Animal Welfare Assessment in Sows and Piglets—Introduction of a New German Protocol for Farm's Self-Inspection and of New Animal-Based Indicators for Piglets

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Abstract: We compare the *Kuratorium für Technik und Bauwesen in der Landwirtschaft e.V.* (KTBL) protocol, a German protocol for sows and piglets developed for farm's self-inspection, to the Welfare Quality® protocol for sows and piglets (WQ). The KTBL protocol introduces new indicators for piglets to be assessed at pen level (face lesions, carpal joint lesions, undersized animals). The reliability of their assessment at pen level was analysed by comparison to assessments at individual level. Both protocols were applied by one observer in 65 farm visits. The protocols are highly similar, although the composition varies (WQ protocol: focus on animal-based, KTBL protocol: focus on management-based indicators). Consequently, the WQ protocol detected more welfare issues (e.g., welfare issues related to appropriate behaviour: 62.9% (WQ) vs. 21.0% (KTBL protocol)). The comparison between pen and individual level of piglets' indicators was determined using Spearman's rank correlation coefficient (RS), intraclass correlation coefficient (ICC) and limits of agreement (LoA). Carpal joint lesions and undersized animals (RS 0.73/0.80 ICC 0.55/0.57 LoA −0.12 to 0.03/−0.01 to 0.01) are reliably assessed at pen level but face lesions (RS 0.19 ICC 0.18 LoA −0.42 to 0.03) are not. Concluding, we present advantages and disadvantages of the KTBL protocol and introduce indicators for piglets which may enhance existing protocols.

Keywords: animal welfare assessment; piglets; pen level; sows; Welfare Quality®

1. Introduction

For the assessment of welfare in farm animals, the Welfare Quality® animal welfare assessment protocols have received great scientific recognition [1]. The Welfare Quality® protocols were developed between 2004 and 2009 as an EU initiative by scientists with the involvement of farmers, stakeholders and the society. As a result, a generally accepted, valid and reliable assessment system for animal welfare was designed. The Welfare Quality® protocols are based on four main principles (good feeding, good housing, good health, appropriate behaviour), which are evaluated using twelve independent but complementary criteria, for which different, mainly animal-based indicators were chosen [1]. This assessment system ought to be feasible, but the feasibility of the Welfare Quality® protocols is often criticised because of the long time required for the collection of all data, which can take up to eight hours [2]. However, feasibility is important in order to increase the acceptance of the protocols and thus make them accessible to a wider public [2]. Therefore, many efforts, particularly at national

level, exist to construct a shortened and in this sense more feasible animal welfare assessment system (e.g., in Denmark [3]).

Likewise in Germany, a new protocol for assessing welfare in sows and piglets was published in 2016 based on the Welfare Quality® protocol for sows and piglets [4]. The reason for this is that an on-farm inspection of animal welfare by the farmers using animal-based indicators has been legally required in Germany since 2014 by the German Animal Welfare Act (German designation: Tierschutzgesetz, TierSchG) in § 11, 8 TierSchG [5]. Thus, a recommendation for the implementation of the legislative requirements was issued by *Kuratorium für Technik und Bauwesen in der Landwirtschaft e.V.* (KTBL) in 2016. The species-specific KTBL protocols have been developed for cattle, pigs and poultry, e.g., 'Animal welfare indicators: Practical guide—Pigs' [4], in which a protocol for sows and piglets as mentioned above is also provided.

The present study aimed to present the KTBL protocol for sows and piglets and to point out the similarities and differences compared to the Welfare Quality® protocol for sows and piglets reflecting the Welfare Quality® principles and criteria. The composition of the protocols concerning the types of indicators (animal-, management- or resource-based) is compared as well as which areas of animal welfare are assessed and whether both protocols detect the same proportions of animals/litters with affected welfare.

Further, a special emphasis is placed on the animal-based indicators in piglets, which were newly introduced in the KTBL protocol (face lesions, carpal joint lesions, undersized animals). These indicators are defined to be evaluated at pen level. It was investigated for the first time whether the assessment at pen level of indicators in piglets in general and these indicators in particular is suitable to mirror the real welfare state of the piglets. Assessments performed in the same litters at individual animal level and at pen level were compared. The study resulted from the fact that indicators in piglets are challenging, particularly in terms of feasibility since a litter consists of several, usually fast-moving individual animals. If the assessment at pen level is confirmed as suitable, it can be fully recommended based on scientific validation.

2. Materials and Methods

2.1. Data Collection

For the comparison of the protocols, data collection was performed by one observer on 4529 sows and 237 litters at 13 farms in Schleswig-Holstein, Germany between September 2016 and April 2018 (40–5000 sows per farm with different production systems (11 farms conventional, 2 farms organic) representing common German farrowing farms). The complete KTBL protocol and the entire Welfare Quality® protocol for sows and piglets were applied on each farm including assessments in sows and piglets. The observer was trained in the execution of both protocols and the protocols' definitions of the indicators were strictly followed during the data collection [4,6]. Since the KTBL protocol is based on the Welfare Quality® protocol, both protocols possess equal parts and could be collected simultaneously. The assessments followed the structure of the Welfare Quality® protocol for sows and piglets, whose execution is described in detail in Friedrich et al. [7]. The indicators newly introduced by the KTBL protocol are displayed in Table 1.

Additional data were collected for comparison of the methods to assess the KTBL indicators for piglets. The assessment of the KTBL piglets' indicators included another 2596 piglets of 200 litters of different ages in equal parts (within one week after farrowing, two to three weeks suckling period and in the week of weaning) and were performed on only one of the study's farms because of practical reasons. For the evaluation of the methods, an individual animal assessment was conducted in each litter following the assessment at pen level. In the assessment at pen level, all piglets in a pen were observed at the same time and the resulting individual outcomes were summarised into a pen level score as percentage of affected piglets per litter. The piglets were separated, lifted and examined

individually for the assessment at individual animal level. The time required per litter was measured for both methods.

Table 1. Type (AB: animal-based, MB: management-based, RB: resource-based), scoring scale, definition and assigned Welfare Quality® principle of indicators, which were newly introduced in the protocol for sows and piglets published by *Kuratorium für Technik und Bauwesen in der Landwirtschaft e.V.* (KTBL) [4].

Indicator	Type	Scoring Scale	Definition	Assigned Principle
Sows				
Evidence of ectoparasites	AB	0	No evidence of ectoparasites	Good health
		1	Evidence of ectoparasites (lice or their eggs, beginning or manifested mange)	
Trauma on teats and udder	AB	0	≤4 lesions on the udder, teats without lesions	Good health
		1	≥5 lesions on the udder or ≥1 injured teat	
Claw alterations [1]	AB	0	No evidence of claw alterations	Good health
		1	Evidence of alterations (injured, overgrowth (claws, dewclaws, sole, heel), bleeding erosion (side wall), cracks (heel, sole, sole/heel junction, side wall), panaritium)	
Antibiotic treatment index [2]	MB	-	$= \frac{\text{Total of antibiotic treatments 3}}{\text{Average of occupied animal places}}$	Good health
Return rate	MB	%	$= \frac{\text{Number of returning sows}}{\text{Number of inseminated sows}} \times 100$	Good health
Abortion rate	MB	%	$= \frac{\text{Number of abortions 4}}{\text{Total number of litters inclusive of abortions}} \times 100$	Good health
Number of parities	MB	-	$= \frac{\text{Sum of number of litters of outgoing sows 5}}{\text{Sum of outgoing sows}}$	Good health
Slaughter results [6]	MB	%	$= \frac{\text{Number of affected sows}}{\text{Total number of slaughtered sows}} \times 100$	Good health
Nest building material	RB	0	Nest building material is not supplied, not used or soiled with faeces	Appropriate behaviour
		1	Nest building material is supplied, used and not soiled with faeces	
Piglets				
Face lesions	AB	%	Number of piglets with ≥3 bleeding or healing injuries compared to total number of piglets in a litter	Good feeding
Carpal joint lesions	AB	%	Number of piglets with bleeding or healing injuries at carpal joints compared to total number of piglets in a litter	Good housing
Undersized animals	AB	%	Number of animals, which possess at least two of the following characteristics: significantly smaller than the rest of the group, prominent ribs, sides of the body shrunk, long bristles; compared to total number of piglets in a litter	Good feeding
Stillborn piglets [7]	MB	%	$= \frac{\text{Number of stillborn piglets}}{\text{Total number of piglets in the litter}} \times 100$	Good health

[1] Solely claws at the hind legs are assessed; [2] calculated separately for sows and piglets; [3] the duration of application including effective days multiplied by the number of animals treated and the number of active substances in a drug provides the total number of antibiotic treatments; [4] the delivery of stillborn and immature foetuses before the 110th gestation day is defined as abortion; [5] number of sows leaving the herd because of loss (death or euthanasia) or remounting (slaughter); [6] slaughter results may represent data on pleuritis, pneumonia, pericarditis, liver condition, abscesses, arthritis or emergency killing of animals. Thus, slaughter results can inform about health issues or technopathies. For each finding, the proportion of affected sows is calculated; [7] expressed as average over all litters.

2.2. Data Processing and Statistical Analysis

The data processing for the comparison of the protocols and for the comparison of pen level to individual animal level in piglets, including the statistical analysis, was conducted applying the statistical software SAS® 9.4 [8]. For the comparison of the protocols, first, indicators which are

only included in the KTBL protocol were sorted into the Welfare Quality® principles and criteria to permit a comparison concerning the composition of the protocols, areas of animal welfare covered and discovered proportion of animals/litters with affected welfare. The proportion of animals/litters with affected welfare was only calculated for animal-based indicators. Management- and resource-based indicators as well as indicators assessed at group level (social and exploratory behaviour, qualitative behaviour assessment) were not included in the evaluation since either no thresholds are defined (e.g., at which point is the return rate too high?) or no individual animal observations were available but only assessments of groups of different sizes. Following the protocols, as many indicators as possible were collected on the same animal. The observations in a single animal were not cumulated in the evaluations. For example, if an animal was found to have both deviations in the indicator wounds on the body and the indicator vulva lesions, which belong to the principle of good health, the animal was only counted once as having restrictions in animal welfare for this principle.

For the purpose of comparing the assessments at individual animal level with the assessments at pen level in piglets, the assessments at individual animal level were converted into a pen level score (percentage of affected animals per litter). The calculated pen level score and the actually assessed pen level score were then compared. The statistical analysis combined reliability parameters with regard to existing studies in pigs [7,9–13]: Spearman's rank correlation coefficient (RS) and intraclass correlation coefficient (ICC) were applied to measure the reliability between calculated and assessed pen level scores. Limits of agreement (LoA) was chosen to determine the agreement between these methods. RS is obtained from non-parametric statistics and measures the proximity of two values by means of rank correlation [14]. The values are closer to each other the closer RS reaches the value 1.00. The interpretation of the present study is based on Martin and Bateson [15]. RS must reach a value ≥ 0.40 to show an acceptable correlation and a value ≥ 0.70 to show a good correlation. The underlying principle of the ICC is the variance. The ICC relates the variance between study objects to the variance between the study objects and the measurement error [16]. Based on Shrout and Fleiss [17] a two-way model was applied for calculation. In the bounds of the interpretation, an ICC ≥ 0.40 was interpreted as acceptable and an ICC ≥ 0.70 as good reliability [18]. LoA calculates the differences between two sets of measured values. Most differences are expected to be less than two standard deviations [19]. If the result of the calculation is an interval ≤ −0.10 to 0.10 this signifies an acceptable agreement, if the interval is ≤ −0.05 to 0.05 this represents a good agreement between the measured values. These assumptions are based on the simple coefficient of agreement of de Vet et al. [16]. Overall, an acceptable respectively good reliability between pen level scores calculated from individual animal level and assessed pen level scores was achieved when all statistical parameters reached the threshold values for acceptable or good, respectively.

2.3. Ethical Statement

The authors declare that the study was carried out strictly following national animal welfare guidelines. The animals in the study were normally kept farm animals, which were housed according to national and European law requirements ('German Animal Welfare Act' (German designation: TierSchG) [5] and the 'German Order for the Protection of Production Animals used for Farming Purposes and other Animals kept for the Production of Animal Products' (German designation: TierSchNutztV) [20]). No pain, suffering or injury was inflicted on the animals during the study.

3. Results

3.1. The KTBL Protocol in Comparison to the Welfare Quality® Protocol

The Welfare Quality® protocol defined 32 indicators to be used in sows. Of these, 81.3% are animal-based indicators and 9.38% each management-based and resource-based indicators. The KTBL protocol contains in total less indicators for sows (18 indicators) than the Welfare Quality® protocol. In addition, the KTBL protocol uses more management-based indicators (55.6% animal-based, 33.3%

management-based and 11.1% resource-based indicators). A similar picture can be seen for piglets. Again, the Welfare Quality® protocol specified more indicators (17 indicators) than the KTBL protocol (5 indicators). Of these indicators, 64.7% are animal-based, 29.4% management-based and 5.88% resource-based in the Welfare Quality® protocol, whereas the proportion of management-based indicators in the KTBL protocol is once again larger (60.0% animal-based, 40.0% management-based and 0.00% resource-based indicators).

A detailed comparison of the KTBL protocol and the Welfare Quality® protocol is given in Table 2 (sows) and Table 3 (piglets).

The animal-based indicators stereotypies, absence of manure on the body, wounds on the body, body condition score, bursitis, lameness and shoulder scores of the KTBL protocol are based on the definitions published in the Welfare Quality® protocol [6]. In contrast to the Welfare Quality® protocol, absence of prolonged hunger in piglets in the KTBL protocol is not measured by a management-based indicator (age of weaning) but by the animal-based indicators face lesions and undersized animals. No indicators were included in the KTBL protocol to evaluate thermal comfort and ease of movement but new animal-based indicators were introduced for sows in the KTBL protocol to measure the absence of injuries: trauma on teats and udder and claw alterations. In contrast, most of the animal-based indicators of the Welfare Quality® protocol to evaluate the criteria absence of disease were replaced by management-based indicators, e.g., the return rate. Only two indicators were included in the KTBL protocol to assess the Welfare Quality® principle of appropriate behaviour (stereotypies and nest building material). No indicators were considered in the KTBL protocol to determine social and exploratory behaviour in sows, the human-animal relationship or to assess the animals' positive emotional state. Both protocols do not possess indicators to assess appropriate behaviour in piglets.

Tables 2 and 3 further presents the number of animals/litters with affected welfare per criterion and principle. The comparison is only carried out for animal-based indicators as explained above. It can be seen that for sows the KTBL protocol detected less animals with affected welfare, especially in the principle of appropriate behaviour. A different picture appears with respect to piglets. Here, the new indicators led to the identification of more litters as affected in the principles of good feeding and good housing. In the principle of good health, on the other hand, more deviations could be detected through the Welfare Quality® protocol.

Table 2. Comparison of the protocol for sows and piglets published by *Kuratorium für Technik und Bauwesen in der Landwirtschaft e.V.* (KTBL) [4] with the Welfare Quality® animal welfare assessment protocol for sows and piglets (WQ) [6] divided by the WQ criteria and principles. Comparison for indicators applied in sows.

Principle	Criteria	WQ	KTBL	Proportion of Affected Animals Per Criterion		Proportion of Affected Animals Per Principle	
				WQ	KTBL	WQ	KTBL
Good feeding	Absence of prolonged hunger	Body condition score	Body condition score	8.07%	8.07%	8.07%	8.07%
	Absence of prolonged thirst	Water supply	Water supply	RB [1]	RB [1]		
Good housing	Comfort around resting	Bursitis Shoulder sores Absence of manure on the body	Bursitis Shoulder sores Absence of manure on the body	46.7%	46.7%	49.2%	46.7%
	Thermal comfort	Panting Huddling	n/a * n/a *	49.0%	n/a *		
	Ease of movement	Space allowance Farrowing crates	n/a * n/a *	RB [1]	n/a *		
	Absence of injuries	Wounds on the body Vulva lesions Lameness n/a * n/a *	Wounds on the body (including vulva lesions) Lameness Trauma on teats and udder Claw alterations	10.8%	17.4%	18.6%	17.4%
Good health	Absence of disease	Constipation Metritis Mastitis Uterine prolapse Skin condition Ruptures and hernias Local infections Coughing Sneezing Pumping Rectal prolapse Scouring Mortality [1] n/a * n/a * n/a * n/a * n/a * n/a *	n/a * n/a * n/a * n/a * n/a * n/a * n/a * n/a * n/a * n/a * n/a * n/a * Animal losses [1] Evidence of ectoparasites Antibiotic treatment index [1] Return rate [1] Abortion rate [1] Number of parities [1] Slaughter results [1]	11.5%	0.00%		

Table 2. *Cont.*

Principle	Criteria	WQ	KTBL	Proportion of Affected Animals Per Criterion		Proportion of Affected Animals Per Principle	
				WQ	KTBL	WQ	KTBL
	Absence of pain induced by management procedures	Nose ringing Tail docking	n/a * n/a *	MB [1]	n/a *		
Appropriate behaviour	Expression of social behaviour	Social behaviour	n/a *	Group level [2]	n/a *	62.9%	21.0%
	Expression of other behaviour	Stereotypies Exploratory behaviour [2] n/a *	Stereotypies n/a * Nest building material [1]	21.0%	23.8%		
	Good human-animal relationship	Fear of humans	n/a *	55.2%	n/a *		
	Positive emotional state	Qualitative Behaviour Assessment (QBA)	n/a *	Group level [2]	n/a *		

* n/a = not assessed; [1] management-based and resource-based indicators were not included in the comparison of affected animals/litters; [2] assessments at group level could not be included in the comparison.

Table 3. Comparison of the protocol for sows and piglets published by *Kuratorium für Technik und Bauwesen in der Landwirtschaft e.V.* (KTBL) [4] with the Welfare Quality® animal welfare assessment protocol for sows and piglets (WQ) [6] divided by the WQ criteria and principles. Comparison for indicators applied in piglets.

Principle	Criteria	WQ	KTBL	Proportion of Affected Animals Per Criterion		Proportion of Affected Animals Per Principle	
				WQ	KTBL	WQ	KTBL
Good feeding	Absence of prolonged hunger	Age of weaning n/a * n/a *	n/a * Face lesions Undersized animals	MB [1]	42.1%	MB [1]	42.1%
	Absence of prolonged thirst	Water supply	n/a *	MB [1]	n/a *		
Good housing	Comfort around resting	Absence of manure on the body n/a *	n/a * Carpal joint lesions	0.00%	39.5%	13.2%	39.5%
	Thermal comfort	Panting Huddling	n/a * n/a *	13.2%	n/a *		
	Ease of movement	n/a *	n/a *	n/a *	n/a *		
Good health	Absence of injuries	Lameness	n/a *	13.2%	n/a *	34.2%	MB [1]
	Absence of disease	Neurological disorders Splay leg Coughing Sneezing Pumping Rectal prolapse Scouring Mortality [1] n/a * n/a *	n/a * n/a * n/a * n/a * n/a * n/a * n/a * Animal losses [1] Stillborn piglets [1] Antibiotic treatment index [1]	23.7%	MB [1]		
	Absence of pain induced by management procedures	Castration Tail docking Teeth grinding	n/a * n/a * n/a *	MB [1]	n/a *		
Appropriate behaviour	Expression of social behaviour	n/a *	n/a *	n/a *	n/a *	n/a *	n/a *
	Expression of other behaviour	n/a *	n/a *	n/a *	n/a *		
	Good human-animal relationship	n/a *	n/a *	n/a *	n/a *		
	Positive emotional state	n/a *	n/a *	n/a *	n/a *		

* n/a = not assessed. [1] Management-based and resource-based indicators were not included in the comparison of affected animals/litters.

3.2. Comparison of Assessment at Individual Animal Level and Assessment at Pen Level Concerning Animal-Based Indicators in Piglets Defined in the KTBL Protocol (Face Lesions, Carpal Joint Lesions, Undersized Animals)

The assessment at individual animal level took on average 6 to 7 min per litter. Withal, the time needed increased with growing litter age (within one week after farrowing: 6 min 12 s, two to three weeks suckling period: 6 min 54 s, week of weaning: 7 min 30 s). The assessment at pen level was carried out within approximately 1 min on average.

Table 4 demonstrates the results for the comparison of the two methods of assessment of animal-based indicators in piglets (assessment at individual animal level vs. assessment at pen level). The table contains the mean values in percent and the standard error of the observer and the corresponding statistical parameters. The assessment at individual animal level detected around twice as much affected animals as the assessment at pen level. Still, acceptable reliability presented by RS and ICC could be found except for face lesions. With regard to the agreement indicated by LoA, face lesions also showed poor agreement, whereas carpal joint lesions and undersized animals achieved acceptable or good agreement, respectively.

Table 4. Comparison of the assessment of animal-based indicators in piglets at individual animal level and at pen level: mean values [%] of the two methods of assessment (including standard error) and corresponding statistical parameters.

Indicator	Individual Animal Level	Pen Level	RS	ICC	LoA
Face lesions	43.8 (2.25)	21.0 (0.93)	0.19	0.18	−0.42 to −0.03
Carpal joint lesions	6.90 (1.23)	2.57 (0.51)	**0.80**	*0.57*	*−0.12 to 0.03*
Undersized animals	0.61 (0.14)	0.38 (0.12)	**0.73**	*0.55*	**−0.01 to 0.01**

Note: Statistical parameters (Spearman's rank correlation coefficient: RS, intraclass correlation coefficient: ICC, limits of agreement: LoA), indicating poor (normal type), acceptable (italic type) and good agreement (bold type).

4. Discussion

4.1. The KTBL Protocol in Comparison to the Welfare Quality® Protocol

The Welfare Quality® protocols were designed to reliably assess animal welfare on-farm but also to provide standardised information about a product, thus, to be used for certification purposes [1]. The KTBL protocol is intended to be a guideline for a farm's self-inspection. The purpose of the self-inspection is to assess at regular intervals whether the animals kept on the farm are adequately fed, cared for and housed in a behaviour-appropriate manner [5]. Furthermore, self-inspection should also record whether the animals' movement is not restricted to the extent that pain, suffering or damage results. In its essence, self-inspection is a monitoring of animal welfare. The KTBL protocol is based on the Welfare Quality® protocol for sows and piglets. Conclusively, it contains indicators concerning the four Welfare Quality® principles of good feeding, good housing, good health and appropriate behaviour, thus, the legal requirement of self-inspection is fulfilled.

The protocols differ in the proportion of the types of indicators used. Not only does the KTBL protocol contain fewer indicators, but these are also rather management-based. The composition of protocols must be addressed from two sides. On the one hand, the combination of animal-based, management-based and resource-based indicators is recommended to identify risk factors for animal welfare on-farm [1,21]. In doing so, there is common scientific agreement to rest assessment protocols for animal welfare on animal-based indicators [22] since animal-based indicators mirror the response of the animals to their environment [23]. In addition, the relationship between resources and the animal itself is not always fully understood but may be influenced by the farm's management or animal's genetics [24]. Therefore, recent animal welfare protocols such as the Welfare Quality® protocol aim to

focus on animal-based indicators, which are used to assess animal welfare from the animal's point of view and thereby identify possible risk factors [25]. Accordingly, the German Animal Welfare Act also requires that animal-based indicators are used for the farm's self-inspection [5]. On the other hand, assessment systems for animal welfare are often criticised for their lack of feasibility. When developing the Welfare Quality® protocols, surveyed farmers were willing to invest solely 1.5 h in data collection [2]. Thus, although animal-based indicators are considered the gold standard, the increased use of existing data or internal recordings such as management-based data is demanded to enhance feasibility [26]. This is why the animal-based indicators of the criterion absence of disease of the Welfare Quality® protocol were mainly replaced by management-based indicators such as antibiotic treatment index or return rate in the KTBL protocol. In Germany, this approach speeds up data collection even more, since much of the data are already required by law and is therefore constantly available on the farms, e.g., animal losses [20].

The proportion of affected animals/litters indicates that both protocols were able to identify potential risk factors for animal welfare even though several indicators, e.g., for the criterion thermal comfort or the criteria expression of social behaviour, good human-animal relationship and positive emotional state, were not considered in the KTBL protocol and the proportion of types of indicators is different. Still, it is also apparent that where animal-based indicators were used more frequently, more deviations were discovered, such as in the principle of good feeding in piglets or with regard to the criterion absence of injuries in sows where new animal-based indicators were introduced (claw alterations, trauma on teats and udder). In contrast, the application of the Welfare Quality® protocol detected more deviations concerning appropriate behaviour than the KTBL protocol (Welfare Quality®: 62.9%, KTBL: 21.0%) because here, in turn, the Welfare Quality® protocol defines more animal-based indicators; even though the study is restricted in the sense that animal-based indicators assessed at group level were not considered in the analysis (e.g., the qualitative behaviour assessment is not considered in the present study). Consequently, important behavioural tests have not yet been taken into account.

In conclusion, the KTBL protocol covers all dimensions of animal welfare with regard to the Welfare Quality® principles (good feeding, good housing, good health and appropriate behaviour), but not all of the twelve Welfare Quality® criteria forming the principles are involved, e.g., no indicators for the criterion thermal comfort in sows and piglets. Especially with regard to the farrowing unit, it is difficult to adapt the ambient temperature to the different needs of sows and piglets [27], which is why the assessment of the thermal comfort is an important aspect in sow husbandry. This is covered in the Welfare Quality® protocol by the indicators panting (heat stress) and huddling (cold stress) [6]. However, potential constraints for the animals could be identified by the KTBL protocol although fewer animal-based indicators were included. The reduction of indicators enhances the feasibility of an assessment system. With focus on management-based indicators the KTBL protocol can provide an early indication of compromised animal welfare and, because of its greater feasibility, can be recommended for the farm's self-inspection. Still, it must be kept in mind that the information especially regarding the animals' behaviour is limited. In case of detected deviations in the animals' welfare, the more detailed Welfare Quality® protocol could subsequently be used, which was also suggested by Viksten et al. [28] in the comparison of two protocols for horses. This concerns particularly the Welfare Quality® indicators of the principle of appropriate behaviour, which have proven reliability, e.g., the assessment of social and exploratory behaviour [11,12]. A first- and second-level approach is moreover used in the AWIN welfare assessment protocol for horses [29] performing a visual inspection of a sample of horses at first level and a more detailed assessment of all horses at second level. Czycholl et al. [30] confirmed that the division of the welfare assessment in horses into two levels is reliable and that only for some indicators information is lost. Thus, Czycholl et al. [30] assumed that such a division has the capacity to increase the feasibility of other animal welfare protocols as well. Another approach, as used in the EARS tool for horses [31], could be to combine existing

protocols and solely use certain questions depending on the context so that the protocols are tailored to the specific situation of assessment.

Instead of replacing animal-based indicators with management-based ones, it might be more beneficial to continue the search for so-called iceberg indicators. By using iceberg indicators, many indicators are effectively combined and a general picture of animal welfare is obtained, although only one indicator is measured [32]. This can further contribute to increasing the feasibility of an assessment system [32]. Studies have already been carried out in cattle [33] and poultry [34]. In growing pigs, Spoolder et al. [35] and Czycholl et al. [36] proposed tail lesions as an iceberg indicator. With regard to sows and piglets, another study revealed that indicators may be used as iceberg indicators that do not appear in the KTBL protocol, e.g., panting in sows as indicator of thermal comfort, but also various behavioural indicators [37]. Still, both protocols miss indicators to assess appropriate behaviour in piglets.

4.2. Comparison of Assessment at Individual Animal Level and Assessment at Pen Level Concerning Animal-Based Indicators in Piglets Defined in the KTBL Protocol (Face Lesions, Carpal Joint Lesions, Undersized Animals)

The assessment at pen level exposed a higher feasibility since it took less time to be performed. The prevalence for all indicators was twice as high at individual animal level as at pen level. Still, the comparison of the assessment methods detected good reliability for the indicators carpal joint lesions and undersized animals which indicates that conclusions between the assessment at individual animal level and the assessment at pen level can be drawn. This further indicates that the ranking of farms under comparison would stay the same. In contrast, the indicator face lesions revealed low correlation with regard to RS and ICC and low agreement concerning LoA. In that case, the values obtained in the assessment at individual animal level and in the assessment at pen level are inconsistent. Because of the large deviation in the recorded prevalences, it is likely that especially smaller injuries could not be adequately recorded at pen level. Movement of animals or animals that were located in poorly illuminated parts of the pen may have been a contributing factor [2]. Therefore, an assessment of face lesions at pen level is not appropriate to draw conclusions about the individual condition of the animals. Concerning carpal joint lesions and undersized animals, the results indicate that farms might be successfully ranked by assessments at pen level and differences between farms might be quantified, which was a goal in the development of the protocols [38]. However, no statement can be made about the actual status of animal welfare. Again, the simplified assessment for the farm's self-inspection allows the farmer to feasibly compare himself within his farm and with other farms. But in case of deviations, the more complex assessment at individual animal level may be advisable.

5. Conclusions

The present study aimed at introducing the KTBL protocol, a German animal welfare assessment protocol for sows and piglets, which is intended to be used for farm's self-inspection. The KTBL protocol is based on the Welfare Quality® protocol for sows and piglets. Adaptions to the KTBL protocol were applied to enhance feasibility: some indicators were excluded and some animal-based indicators were replaced by management-based indicators. This makes the KTBL protocol easier to implement in daily routine, i.e., for farm's self-inspection, and the KTBL protocol could provide a first insight to the farmer concerning the welfare state on-farm. In case of deviations and with regard to the assessment of behaviour, which is only considered to a small extent in the KTBL protocol, the application of the more detailed Welfare Quality® protocol is recommended. Furthermore, the present study compared the assessment at individual animal level and pen level of indicators applied to piglets. The assessment at pen level was confirmed to be more feasible. Except for face lesions, there was a high level of reliability between the methods. Possible reasons for the low reliability in face lesions are the presence of small wounds, the movement of the animals or poor lighting of the pens. However, the prevalence of the indicators could not be properly reflected in the assessment at pen level. Thus, this method

only gives a first hint on affection in animal welfare and has to be supplemented with more detailed methods in case of deviations. In summary, the present study demonstrates that simplified protocols and methods can give a first indication of affected animal welfare but need to be supplemented by detailed assessments. With its results, the present study contributes to the development of existing assessment systems and the assessment of animal welfare in general as well as to the improvement of animal welfare.

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