



Development of an index for the assessment of welfare of finishing pigs from farm to slaughter based on expert opinion



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ABSTRACT

For pigs, the day of slaughter involves potential animal welfare threatening elements at different stages such as pick-up pens, loading, transport, unloading, lairage and race. At present no tool for assessing the welfare of finishing pigs from farm exit to stunning is available. The present study builds on a protocol for assessment of animal welfare of finishing pigs on the day of slaughter, a protocol which was based on the structure of the Welfare Quality[®] protocol for finishing pigs at an abattoir. The present study aimed to develop an animal welfare index (AWI) for the day of slaughter by aggregating 25 primarily animal-based measurements based on 38 experts opinion on inter-measurement and inter-stage weights. AWIs were calculated on animal level as the weighted sums of prevalence of the measurements, and were calculated for each of the six stages: pick-up pen, loading, transport, unloading, lairage and race (AWI_{Stage}) and across the stages (AWI_{Overall}). The AWIs were tested in 5 farms including a total of 45 fattening pigs delivered to two Danish abattoirs. Possible inter-relations between the AWI and heart rate measurements were examined.

For each welfare measurement within stage, significant differences between the mean expert scores were found. However, no difference between stage weights was found. Statistically significant differences in average heart rate between stages were found: 123^a (pick up pen), 139^b (loading), 120^a (transport), 132^d (unloading), 114^c (lairage) and 134^{bd} (race) bpm, respectively, (different letters indicate differences of $P < 0.05$). No significant relationship between the score assigned by the expert panel per stage and the average heart rate within stage ($r=0.61$, $P=0.19$) or between AWI_{Stage} and heart rate ($r=0.43$, $P=0.40$) was found.

In conclusion, this work has suggested a potential model for the aggregation of animal welfare measurements into animal welfare indexes for slaughter pigs on the day of slaughter. Further validation may allow simple comparison of the level of welfare between lorries, days, abattoirs etc. and may be used for future development of a feedback mechanism for optimization of the welfare of the pigs as well as for marketing.

1. Introduction

Increasing interest and concerns from the market and the authorities regarding animal welfare have created a need, not only to improve the welfare of animals, but also to document the level of animal welfare. So far, the European Council Regulation (EC) No. 1099/2009 prescribes only documentation of stunning effectiveness. However, besides stunning, the day of slaughter involves a series of potential animal welfare threatening elements for pigs (*Sus scrofa domestica*) (Barton, 2004; Gregory, 2008; Stoier et al., 2001), and at present no tool for documentation of the welfare consequences of these is available.

The Welfare Quality[®] has developed a comprehensive protocol for assessment of welfare of pigs at abattoirs (Welfare Quality[®], 2009).

However, an aggregation model for welfare of finishing pigs on the day of slaughter is not yet available. For the welfare protocol proposed by Welfare Quality[®] for pigs on farms, the aggregation of welfare measurements were carried out in a hierarchic manner (Botreau et al., 2007). For simplicity and transparency reasons, recent studies have presented alternative welfare indexes based on the weighted linear sum of the prevalence of individual welfare measurements (Burow et al., 2013; Knage-Rasmussen et al., 2015; Otten et al., 2016). Common to both models is the expert opinion underlying the weighted aggregation of the welfare measurements when overall welfare assessment is performed at herd level (Burow et al., 2013; Jensen et al., 2012; Rousing et al., 2007). In the present study, expert opinion was used to assign weights for aggregation of animal welfare measurements on the day of slaughter.

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Animal stress responses may be related to animal welfare. It has been demonstrated that exposure to acute stressors on the day of slaughter result in changes in heart rate of pigs (Lewis et al., 2008; Correa et al., 2010, 2013). Pigs loaded by use of an electric prod had significantly higher heart rate during loading compared with pigs loaded by use of a compressed air prod or board and paddle (Correa et al., 2010). Thus, changes in heart rate may reflect the level of stress in pigs within single stages of the day of slaughter. Consequently, in the present study, changes in heart rate were used to evaluate the newly developed animal welfare index (AWI).

The potentially animal welfare threatening elements from the day of slaughter can be split into stages based on chronology and physical location (as suggested by Brandt and Aaslyng, 2015): the potential housing in pick-up facilities, loading, transport, unloading, lairage and the race to the stunning chamber. Access to data on welfare within the single stages of the day of slaughter as well as for the entire day will allow future development of feedback mechanisms for optimization of the welfare of the pigs. Furthermore, aggregation of the assessments into an index would allow simple comparison of the level of welfare between stages as well as between lorries, days, abattoirs etc. and may be used for documentation as well as marketing (Johnsen et al., 2001).

Hence, the aim of the present study was to develop an aggregated animal welfare assessment based on the animal welfare assessment protocol developed by Brandt et al. (2015) by use of expert opinion to establish the weights of the included measurements. In addition, we aimed to develop an animal welfare index (AWI) for finishing pigs on the entire day of slaughter as well as an index within single stages. Our hypotheses were that different animal welfare measurements within stage, as well as the different stages from farm to slaughter, would be assigned different weights in the aggregated welfare assessment.

2. Materials and methods

The present study builds on a protocol developed by Brandt et al. (2015) for measuring animal welfare of finishing pigs on the day of slaughter, a protocol which was based on the structure of the Welfare Quality® protocol for finishing pigs at an abattoir (Welfare Quality®, 2009). Supplementary to Welfare Quality®, we collected data from the pick-up pens, loading, transport as well as during unloading, lairage and race to the stunning chamber. During transport, only outdoor temperature, duration of transport and heart rate of the pigs were recorded. The protocol included direct animal-based measurements such as slipping, falling, reluctance to move, turning back and skin damage. In addition to the Welfare Quality® measurements, we included the following measurements: duration of each stage, mixing with other pigs, postures of pigs during lairage, score of driving (pigs moved voluntarily or pigs moved by paddle or board), pigs being lifted

by other pigs (overlapping) and pigs moved by gate in the race. The involved behavioural measurements are shown in Table 1.

An expert panel was selected to provide aggregated weights for the welfare measurements of the finishing pigs on the day of slaughter by use of an online questionnaire. In the recruitment of experts, we focused on a narrow animal science panel using the following inclusion criteria: current employment in Denmark, expertise within health and welfare of finishing pigs via employment in the industry, authorities, private research centres or universities combined with an education within animal science, veterinary medicine or alike of at least the level of Master of Science. A list of 39 Danish experts was formed, and the selected experts were invited to participate. The invitation included names of other invited participants within the same organisation and suggested that the experts further invited supplementary candidates of relevance if possible. As a result, the questionnaire was completed by 24 of the 39 experts (response rate of 62%) and by another 15 supplementary candidates suggested by experts from the original list. The respondents were employees from Danish abattoirs (2), universities (9), the government authorities (3), production consultants (13), employees from private research centres (8), and other (4). The answers to the questionnaire were kept anonymous, but all respondents gave information on education and affiliation.

In the questionnaire, the experts were asked to assess the importance of selected welfare measurements (presented in Table 4) on a 5-point scale, where 1 was “not important” and 5 “essential” at the six stages during the day of slaughter: in the pick-up facility, during loading, transport, unloading, lairage and in the race to the stunning chamber. In connection with questions about loading, unloading and the race to stunning, short video clips were shown to visualize the typical handling related to these stages. Each expert was asked to put one answer to each measurement and invited to add further measurements, if essential measurements did not appear from the questionnaire. Eighteen of the experts added the following factors: availability of feed and water in the pick-up facilities, cover of pick-up facilities, non-slip surfaces, vocalizations (human and animal), noise, group size, temperature differences between in- and outdoor, bedding and ventilation on the lorry, pigs diagnosed as injured upon arrival at the abattoir, moving backwards or sideways in the race and a differentiation between a minor contact and a push by the automatic gate in the race. Additionally, the members of the expert panel were asked to score the importance of the different six stages by the 5-point scale.

One expert (affiliation: other) assigned “essential” for every measurement and was removed before further analyses since this response provided no variation. Thus, 38 expert opinions were included in the calculations of weights for the welfare index.

In order to evaluate the developed AWI, a welfare assessment including a total of 45 pigs was carried out for each of the six stages and

Table 1.

Ethogram of pig behaviour used for welfare assessment of finishing pigs during the day of slaughter obtained from video recordings at loading, unloading and in the race to the stunner at an abattoir. During lairage, the behavioural observations were obtained by direct observation.

Stage*	Behaviour	Definition
l, u, r	Slipping	The pig slips at least one leg, the body does not come into contact with the floor (Dalmau et al., 2009).
l, u, r	Falling	The pig loses balance on one or more legs, and falls to its knees, or another part of the body other than legs comes into contact with the floor (Dalmau et al., 2009).
l, u	Reluctance to move when being driven	The pig stops for > 2 s (Correa et al., 2010; Dalmau et al., 2009; Welfare Quality®, 2009) when being driven forward by rattle stick or board. When the pig resumes forward movement, the event is ended, and a new event recorded when the pig stops again for > 2 s
l, u	Turning back when being driven	The pig turns more than 90 degrees away from the direction of movement when being driven forward by rattle stick or board (Welfare Quality®, 2009).
la	Posture during lairage	Lying: the body of the pig is in contact with the floor, either externally or laterally. Sitting: the pig rests on its thighs and front legs (Terlouw et al., 2009). Standing: the pig is supported on all four legs, active or inactive.
l, u, r	Overlapping	During driving, the pig was lifted by another pig, while its forelegs are placed on the back of another pig (Correa et al., 2010).

* l = loading, u = unloading, la = lairage, r = race to stunning.

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