at abattoir affects pigs more, the answer was transport, specifically the stops during the transport. Another concern was mixing with unfamiliar pigs. Animals' previous experience of handling is something that the respondent considered as the potential to improve. However, the respondent added that moving pigs, as weighing before slaughter, probably has more positive impact compared to regular moving during rearing. If a future protocol was about to be used to document animal welfare from farm to abattoir, driving technique and design of animal facilities are important to include. The difficulties of a potential protocol were pointed out as time-consuming, difficult to interpret and that the assessment can vary among individuals. The motivation to implement a protocol was financial compensation and a clear protocol that is easy to understand.

KRAV hauler

Unwanted pig behaviours during loading and unloading are reluctance to move. However, the respondent mentioned that pigs' behaviour varies depending on the design of the pick-up facility. According to the respondent, if pigs are moved through a corner, they become curious and easier to load. Factors crucial regarding loading and unloading are previous handling, pick-up facility, available time, and weather. Regarding the weather, the respondent mentioned that cold and windy weather affects the easiness handling. When asked about which part from farm to stunning at abattoir affects pigs more, the answer was that all parts affect the pigs. They are exposed to new environments with new humans and pigs in all parts that can have an impact. However, making a change and improving the different parts from farm to abattoir demands interest and knowledge. During the transportation of animals, the respondent has not experienced any difficulties regarding

supervision of the animals or time pressure. The respondent has not experienced any difference in the pigs' behaviour between conventional and organic raised pigs. There is also no difference in handling techniques for pigs from different production systems. On the contrary, handling techniques may vary among humans according to the respondent. No additional information other than the supervision and transport document is used to check the animal welfare during the transport. When the question regarding a future protocol was asked, the respondent thought the question was difficult to answer but mentioned that different handling technique is required for different pick-up facilities. The difficulties of a potential protocol were pointed out as time consuming and requiring additional resources such as employees. The respondent believed that a protocol must be feasible, go on automatically and not disturb the animals.

KRAV abattoir personnel

The respondent does not usually work in the animals' stables at the abattoir but has some experience and communicates with other employees. Unwanted pig behaviour that has been observed during unloading is reluctance to move. According to the respondent, the environment in the lairage affects how pigs behave, for instance, water on the floor that reflects can cause reluctance to move. The same applies to pig behaviour in the driving race, environmental factors such as sharp turns affect how pigs move and behave. Questions regarding how often the pigs perform behaviours in lairage and driving race and if problematic was excluded, since the respondent was not usually in the stables. When asking about which part from farm to stunning at abattoir affects pigs more, the respondent raised mixing with unfamiliar pigs, which may include several parts: loading, transport, unloading, lairage, overnight lairage and driving to stunning. Several improvements have recently been accomplished, such as light and removal of sharp turns at the abattoir. Thus, it was difficult for the respondent to answer the question regarding improvements from the animals' perspective with available resources. Furthermore, the respondent has not experienced any difference in the pigs' behaviour between conventional and KRAV-certified raised pigs. However, the respondent highlighted the difference in lairage between the conventional and KRAV-certified pigs. Regarding the working conditions at the abattoir, pressure of time during the handling of animals has not been experienced. When the question regarding a potential protocol was asked, the respondent thought the question was difficult to answer, but raised that the design of the animal facilities was an important factor. The difficulties of a potential protocol were pointed out as a generation aspect. The respondent mentioned that the younger generation might have easier for a protocol compared to the older generation. Furthermore, the motivation to implement a protocol includes financial compensation and a clear

protocol that is easy to understand. Another motivation for applying a protocol is if the meat quality is improved.

Conventional abattoir personnel

According to the respondent, unwanted pig behaviour that has been observed is reluctance to move. Pigs displaying unwanted behaviour is affected by weather, if it is cold, or if several humans are present. In lairage, aggressive behaviour has been seen if the pigs are mixed with unfamiliar pigs. The respondent mentioned that if one pig walked forward in the driving race the other pigs followed. The questions regarding how often the behaviour occurs in lairage and driving race were difficult to answer. The same applied to the question regarding if behaviours are problematic. The respondent emphasised that pigs are calm if driven in a group. However, the pigs can react when the handler enters the lairage pen. When asking about possible improvements at the abattoir from an animal perspective, the respondent replied that it was generally good at this abattoir. Furthermore, the respondent has not experienced any difference in the pigs' behaviour between conventional and KRAV-certified raised pigs. When the question regarding a protocol was asked, the respondent emphasised that design of animal facilities was an important factor to include. The difficulties of a potential protocol were that the assessment might vary among individuals. Furthermore, financial compensation can be an alternative to motivate implementation of a future protocol.

Discussion

This study aimed to develop and evaluate protocols based on animal welfare indicators to investigate how different production systems affect the pigs' welfare in connection with loading, unloading, transport, and time spent in lairage at the abattoir. Due to the low number of observed animals and batches in this study, the results should be interpreted with caution and are not necessarily representative for conventional and KRAV-certified animals in general.

5.1 Loading on-farm

Pigs from the conventional batch displayed a larger variation of pig behaviours and were involved in a larger number of human-animal interactions.

5.1.1 Pig behaviour

The behavioural observations at loading showed that pigs from both conventional and KRAV-certified batches displayed reluctance to move and explorative behaviour. According to the results 100 % for pigs from the conventional batch displayed explorative behaviour while corresponding number was 80 % of the pigs from the KRAV-certified batch. One factor that may have affected the pig's behaviour during loading at the conventional farm was that sawdust and salt were spread out on the floor in the pick-up pen due to ice. In contrast, no sawdust or salt was spread in the pick-up pen at the KRAV-certified farm. However, the pick-up pen consisted of soil, which could explain the high percentage of pigs displaying explorative behaviour since pigs have the motivation to explore new environments (Studnitz et al. 2007). Beside explorative behaviour, the conventional batch of pigs displayed the following behaviours: turning back, backing up, slipping, and shivering. One of the reasons why the pigs turned back and backed up may be caused by the design of the pick-up pen. A gate separating the pick-up pen and the lorry was pushed towards the pigs, causing them to turn back and back up away from the lorry. During loading, the behavioural observations showed that a higher percentage of pigs from the KRAV-certified batch showed reluctance to move compared to the conventional batch. The reason why several pigs displayed reluctance to move can be explained by the design of the pick-up pen that had a raised edge before the 90° turn. However, it is important to emphasise the difference in number of observed animals, which was considerably higher for the conventional farm (72) compared to the KRAV-certified (15). Another factor that needs to be considered is that different lorries were used for the conventional and KRAV-certified batches, which may have affected the behaviour. This study did not include

the ramp slope as a measured factor. However, prior studies have noted the importance of the design of the ramp, suggesting it can have an impact on the handling of pigs at loading and unloading (Goumon et al. 2013a). Therefore, the design of the ramp is a factor that could be included in future studies.

5.1.2 Human-animal interactions

The human-animal interaction was recorded as numbers of interactions per group and per batch. Pigs from the conventional batch were involved in a larger number of interactions compared to pigs from the KRAV-certified batch. The conventional batch consisted of 72 pigs divided into five groups, while the KRAV-certified batch consisted of 15 pigs divided into two groups. During loading, handling consisted of speaking, touching with a board and hand touching in conventional and KRAV-certified batches. Previously, gentle handling was defined as using a board with gentle pressure (Čobanović et al. 2020b), which was the second most performed interaction during the observations from this study. Rough handling as in electric prod, repeated slaps or beats with tool did not occur during the observations in this study. However, pigs handled with a larger number of gentle interactions may not necessarily be negative for the pigs, instead the type of interaction needs to be considered. If the human-animal interactions during loading in this study would be categorised in a four-point scale according to Brandt et al. (2013), a possible scoring could be: score 0; pigs moved voluntarily and score 1; touch with a board. However, the observations in this study were performed on a group level and did not measure how hard the animals were handled, which makes it difficult to categorise the interactions. Additionally, it is impossible from the data to know if one pig or all pigs in the group received repetitive interactions from the handler.

5.1.3 Skin damages and lameness

Important findings from this study show that pigs from the conventional batch had wounds front and hind compared to pigs from the KRAV-certified batch, which had no visible wounds. A possible explanation of the findings is that pigs from the KRAV-certified batch were not mixed during loading as the pigs from the conventional batch. Additionally, pigs from the KRAV-certified batch had more bristles than pigs from the conventional batch, which made the assessment of skin damage more challenging. The results from the skin damage for the pigs from the conventional batch reflect what the conventional farmer mentioned during the interview, that water nipples in the dunging passage can cause skin damage. The findings in this study show that a higher percentage of pigs had wounds front compared to hind during loading, which can be an indicator of pigs displaying aggressive behaviour (Aaslyng et al. 2013).

5.2 Transport and unloading at the abattoir

A higher percentage of pigs from the conventional batch displayed a larger variation of behaviours and were involved in a larger number and types of human-animal interactions compared to pigs from the KRAV-certified batch.

5.2.1 Pig behaviour

Interesting findings from the observation during unloading are that pigs from the conventional batch displayed turned back, slipped, and shivered which were not displayed by pigs from the KRAV-certified batch. A possible explanation for this might be that more data were collected during the observations with 72 pigs from the conventional batch compared to 15 pigs from the KRAV-certified batch. However, a higher percentage of pigs from the KRAV-certified batch displayed reluctance to move compared with pigs from the conventional batch. Reluctance to move, turning back and slipping is an indicator of experiencing negative emotions such as stress (Dalmau et al. 2009; Zappaterra et al. 2022). In conclusion, pigs from conventional and KRAV-certified batches showed signs of experiencing negative emotions during unloading at the abattoir. Regarding the explorative behaviour, a higher percentage of pigs from the KRAV-certified batch displayed explorative behaviour compared to pigs from the conventional batch. There are two likely causes for the difference in explorative behaviour between the conventional and KRAV-certified batches. The first cause may be explained by the observer missed annotate pigs displaying explorative behaviour because of too many behaviours in the protocol. The second cause may be explained by the narrow observation duration, which may not be adequate for the pigs to display the behaviour. Another factor that may affect the results during unloading is that the position of the observers differed between the conventional and KRAV-organic batches. When pigs from the conventional batch were observed, the observers were positioned inside the stable and could observe the entire ramp and unloading area. However, the position inside the stable made the distance to the lorry longer. On the contrary, pigs from the KRAV-certified batch were observed from the outside of the stable, still able to see the entire lorry ramp. The positioning outside the stable made the distance to the lorry shorter, which may have exposed the observers and thereby more visible to the pigs. Although the observer changed position due to circumstances, the ramp was still visible during the two observations.

5.2.2 Human-animal interaction

A larger number of types of human-animal interaction were performed on pigs from the conventional batch compared with the KRAV-certified batch. This result may be explained by the different haulers unloading the pigs from the conventional batch and KRAV-certified batch, respectively. Another explanation could be that the

observation of human-animal interaction started earlier if the first pig of the group walked down the ramp before the other pigs. Further studies should have a more detailed definition of when the observation starts and ends. An alternative could be only to annotate behaviours at the ramp and not before or after the ramp. However, in that case, important interactions may be missed. Interestingly, the result shows that a larger number of interactions were performed on pigs from the conventional batch compared to pigs from the KRAV-certified batch. However, pigs from the conventional batch had one stop on another farm along with the transport and a longer transport duration, which may cause a stressful situation with new, unfamiliar pigs and thereby resulted in a larger number of human-animal interactions. The driving tools used may have impacted human-animal interaction and pig behaviour. While unloading of pigs from the KRAV-certified batch, hauler used a plastic paddle to drive pigs out of the compartment, which contrasts with the conventional batch that was driven out of the compartment with a board. The driving technique with a plastic paddle resulted in the haulers not entering the compartment with pigs, creating a free passage forward from the beginning of the handling, which could explain why less human-animal interactions were performed. However, it is difficult to draw a conclusion from the result since both handlers, lorries and production systems differed.

5.2.3 Skin damages and lameness

Pigs from the conventional batch had wounds front but not on the hind body, while pigs from the KRAV-certified batch had no observed wounds. Since the pigs from the KRAV-certified batch were not mixed at loading, aggressive behaviour was avoided, which is supported by (Aaslyng et al. 2013). In comparison to loading, pigs from the conventional batch had wounds on the hind body. This can be explained by difficulties assessing skin damage during unloading due to the several other variables measured simultaneously.

5.3 Lairage at the abattoir

5.3.1 Pig behaviour

The scan sampling in lairage results show that explorative behaviour was most common in pigs from the conventional batch, while standing was most common for pigs from the KRAV-certified batch. A possible explanation for why a higher percentage of pigs from the conventional batch displayed explorative behaviour is that pigs destined for overnight lairage received sawdust in the pens. Pigs from the KRAV-certified batch displayed aggressive behaviour during the first observation, while pigs from the conventional batch displayed aggressive behaviour during four

observation occasions. The findings of aggressive behaviour can be explained by pigs from both conventional and KRAV-certified batches being mixed at unloading, which accords with other observations, demonstrating that pig aggression occurs when mixing pigs in lairage at the abattoir (Brandt et al. 2015). In addition, pigs driven to stunning from neither conventional nor KRAV-certified batches received sawdust in lairage, which could have been used for enrichment and an attempt to reduce aggressive behaviour (Studnitz et al. 2007). Laying and sitting behaviour were aggregated as resting behaviour, which showed that pigs from the KRAV-certified batch displayed resting behaviour after 80 minutes. This finding contradicts previous studies, which demonstrated that about 80 % of the pigs laid down after 10-15 minutes (Brandt et al. 2013; Brandt et al. 2015). A possible explanation for why pigs from the KRAV-certified batch did not lay down before 80 minutes of the observation might be that pigs were moved once at 21 minutes and 52 minutes, which could also explain why standing was the most common behaviour. Another explanation could be that pigs from the KRAV-certified batch were not used to the environment in the lairage at the abattoir, causing them to stand instead of resting. At the observation occasion at 20 minutes, 13 behaviours were annotated on 15 pigs, which may be because the observer missed two pigs or because pigs were moved at 21 minutes. Five pigs from the conventional batch displayed resting behaviour on the second observation occasion, contrary to previous studies (Brandt et al. 2013; Brandt et al. 2015). To establish why pigs lay down, measuring heart rate in lairage could be an option to determine the motivation for laying down in lairage (Brandt et al. 2013). However, this may not be feasible in practice, but could complement behaviour observations in future studies.

5.4 Driving race at the abattoir

5.4.1 Pig behaviour

All pigs displayed the behaviour explore. Pigs from the conventional batch displayed a larger variation of behaviours compared to the KRAV-organic batch. A possible explanation for this might be that a larger number of pigs were observed from the conventional batch; 24 compared to the KRAV-certified batch; 15. On the contrary, the behaviour slipping was observed for pigs from the KRAV-certified batch, consistent with previous studies (Brandt et al. 2013; Brandt et al. 2015).

5.4.2 Human-animal interaction

The most common human-animal interaction was touch with the board and speaking for both conventional and KRAV-certified batches, which indicate

relevant measures. This outcome is contrary to that of Zappaterra et al. (2022) who found that shouts and hit with plastic tube were common human-animal interactions when driving pigs in the race to stunning. However, Zappaterra et al. (2022) was not based on Swedish conditions and did not measure the interaction with speaking and touching with board, which could have occurred but not recorded in the study. Pigs from the conventional batch received touch with the hand and a larger number of human-animal interactions per batch than pigs from the KRAV-certified batch. Since the observation for each batch occurred at different occasions, environmental factors such as reflective water pools could be one explanation for why pigs from the conventional batch were involved in more human-animal interactions. Another possible reason might be that the pigs from the different batches were put in other lairage pens, which made the distance in the driving race longer for pigs from the conventional batch, resulting in a larger number and types of human-animal interactions. For future studies, calculation of the distance in the driving race could be a factor that should be included.

5.4.3 Skin damages

A higher percentage of the pigs from the conventional batch had wounds hind and front of the body compared to the KRAV-certified batch. A possible explanation for the findings might be that pigs from the conventional batch were mixed at loading, unloading and in the driving race, causing aggressive behaviour. Pigs from the KRAV-certified batch mixed during unloading, which according to the regulation should not have occurred (KRAV 2022). However, the reason to why pigs from the KRAV-certified batch were mixed can be explained by technical problems at the abattoir. Another finding from this study is that a higher percentage of pigs from the conventional batch had wounds on the front body compared to the hind body, which might be caused by aggressive behaviour from lairage (Aaslyng et al. 2013). The result for skin damage at loading and driving race shows that a higher percentage of pigs from both conventional and KRAV-certified batches had skin damage at driving to stunning compared to loading and unloading. These differences can be explained by aggressive behaviour during lairage due to mixing unfamiliar pigs, which is an animal welfare issue and an economically sustainable concern if trimming is necessary.

5.5 Duration

The duration at loading on-farm and unloading at the abattoir was considerably shorter for pigs from the KRAV-certified batch compared to pigs from the conventional batch. A possible explanation for the shorter loading duration may be the shorter distance from the pick-up pen to the lorry ramp and a foldable gate that

did not make pigs move away from the lorry. Another explanation for the shorter duration at loading and unloading may be due to the low number of animals observed in this study. Besides the difference in the number of pigs between the batches, pigs were placed in other lairage pens at the abattoir with various distances. The transport duration was longer for pigs from the conventional batch compared to the KRAV-certified batch, which may have caused pigs to adapt and thereby contributed to the longer duration at unloading and more human-animal interactions. The mean duration per batch in lairage and driving race for pigs from the KRAV-certified batch was longer compared to pigs from the conventional batch, which can be explained by technical problems at the abattoir on the day of the observation. The technical problem at the abattoir makes the duration in lairage and driving race challenging to compare between the conventional batch and KRAV-certified batch. In previously study by Zappaterra et al. (2022) showed that the duration in driving races may vary between 10-15 minutes with automatic gates However, the pigs in this study were driven manually by handler, making the result difficult to compare. In addition, as mentioned previously, the distance in the driving race may affect the time duration.

5.6 Observation method

5.6.1 Pig behaviour and human-animal interaction

Several studies used focal animals and video recording while observing pig behaviour during loading on-farm, unloading and lairage at the abattoir (Brandt et al. 2013; Brandt et al. 2015; Brandt et al. 2017). Video recordings allow the observer to analyse the record several times, which is impossible with direct observations. However, this study aimed to develop a feasible protocol; therefore, direct observations were performed since it is not time-consuming as repeated analyse of video recordings. In addition, direct observation provides detailed information about the situation (Martin & Bateson 2007). Furthermore, observing several variables simultaneously at a group of pigs was difficult, which corresponds to the findings of Dalmau et al. (2010). The measured variables included in the protocol may have overtaxed the observer, resulting in missed annotated behaviour or interactions, which indicates that this protocol was difficult to use. The method for observing pig behaviour was to annotate the number of pigs in each group displaying the behaviours, which were challenging in situations with 15 pigs. An alternative to this method is to annotate the frequency of each behaviour continuously during each area, which gives more information on the true frequencies of behaviour (Martin & Bateson 2007). However, annotating the frequency of several behaviours simultaneously on a group of pigs may not be feasible and thereby not reliable. On the contrary, annotating the frequency of

human-animal interaction was feasible since the observer focused on one handler. This study annotated skin damage and lameness simultaneously as behaviour observation. However, the findings from this study may show the difficulties of annotating skin damage during unloading since pigs had wounds on the front and hind body at loading on-farm and in the driving race at the abattoir but not during unloading at the abattoir. The observations in lairage were conducted using the scan sampling method, which allowed to get a quick overview of a large group of pigs behaviour (Martin & Bateson 2007). The disadvantage of scan sampling is that it does not provide any information about the duration of each behaviour. For future studies, it might be possible to use the frequency of pig behaviours during loading, unloading and driving race, but with fewer behaviours included in the protocol. A suggestion would be to exclude the behaviour falling and explore from the protocol, since most of the pigs displayed explorative behaviour and falling was absent. In addition, a previous study by Dalmau et al. (2009) suggested that only one of the behaviours slipping and falling could be enough assessing. Another suggestion regarding the observation method is to maintain several behaviours but annotate only if the behaviour is present or absent. Another alternative could be to observe focal animals which previously studies have performed (Brandt et al. 2013; Brandt et al. 2015; Brandt et al. 2017). Regarding human-animal interactions, electric prod and hand slapping was not annotated during the observations in this study. Although these interactions did not occur in this study, it does not mean that these interactions do not occur in adult pigs since other studies have demonstrated strokes with a hand (Aaslyng et al. 2013) and use of electric prod (Zappaterra et al. 2022). However, it is important to consider that these studies were not based on Swedish conditions, which would be interesting for further studies to investigate.

5.6.2 Skin damages and lameness

Skin damages were assessed as reddish lesions longer than 2 cm in two regions, respectively, front, and hind. The assessment was performed from loading on-farm to stunning at the abattoir, as an attempt to monitor the development of skin damage. Previous studies have used a multi-grade scale that allows for a more detailed assessment (Welfare Quality® 2009; Aaslyng et al. 2013; Bottacini et al. 2018). An alternative in the current study would be to have a more detailed scale and perform the assessment in the pick-up pen on-farm and lairage at the abattoir. On the other hand, the assessment in this study provided the opportunity to include skin damage in the protocol. At the same time, with this observation method the observer did not have to go into the home pens, which is positive from a disease control and stress perspective. Another alternative could be to not divide the pig body into different regions. However, the economic losses are higher when trimming on the hind region (Zappaterra et al. 2022), which emphasises the importance of assessing different regions. Additionally, the causes of skin damage

may be detected by assessing different regions. A limitation in the assessment was that the pigs were observed in a group of pigs, making it challenging to make a detailed assessment of the skin damage and assess each pig individually. During loading on-farm and unloading at the abattoir the assessment was difficult due to the group sizes of about 15 pigs. The assessment of skin damage during driving to stunning was more feasible compared to loading, and unloading, since the group size was two to four pigs. A possible solution could be to assess skin damage on the carcass to achieve a more detailed individual assessment since Aaslyng et al. (2013) demonstrated that skin damage was visible even the day after slaughter. According to the observations, no pig showed lameness. However, other studies have recorded lameness (Dalmau et al. 2010). A possible explanation for why other studies have recorded lame pigs during observations is that they have had a higher number of pigs and investigated several different abattoirs.

5.6.3 Loading on-farm

Besides difficulties assessing several variables simultaneously, the observation needs to be comparable between different production systems. The observation in this study started when the hauler started driving pigs from the pick-up pen, which means that the distance between the pick-up pen and lorry may vary. A suggestion for future studies is to limit the observation to the ramp. However, this may result in missed pig behaviour and human-animal interactions.

5.6.4 Unloading at the abattoir

Pig behaviour and human-animal interaction were observed for each group of pigs during unloading, with a starting-point when the first pig walked down the lorry ramp to the end of the unloading bay. The observations lasted until the last pig were unloaded. This procedure means that human behaviour was annotated inside the truck as well. However, the observation time was the same for pig and human behaviour. Some pigs from the conventional batch were only observed during unloading since they were driven directly to the stun box, however the number of observed pigs were considered as representative to compare with the KRAV-conventional batch. When pigs from the conventional batch were unloaded at the abattoir, it was difficult to count the number of pigs in each group simultaneously as the observations. The reason to it was difficult to keep track of all the pigs in each group was partly because pigs that had already been driven out of the lorry but not put in lairage pens turned back and went up to the lorry again, but also, that 72 pigs from the conventional batch were more difficult to count than 15 from the KRAV-certified batch. Therefore, the number of pigs in each group during loading may be incorrect compared to reality. However, this is a factor reflecting the reality and complexity of direct observations. Further studies need to take this issue into

account, a possible solution could be to ask the person unloading the pigs to announce the number of pigs per group.

5.6.5 Abattoir

The observation method with scan sampling for pigs lairage was feasible. However, it was important to observe all lairage pens in the same order at each time interval. Observer 1 annotated both pig behaviour and human-animal interactions when pigs were driven to stunning. Since pigs were driven in groups of two to four, the protocols and observation method were feasible. The difference in feasibility at loading, unloading and driving race emphasises the challenge of observing a group of 15 pigs.

5.7 Interviews

The third question in this study was to find out how farmers, haulers, and personnel from the abattoir experience pig behaviour during loading on-farm to stunning at the abattoir and their motivation for a potential protocol. Semi-structured interviews were chosen because it is a method that allows the interview to be flexible. The interviewer may deviate from the interview guide and its order to formulate supplemented questions. This creates freedom for the interviewees to formulate and develop the answers further (Bryman & Bell 2017).

5.7.1 Farmers

Conventional farmers and KRAV-certified farmers agreed that unwanted pig behaviour during loading was turning back. The conventional farmer also mentioned reluctance to move as a commonly noted pig behaviour. Both turning back and reluctance to move was behaviour displayed by pigs during loading in this study and other studies (Brandt et al. 2015; Brandt et al. 2017). Both conventional farmer from this study and the pilot study mentioned cold and windy weather as affecting pig behaviour during loading. However, the KRAV-certified farmer did not experience difficulties with cold or windy weather, which may be connected to the that KRAV-certified pigs are raised in an outdoor climate. The motivation for a future protocol was similar for both conventional farmer and KRAV-certified who thought the protocol should be easy to understand and clear. The developed protocol may be clear, but the observation method and number of behaviours and interactions are not feasible since it requires two observers at loading. The restricted feeding on the day of slaughter was a concern that was brought up by the conventional farmer and farmer from the pilot study. Both farmers claimed that restricted feeding could make it more challenging to move pigs, however, the restricted feeding prevents the carcass from being contaminated by the gut content

during slaughter (Barton Gade 2004). On the day of slaughter, the restricted feeding emphasises an ethical dilemma since the pigs could be without feed for a long time, but a gut with feed may contaminate the carcass. Furthermore, the time without feed could be an aspect to include in future studies and how it affects the ease of moving pigs.

5.7.2 Hauler

The hauler from the pilot study did not have an answer to the question regarding commonly performed pig behaviour and surprisingly indicated that animal welfare is connected to the production system and not during transport. However, animal welfare is related to how animals can cope with its environment (Broom 1986:524), which covers loading, transport, and time at the abattoir to debleeding. One concern that emerge from this is what kind of available education haulers receive and how it is followed up. Education can provide equal knowledge of animal welfare, which can be related to social sustainability. KRAV hauler mentioned that reluctance to move is a behaviour that pigs display during loading and unloading. However, pigs that are moved through a corner, become curios and thereby easier to load. This is supported by this study's result with shorter loading duration and fewer human-animal interactions for pigs from the KRAV-certified batch with a 90° turn from pick-up pen up to the lorry ramp compared to the pigs from the conventional batch. KRAV hauler believed that a protocol must be feasible and not cause difficulties.

5.7.3 Abattoir personnel

Abattoir personnel from the pilot study and abattoir personnel KRAV, and conventional have noted the behaviour reluctance to move during unloading. This study confirms that reluctance to move is displayed during unloading by pigs from the conventional batch and the KRAV-certified batch. Previous handling to enhance the handling of pigs was a factor that was brought up by the conventional farmer, KRAV-certified farmer, KRAV hauler, and hauler and personnel at the abattoir from the pilot study. Previous studies have demonstrated that pigs trained to be loaded or moves freely out of the home pen, requires less time at loading (Geverink et al. 1998; Krebs & McGlone 2009). Training pigs could be time consuming for the farmer. On the contrary, pigs from the KRAV-certified batch moved out of their home pen more than twice, at weighing and when pigs were sent to slaughter, had a shorter duration at loading and unloading compared to pigs from the conventional batch.

5.8 Limitations

The study included two farms with different production systems. Due to the small sample size, the statistical analysis was focused on descriptive analysis. In addition, no observations were made during the transport from the farm to the abattoir, because that would have required video recordings and this study aimed to develop a feasible protocol with direct observations. Further data collection of pigs from different production systems is required to determine exactly how different production systems affect the pig's welfare before slaughter. In all observational studies, there is a potential bias from selected farms and interviewees. The observers position during loading and unloading varied between KRAV-certified and conventional batches, which could affect the assessment.

Conclusion

Pigs from both conventional and KRAV-certified batches displayed unwanted behaviours indicating fear and stress during loading on-farm, unloading at the abattoir and in the driving race to stunning. The pigs from the conventional batch displayed a larger variation and repertoar of behaviours and more pigs in that batch had skin damage compared to pigs from the KRAV-certified batch. In addition, pigs from the conventional batch were involved in a larger number and types of human-animal interactions compared to pigs from the KRAV-certified batch. There is no clear answer to how the production system affects pigs' animal welfare during loading on-farm, transport and time spent on the abattoir, but differences between batches and farms were observed. The animal welfare indicators that were tested and considered feasible to include in a protocol are skin damage, turning back, reluctance to move, backing up, slipping and thermoregulatory behaviour. The developed protocol for human-animal interaction and pig behaviour in lairage was feasible, while the protocol for pig behaviours, skin damages and lameness during loading on-farm, unloading at the abattoir and driving race requires less types of behaviours to be feasible. Farmers, haulers and personnel from the abattoir experienced, turning back and reluctance to move as unwanted pig behaviours during loading on-farm and unloading at the abattoir, which was supported by the result from this study. The motivation to implement a protocol varied between the respondents, but the factors that were emphasised was financial compensation and a clear protocol easy to understand.

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Popular science summary

The welfare of livestock animals is of great importance among Swedish citizens and has economical importance for the profitability of pig production. On the day of slaughter, pigs are exposed to new environments and interactions that may compromise their welfare due to stress. The overall aim of this master thesis was to develop and evaluate protocols based on animal welfare indicators to investigate how different production systems affect the pigs' welfare in connection to loading, transport, unloading and time at the abattoir. Three protocols were developed and tested with direct observations on growing-finishing pigs from a conventional batch and a KRAV-certified batch at loading on-farm, unloading at the abattoir, lairage and in the driving race to stunning. The protocols consisted of pig behaviours, skin damages, lameness and human-animal interactions. In addition to the protocols, interviews were performed with farmers, haulers and personnel from the abattoir to identify their experience of pig behaviour and their motivation to use a potential protocol. The developed protocol for human-animal interaction and the protocol for pig behaviour in lairage were feasible to perform, while the protocol for pig behaviours, skin damages and lameness during loading on-farm, unloading at the abattoir and driving race requires fewer types of behaviours to be feasible. However, the protocol for human-animal interactions was feasible to perform as only one handler was observed in each area. Furthermore, the protocol for lairage contained relevant behaviours to achieve an overview of the pig's behaviour. This study shows that pigs from the conventional batch displayed a larger variation and repertoar of behaviours and that more pigs in that batch had skin damage than pigs from the KRAV-certified batch. In addition, pigs from the conventional batch were involved in a larger number and types of human-animal interactions compared to pigs from the KRAV-certified batch. The motivation to implement a protocol varied among farmers, haulers and abattoir personnel, but a recurring message was that the protocol must make improvements to be implemented. Other factors emphasised were financial compensation for implementing a protocol and a clear protocol that is easy to understand.

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Appendix 1

Note number of animals performing behavior during loading, unloading, and driving race.

Date: Time start: Time end: Farm: Number of animals:

Area: Observer:

Group	Turning back	Reluctance to move	Backing up	Slipping	Falling	Panting	Shivering	Explore	HPV	Wounds Hind	Wounds front	Lameness

Appendix 2

Date: Time start: Time end: Farm: Number of animals:

Nr = Number of performed behavior Area: Observer:

Group	Speaking	Shouting	Paddle	Board	Hand touching	Hand slapping	Electric prod

Appendix 3

Scan sample all lairage pens every 10 minutes and note numbers of animals that perform behaviors.

Pen:

Date: Farm: Observer:

Number of animals per pen: Time start: Time end:

Time	Aggressive	Explore	Panting	Huddling	Shivering	Laying	Sitting	Standing
0								
10								
20								
30								
40								
50								
60								

Comments:

Appendix 4

Interview guide farmer:

1. Hur många gånger har djuren blivit lastade förut?
    - 0
    - 1–2
    - >2

Övrigt:

---

2. Hur många gånger har djuren blivit flyttade förut?
    - 1
    - 2
    - >2

Övrigt:

---

3. Har du upplevt att inredning vid lastningszonen på gården gett skador på djuren under lastning?
    - Ja
    - Nej

Övrigt:

---

4. Har du sett några vanligt förekommande beteenden hos djuren i samband med lastning?
    - Tvekar
    - Vänder
    - Backar
    - Halkar
    - Trillar
    - Hälta
    - Vokalisering
    - Aggressivt beteende
    - Ligger
    - Sitter
    - Står
    - Hässjar
    - Skakar
    - Kurar ihop sig

Övrigt:

---

5. Tror du att det är vissa faktorer som är avgörande för en smidig lastning av djuren?
    - Tidigare hantering
    - Utlastningsutrymme
    - Tid
    - Väder

Övrigt:

---

6. Vilken del av slaktledet, från lastning på gård till bedövning och avblodning, anser du påverka djuren mest?
    - Lastning

- Transport
- Avlastning
- Inhysning
- Övernattning
- Drivning till bedövning

Övrigt:

---

7. Vad tror du skulle kunna förbättras inom slaktledet?
    - Mer tid vid lastning, avlastning och drivning
    - Djurens tidigare upplevelse av hantering
    - Lastningsutrymme
    - Ramp på transporten
    - Boxar på slakteriet
    - Drivgångar på slakteriet
    - Djurdensitet
    - Mobilt slakteri

Övrigt:

---

8. Om det utformas ett protokoll som ska användas som ett verktyg av er djurhållare för att ha uppsikt över djurvälfärden från gård till slakteri. Vilka faktorer hade du tyckt varit viktigt att inkludera?

    - Beteenden
    - Drivningsteknik
    - Djurutrymme

---

9. Tror du att det skulle finnas svårigheter med att praktiskt använda ett protokoll?
    - Tidskrävande
    - Resurser
    - Svårt att tolka

- Bedömningen kan skilja sig beroende på vem som utför den

Övrigt:

---

10. Vad skulle motivera er för att implementera ett protokoll?
    - Ekonomisk ersättning för bra djurvälfärd
    - Kunskap och information
    - Lättförståeligt och tydligt protokoll

Övrigt:

Appendix 5

Interview guide hauler:

1) Har du sett några vanligt förekommande beteenden hos djuren vid något lastning/avlastning?
    - Tvekar
    - Vänder
    - Backar
    - Halkar
    - Trillar
    - Hälta
    - Vokalisering
    - Aggressivt beteende
    - Ligger
    - Sitter
    - Står
    - Hässjar
    - Skakar
    - Kurar ihop sig

Övrigt:

---

2) Är det något av ovanstående beteenden mer förekommande?

---

3. Tror du att vissa faktorer är avgörande för en smidig lastning/avlastning av djuren?

- Tidigare hantering
- Utlastningsutrymme
- Tid
- Väder

Övrigt:

---

4. Arbetar ni för att utveckla djurmiljön under transporten?
    - Strö i lastbil
    - Möjlighet till vatten och mat
    - Ventilation
    - Lutning på ramp

Övrigt:

---

5. Är det någon del i slaktledet som du tror påverkar djuren mer?
    - Lastning
    - Transport
    - Avlastning
    - Inhysning
    - Övernattning
    - Drivning till bedövning

Övrigt:

---

6. Är det någon del som du tror skulle kunna förbättras?
    - Mer tid vid lastning, avlastning och drivning
    - Djurens tidigare upplevelse av lastning
    - Lastningsutrymme
    - Ramp på transporten
    - Boxar på slakteriet
    - Drivgångar på slakteriet

- Djurdensitet

Övrigt:

---

7. Upplever ni några svårigheter under transport?
   - Tillsyn av djuren
   - Om något djur skadas
   - Djurmiljö i transporten
   - Tidspress
   - Vägförhållanden

Övrigt:

---

8. Om du har transporterat djur inom både konventionell- och ekologisk produktion, har du upplevt skillnad i djurens beteende?
   - Ja
   - Om ja, vilka?

   - Nej

Övrigt:

---

9. Används olika drivtekniker för djur från olika produktionssystem (konventionell/ekologisk)?
   - Ja
   - Om ja, vad skiljer sig?

- Nej

Övrigt:

---

10. Har ni något protokoll utöver transporthandlingarna för att stämma av djurhälsan?
    - Ja
    - Ja, men inget specifikt för lastning/avlastning
    - Nej

Övrigt:

---

11. Om det utformas ett protokoll som ska användas som ett verktyg för att ha uppsikt över djurvälfärden från gård till slakteri. Vilka faktorer hade du tyckt varit viktigt att inkludera?
    - Beteenden
    - Drivningsteknik
    - Djurutrymme

---

12. Tror du att det skulle finnas några svårigheter med att praktiskt använda ett protokoll?
    - Tidskrävande
    - Resurser
    - Svårt att tolka
    - Bedömningen kan skilja sig beroende på vem som utför den

Övrigt:

---

13. Vad tror du hade motiverat er att implementera ett protokoll?
    - Ekonomisk ersättning
    - Kunskap och information
    - Lättförståeligt och tydligt protokoll

Övrigt:

Appendix 6

Interview guide abattoir personnel:

1. Har du sett några beteenden hos djuren vid avlastning?
    - Tvekar
    - Vänder
    - Backar
    - Halkar
    - Trillar
    - Hälta
    - Vokalisering
    - Aggressivt beteende
    - Hässjar
    - Skakar

Övrigt:

---

2. Har du sett några beteenden hos djuren vid inhysning?
    - Halkar
    - Trillar
    - Hälta
    - Vokalisering
    - Aggressivt beteende
    - Ligger
    - Sitter
    - Står
    - Hässjar
    - Skakar
    - Kurar ihop sig

Övrigt:

3. Hur ofta ses ovanstående beteende?
    - Varje dag
    - Varje vecka

Övrigt:

---

4. Har du sett några beteenden hos djuren vid drivning till bedövning?
    - Tvekar
    - Vänder
    - Backar
    - Halkar
    - Trillar
    - Hälta
    - Vokalisering
    - Aggressivt beteende
    - Hässjar
    - Skakar

Övrigt:

---

5. Är det vanligt att djuren uppvisar ovanstående beteende?

---

6. Upplever ni något av beteendena mer eller mindre problematiskt?

7. Vilken del av ledet anser du påverkar djuren mest?
    - Lastning
    - Transport
    - Avlastning
    - Inhysning
    - Övernattning
    - Drivning till bedövning

Övrigt:

---

8. Om det hade funnits resurser, är det något du anser skulle kunna förbättras ur djurens perspektiv?
    - Inhysningssystem
    - Drivgångar
    - Drivning
    - Fler mätningar på slaktkroppen
    - Rådgivning
    - Utbildning

Övrigt:

---

9. Har ni upplevt skillnad i djurens beteende för konventionell respektive KRAV produktion?
    - Ja

Om ja, vilka?

- Nej

Övrigt:

---

10. Skiljer inhysningen sig åt för konventionell respektive KRAV-producerade djur?
    - Ja

Om ja, hur?

- Nej

Övrigt:

---

11. Upplevs tidspress vid hantering av djuren, vid avlastning och drivning?
    - Ja
    - Nej

Övrigt:

---

12. Om det skulle utformas ett protokoll som ska användas som ett verktyg för att hålla uppsikt över djurvälfärden. Vilka faktorer hade du tyckt varit viktigt att inkludera?

- Beteenden
- Drivningsteknik
- Djurutrymme

---

13. Tror du att det skulle finnas några svårigheter med att praktiskt använda ett protokoll?
    - Tidskrävande
    - Resurser
    - Svårt att tolka
    - Bedömningen kan skilja sig beroende på vem som utför den

Övrigt:

---

14. Vad tror du skulle motivera er att implementera ett protokoll?
    - Ekonomisk ersättning för bra djurvälfärd
    - Kunskap och information
    - Lättförståeligt och tydligt protokoll

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