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*Publication date:*
2016

*Document version*
Publisher's PDF, also known as Version of record

*Citation for published version (APA):*
Nøhr, R., Lund, T. B., Forkman, B., & Sandøe, P. (2016). *How do different kinds of animal experts view and weigh animal welfare indicators?* Department of Food and Resource Economics, University of Copenhagen. IFRO Report No. 244

Download date: 11. okt.. 2026

DEPARTMENT OF FOOD AND RESOURCE ECONOMICS
UNIVERSITY OF COPENHAGEN

IFRO Report

# How do different kinds of animal experts view and weigh animal welfare indicators?

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**244**

**IFRO Report 244**

How do different kinds of animal experts view and weigh animal welfare indicators?

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Published January 2016
Amended version published 29 February 2016 (tables 3.4 and 3.6 are corrected)

This report is part of and provides input to the development of an index aiming to monitor the animal welfare of farm animals in Denmark (DVFA 2014: 68). This is a joint project where the Danish Veterinary and Food Administration, Aarhus University and the University of Copenhagen collaborate.

IFRO Report is a continuation of the series FOI Report that was published by the Institute of Food and Resource Economics.

ISBN: 978-87-92591-64-7

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## Summary

In the Danish index, experts play a key role in monitoring the welfare of farmed pigs and dairy cattle in Denmark. In the current project they will give the relative weights to the different aspects of animal welfare measured (the welfare criteria) to enable the aggregation of the various welfare indicators to a total welfare score. Therefore there are good reasons to study how the experts view and weigh the welfare indicators used.

A study was conducted that, through a questionnaire, examined to what extent assessed validity of different empirical indicators, and thereby the underlying criteria and principles, vary by groups of animal experts. Assessed validity is defined as the extent to which animal experts view an indicator as making a valid contribution when aiming to assess a herd's overall welfare. In the study we both looked at how the degree of assessed validity varied across educational and professional groups, on whether the relative weight given to different types of indicators varied across educational and professional groups as well as the consistency of their answers across different questions.

The participating experts in the survey were recruited from six European countries. In total 307 animal experts were contacted, of which 196 participated by completing an online questionnaire, which gave us a response rate of 64 %. The largest group of experts had a profession as animal welfare controllers/inspectors (33,1 %), closely followed by researchers (30,9 %) involved in pig and/or cattle research. 17,7 % of the experts were employed as consultants, while 15,5 % were veterinary practitioners working with pigs or cattle.

17 different animal welfare indicators from the Welfare Quality® project were chosen, relating to either pig or cattle welfare. Respondents were presented with these indicators, and were asked to rate on a scale from 0 to 10 to what extent it is a poor/good "…indicator of animal welfare".

Differences in response for groups of experts relating both to education and profession were analyzed. In general, the differences between educational groups were very modest whereas there were a number of significant differences relating to professions.

Consultants in general assigned higher validity to the indicators that were examined, whereas practicing veterinarians assigned a lower validity. The groups differed in their assessment of the validity of indicators relating to good health versus indicators relating to appropriate behavior. They also varied concerning the relative weight that they thought should be given to these two kinds of indicators. For indicators relating to the welfare of pigs only the professions differed in their assessment of the validity of animal based and resource based indicators and in their preference for these two kinds of indicators. It is important to notice

that *between* the individuals within the professions studied the assessed validity of the animal welfare indicators vary more than between the professions.

The study documents that there are large variations both between and within groups as to how the experts view and weigh the welfare indicators used. This emphasises the need for a discussion of the justification for the choice of indicators as well as of the aggregation procedure.

## Resumé

I det danske dyrevelfærdsindeks, der skal danne grundlag for en vurdering af velfærden hos dyrene i landets svine- og malkekvægbesætninger, spiller eksperter en afgørende rolle. I projektet tildeler eksperterne en relativ vægt til de forskellige aspekter af dyrevelfærd (velfærdskriterierne), der indgår i indekset som grundlag for en aggregering af de forskellige velfærdsindikatorer til en samlet velfærdsklassifikation. Der er derfor gode grunde til at undersøge, hvorledes eksperterne anskuer og vægter de velfærdsindikatorer, der anvendes.

En spørgeskemaundersøgelse blev gennemført med henblik på at undersøge, i hvilket omfang eksperters vurdering af validiteten af forskellige indikatorer, og dermed af de underliggende velfærdskriterier og principper, varierer indenfor grupper af dyreeksperter. Når vi refererer til den vurderede validitet, mener vi her, i hvilken grad en indikator, et kriterium eller et princip vurderes som rammende eller dækkende i forhold til at vurdere en husdyrbesætnings velfærd. I undersøgelsen blev det både belyst, i hvilken grad den vurderede validitet varierede på tværs af uddannelses- og professionsgrupper, om den relative vægtning af forskellige typer af indikatorer varierede på tværs af disse grupper, og i hvilken grad de givne svar var konsistente på tværs af forskellige spørgsmål.

De eksperter, der deltog i undersøgelsen, blev rekrutteret fra seks europæiske lande. I alt blev 307 dyreeksperter kontaktet, hvoraf 196 deltog ved at udfylde et online spørgeskema, hvilket gav os en svarprocent på 64 %. Den største gruppe af eksperter havde en profession som dyrevelfærdskontrollanter/inspektører (33,1 %), tæt fulgt af forskere (30,9 %) beskæftiget med svine- og/eller malkekvægsforskning. 17,7 % af eksperterne var ansat som konsulenter, mens 15,5 % var dyrlæger, der arbejdede med svin eller kvæg.

17 forskellige dyrevelfærdsindikatorer fra Welfare Quality®-projektet, som enten vedrørte svine- eller kvægvelfærd, blev udvalgt. Respondenterne blev præsenteret for disse indikatorer, og blev for hver indikator bedt om at vurdere på en skala fra 0 til 10, i hvilket omfang den pågældende indikator er en dårlig/god "... indikator for dyrevelfærd".

Svarforskelle hos ekspertgrupperne inden for henholdsvis uddannelse og profession blev analyseret. Generelt set var forskellene mellem uddannelsesgrupperne meget beskedne, mens der var en række signifikante svarforskelle inden for professionsgrupperne.

Overordnet tildelte konsulenter en højere validitet til de vurderede indikatorer, mens praktiserende dyrlæger tildelte dem en lavere validitet. Professionsgrupperne adskilte sig fra hinanden i deres vurdering af validiteten af indikatorer vedrørende god sundhed kontra indikatorer for hensigtsmæssig adfærd. De

varierede også i forhold til den relative vægting af de to bagvedliggende principper. Desuden varierede professionsgrupperne med hensyn til vurderet validitet af dyre- og miljøbaserede indikatorer (dog kun i relation til velfærd hos svinebesætninger). De varierede også i forhold til den relative vægting af disse to indikatorer. Det er vigtigt at bemærke, at den vurderede validitet af dyrevelfærdsindikatorerne varierede i større omfang indenfor de enkelte professionsgrupper end mellem grupperne.

Undersøgelsen dokumenterer, at der er store forskelle både mellem og indenfor grupperne, i forhold til hvordan eksperterne anskuer og vægter de velfærdsindikatorer, der anvendes. Dette understreger betydningen af en diskussion af begrundelserne for valget af indikatorer og af aggregeringsprocedure.

# 1. Introduction

This report is part of and provides input to the development of an index aiming to monitor the animal welfare of farm animals in Denmark (DVFA 2014: 68). This is a joint project where the Danish Veterinary and Food Administration and the University of Aarhus and Copenhagen University are collaborators.

The index is based on four principles of what is considered to be the essentials of animal welfare (Good Feeding, Good Housing, Good Health, and Appropriate Behavior). Each principle comprises several criteria of animal welfare; and these criteria again serve as an umbrella for a number of indicators assessing animal welfare at an animal herd level (e.g. lameness, vulva lesions and panting). These indicators can be divided into two types of different empirical indicators, resource based and animal based, where the former includes factors relating to the environment which are considered likely to affect the welfare of the animals, and the latter indicates how the animals react to their environment.

The aim of this report is to report a study that, through a questionnaire, examines whether assessed validity of different empirical indicators, denoting either a criterion (within a principle) or a specific type of empirical indicator, vary by groups of animal experts. Assessed validity is defined as the extent to which animal experts view an indicator as making a valid contribution when aiming to assess a herd's overall welfare.

Animal welfare in farmed animals is evaluated by experts that have different educational and professional background and animal-specific expertise. We therefore want to find out whether there is systematic variation in the extent to which particular principles or types of empirical indicators are assessed as valid by different groups of experts. Thus we want find out whether there are fundamentally different perceptions of animal welfare depending on the expert's educational or occupational background. As part of this, we also check the level of consistency of assessed validity within the different groups of experts.

Whether the different groups of experts view the validity of the indicators differently is of interest firstly for the purpose of assessing the validity of the chosen indicators. Lack of agreement will mean that there is room for discussing whether the right indicators have been chosen. Secondly, lack of agreement will affect aggregation of indicators and criteria. In the Welfare Indicator project experts have a role to play in defining the relative weight that is ascribed to different criteria (and thereby also to the underlying indicators). If different groups of experts ascribe different weight to the criteria, or if there is large variation even within groups, that will cast doubt on the soundness of the aggregation procedure.

In this report, a comparison of assessed validity among experts is made for *Animal based* versus *Resource based* empirical indicators. A similar comparison is made for the indicators and criteria falling under the

*Good health* or *Appropriate behavior* principles. Here the experts are grouped in terms of both their educational background and their current occupation. Furthermore, to examine whether the experts' background has differential effect on their assessments across animal species, it is also compared whether experts in the field of pigs and cattle, respectively, assess the two groups of animals differently.

In chapter 2, recruitment and sample, and demographic characteristics of the sample, as well as pertinent indicators from the questionnaire that are employed in the analysis, are outlined. Chapter 3 examines whether experts with different professional background and animal-specific expertise assess the validity of particular animal welfare principles and types of indicators differently. Chapter 4 examines whether educational background and animal-specific expertise will make a difference. A conclusion is provided in chapter 5.

# 2. Method

## 2.1. Recruitment and sample

The target group of this study comprises four groups of experts: Controllers/inspectors, veterinarians, researchers and consultants.

The participating experts in the survey were recruited from six European countries[1] through the professional network of two of the involved project members (Peter Sandøe and Björn Forkman). A number of key persons were contacted who delivered e-mail address lists of relevant experts.

A literature review was conducted and an online questionnaire was developed. As part of this, a pilot study was conducted. This involved eight animal experts and was carried out in March 2015 in order to optimize the design of the questionnaire. A mail with a link to the online questionnaire was distributed to the identified experts. Data collection was carried out from the 7th of April to the 6th of July 2015. Two reminder mails were sent out in this period. Out of the 307 animal experts who were contacted, 196 participated - a response rate of 64 %.

## 2.2 Demographic characteristics

The sample of the survey has a slight predominance of women (Table 2.2). There is a fairly good age distribution where the youngest age group (24-34 years) is the smallest (12.8%), while the following three groups are of equal size. The average age is 47.5 years. Experts from Denmark are predominant by almost 40 %, while the second largest share of experts comes from Sweden (25 %). Nearly all of the experts have completed a university degree (95,3 %), whereas 4,7 %. has completed a technical or vocational education. One third of the experts has a profession as animal welfare controllers/inspectors (33,1 %), closely followed by researchers (30,9 %) involved with pigs and/or cattle in livestock. 17,7 % of the experts are currently employed as consultants, whereas 15,5 % are veterinary animal production practitioners. Furthermore, more than half of the experts are employed in the public sector (54,4 %), while nearly a quarter work in the private sector (23,3 %). 14 % are employed across sectors, whereas a minority are self-employed (1,6 %) or work in a nonprofit sector (3,6 %). Additionally, more than a third of the experts have previously been employed as a veterinarian (38,3 %).

[1]Denmark, Sweden, Finland, England, Scotland and the Netherlands.

**Table 2.2** Demographic characteristics

| Factor | Category | Frequency/Percentage |
|---|---|---|
| GENDER | Male | 78 / 40 % |
| | Female | 118 / 60 % |
| | **Total** | **196 / 100 %** |
| AGE | 24-34 years | 25 / 12,8 % |
| | 35-44 years | 56 / 28,6 % |
| | 45-54 years | 57 / 29,1 % |
| | 55-72 years | 58 / 29,6 % |
| | **Total** | **196 / 100 %** |
| COUNTRY OF RESIDENCE | Denmark | 77 / 39,3 % |
| | Sweden | 49 / 25 % |
| | Finland | 17 / 8,7 % |
| | England | 29 / 14,8 % |
| | Scotland | 12 / 6,1 % |
| | Netherlands | 8 / 4,1 % |
| | Other country | 4 / 2 % |
| | **Total** | **196 / 100 %** |
| LEVEL OF EDUCATION | Technical or Vocational | 9 / 4,7 % |
| | University degree | 123 / 64 % |
| | PhD | 60 / 31,3 % |
| | **Total** | **192 / 100 %** |
| EDUCATIONAL BACKGROUND | Animal welfare | 40 / 20,8 % |
| | Agronomy, agriculture and | 43 / 22,4 % |
| | Animal Science | 38 / 19,8 % |
| | Veterinary Science | 115 / 59,9 % |
| | Biology | 17 / 8,7 % |
| | **Total** | **196 / 100 %** |
| PROFESSION | Researcher | 56 / 29 % |
| | Vet | 35 / 18,1 % |
| | Consultant | 52 / 26,9 % |
| | Controller/Inspector | 65 / 33,7 % |
| | Other | 5 / 2,8 % |
| | **Total** | **196 / 100 %** |
| EMPLOYMENT SECTOR | Public sector | 105/ 54,4 % |
| | Private sector | 45 / 23,3 % |
| | Self-employed | 3 / 1,6 % |
| | Non profit | 6 / 3,1 % |
| | Other | 7 / 3,6 % |
| | Across sectors | 27 / 14 % |
| | **Total** | **196 / 100 %** |
| FORMER PROFESSION | Researcher | 25 / 13 % |
| | Vet | 74 / 38,3 % |
| | Consultant | 15 / 7,8 % |
| | Controller/Inspector | 31 / 16,1 % |
| | Other employment | 29 / 15 % |
| | No former employment | 19 / 9,8 % |
| | **Total** | **193 / 100 %** |
| EXPERTISE OF CATTLE PRODUCTION[A] | Average level of expertise | 62 / 31,6 % |
| | High level of expertise | 134 / 68, 4 % |
| | **Total** | **196 / 100 %** |
| EXPERTISE OF PIG PRODUCTION[B] | Average level of expertise | 99 / 50,5 % |
| | High level of expertise | 97 / 49,5 % |
| | **Total** | **196 / 100 %** |

[A] Respondents were assigned expert status if they responded between 6 and 10 on a scale from 0-10 on the following question: "*How would you evaluate your own professional knowledge and/or experience of cattle production?"* (0= No knowledge at all/10= High level of expertise) (n= 196).
[B] Similar assignment of expertise as in note [A] to the question: "How would you evaluate your own professional knowledge and/or experience of pig production?"

## 2.3 Methodology and indicators employed in analysis

The survey aimed to look at assessed validity of a number of animal welfare indicators comprising criteria within two principles (Good Health and Appropriate Behavior) and two types of empirical indicator (Resource based and Animal based). It took point of departure in the animal welfare indicators, criteria and principles that have been put forward in the EU funded project Welfare Quality® (www.welfarequalitynetwork.net). 17 different animal welfare indicators from this project were chosen. Respondents were presented to these indicators, and were asked to rate on a scale from 0 to 10 to which extent it is a poor/good "…indicator of animal welfare". They were presented with two semantic anchor points: (0= "Very poor" to 10="Very good"). On this basis a number of variables were constructed to analyze their assessed validity of these animal welfare indicators:

### 2.3.1 Assessed validity of type of indicators

Four variables were constructed here. Assessed validity of Resource based and Animal based indicators in cattle were constructed on basis of ratings on the indicators that taps the indicator in question for dairy cattle/dairy calves (see indicators in Table 2.3). Assessed validity of Resource based and Animal based indicators in pigs were constructed on basis of ratings on the indicators that tap validity for Animal based indicators in sows and gilts/finishing pigs and weaners. Note that since only one Resource based empirical indicator of pigs is included in the survey, it was not relevant to compute a composite variable in this case. All four variables were rescaled to range from 0 to 10.

### 2.3.2 Assessed validity of principles to measure animal welfare

Four variables were constructed here. Assessed validity of the indicators representing the principles of Good Health or Appropriate Behavior to measure animal welfare in herds of cattle were constructed on basis of ratings on the indicators that taps the principle in question for dairy cattle/dairy calves. Assessed validity of the indicators representing the principles of Good Health or Appropriate Behavior in pigs was constructed in a similar way (see overview in Table 2.3). All four variables were rescaled to range from 0 to 10.

**Table 2.3** Indicators of assessed validity and preference employed in the analysis

| **Overall Indicator** | **Indicator to assess animal welfare (prompted to the respondents)** |
|---|---|
| | *Dairy Cattle/Calves* |
| *Assessed validity for* Animal Based indicators*:* | *Getting up behavior* (cattle) and *lying outside the lying area* (cattle) |
| *Assessed validity for* Resource Based indicators: | *Bedding material* (cattle) and *size of cubicles* (cattle) |
| *Assessed validity for* Good Health principle: | *Milk somatic cell count* (cattle), *diarrhea* (calves) and *lameness* (cattle) |
| *Assessed validity for* Appropriate Behavior principle: | *Access to other calves* (calves), *access to cow brush* (cattle) and *avoidance distance to the feeding table* (cattle) |
| *Preference* for type of empirical indicator: | see equation 1 |
| *Preference for Good health over Appropriate behavior*: | see equation 2 |
| | *Sows and gilts/Finishing pigs and weaners* |
| *Assessed validity for* Animal Based indicators*:* | *Panting* (sows) and *lameness* (pigs) |
| *Assessed validity for* Resource Based indicators: | *Cooling* (sows) |
| *Assessed validity for* Good Health principle: | *Vulva lesions* (sows) and *tail bite* (pigs) |
| *Assessed validity for* Appropriate Behavior principle: | *Vacuum chewing* (sows) and *rooting material* (pigs) |
| *Preference* for type of empirical indicator: | see equation 3 |
| *Preference for Good health over Appropriate behavior*: | see equation 4 |

### 2.3.3 Relative weight (preference for type of empirical indicator or type of principle)

It is likely that experts in practice will assign more weight to the empirical indicators or principles that they asses as most valid. In order to tap this, a number of measures were constructed indicating degree of preference for type of empirical indicator and preference for type of principle. The measures were constructed on basis of scores on the variables described above regarding assessed validity:

1. $Preference\ for\ type\ of\ empirical\ indicator\ (Cattle)\ = \frac{Ass.validity\ of Animal\ Based\ measures\ (cattle)}{Ass.validity\ of Resource\ Based\ score(cattle)}$

2. $Preference\ for\ Good\ health\ over\ Appropriate\ behavior\ (Cattle) = \frac{Ass.validity\ of Good\ Health\ (cattle)}{Ass.validity\ of Appropriate\ Behavior\ (cattle)}$

3. $Preference\ for\ type\ of\ empirical\ indocator\ (Pigs)\ = \frac{Ass.validity\ of Animal\ Based\ measure\ (pigs)}{Ass.validity\ of Resource\ Based\ measure\ (pigs)}$

4. $Preference\ for\ Good\ health\ over\ Appropriate\ behavior\ (Pigs) = \frac{Ass.validity\ of Good\ Health\ (pigs)}{Ass.validity\ of Appropriate\ Behavior\ (pigs)}$

A score of 1 on these preference variables means that that there is no preference for type of indicator or principle. A score over 1 indicates higher preference for the indicator or principle on the numerator, whilst a score below 1 indicates higher preference for the indicator or principle on the denominator.

### 2.3.4 Profession

This variable is a re-coding of the question regarding the profession of the experts (cf. Table 2.4). As experts may have multiple employment activities, they were allowed to give multiple responses to this question. The 32 respondents that reported more than one profession were assigned to one profession only. The principle of this assignment was based on considerations of the prevalence of the profession in the sample, where priority was given to the less frequent profession (i.e. veterinary animal production), followed by the second less frequent (consultant), etc. – see Table 2.4 for the overlap in professions, where the column variable represents the re-coded variable, which is used in the analysis.

**Table 2.4** Coding of the profession variable

| | Controller | Researcher | Consultant | Vet | Total |
|---|---|---|---|---|---|
| **Veterinary animal production practitioner** | 0 | 0 | 0 | **35** | 35 |
| **Consultant** | 0 | 0 | **42** | 15 | 57 |
| **Researcher** | 0 | **47** | 5 | 7 | 59 |
| **Animal Welfare Controller/Inspector** | **61** | 0 | 2 | 3 | 66 |
| **Total** | 61 | 47 | 42 | 35 | 185 |

### 2.3.5 Education

This variable is a re-coding of the question regarding the education of the experts (cf. Table 2.5). As there only were 17 biologists in the sample, this was removed as a separate category. 11 of the biologists also have an educational background of animal welfare, and therefore they are also partly represented in this category. The remaining six biologists were excluded in this analysis. The experts were allowed to give multiple responses about their educational backgrounds. The 49 respondents that reported more than one education were assigned to one education only. The principle of this assignment was to give priority to the less frequent education in the sample. Hence the animal welfare category was given precedence so that respondents with an animal welfare and another educational background were placed in this category (see Table 2.5 for these overlap where the column variable represents the re-coded variable, which is used in the analysis). Due to the relative small categories of Agronomy and Agriculture and Animal science these were merged based on similarities concerning the professional content of the two educations.

**Table 2.5** Coding of the educational variable

| | **Veterinary** | **Agronomy and Agriculture & Animal Science[A]** | **Animal Welfare** | **Total** |
|---|---|---|---|---|
| **Animal Welfare** | 0 | 0 | **40** | 40 |
| **Animal Science** | 0 | **20** | 18 | 38 |
| **Agronomy and Agriculture[A]** | 0 | **32** | 11 | 43 |
| **Veterinary** | **96** | 2 | 17 | 115 |
| **Total** | 96 | 44 | 40 | **180** |

[A]This variable is a composite of Agronomy & Agriculture and Animal Science.

[B]Biology as a category was excluded due to low *n*.

# 3. Assessed validity for animal welfare principles and types of empirical indicators – a comparison between professions

In this chapter it is examined whether assessed validity of animal welfare indicators, criteria and principles vary as a function of professional occupation. It is also examined whether there are differences in the extent to which distinct professions prefer the Resource Based empirical indicators over the Animal Based empirical indicators, and prefer the Good Health over the Appropriate Behavior principle.

## 3.1 Summary of the results

Regarding animal welfare in herds of *dairy cattle and calves*, the professions neither differ in their assessments of validity of Animal based and Resource based indicators or in their preference for these two kinds of indicators. They do, however, differ in their assessment of the validity of Good health and Appropriate behavior principles as well as in their preference for these principles.

In terms of the animal welfare in herds of *pigs & weaners and sows & gilts* the professions differ in their assessment of the validity of Animal based and Resource based indicators and in their preference for these two kinds of indicators. Finally, the professions also differ in their assessment of Good health and Appropriate behavior indicators, criteria and principles.

In the cases where there are significant differences between the professions, consultants in general assign higher validity to indicators that were examined, whilst veterinarians assign the lower validity. In most of the cases where there were differences in preferences for types of indicator or principle, the preferences had the same direction across the professions. The only deviation from this trend was in the preference for Good health versus Appropriate behavior indicators regarding the animal type of *pigs*. Here, the controllers preferred Appropriate behavior indicators whilst the remaining professions preferred Good health principles (see Table 3.5).

## 3.2 Analysis

We examined (F-tests) whether there were differences between the professions on all indicators of assessed validity and preference (relative weight) laid out in the Method section. In Table 3.1 an overview of the tests results is provided. In the following sub-sections, the significant differences between the professions that were identified from this table are detailed with means/sd./N, and it is examined whether the results could be an artifact of response inconsistency. It is also discussed whether differences are higher *within* or *between* the professions.

In analyses where differences were identified, follow-up analysis was conducted to control for the possibility that the differences are explained by other factors. Here we controlled for gender, age, and nationality (Danish versus non-Danish). Since the variables of assessed validity include several empirical indicators (between 2 and 4) that have been combined to produce a composite indicator (see Table 2.3), it is also necessary to examine whether any of the single indicators are responded to differently by the groups, since this could potentially account for the difference observed at the composite level of analyses. We will refer to the analysis of this as response inconsistency. In all analyses the differences within and between professions are also laid out by means of a joint examination of the standard deviation per profession and the mean between the professions (see Appendix B, Table B-1). We compare this at 1 standard deviation, which designates the variation on a given variable for 68.2% of a group (cf. https://en.wikipedia.org/wiki/Standard_deviation).

**Table 3.1** Overview of overall test results (ANOVA) - from comparison in the professions[A]

| **Animal type & sample/Type of aggregated animal indicator** | Assessed validity for Animal based indicators | Assessed validity for Resource based indicators | Preference for animal based over resource based indicator | Assessed validity for Good health indicators | Assessed validity for Appropriate behavior indicators | Preference for Good health over Appropriate behavior |
|---|---|---|---|---|---|---|
| **Dairy cattle/Calves** | | | | | | |
| *Total sample* | Ns | Ns | Ns | 0,001 | 0,021 | 0,025 |
| *Cattle experts only* | Ns | Ns | Ns | 0,0 | Ns | 0,03 |
| **Pigs & weaners/Sows & gilts** | | | | | | |
| *Total sample* | 0,003 | 0,013 | 0,012 | 0,024 | Ns | 0,015 |
| *Pig experts only* | 0,0 | 0,008 | Ns | 0,029 | 0,005 | 0,041 |

[A]Veterinarian, consultants, controllers and researchers.
Control variables: gender, age and nationality (Danish/non-Danish).

The presentation is divided into a sub-section focusing on differences regarding Dairy cattle/Calves (3.2.1) followed by a subsection on differences regarding Pig & weaners/Sows & Gilts (3.3.1). In both sections, we start by outlining differences between professions for the whole sample and then outline these differences for the subgroup of cattle experts (3.2.2), and pig experts (3.3.2).

### 3.2.1 Assessed validity regarding cattle - the professions compared

#### 3.2.1.1 Animal based and Resource based empirical indicators

The professions do not differ significant in their assessments of Animal based or Resource based empirical indicators, nor the extent to which one of these two are preferred to the other.

It has also been examined whether any of the single indicators that were combined to produce the composite variables of assessed validity were responded to differently by the professions. Significant differences were identified between at least one of the groups and the remaining groups, however a consistent trend was found in the response pattern of each profession, which means that there is no indication of response inconsistency (see Appendix A, Table A-1).

Regarding differences of the responses *between* the individuals within the groups, the assessed validity of the animal welfare indicators vary more within each profession than between the professions. The responses in terms of this can be seen by making joint examination of the standard deviation per profession and the mean between the professions (see Appendix B, Table B-1).

#### 3.2.1.2 Good Health and Appropriate Behavior principles

The professions differ in their assessments of the Good Health and Appropriate Behavior principles, and in the preference of these two (see Table 3.2).

**Table 3.2** Assessments of Good Health and Appropriate Behavior based on the examples given, as well as the preference in herds of dairy cattle and calves - in the professions

| Dairy cattle/calves: Professions | Assessed validity of Good health[A] (Mean/N/Std. dev.) ***(0,001) | Assessed validity of Appropriate behavior[B] (Mean/N/Std. dev.) **(0,021) | Preference for Good health over Appropriate behavior (Mean/N/Std. dev.) *(0,025) |
|---|---|---|---|
| Controller | 6,5 / 60 / 1,9 | 6,1 / 52 / 1,4 | 1,1 / 52 / 0,4 |
| Researcher | 7,3 / 43 / 1,5 | 6,4 / 44 / 1 | 1,2 / 42 / 0,3 |
| Consultant | 7,9 / 39 / 1,4 | 6,4 / 38 / 1,5 | 1,3 / 37 / 0,5 |
| Veterinarian | 6,8 / 32 / 1,8 | 5,4 / 29 / 1,7 | 1,4 / 29 / 0,5 |
| Total | 7,1 / 174 / 1,8 | 6,1 / 163 / 1,4 | 1,2 / 160 / 0,4 |

[A]Aggregate of three indicators: Milk somatic cell count (cattle), lameness (cattle) and diarrhea (calves)
[B]Aggregate of three indicators: Access to other calves, avoidance distance from the feeding table (cattle) and access to cow brush (cattle)
Note: The significant differences are retained when controlling for gender, age and nationality (Danish/non-Danish)

When examining whether any of the single indicators that were combined to produce the composite variables of assessed validity were responded to differently by the professions, significant differences were identified between more than one of the groups and the remaining groups. However a consistent trend was found in the response pattern of each profession, which means that there is no indication of response inconsistency (see Appendix A-3.1). This also means that the difference observed at the composite level of analyses is not due to any response inconsistencies between the groups. The examination of potential response inconsistencies will only be briefly addressed in the following sections.

The assessed validity of the animal welfare indicators varies more within each profession than between the professions. This can be seen by a joint examination of the standard deviation per profession and the mean between the professions (see Appendix B, Table B-1).

A standard deviation of e.g. 1 implies a variation in response by 2 points on the scale from 0-10. Since there are no standard deviations below 1, and many which are over 2, there is a general tendency for the individuals within the professions to assess the validity of the indicators differently. When comparing the mean between the professions, the variation of responses rarely exceeds 1 point on the 0-10 scale and is general under 0,5 point (See Table 3.2).

This difference in response that varies more between the individuals *within* the groups than *between* the groups also applies in the following sections and will therefore hereafter only be referred to briefly.

### 3.2.2 Preference regarding cattle - the professions compared (in the cattle-expert sub-sample)

#### 3.2.2.1 Animal based and Resource Based empirical indicators (in the cattle-expert sub-sample)

Among cattle-experts, professional occupation does not have an effect on assessment of validity of Animal Based or Resource Based indicators, nor the extent to which one of these two are preferred relative to the other.

There are no indications of response inconsistency for the single-item indicators (see Appendix A, Table A-1 for details).

When examining whether there are any differences regarding the responses between the individuals *within* the groups, the assessed validity of the animal welfare indicators vary more within each profession than between the professions (see Appendix B, Table B-1).

#### 3.2.2.2 Good Health and Appropriate Behavior principles (in the cattle-expert sub-sample)

Among cattle-experts, professional occupation has an effect on assessment of the Good Health principle and in the preference of Good Health versus Appropriate Behavior. The professions do not differ in their assessment of validity of Appropriate behavior (see Table 3.3).

**Table 3.3** Assessments of Good Health and Appropriate Behavior based on the examples given, as well as the preference in herds of dairy cattle and calves - in the professions by cattle experts only

| EXPERTS: Dairy cattle/calves: Professions | Assessed validity of Good health[A] (Mean/N/Std. dev.) ***(0,0) | Assessed validity of Appropriate behavior[B] (Mean/N/Std. dev.) Ns | Preference for Good health over Appropriate behavior (Mean/N/Std. dev.) *(0,03) |
|---|---|---|---|
| Controller | 6,5 / 49 / 2 | 6,1 / 42 / 1,4 | 1,1 / 42 / 0,4 |
| Researcher | 7,3 / 32 / 1,4 | 6,4 / 32 / 1 | 1,2 / 31 / 0,3 |
| Consultant | 8,2 / 30 / 1,4 | 6,2 / 30 / 1,5 | 1,4 / 29 / 0,5 |
| **Veterinarian** | 6,8 / 25 / 1,8 | 5,8 / 25 / 1,6 | 1,2 / 25 / 0,4 |
| Total | 7,1 / 136 / 1,8 | 6,1 / 129 / 1,4 | 1,2 / 127 / 0,4 |

[A]Aggregate of three indicators: Milk somatic cell count (cattle), lameness (cattle) and diarrhea (calves)
[B]Aggregate of three indicators: Access to other calves, avoidance distance from the feeding table (cattle) and access to cow brush (cattle)
Note: The significant differences are retained when controlling for gender, age and nationality (Danish/non-Danish)

There are no indications of response inconsistency for the empirical indicators (see Appendix A-3.2 for details).

When examining whether there are any differences regarding the responses between the individuals *within* the groups, the assessed validity of the animal welfare indicators vary more within each profession than between the professions (see Appendix B, Table B-1).

### 3.3.1. Preference regarding pigs - the professions compared

#### 3.3.1.1 Animal based and Resource Based empirical indicators

The professions differ in their assessment of Animal Based and Resource Based empirical indicators, and in the preference for these two (see Table 3.4).

**Table 3.4** Assessments of Animal based and Resource based indicators based on the examples given, as well as the preference in herds of pigs, weaners, sows and gilts - in the professions

| Pigs, weaners, sows and gilts: Professions | Assessed validity of Animal based[A] (Mean/N/Std. dev.) ***(0,003) | Assessed validity of Resource based[B] (Mean/N/Std. dev.) *(0,013) | Preference for animal based over resource based indicator (Mean/N/Std. dev.) *(0,012) |
|---|---|---|---|
| Controller | 7 / 57 / 2,5 | 6,8 / 59 / 1,9 | 1,1 / 57 / 0,6 |
| Researcher | 8 / 42 / 1,1 | 5,9 / 43 / 1,8 | 1,6 / 42 / 1 |
| Consultant | 8,1 / 36 / 1,8 | 6,8 / 36 / 2,1 | 1,2/ 33 / 0,4 |
| Veterinarian | 6,5 / 31 / 2,6 | 5,6 / 29 / 2,6 | 0,8 / 29 / 0,8 |
| Total | 7,4 / 166 / 2,2 | 6,3 / 167 / 2,1 | 2,1 / 161 / 2,1 |

[A]Aggregate of two indicators: Panting (sows and gilts) and lameness (pigs and weaners)
[B]Single indicator: Cooling (sows and gilts)
Note: The significant differences are retained when controlling for gender, age and nationality (Danish/non-Danish)

There are no indications of response inconsistency for the single-item indicators (see Appendix A-3.3 for details).

When examining whether there are any differences regarding the responses between the individuals *within* the groups, the assessed validity of the animal welfare indicators vary more within each profession than between the professions (see Appendix B, Table B-1).

#### 3.3.1.2 Good Health and Appropriate Behavior principles

The professions differ in their assessment of the Good Health principle and in the relative preference of the Good Health versus Appropriate principle. The professions do not differ in their preferences for Appropriate behavior (see Table 3.5).

**Table 3.5** Assessments of Good Health and Appropriate Behavior based on the examples given, as well as the preference in herds of pigs, weaners, sows and gilts - in the professions

| **Pigs, weaners, sows and gilts: Professions** | **Assessed validity of Good health[A] (Mean/N/Std. dev.) *(0,024)** | **Assessed validity of Appropriate behavior[B] (Mean/N/Std. dev.) Ns** | **Preference for Good health over Appropriate behavior (Mean/N/Std. dev.) *(0,015)** |
|---|---|---|---|
| Controller | 7,6 / 58 / 2,5 | 8,1 / 58 / 1,5 | 0,92 / 57 / 0,27 |
| Researcher | 8,5 / 43 / 1,1 | 8,2 / 44 / 1,4 | 1,07 / 43 / 0,2 |
| Consultant | 8,5 / 36 / 1,9 | 8,1 / 38 / 1,6 | 1,07 / 36 / 0,28 |
| Veterinarian | 7,3 / 31 / 2,6 | 7,2 / 30 / 2,5 | 1,04 / 30 / 0,33 |
| Total | 8 / 168 / 2,2 | 8 / 170 / 1,7 | 1,01 / 166 / 0,27 |

[A]Aggregate of two indicators: Vulva lesions (sows and gilts) and tail bite (pigs and weaners)
[B]Aggregate of two indicators: Vacuum chewing and bar biting (sows and gilts) and rooting material (pigs and weaners)
Note: The significant differences for 'proportional difference' are retained when controlling for gender, age and nationality (Danish/non-Danish), however the variable of health doesn't ´remain significant (0,055).

There is some indication of response inconsistency for the single-item indicator *rooting material (pigs and weaners)* (see Appendix A-3.4).

When examining whether there are any differences regarding the responses between the individuals *within* the groups, the assessed validity of the animal welfare indicators vary more within each profession than between the professions (see Appendix B, Table B-1).

### 3.3.2 Preference regarding pigs - the professions compared (in the pig-expert sub-sample)

#### 3.3.2.1 Animal based and Resource Based empirical indicators (in the pig-expert sub-sample)

Among pig-experts, professional occupation influences the assessment of the Animal Based and Resource Based empirical indicators. The occupations do not differ in their preference for the two indicators (see Table 3.6).

**Table 3.6** Assessments of Animal based and Resource based indicators based on the examples given, as well as the preference in herds of pigs, weaners, sows and gilts - in the professions by pig-experts only

| EXPERTS: Pigs, weaners, sows and gilts: Professions | Assessed validity of Animal based[A] (Mean/N/Std. dev.) ***(0,0) | Assessed validity of Resource based[B] (Mean/N/Std. dev.) **(0,008) | Preference for animal based over resource based indicator (Mean/N/Std. dev.) Ns |
|---|---|---|---|
| Controller | 6,8 / 39 / 2,6 | 6,8 / 40 / 2,1 | 1,1 / 39 / 0,6 |
| Researcher | 7,9 / 30 / 1,1 | 6 / 30 / 1,6 | 1,4 / 30 / 0,4 |
| Consultant | 8 / 23 / 2 | 6,7 / 23 / 2,4 | 1,2/ 21 / 0,4 |
| Veterinarian | 5,3 / 17 / 2,6 | 4,7 / 17 / 2,7 | 1,4 / 17 / 0,9 |
| Total | 7,1 / 109 / 2,3 | 6,2 / 110 / 2,3 | 1,3 / 107 / 0,6 |

[A]Aggregate of two indicators: Panting (sows and gilts) and lameness (pigs and weaners)
[B]Single indicator: Cooling (sows and gilts)
Note: The significant differences are retained when controlling for gender, age and nationality (Danish/non-Danish)

There are no indications of response inconsistency for the single empirical indicators (see Appendix A-3.5 for details).

When examining whether there are any differences regarding the responses between the individuals *within* the groups, the assessed validity of the animal welfare indicators vary more within each profession than between the professions (see Appendix B, Table B-1).

#### 3.3.2.2 Good Health and Appropriate Behavior principle (in the pig-expert sub-sample)

Among pig-experts, professional occupations influences assessment of the Good health and Appropriate behavior principles, and in the preference for these two (see Table 3.7).

**Table 3.7** Assessments of Good Health and Appropriate Behavior based on the examples given, as well as the preference in herds of pigs, weaners, sows and gilts - in the professions by pig experts only

| EXPERTS: Pigs, weaners, sows and gilts: Professions | Assessed validity of Good health[A] (Mean/N/Std. dev.) *(0,029) | Assessed validity of Appropriate behavior[B] (Mean/N/Std. dev.) **(0,005) | Preference for Good health over Appropriate behavior (Mean/N/Std. dev.) *(0,041) |
|---|---|---|---|
| Controller | 7,5 / 40 / 2,6 | 8,1 / 40 / 1,7 | 0,9 / 40 / 0,3 |
| Researcher | 8,4 / 30 / 1,2 | 7,9 / 30 / 1,4 | 1,1 / 30 / 0,2 |
| Consultant | 8,2 / 23 / 2,3 | 8 / 24 / 2 | 1 / 23 / 0,3 |
| Veterinarian | 6,4 / 17 / 2,8 | 6,2 / 17 / 2,6 | 1,1 / 17 / 0,4 |
| Total | 7,7 / 110 / 2,3 | 7,7 / 111 / 1,9 | 1/ 110 / 0,3 |

[A]Aggregate of two indicators: Vulva lesions (sows and gilts) and tail bite (pigs and weaners)
[B]Aggregate of two indicators: Vacuum chewing and bar biting (sows and gilts) and rooting material (pigs and weaners)
Note: The significant differences are retained when controlling for gender, age and nationality (Danish/non-Danish)

There is some indication of response inconsistency for the single-item indicator *rooting material (pigs and weaners)* (see Appendix A-3.6 for details).

When examining whether there are any differences regarding the responses between the individuals *within* the groups, the assessed validity of the animal welfare indicators varies more within each profession than between the professions (see Appendix B, Table B-1).

# 4. Preferences for animal welfare principles and types of empirical indicator – a comparison between educational groups

In this chapter it is examined whether assessed validity of animal welfare principles and types of indicators vary as a function of education. Relative weight is also examined: it is asked whether there are differences in the extent to which educational groups prefer the Resource Based empirical indicators relative to the Animal Based empirical indicators, and prefer the Good Health principle relative to Appropriate Behavior principle.

## 4.1 Summary of the results

In general, the differences between educational groups are very modest. There is only one instance where the educational groups differ from each other at a statistically significant level. This is in their assessment of the validity of resource based indicators in dairy/calves where experts with an agronomy/animal science educational background assign less validity to this kind of indicator.

## 4.2 Analysis

We examined (F-tests) whether there were difference between the educational groups on all indicators of assessed validity and preference laid out in the Method section. In Table 4.1 an overview of the tests results is provided. In the following sub-sections, the significant differences between the educations that were identified from this table are detailed with means/sd./N, and it is discussed whether the results could be an artifact of response inconsistency. It is also discussed whether differences are higher *within* or *between* the educational groups.

In analyses where differences were identified, follow-up analysis was conducted to control for the possibility that the differences are explained by other factors. Here we controlled for gender, age, and nationality (Danish versus non-Danish). Since the variables of assessed validity include several empirical indicators (between 2 and 4) that have been combined to produce a composite indicator (see Table 2.3), it is also necessary to examine whether any of the single indicators are responded to differently by the groups, since this could potentially account for the difference observed at the composite level of analyses. We will refer to the analysis of this as response inconsistency. In all analyses the differences within and between educational groups are also laid out by means of a joint examination of the standard deviation per group and the mean between the groups (see Appendix B, Table B-1). We compare this at 1 standard deviation, which designates the variation on a given variable for 68.2% of a group (cf. https://en.wikipedia.org/wiki/Standard_deviation).

**Table 4.1** Overview of overall test results (ANOVA) - from comparison of educational groups[A]

| Animal type & sample/Type of aggregated animal welfare indicator | **Assessed validity of Animal based indicators** | **Assessed validity of Resource based indicators** | Preference for animal based over resource based indicator | **Assessed validity of Good health indicators** | **Assessed validity of Appropriate behavior indicators** | Preference for Good health over Appropriate behavior |
|---|---|---|---|---|---|---|
| **Dairy cattle/Calves** | | | | | | |
| ***Total sample*** | Ns | 0,045 | Ns | Ns | Ns | Ns |
| ***Cattle experts only*** | Ns | 0,022 | Ns | Ns | Ns | Ns |
| **Pigs & weaners/Sows & gilts** | | | | | | |
| ***Total sample*** | Ns | Ns | Ns | Ns | Ns | Ns |
| ***Pig experts only*** | Ns | Ns | Ns | Ns | Ns | Ns |

[A]Veterinarian, animal welfare, agronomy & animal science.
Control variables: gender, age and nationality (Danish/non-Danish).

Presentation of the results in this section is divided into a sub-section focusing on differences regarding Dairy cattle/Calves (4.2.1) followed by a sub-section on differences regarding Pig & weaners/Sows & Gilts (4.3.1). In both sections, we start by outlining differences between educational groups for the whole sample and then outline these differences for the subgroup of cattle experts (4.2.2), and pig experts (4.3.2).

### 4.2.1 Preference regarding cattle - the educations compared

#### 4.2.1.1 Animal based and Resource Based empirical indicators

Educational background influences assessment of Resource Based empirical indicators. It does not influence the preference for Animal Based empirical indicators nor the relative preference for Animal based versus Resource based indicators (see Table 4.2).

**Table 4.2** Assessments of Animal based and Resource based indicators based on the examples given, as well as the preference in herds of dairy cattle and calves - in the educations

| **Dairy cattle/calves: Educations** | **Assessed validity of Animal based[A] (Mean/N/Std. dev.)** | **Assessed validity of Resource based[B] (Mean/N/Std. dev.)** | **Preference for animal based over resource based indicator (Mean/N/Std. dev.)** |
|---|---|---|---|
| | **Ns** | ***(0,045)** | **Ns** |
| Animal welfare | 7,3 / 39 /2 | 7,3 / 38 / 1,9 | 1,1 / 38 / 0,4 |
| Agronomy / Animal Science | 7,1 / 43 / 1,8 | 6,4 / 42 / 2,2 | 1,2 / 41 / 0,8 |
| Veterinarian | 7 / 92 / 2,1 | 7,3 / 92 /1,8 | 1 / 91 / 0,6 |
| Total | 7,1 / 174 / 2 | 7,1 / 172 / 2 | 1,1 / 170 / 0,6 |

[A]Aggregate of two indicators: Getting up behavior (cattle) and lying outside the lying area (cattle)
[B]Aggregate of two indicators: Bedding material (cattle) and the size of cubicles (cattle)
Note: The significant difference (resource-based) is retained when controlling for gender, age and nationality (Danish/non-Danish)

There are no indications of response inconsistency for the single-item indicators (see Appendix A-4.1 for details).

When examining whether there are any differences regarding the responses between the individuals *within* the groups, the assessed validity of the animal welfare indicators vary more within each profession than between the professions (see Appendix B, Table B-2).

#### 4.2.1.2 Good Health and Appropriate Behavior principles

The educational groups do not differ in their assessment of Good Health and Appropriate Behavior principles, nor the extent to which one of these two are preferred relative to the other.

There are no indications of response inconsistency for the single-item indicators (see Appendix A, Table A-2 for details).

When examining whether there are any differences regarding the responses between the individuals *within* the groups, the assessed validity of the animal welfare indicators vary more within each profession than between the professions (see Appendix B, Table B-2).

### 4.2.2. Preference regarding cattle - the educations compared (in the cattle expert sub-sample)

#### 4.2.2.1 Animal based and Resource Based empirical indicators (in the cattle expert sub-sample)

In the cattle-expert-group, there are educational differences in the assessment of the Resource Based principle. There are no educational differences in assessment of Animal Based indicators or in the relative preference of the two principles (see Table 4.3).

**Table 4.3** Assessments of Animal based and Resource based indicators based on the examples given, as well as the preference in herds of dairy cattle and calves - in the educations only by cattle experts

| **Experts: Dairy cattle/calves: Educations** | **Assessed validity of Animal based[A] (Mean/N/Std. dev.)** | **Assessed validity of Ressource based[B] (Mean/N/Std. dev.)** | **Preference for animal based over resource based indicator (Mean/N/Std. dev.)** |
|---|---|---|---|
| | **Ns** | ***(0,022)** | **Ns** |
| Animal welfare | 7,2 / 31 / 2 | 7,1 / 31 / 2,1 | 1,1 / 31 / 0,4 |
| Agronomy / Animal Science | 7,2 / 33 / 2 | 6,3 / 33 / 2,4 | 1,3 / 32 / 0,9 |
| Vet | 7,2 / 77 / 1,9 | 7,4 / 77 / 1,8 | 1,1 / 77 / 0,7 |
| Total | 7,2 / 141 / 2 | 7,1 / 141 / 2 | 1,1 / 140 / 0,7 |

[A]Aggregate of two indicators: Getting up behavior (cattle) and lying outside the lying area (cattle)
[B]Aggregate of two indicators: Bedding material (cattle) and the size of cubicles (cattle)

Note: The significant difference (resource-based) is retained when controlling for gender, age and nationality (Danish/non-Danish)

There are no indications of response inconsistency for the single empirical indicators (see Appendix A-4.2 for details).

When examining whether there are any differences regarding the responses between the individuals *within* the groups, the assessed validity of the animal welfare indicators vary more within each profession than between the professions (see Appendix B, Table B-2).

#### 4.2.2.2 Good Health and Appropriate Behavior principles (in the cattle expert sub-sample)

When comparing the cattle experts only, there are no educational differences in assessment of the validity of Good Health and Appropriate Behavior principles, nor the extent to which one of these two are preferred relative to the other.

There are no indications of response inconsistency for the single empirical indicators (see Appendix A, Table A-2.1 for details).

When examining whether there are any differences regarding the responses between the individuals *within* the groups, the assessed validity of the animal welfare indicators vary more within each profession than between the professions (see Appendix B, Table B-2).

### 4.3.1 Preference regarding pigs - the educations compared

#### 4.3.1.1 Animal based and Resource Based empirical indicators

Educational background neither influences the assessment of Animal Based or Resource Based indicators nor the extent to which one of these two are preferred relative to the other.

There are no indications of response inconsistency for the single empirical indicators (see Appendix A, Table A-2 for details).

When examining whether there are any differences regarding the responses between the individuals *within* the groups, the assessed validity of the animal welfare indicators vary more within each profession than between the professions (see Appendix B, Table B-2).

#### 4.3.1.2 Good Health and Appropriate Behavior principles

Educational background neither influences the assessment of Good Health or Appropriate Behavior principles nor the extent to which one of these two are preferred relative to the other.

There are no indications of response inconsistency for the single empirical indicators (see Appendix A, Table A-2 for details).

When examining whether there are any differences regarding the responses between the individuals *within* the groups, the assessed validity of the animal welfare indicators vary more within each profession than between the professions (see Appendix B, Table B-2).

### 4.3.2 Preference regarding pigs - the educations compared (in the pig expert sub-sample)

#### 4.3.2.1 Animal based and Resource Based empirical indicators (in the pig-expert sub-sample)

When comparing the pig experts only, educational background neither influences the assessment of Animal Based or Resource Based indicators nor the extent to which one of these are preferred relative to the other.

There are no indications of response inconsistency for the single empirical indicators (see Appendix A, Table A-2.1 for details).

When examining whether there are any differences regarding the responses between the individuals *within* the groups, the assessed validity of the animal welfare indicators vary more within each profession than between the professions (see Appendix B, Table B-2).

#### 4.3.2.2 Good Health and Appropriate Behavior principles (in the pig-expert sub-sample)

When comparing the pig experts only, educational background neither influences preference for the Good Health or Appropriate Behavior principles nor the extent to which one of these are preferred relative to the other.

There are no indications of response inconsistency for the single empirical indicators (see Appendix A, Table A-2.1 for details).

When examining whether there are any differences regarding the responses between the individuals *within* the groups, the assessed validity of the animal welfare indicators vary more within each profession than between the professions (see Appendix B, Table B-2).

# 5. Conclusion

## 5.1 General conclusion

This report compared the assessed validity among experts for *Animal based* versus *Resource based* empirical indicators. A similar comparison was undertaken for indicators tapping criteria within principles of *Good health* or *Appropriate behavior*. The experts were grouped according to educational background and their current profession. Furthermore, it was examined whether the experts' background had differential effect on their assessments across animal species. It was also compared whether experts in the field of pigs and cattle, respectively, assess the two groups of animals differently.

For the experts grouped according to their education the analyses showed that for pigs there were no differences in the assessment of neither the validity of animal welfare empirical indicators nor the relative weight of these. For cattle only one aggregated type of indicator shows significant differences when comparing the educational groups. The overall conclusion is that educational background do not have a major impact on experts' assessments of animal welfare.

When the experts were grouped according to their professions (researchers, veterinarians, controllers/inspectors and consultants), several significant differences in assessment of animal welfare were identified. This finding indicates that animal experts from different professions do not agree on the validity of distinct indicators to assess the underlying animal welfare in an animal herd. These differences may affect aggregation of animal welfare criteria.

However, it should be noted that the observed differences between professions are far exceeded by the within differences of the professions and also the educational groups (cf. Appendix B). So from that point of view, the between group differences that have been under investigation here can be argued to be less of a challenge than the general variability observed in the experts´ responses.

Socio-demographic factors such as age, gender, nationality, level of education and sector of employment did not confound the identified associations between experts groups and assessed validity of the animal welfare indicators.

## 5.2 Specific conclusion regarding indicators for dairy cattle and calves

When *Resource based* indicators of cattle welfare are assessed by animal experts, their assessment of the validity of these indicators varies significantly, when comparing across the educational groups. This is however the only aggregated type of animal welfare indicator that varies significantly when compared across educations.

The experts' assessment of the applied *Animal based* indicators of cattle do not vary when compared across professions. This indicates that the animal experts agree in their validation of these types of indicators.

Across professions, the assessment of the *Good health* and *Appropriate behavior* principles varied significantly. This also includes their preference for these principles, which implies that the professions are different insofar as the relative weight given to these two indicators is concerned.

## 5.3 Specific conclusion regarding indicators for pigs, weaners, sows and gilts

Regarding the animal welfare of pigs & weaners and sows & gilts, the groups of profession differed in their assessment of the validity of *Animal based* and *Resource based* indicators, as well as in their preference (relative weight) for these two types of indicator.

The animal experts also differed in their assessment of *Good health* and *Appropriate behavior* principles regarding pigs, and in their preference (relative weight) for these two principles.

In general, the differences summarized above also appeared in the sub-analyses where only the cattle or pig experts were examined.

## 5.4 Response consistency and differences observed between professions and educations

There were no indications of response inconsistency for the single empirical indicators (see Appendix A, Table A-2.1 for details). When identifying the pattern of responses between the professions, experts that are employed as consultants in general assign higher validity to all the indicators and principles that were examined, whilst veterinarians in general assigned lower validity. The two other professions (controllers and researchers) typically had average response patterns. In most of the cases where there were differences in preferences for the indicators associated with types of indicator or principle, the preferences had the same direction across the professions. The only deviation from this trend was in the preference for the indicators of the principle of Good health versus Appropriate behavior in pigs. Here, the controllers preferred indicators of Appropriate behavior whilst the remaining professions preferred indicators of Good health principles (see Table 3.5).

## Appendix A – Analysis of response inconsistency

**Table A-1** provides an overview of statistical significant differences in preferences for the single item empirical indicators by profession, while **Table A-1.1** provides the same overview for the professions but divided into the sub-sample of cattle and pig experts. **Table A-2** provides the same summary for educational groups while **Table A-2.1** provides the same overview but divided into the sub-sample of cattle and pig experts. The identified significant differences could, but need not, imply potential response inconsistencies. In any instances of significant differences between one of the groups and the remaining groups, the pattern of this difference is discussed in the following sub-sections with a view to assess whether there is a response inconsistency.

**Table A-1.** Overview of statistical significant differences in preferences for single-item indicators by profession.

| **Animal welfare indicators** | **Veterinarians vs. other professions** | **Controllers vs. other professions** | **Consultants vs. other professions** | **Researchers vs. other professions** |
|---|---|---|---|---|
| Animal based indicators | | | | |
| Getting up behavior (cattle) | | | | |
| Lying outside the lying area (cattle) | | | | |
| Panting (sows) | **(0,01) | | *(0,017) | |
| Lameness (pigs) | | | | *(0,041) |
| Resource based indicators | | | | |
| Bedding material (cattle) | | | | |
| Size of cubicles (cattle) | | | | |
| Cooling (sows) | *(0,025) | *(0,047) | | |
| Good health | | | | |
| Milk somatic cell count (cattle) | | *(0,026) | ***(0,0) | |
| Diarrhea (calves) | | | *(0,036) | |
| Lameness (cattle) | | **(0,002) | *(0,025) | |
| Vulva lesions (sows) | | | | |
| Tail bite (pigs) | | | | |
| Appropriate behavior | | | | |
| Access to other calves | ***(0,0) | | | |
| Access to cow brush (cattle) | | | | |
| Avoidance distance to the feeding table (cattle) | | | | |
| Vacuum chewing (sows) | | | | |
| Rooting material (pigs) | *(0,014) | **(0,01) | | |

**Table A-1.1** Overview of statistical significant differences in preferences for single-item indicators by profession, the cattle and pig experts sub-sample.

| **Animal welfare indicators** | **Veterinarians vs. other professions** | **Controllers vs. other professions** | **Consultants vs. other professions** | **Researchers vs. other professions** |
|---|---|---|---|---|
| Animal based indicators | | | | |
| Getting up behavior (cattle) | | | | |
| Lying outside the lying area (cattle) | | | 0,014 | |
| Panting (sows) | | | 0,010 | |
| Lameness (pigs) | | | | 0,047 |
| Resource based indicators | | | | |
| Bedding material (cattle) | | | | |
| Size of cubicles (cattle) | | | | |
| Cooling (sows) | | 0,041 | | |
| Good health | | | | |
| Milk somatic cell count (cattle) | | 0,070 | 0,001 | |
| Diarrhea (calves) | | 0,039 | 0,003 | |
| Lameness (cattle) | | 0,001 | 0,025 | |
| Vulva lesions (sows) | | | | |
| Tail bite (pigs) | | | | |
| Appropriate behavior | | | | |
| Access to other calves | 0,042 | | | |
| Access to cow brush (cattle) | | | | |
| Avoidance distance to the feeding table (cattle) | | | | |
| Vacuum chewing (sows) | | | | |
| Rooting material (pigs) | | 0,007 | | |

**Table A-2.** Overview of statistical significant differences in preferences for single-item indicators by education.

| **Animal welfare indicators** | **Veterinarians vs. other educations** | **Animal Welfare vs. other educations** | **Animal Science & Agronomy vs. other educations** |
|---|---|---|---|
| Animal based indicators | | | |
| Getting up behavior (cattle) | | | |
| Lying outside the lying area (cattle) | | | |
| Panting (sows) | | | |
| Lameness (pigs) | | | |
| Resource based indicators | | | |
| Bedding material (cattle) | | | |
| Size of cubicles (cattle) | | | 0,006 |
| Cooling (sows) | | | |
| Good health | | | |
| Milk somatic cell count (cattle) | | | |
| Diarrhea (calves) | | | |
| Lameness (cattle) | | | |
| Vulva lesions (sows) | | | |
| Tail bite (pigs) | | | |
| Appropriate behavior | | | |
| Access to other calves | | | |
| Access to cow brush (cattle) | | | |
| Avoidance distance to the feeding table (cattle) | | | |
| Vacuum chewing (sows) | | | |
| Rooting material (pigs) | | | |

**Table A-2.1** Overview of statistical significant differences in preferences for single-item indicators by education, the cattle and pig experts sub-sample.

| **Animal welfare indicators** | **Veterinarians vs. other educations** | **Animal Welfare vs. other educations** | **Animal Science & Agronomy vs. other educations** |
|---|---|---|---|
| Animal based indicators | | | |
| Getting up behavior (cattle) | | | |
| Lying outside the lying area (cattle) | | | |
| Panting (sows) | 0,043 | | |
| Lameness (pigs) | | | |
| Resource based indicators | | | |
| Bedding material (cattle) | | | 0,047 |
| Size of cubicles (cattle) | 0,012 | | 0,001 |
| Cooling (sows) | | | |
| Good health | | | |
| Milk somatic cell count (cattle) | | | |
| Diarrhea (calves) | | | |
| Lameness (cattle) | | | |
| Vulva lesions (sows) | | | |
| Tail bite (pigs) | | | |
| Appropriate behavior | | | |
| Access to other calves | | | |
| Access to cow brush (cattle) | | | |
| Avoidance distance to the feeding table (cattle) | | | |
| Vacuum chewing (sows) | | | |
| Rooting material (pigs) | | | |

## A-3 Analysis of response inconsistency in professions

### A-3.1 Analysis of response inconsistency in the Good Health and Appropriate Behavior items – Cattle

The *controllers* respond differently to two Good Health indicators at the statistically significant level. However, it can be seen by their response to all the Good Health indicators (Figure A-3.1.1 below), that there is a consistent trend in their response pattern (lower preference). Therefore, there is no indication of response inconsistency.

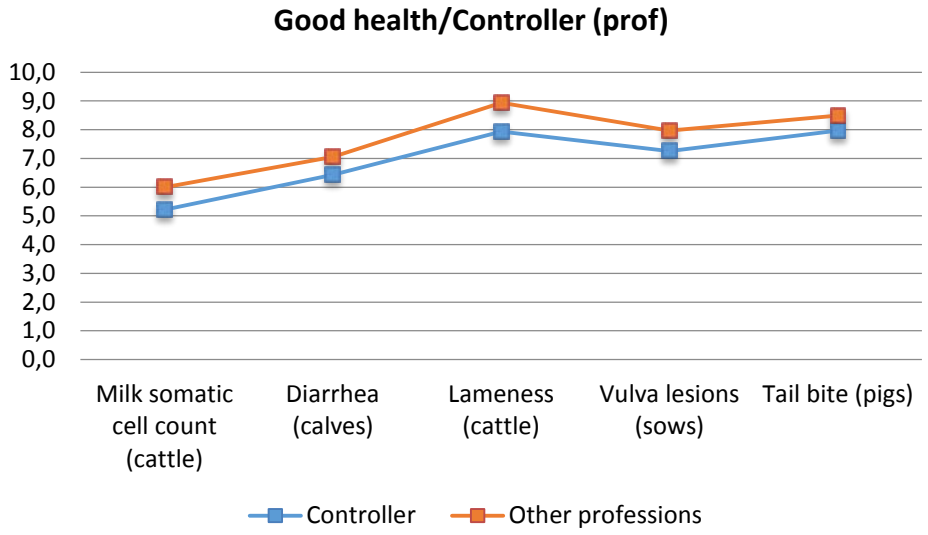


**Figure A-3.1.1**

The *consultants* respond differently to all three Good Health indicators at the statistically significant level. However, it can be seen by their response to all three Good Health indicators (Figure A-3.1.2 below), that there is a consistent trend in their response pattern (higher preference). Therefore, there is no indication of response inconsistency.

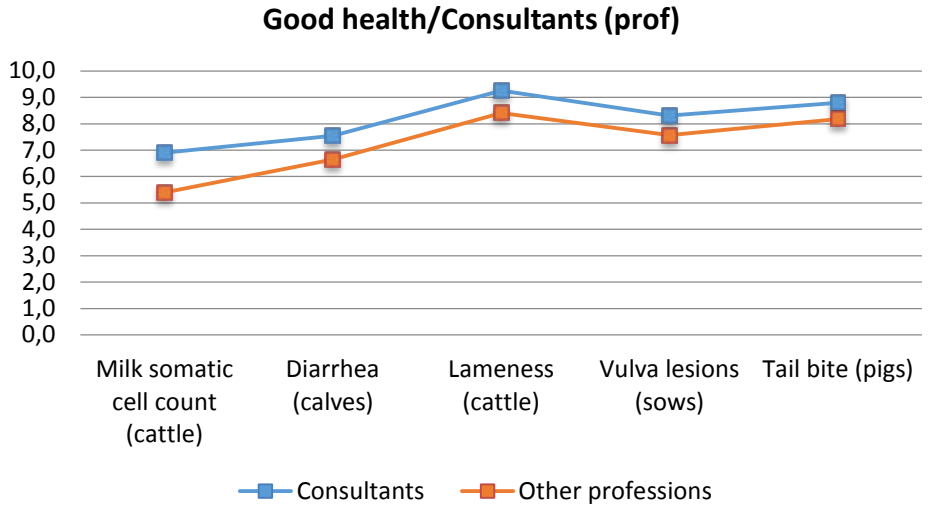


**Figure A-3.1.2**

The *vets* respond differently to one Appropriate Behavior indicator at the statistically significant level. However, it can be seen by their response to all Good Health indicators (Figure A-3.1.3 below), that there is a consistent trend in their response pattern (lower preference). Therefore, there is no indication of response inconsistency.

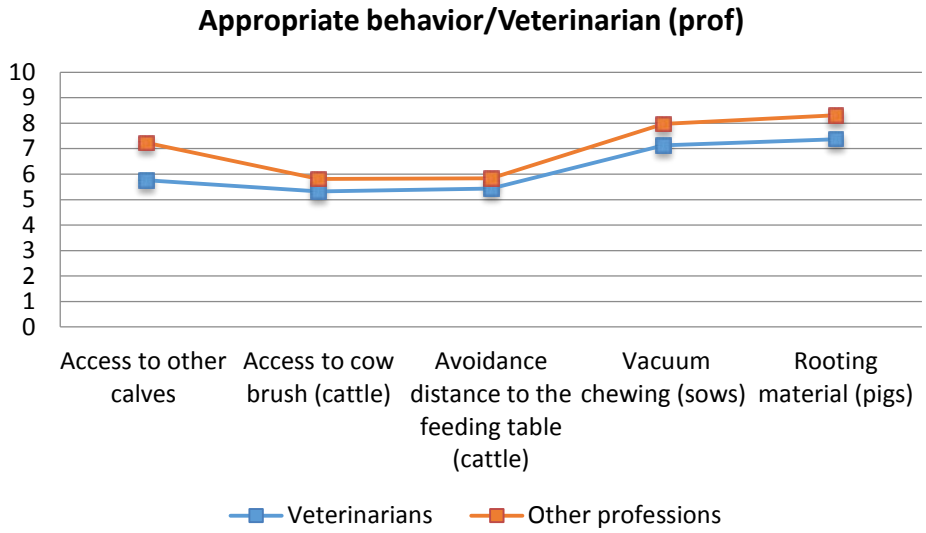


**Figure A-3.1.3**

### A-3.2 Analysis of response inconsistency in the Good Health and Appropriate Behavior items - Cattle (in the cattle-expert sub-sample)

The *controllers* of the cattle-expert sub-sample respond differently to two Good Health indicators at the statistically significant level. However, it can be seen by their response to all the Good Health indicators (Figure A-3.2.1 below), that there is a consistent trend in their response pattern (lower preference). Therefore, there is no indication of response inconsistency.

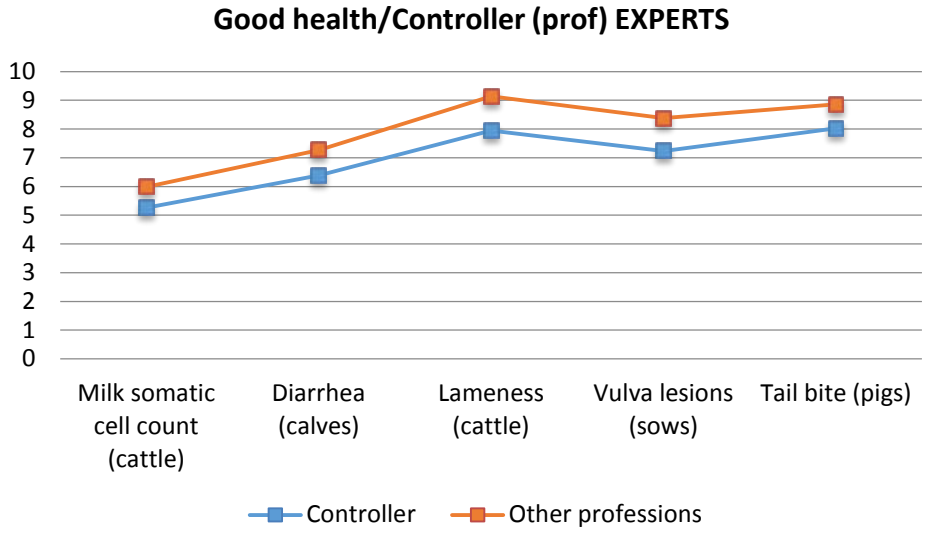


**Figure A-3.2.1**

The *consultants* of the cattle-expert sub-sample respond differently to all three Good Health indicators at the statistically significant level. However, it can be seen by their response to all three Good Health indicators (Figure A-3.2.2 below), that there is a consistent trend in their response pattern (higher preference). Therefore, there is no indication of response inconsistency.

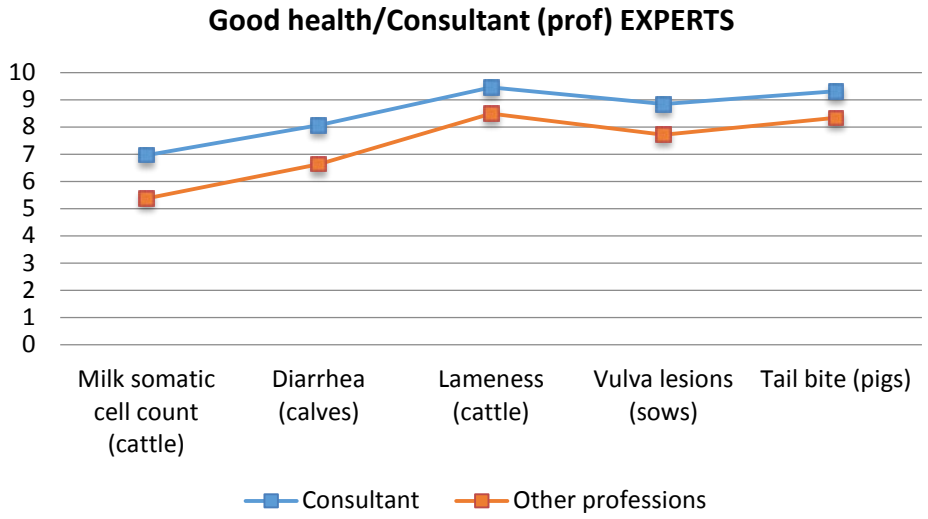


**Figure A-3.2.2**

### A-3.3 Analysis of response inconsistency in the Animal based and Resource Based empirical indicators - Pigs

The *vets* respond differently to one Animal based indicator at the statistically significant level. However, it can be seen by their response to all Animal based indicators (Figure A-3.3.1 below), that there is a consistent trend in their response pattern (lower preference). Therefore, there is no indication of response inconsistency.

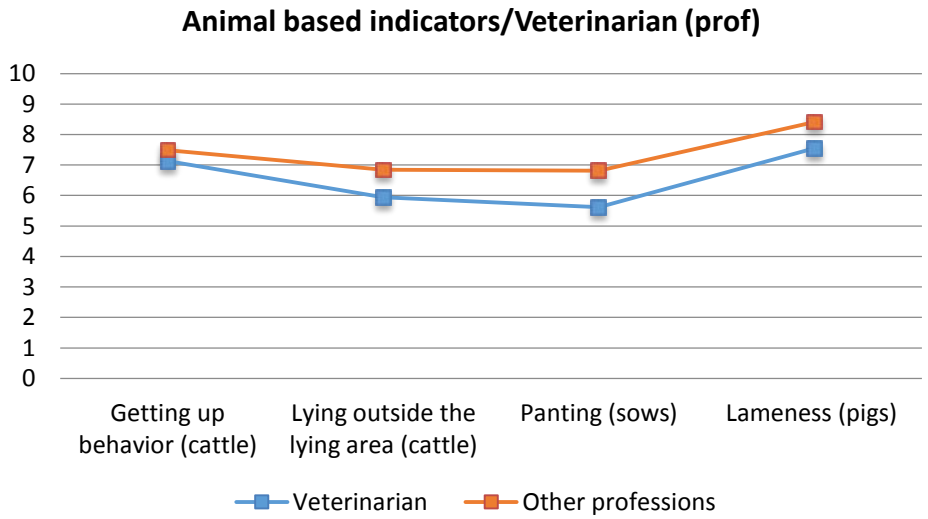


**Figure A-3.3.1**

The *consultants* respond differently to one Animal based indicator at the statistically significant level. However, it can be seen by their response to all Animal based indicators (Figure A-3.3.2 below), that there is a consistent trend in their response pattern (higher preference). Therefore, there is no indication of response inconsistency.

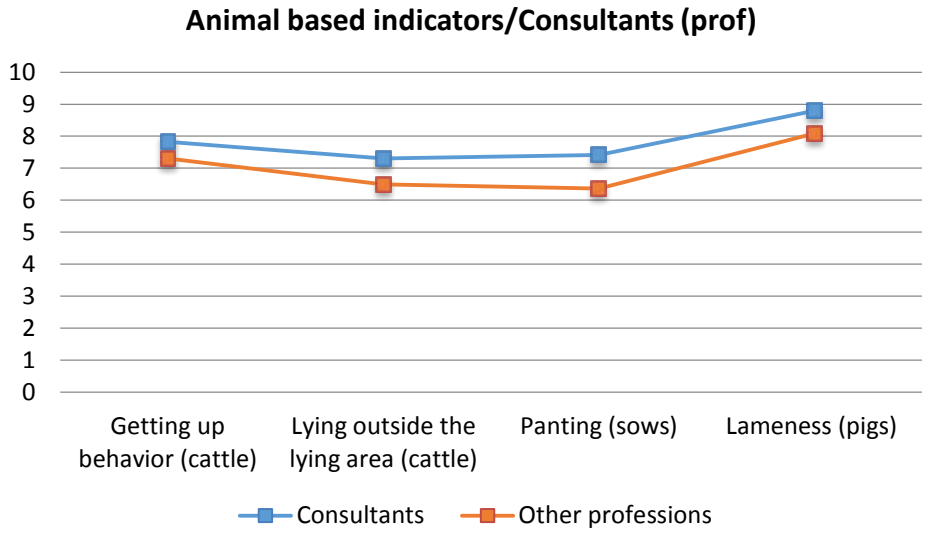


**Figure A-3.3.2**

The *researchers* respond differently to one Animal based indicator at the statistically significant level. However, it can be seen by their response to all Animal based indicators (Figure A-3.3.3 below), that there is a consistent trend in their response pattern (higher preference). Therefore, there is no indication of response inconsistency.

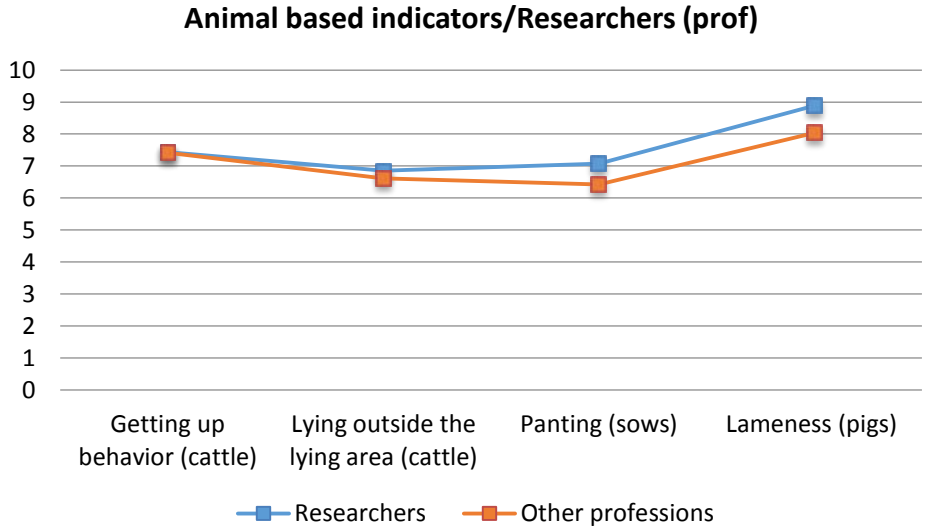


**Figure A-3.3.3**

### A-3.4 Analysis of response inconsistency in the Good Health and Appropriate Behavior items – Pigs

The *controllers* respond differently to one Appropriate behavior indicator at the statistically significant level. Furthermore, it can be seen by their response to this indicator (Rooting materials – pigs) that the response trend is different from other indicators (Figure A-3.4.1 below). So here there is some indication of response inconsistency.

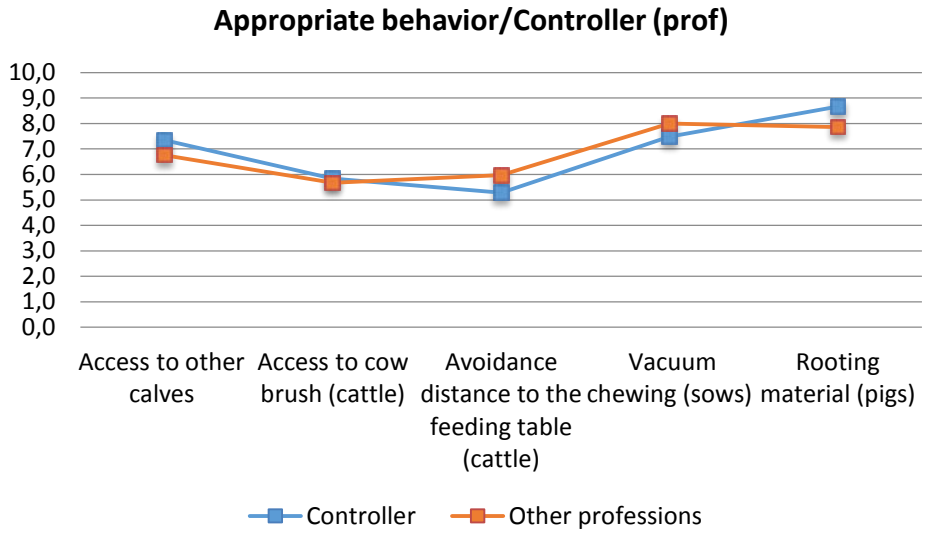


**Figure A-3.4.1**

The *veterinarians* respond differently to one Appropriate Behavior indicator at the statistically significant level. However, it can be seen by their response to all Appropriate Behavior indicators (Figure A-3.4.2 below), that there is a consistent trend in their response pattern (higher preference). Therefore, there is no indication of response inconsistency.

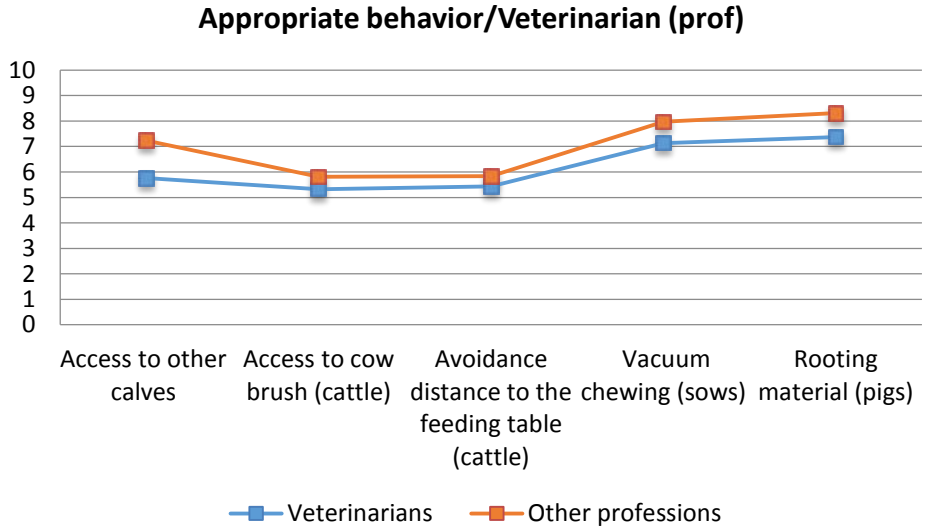


**Figure A-3.4.2**

**A-3.5 Analysis of response inconsistency in the Animal based and Resource Based empirical indicators – Pigs (in the pig-expert sub-sample)**

The *consultants* of the pig-expert sub-sample respond differently to one Animal based indicator at the statistically significant level. However, it can be seen by their response to all Animal based indicators (Figure A-3.5.1 below), that there is a consistent trend in their response pattern (higher preference). Therefore, there is no indication of response inconsistency.

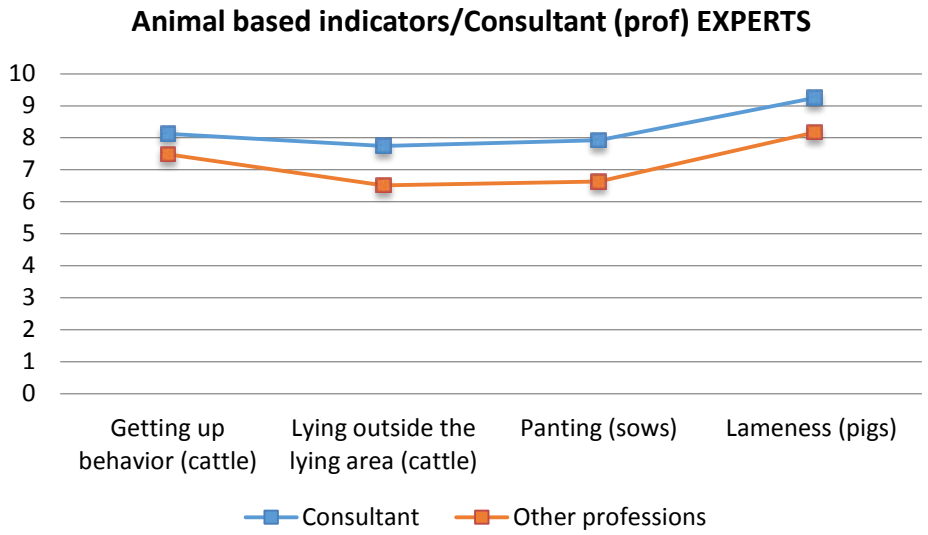


**Figure A-3.5.1**

The *researchers* of the pig-expert sub-sample respond differently to one Animal based indicator at the statistically significant level. However, it can be seen by their response to all Animal based indicators (Figure A-3.5.2 below), that there is a consistent trend in their response pattern (response close to the average). Therefore, there is no indication of response inconsistency.

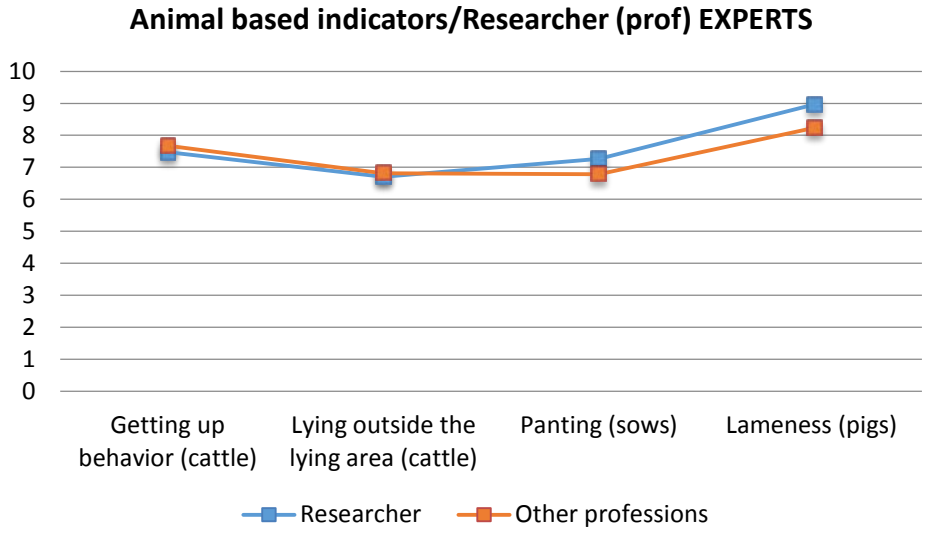


**Figure A-3.5.2**

**A-3.6 Analysis of response inconsistency in the Good health and Appropriate behavior indicators - Pigs (in the pig-expert sub-sample)**

The *controllers* of the pig-expert sub-sample respond differently to one Appropriate Behavior indicator at the statistically significant level. Furthermore, it can be seen by their response to the indicator in question (Rooting material pigs) that the response does not follow a clear trend (see Figure A-3.6.1 below). Therefore, there is some indication of response inconsistency.

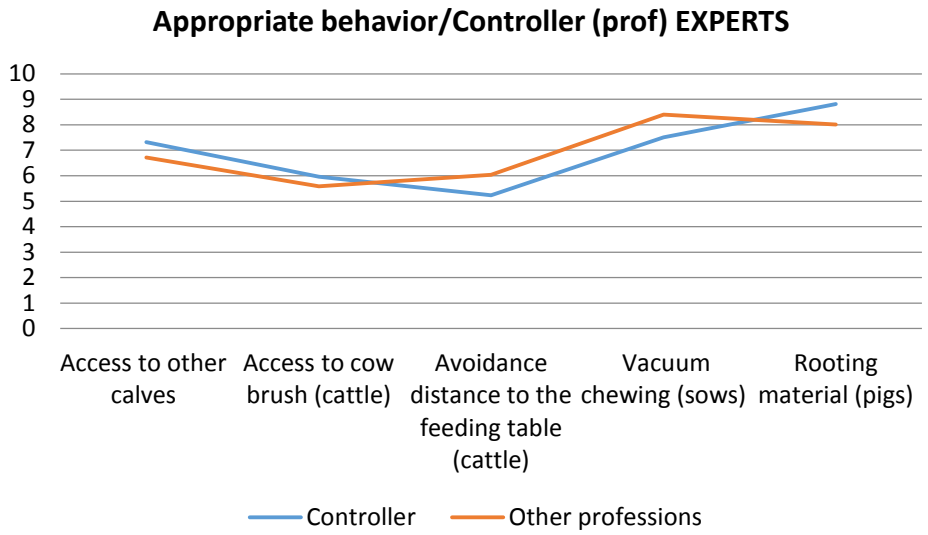


**Figure A-3.6.1**

## A-4 Analysis of response inconsistency in educations

### A-4.1 Analysis of response inconsistency in the Animal based and Resource Based empirical indicators - Cattle

The *educations of animal science and agronomy* respond differently to one Resource based indicator at the statistically significant level. However, it can be seen by their response to all Resource based indicators (Figure A-4.1.1 below), that there is a consistent trend in their response pattern (lower preference). Therefore, there is no indication of response inconsistency.

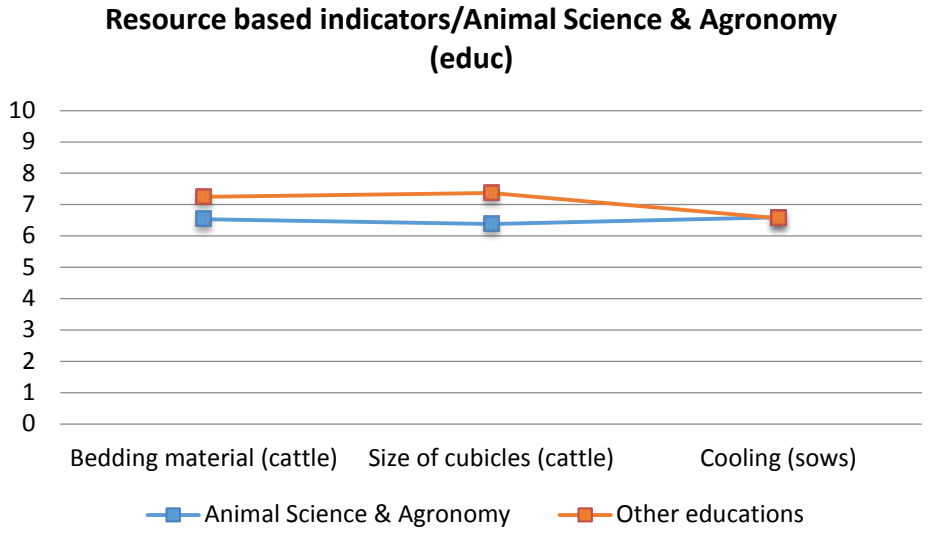


**Figure 4.1.1**

### A-4.2 Analysis of response inconsistency in the Animal based and Resource Based empirical indicators – Cattle (in the cattle expert sub-sample)

The *veterinarians (education)* of the cattle-expert sub-sample respond differently to one Resource based indicator at the statistically significant level. However, it can be seen by their response to all Resource based indicators (Figure A-4.2.1 below), that there is a consistent trend in their response pattern (higher preference). Therefore, there is no indication of response inconsistency.

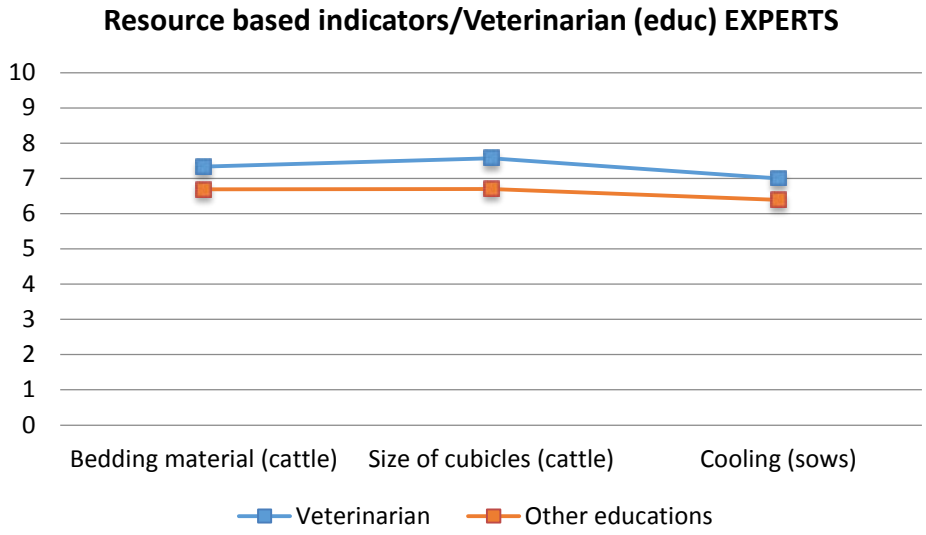


**Figure A-4.2.1**

The *educations of animal science and agronomy* of the cattle expert sub-sample respond differently to two Resource based indicators at the statistically significant level. However, it can be seen by their response to all Resource based indicators (Figure A-4.2.2 below), that there is a consistent trend in their response pattern (lower preference). Therefore, there is no indication of response inconsistency.

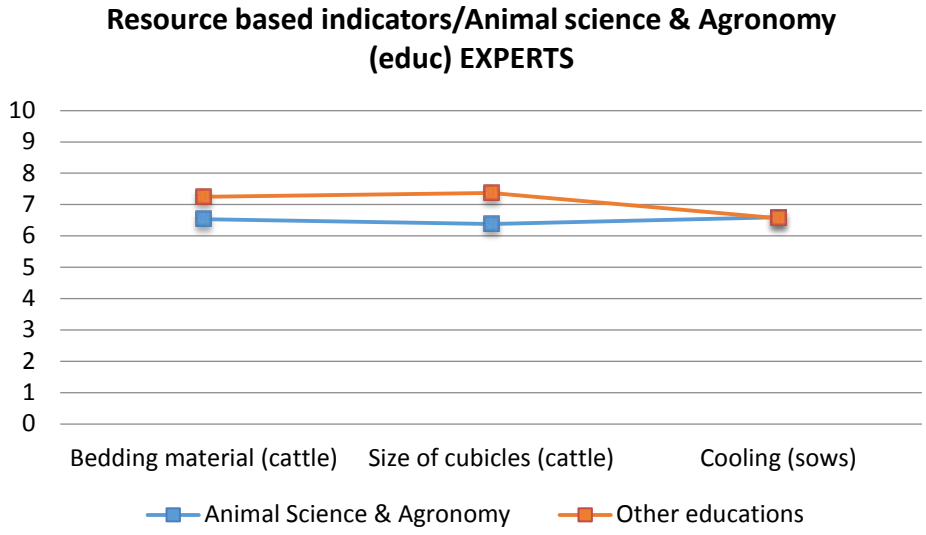


**Figure A-4.2.2**

## Appendix B – Response differences between and within the groups of professions and educations

**B-1.** Response differences *between and within* the groups of professions

**Table B-1** provides an overview of all the empirical indicators used in the analysis assessed by professions divided into animal types (total sample and sample of experts only).

The responses in terms of the assessed validity of the animal welfare indicators vary more within each profession than between the professions. This can be seen by making joint examination of the standard deviation per profession and the mean between the professions (see Table B-1).

A standard deviation of e.g. 1 implies a variation in response by 2 points on the scale from 0-10. Since there are no standard deviations below 1, and many which are over 2, there is a general tendency for the individuals within the professions to assess the validity of the indicators differently. When comparing the mean between the professions, the variation of responses rarely exceeds 1 point on the 0-10 scale and is general under 0,5 point.

**Table B-1.** Summary of the Assessments of the empirical indicators of the principles of Good health and Appropriate behavior and resource and animal based indicators, as well as the preference in herds of pigs, weaners, sows and gilts, dairy cattle and dairy calves - by the professions in the total sample and experts only

**Dairy cattle/Calves: Professions**

| **Dairy cattle/Calves: Professions** | Assessed validity of Animal based indicators[A] | Assessed validity of Resource based indicators[B] | Preference for animal based over resource based indicator |
|---|---|---|---|
| | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) |
| Controller | 6,9 / 59 / 2 | 7,3 / 59 / 2,1 | 1 / 58 / 0,3 |
| Researcher | 7,1 / 46 / 1,8 | 6,6 / 46 / 2 | 1,2 / 45 / 0,8 |
| Consultant | 7,6 / 40 / 1,8 | 7,2 / 39 / 2 | 1,1 / 38 / 0,4 |
| Veterinarian | 6,5 / 32 / 2,2 | 6,5 / 32 / 2,3 | 1,2 / 31 / 1 |
| Total | 7,1 / 177 / 2 | 7 / 176 / 2,1 | 1,1 / 172 / 0,6 |
| **Dairy cattle / Calves: Professions** | Assessed validity of Good health[A] | Assessed validity of Appropriate behavior[B] | Preference for Good health over Appropriate behavior |
| | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) |
| Controller | 6,5 / 60 / 1,9 | 6,1 / 52 / 1,4 | 1,1 / 52 / 0,4 |
| Researcher | 7,3 / 43 / 1,5 | 6,4 / 44 / 1 | 1,2 / 42 / 0,3 |
| Consultant | 7,9 / 39 / 1,4 | 6,4 / 38 / 1,5 | 1,3 / 37 / 0,5 |

| | | | |
|---|---|---|---|
| Veterinarian | 6,8 / 32 / 1,8 | 5,4 / 29 / 1,7 | 1,4 / 29 / 0,5 |
| Total | 7,1 / 174 / 1,8 | 6,1 / 163 / 1,4 | 1,2 / 160 / 0,4 |
| **EXPERTS: Dairy cattle/Calves: Professions** | Assessed validity of Animal based indicators[A] | Assessed validity of Resource based indicators[B] | Preference for animal based over resource based indicator |
| | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) |
| Controller | 6,9 / 48 / 2,1 | 7,3 / 49 / 2,2 | 1 / 48 / 0,3 |
| Researcher | 7,1 / 34 / 1,9 | 6,4 / 34 / 2,2 | 1,2 / 33 / 0,9 |
| Consultant | 7,9 / 31 / 1,8 | 7,1 / 31 / 2,2 | 1,1 / 30 / 0,4 |
| Veterinarian | 7,1 / 25 / 1,8 | 6,7 / 25 / 2,3 | 1,3 / 25 / 1,1 |
| Total | 7,2 / 138 / 1,9 | 6,9 / 139 / 2,2 | 1,1 / 136 / 0,7 |
| **EXPERTS: Dairy cattle / Calves: Professions** | Assessed validity of Good health[A] | Assessed validity of Appropriate behavior[B] | Preference for Good health over Appropriate behavior |
| | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) |
| Controller | 6,5 / 49 / 2 | 6,1 / 42 / 1,4 | 1,1 / 42 / 0,4 |
| Researcher | 7,3 / 32 / 1,4 | 6,4 / 32 / 1 | 1,2 / 31 / 0,3 |
| Consultant | 8,2 / 30 / 1,4 | 6,2 / 30 / 1,5 | 1,4 / 29 / 0,5 |
| Veterinarian | 6,8 / 25 / 1,8 | 5,8 / 25 / 1,6 | 1,2 / 25 / 0,4 |
| Total | 7,1 / 136 / 1,8 | 6,1 / 129 / 1,4 | 1,2 / 127 / 0,4 |

## Pigs, Weaners, Sows and Gilts: Professions

| | | | |
|---|---|---|---|
| **Pigs, Weaners, Sows and Gilts: Professions** | Assessed validity of Animal based indicators[A] | Assessed validity of Resource based indicators[B] | Preference for animal based over resource based indicator |
| | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) |
| Controller | 7 / 57 / 2,5 | 6,8 / 59 / 1,9 | 1,7 / 58 / 2,9 |
| Researcher | 8 / 42 / 1,1 | 5,9 / 43 / 1,8 | 0,7 / 42 / 0,3 |
| Consultant | 8,1 / 36 / 1,8 | 6,8 / 36 / 2,1 | 0,9 / 34 / 0,4 |
| Veterinarian | 6,5 / 31 / 2,6 | 5,6 / 29 / 2,6 | 1 / 29 / 0,4 |
| Total | 7,4 / 166 / 2,2 | 6,3 / 167 / 2,1 | 1,7 / 163 / 1,8 |
| **Pigs, Sows and Gilts/Professions** | Assessed validity of Good health[A] | Assessed validity of Appropriate behavior[B] | Preference for Good health over Appropriate behavior |
| | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) |
| Controller | 7,6 / 58 / 2,5 | 8,1 / 58 / 1,5 | 0,92 / 57 / 0,27 |

| | | | |
|---|---|---|---|
| Researcher | 8,5 / 43 / 1,1 | 8,2 / 44 / 1,4 | 1,07 / 43 / 0,2 |
| Consultant | 8,5 / 36 / 1,9 | 8,1 / 38 / 1,6 | 1,07 / 36 / 0,28 |
| Veterinarian | 7,3 / 31 / 2,6 | 7,2 / 30 / 2,5 | 1,04 / 30 / 0,33 |
| Total | 8 / 168 / 2,2 | 8 / 170 / 1,7 | 1,01 / 166 / 0,27 |
| **EXPERTS: Pigs, Sows and Gilts/professions** | Assessed validity of Animal based indicators[A] | Assessed validity of Resource based indicators[B] | Preference for animal based over resource based indicator |
| | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) |
| Controller | 6,8 / 39 / 2,6 | 6,8 / 40 / 2,11 | 1,8 / 40 / 3,4 |
| Researcher | 7,9 / 30 / 1,1 | 5,97 / 30 / 1,65 | 0,8 / 30 / 0,2 |
| Consultant | 8 / 23 / 2 | 6,65 / 23 / 2,44 | 0,9/22 / 0,5 |
| Veterinarian | 5,3 / 17 / 2,6 | 4,71 / 17 / 2,66 | 1,1 / 17 / 0,9 |
| Total | 7,1 / 109 / 2,3 | 6,2 / 110 / 2,3 | 1,2 / 109 / 2,1 |
| **EXPERTS: Pigs, Sows and Gilts/professions** | Assessed validity of Good health[A] | Assessed validity of Appropriate behavior[B] | Preference for Good health over Appropriate behavior |
| | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) |
| Controller | 7,5 / 40 / 2,6 | 8,1 / 40 / 1,7 | 0,9 / 40 / 0,3 |
| Researcher | 8,4 / 30 / 1,2 | 7,9 / 30 / 1,4 | 1,1 / 30 / 0,2 |
| Consultant | 8,2 / 23 / 2,3 | 8 / 24 / 2 | 1 / 23 / 0,3 |
| Veterinarian | 6,4 / 17 / 2,8 | 6,2 / 17 / 2,6 | 1,1 / 17 / 0,4 |
| Total | 7,7 / 110 / 2,3 | 7,7 / 111 / 1,9 | 1/ 110 / 0,3 |

**B-2.** Response differences *between and within* the groups of educations

**Table B-2** provides an overview of all the empirical indicators used in the analysis assessed by educations divided into animal types (total sample and sample of experts only).

The responses in terms of the assessed validity of the animal welfare indicators vary more within the educational groups than between them. This is explained in the following by referring to the standard deviation within each education and the mean between the educations (see Table B-2).

Similar to the observations laid out in Appendix B-1, For each educational groups all standard deviations exceed 1, and many are over 2, implying a clear tendency for individuals within the educations to assess the validity of the indicators differently. In contrast, the mean differences between the groups rarely exceeds 1 point on the 0-10 scale and is general under 0,5 point.

**Table B-2.** Summary of the assessments of the empirical indicators of the principles of Good health and Appropriate behavior and resource and animal based indicators, as well as the preference in herds of pigs, weaners, sows and gilts, dairy cattle and dairy calves – by the educations in the total sample and experts only

## Dairy cattle/Calves: Educations

| **Dairy Cattle/Calves: Educations** | Assessed validity of Animal based indicators[A] | Assessed validity of Resource based indicators[B] | Preference for animal based over resource based indicator |
|---|---|---|---|
| | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) |
| Animal welfare | 7,3 / 39 /2 | 7,3 / 38 / 1,9 | 1,1 / 38 / 0,4 |
| Agronomy / Animal Science | 7,1 / 43 / 1,8 | 6,4 / 42 / 2,2 | 1,2 / 41 / 0,8 |
| Veterinarian | 7 / 92 / 2,1 | 7,3 / 92 /1,8 | 1 / 91 / 0,6 |
| Total | 7,1 / 174 / 2 | 7,1 / 172 / 2 | 1,1 / 170 / 0,6 |
| **Dairy Cattle/Calves: Educations** | Assessed validity of Good health[A] | Assessed validity of Appropriate behavior[B] | Preference for Good health over Appropriate behavior |
| | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) |
| Animal welfare | 7,3 / 35 / 1,6 | 6,2 / 38 / 1,3 | 1,2 / 35 / 0,3 |
| Agronomy / Animal Science | 6,9 / 43 / 1,7 | 6,4 / 39 / 1,3 | 1,2 / 39 / 0,4 |
| Veterinarian | 7,1 / 92 / 1,8 | 6,2 / 82 / 1,4 | 1,2 / 82 / 0,4 |
| Total | 7,1 / 170 / 1,8 | 6,2 / 159 / 1,4 | 1,2 / 156 / 0,4 |
| **EXPERTS: Dairy Cattle/Calves: Educations** | Assessed validity of Animal based indicators[A] | Assessed validity of Ressource based indicators[B] | Preference for animal based over resource based indicator |
| | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) |
| Animal welfare | 7,2 / 31 / 2 | 7,1 / 31 / 2,1 | 1,1 / 31 / 0,4 |
| Agronomy / Animal Science | 7,2 / 33 / 2 | 6,3 / 33 / 2,4 | 1,3 / 32 / 0,9 |
| Veterinarian | 7,2 / 77 / 1,9 | 7,4 / 77 / 1,8 | 1,1 / 77 / 0,7 |
| Total | 7,2 / 141 / 2 | 7,1 / 141 / 2 | 1,1 / 140 / 0,7 |
| **EXPERTS: Dairy Cattle/Calves: Educations** | Assessed validity of Good health[A] | Assessed validity of Appropriate behavior[B] | Preference for Good health over Appropriate behavior |
| | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) |
| Animal welfare | 7,3 / 28 / 1,6 | 6,1 / 30 / 1,4 | 1,2 / 28 / 0,4 |
| Agronomy / Animal Science | 7 / 33 / 1,9 | 6,3 / 30 / 1,4 | 1,2 / 30 / 0,4 |
| Veterinarian | 7,2 / 77 / 1,8 | 6,3 / 71 / 1,3 | 1,2 / 71 / 0,3 |
| Total | 7,2 / 138 / 1,8 | 6,3 / 131 / 1,3 | 1,2 / 129 / 0,4 |

## Pigs, Weaners, Sows and Gilts: Educations

| **Pigs, Weaners, Sows and Gilts: Educations** | Assessed validity of Animal based indicators[A] | Assessed validity of Resource based indicators[B] | Preference for animal based over resource based indicator |
|---|---|---|---|
| | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) |
| Animal welfare | 7,9 / 37 / 2 | 6,3 / 37 / 2,1 | 1 / 37 / 1,4 |
| Agronomy / Animal Science | 7,2 / 37 / 2,3 | 6,2 / 38 / 1,8 | 1,2 / 36 / 1,5 |
| Veterinarian | 7,3 / 87 / 2,3 | 6,6 / 86 / 2,2 | 1,3 / 85 / 2,2 |
| Total | 7,4 / 161 / 2,3 | 6,4 / 161 / 2,1 | 1,2 / 158 / 1,9 |
| **Pigs, Weaners, Sows and Gilts: Educations** | Assessed validity of Good health[A] | Assessed validity of Appropriate behavior[B] | Preference for Good health over Appropriate behavior |
| | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) |
| Animal welfare | 8,3 / 38 / 2,2 | 8,4 / 39 / 1,7 | 1 / 38 / 0,2 |
| Agronomy / Animal Science | 7,8 / 37 / 2,7 | 7,8 / 38 / 1,5 | 1 / 37 / 0,3 |
| Veterinarian | 7,9 / 87 / 2,1 | 8 / 87 / 1,7 | 1 / 85 / 0,3 |
| Total | 8 / 162 / 2,3 | 8,1 / 164 / 1,7 | 1 / 160 / 0,3 |
| **EXPERTS: Pigs, Weaners, Sows and Gilts: Educations** | Assessed validity of Animal based indicators[A] | Assessed validity of Resource based indicators[B] | Preference for animal based over resource based indicator |
| | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) |
| Animal welfare | 7,7 / 31 / 2,1 | 6,1 / 31 / 2,2 | 1 / 31 / 1,5 |
| Agronomy / Animal Science | 7,3 / 26 / 2 | 6,2 / 26 / 1,9 | 1,1 / 26 / 1,2 |
| Veterinarian | 6,7 / 51 / 2,7 | 6,5 / 51 / 2,3 | 1,6 / 51 / 2,8 |
| Total | 7,1 / 108 / 2,4 | 6,3 / 108 / 2,2 | 1,3 / 108 / 2,2 |
| **EXPERTS: Pigs, Weaners, Sows and Gilts: Educations** | Assessed validity of Good health[A] | Assessed validity of Appropriate behavior[B] | Preference for Good health over Appropriate behavior |
| | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) | (Mean/N/Std. dev.) |
| Animal welfare | 8,1 / 31 / 2,3 | 8,3 / 31 / 1,8 | 1 / 31 / 0,2 |
| Agronomy / Animal Science | 7,8 / 26 / 2,6 | 7,5 / 26 / 1,6 | 1 / 26 / 0,4 |
| Veterinarian | 7,4 / 51 / 2,4 | 7,7 / 52 / 1,9 | 1 / 51 / 0,3 |
| Total | 7,7 / 108 / 2,4 | 7,8 / 109 / 1,8 | 1 / 108 / 0,3 |