AWIN welfare assessment protocol for

Goats

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ANIMAL WELFARE INDICATORS

Acknowledgement

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- The purpose of carrying out the welfare assessment is to gain information on goat welfare mainly by observation. Most measures do not require the animals to be touched. Handling should be kept to a minimum and always performed in obedience with good practice rules or European and national Laws on animal ethics.
- The photos and drawings included are examples to illustrate a specific condition; these must not be considered as the only representation of animal or farm conditions.

Safety and welfare are the first priorities. The assessor, the owner, the farm manager and the animals should never be put in danger. The animals should be handled gently and with consideration at all times. If it is not possible to complete all or part of the assessment without compromising the animal welfare through fear, discomfort, pain, or excessive restraint, the assessment should be stopped.

This document forms an integral part of the protocol.

For specific information about this protocol, contact George Stilwell (stilwell@fmv.ulisboa.pt), Silvana Mattiello (silvana.mattiello@unimi.it).

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FOREWORD

The European Animal Welfare Indicators Project (AWIN) addressed the development, integration and dissemination of animal-based welfare indicators, with an emphasis on pain assessment and pain recognition.

AWIN research objectives were carried out in four complementary workpackages and focused on sheep, goats, horses, donkeys and turkeys, species that, although commercially relevant world-wide, have so far been overlooked in previous science-based animal welfare assessments.

Workpackage 1 developed practical, science-based, welfare assessment protocols, including pain indicators. AWIN also translated the welfare assessment protocols into interactive apps to facilitate data collection, data storage and data analysis.

Workpackage 2 studied the impact of diseases and pain on animal welfare and developed interactive apps to facilitate data collection, data storage and data analysis.

Workpackage 3 examined the effects of different prenatal social environments, social dynamics and prenatal handling methods on developmental and welfare outcomes of the offspring of sheep, goats and horses.

Workpackage 4 developed interactive learning objects to disseminate the scientific work developed in the AWIN project, and created the Animal Welfare Science Hub to promote transparency, establishing a global research and education repository in animal welfare science.

The AWIN project remains committed to promote solid science, which could be used in practical settings.

A list of partners of the AWIN project is reported at the end of the document.

Draft protocols were subjected to an extensive consultation process with interested parties, across many European countries, and the wider world. Stakeholders actively contributed to testing the draft protocols and offered useful feedback. In order to increase the feasibility of protocols, AWIN proposes a stepwise strategy of assessment, with a more detailed assessment dependent on the outcome of a smaller number of important first measures.

This document includes the AWIN welfare assessment protocol for goats, developed by:

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This document was edited by Monica Battini, Silvana Mattiello, George Stilwell and Ana Vieira, with the contribution of Elisabetta Canali, Sara Barbieri (Università degli Studi di Milano, Italy) and Adroaldo J. Zanella (Universidade de São Paulo, Brazil).

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HOW TO USE THIS DOCUMENT

This document presents the on-farm protocol to assess the welfare of goats developed by AWIN and it is divided into three parts:

- **Chapters 1, 2, 3** – preliminary information relevant for applying the protocol.
- **Chapters 4, 5** – flow of the first and second level welfare assessment; description, assessment and scoring of the welfare indicators (presented according to the four principles and twelve criteria of Welfare Quality®); description of the outcome of the assessment.
- **Appendix A, B1, B2, C** – recording sheets to collect data.

TABLE OF CONTENT

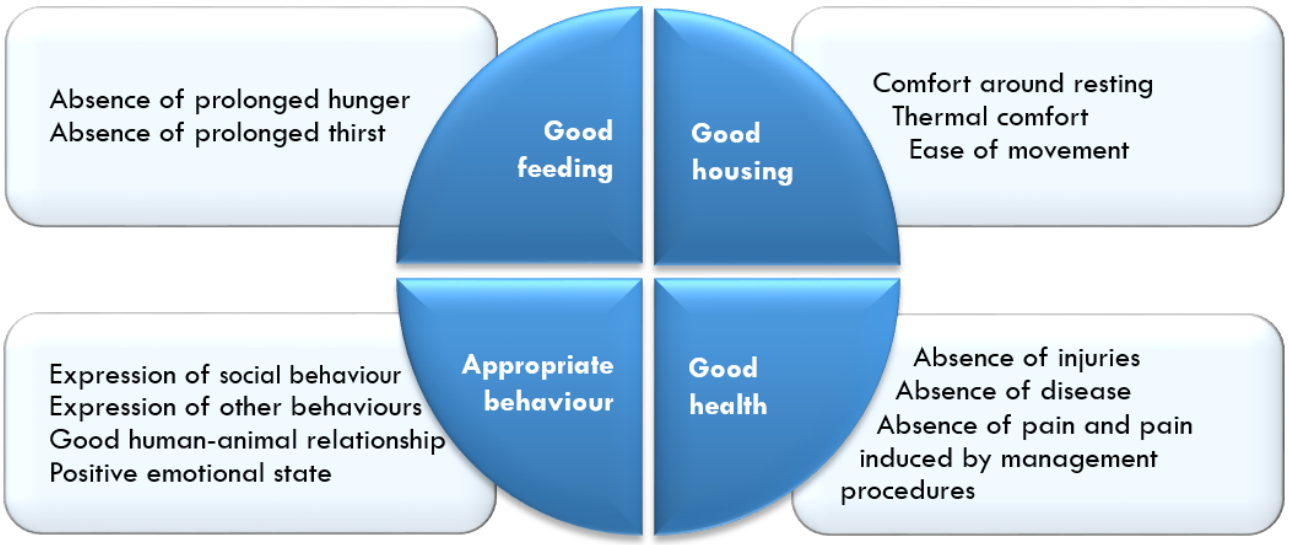
1. INTRODUCTION

Good animal welfare is a prerequisite for high-quality and sound farm animal production. Providing environmental and management conditions that favour animal welfare is not only expected by consumers and the general public, but is also related to achieving system-appropriate levels of performance and profitability. Animal welfare assessment is thus one of the pillars of productive, efficient and sustainable production systems.

In order to develop valid welfare assessment protocols it is important to remember that current, accepted definitions of animal welfare are based on a multidimensional concept, defined as a state of complete mental and physical health where the animal is in harmony with its environment (Hughes, 1976), and as its state as regards its attempts to cope with its environment (Broom, 1986). The physical environment, resources available to the animals and management practices of the farm can affect the welfare of animals, which adjust to these inputs with behavioural, and physiological responses. Since the beginning of the 21st century, on-farm welfare monitoring systems have been developed. Initially monitoring schemes were largely based on environmental assessments, such as design or resource indicators, which assess inputs that could affect animal welfare. These resource-based and management-based measures should be considered as risk factors that might affect welfare; however in order to assess animal welfare at farm level, it is crucial to develop and use animal-based measures. These indicators provide a more accurate welfare assessment as they give direct information about the response of, and the effects on, the animal. Animal-based measures are considered by EFSA to be “the most appropriate indicators of animal welfare and a carefully selected combination of animal-based measures can be used to assess the welfare of a target population in a valid and robust way“ (EFSA, 2012). The European Commission emphasizes the use of science-based animal welfare indicators as a possible means to simplify the legal framework and allow flexibility to improve competitiveness of livestock producers (EC, 2012).

The first welfare assessment protocols built on animal-based measures were developed by the Welfare Quality® project for pigs, poultry, dairy and beef cattle (Welfare Quality® Protocol, 2009a, Welfare Quality® Protocol, 2009b, Welfare Quality® Protocol, 2009c). This project, funded within the 6th EU Framework Programme, developed a scheme where the needs of animals are related to four principles and twelve criteria, considered necessary to cover all aspects of animal welfare (Fig. 1). This approach was the basis for future research on welfare assessment at farm level.

Figure 1. Welfare principles and criteria according to Welfare Quality®



After dealing with welfare assessment of some of the most common farmed species, in the 7th Framework Programme, the European Commission required the development, integration and dissemination of animal-based indicators, including pain, in commercially important husbandry species not yet covered in previous projects. In 2011 the AWIN (Animal Welfare Indicators) project was funded with the overall goal of improving animal welfare of sheep, goats, horses, donkeys and turkeys by developing, integrating and disseminating information about animal welfare indicators. These animal species offer challenges since they have been less studied and thus there is generally less information available on well-validated welfare indicators. In addition, the heterogeneity of the farming systems and environments in which these animals live may make the assessment more difficult. AWIN also puts special emphasis on the recognition and assessment of pain, as pain is an area that is frequently lacking from many animal welfare assessments and yet is often key when animal welfare problems arise.

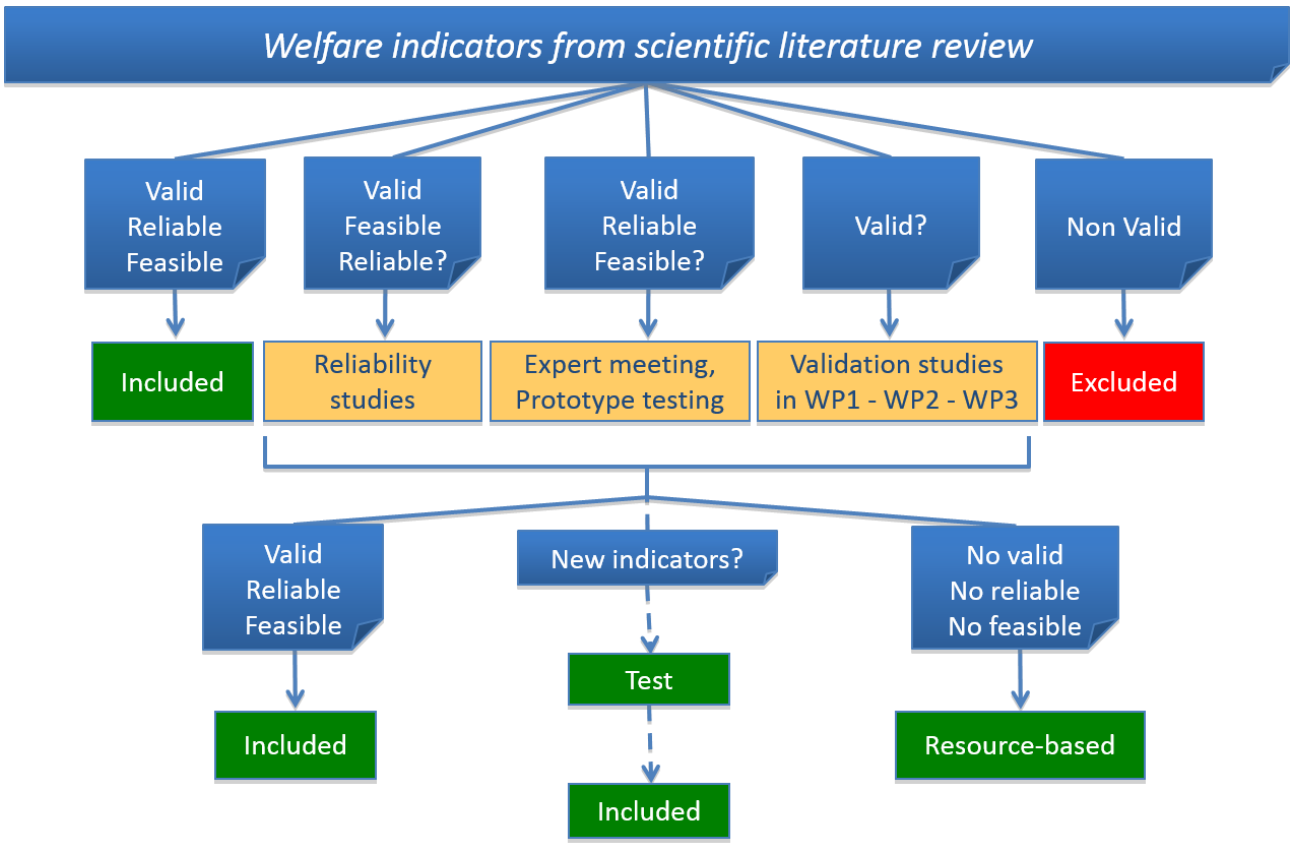
AWIN workpackage 1 (WP1) aimed to develop and refine welfare assessment protocols using animal-based indicators, including pain, in the above mentioned species. The welfare assessment protocols developed by AWIN are grounded on the four welfare principles and twelve criteria developed by Welfare Quality® and are complete but not complex, so that their application can meet current needs.

This Section briefly summarizes the principles and the rationale of the AWIN welfare assessment protocols for sheep, goats, horse, donkeys and turkeys, to be applied for on-farm welfare assessment; information about the animal based indicators, data processing and outcome will be presented later in the document.

As a starting point WP1 reviewed background scientific information to select promising animal-based indicators to be included in the protocols. Indicators were classified according to the 4 principles and the 12

criteria developed by Welfare Quality® (Fig. 1), and assessed for their validity, reliability and feasibility, identifying gaps in current knowledge (Fig. 2).

Figure 2. Characteristics and process to identify promising animal-based indicators



From this process, at least one indicator for each welfare criterion was selected to be included in the protocols. AWIN scientists developed a research action plan to address the lack of knowledge regarding the validity, repeatability and feasibility of single promising indicators where this was not present in the literature.

The work involved collaboration with workpackage 2 of the AWIN project, which addressed the relationship between disease, pain and animal welfare and with workpackage 3, which examined the effects of prenatal social environments, social dynamics and prenatal handling methods on the development and welfare of the considered species. Workpackage 4 maximised the effective translation of WP1 scientific results into learning objects. New indicators were developed and results were published in peer reviewed journals. Welfare assessment protocols were developed using animal-based indicators, although some resource-based indicators were included when no animal-based indicator were available to assess specific aspects.

To develop the welfare assessment protocols, stakeholders' perception of the selected indicators was taken into consideration. The purpose of involving the stakeholders was to increase the acceptability of the project outcomes through stimulation of a multidisciplinary dialogue, and identify solutions to potential barriers to the application of the protocols in practice. Stakeholders' opinion and farmers' experience were crucial for the successful implementation of the protocols. An on-line questionnaire in five languages was developed with the aim of understanding the current opinion of various stakeholders (farmers, veterinarians, owners) on welfare evaluation of the different species. In addition, the welfare assessment protocols for horses, donkeys, sheep, goats and turkeys were discussed with a network of stakeholders in several meetings, gaining feedback on their acceptability and feasibility, and facilitating the experimental phases of the project through practical support for the on-farm testing of the protocols.

The protocols were refined according to the results of WP1 studies and the feedback from the stakeholders favouring the use of indicators with the highest acceptability.

A two level approach is adopted for animal welfare assessment at farm level to increase feasibility and acceptability without losing scientific validity. The protocols offer, as a first level, a quick screening, consisting of a selection of robust and feasible animal-based indicators, which can be readily applied and require no or minimal handling of animals. Depending on the outcome of the first level assessment, a second level, consisting of more comprehensive and in depth assessment, may be recommended. In the second level protocols animals are often handled, but the welfare assessment is still feasible and can be conducted in a reasonable amount of time.

The outcome of the protocols aims to give a clear and immediate visual feedback to the farmers about the welfare of the animals on the farm, highlighting positive conditions and enabling comparison with a reference population.

AWIN protocols are designed to enable comparisons among similar production and management systems and are intended to assess animal welfare in order to guide its improvement throughout Europe and elsewhere in the world.

It should be underlined that this document presents the first version of the assessment protocol for goats on March 2015 and that scientific research will progress, refining indicators such that AWIN protocols could be updated according to new scientific knowledge. It should also be highlighted that proper training and adequate knowledge are essential to apply the protocols.

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2. AIMS

AWIN aimed to develop welfare assessment protocols that provide a toolbox of sound, feasible and practical animal-based indicators to assess animal welfare in order to promote improvements in animal production systems throughout Europe. The protocols were developed for species with broadly different rearing systems, ranging from very intensive to pasture based systems, and different production settings, ranging from intensive milk production to extensive meat production or working animals.

The AWIN welfare assessment protocol for goats is intended to function as a highly accepted and applicable welfare assessment tool for dairy goats kept in intensive[1] or semi-intensive[2] production systems.

These target systems were selected by the AWIN team based on three main reasons:

- these systems are the most widespread goat production systems in the world;
- although Europe only holds 2.5% of the world's dairy goat herds, it produces more than 18% of the world's goat milk. This economic importance results from intensification, that is expected to continuously grow in the future;
- dairy goats' intensive production is a relatively recent part of farming and little is known about its effect on goats' health and welfare. For example, it is expected that new threats, such as metabolic disease in obese animals or lameness in goats with overgrown claws, may arise from husbandry intensification.

This welfare assessment protocol was developed for lactating adult dairy goats kept under intensive or semi-intensive production systems.

As the indicators are based on goat biology, many of them may also be relevant to other categories (e.g. non-lactating females), but the protocol has not been tested yet for use in these animals.

[1]Intensive systems are defined as those in which goats are permanently kept indoors and diet is mainly composed of preserved forages and concentrate.

[2]Semi-intensive systems are similar to the intensive ones, but with occasional access to pasture.

3. PRELIMINARY INFORMATION

The objective of this section is to ensure that assessors know how to organise a visit, how to behave on a dairy goat farm, how to approach the farm manager and how to present the protocol so that results are reliable and useful to all.

Before contacting the farm manager, assessors should be sure that they have a good knowledge of:

- how the protocol works;
- possible constraints in the protocol application;
- dairy farm practices and husbandry features for goats;
- goats and specific breed behaviour;
- market and production strains, local production details, sanitary rules, common diseases.

3.1 Contact the farm manager

It is essential to contact the farm manager and plan an appointment to visit the farm taking into account the timing of the farm routine and the group management, in order to select the pen to be assessed (see Section 3.6).

Specific questions to be asked are:

- number of lactating goats;
- number of pens with lactating goats (excluding infirmary, culling, quarantine and maternity pens);
- pen densities;
- feeding space/animal ratios;
- drinking place/animal ratios;
- presence of both horned and hornless goats in the same pen;
- presence of bucks in the pens of lactating goats;
- feeding routine (time of main meal distribution);
- milking routine (time of milking, type and size of milking parlour).

When talking to the farm manager, assessors should discuss and agree the objectives of the visit, timetable and methods. It should be made clear that special arrangements and changes in routine will be kept to a minimum.

It is important to underline that the welfare assessment is neither dangerous for the goats nor for the people involved. All procedures conducted as part of the welfare assessment are non-invasive and routine operations that any good farmer would conduct as part of daily checks. How and for how long the farmer may be involved should be specified. Assessors should explain that they will need to enter the pen and, if

the second level welfare assessment is required, the goats should be gathered, either at the feeding rack or in the milking parlour.

3.2 Equipment required

Useful materials for the welfare assessment are: recording sheets, tablet or smartphone, pens/pencils, camera, measuring tape or laser distancemeter, stopwatch, safety shoes/boots, overalls and shoe/boot covers, disinfectants, thermometer and hygrometer.

3.3 Biosecurity

Biosecurity is a crucial issue. Welfare assessors should never be a potential disease-spreading source, or be seen as such. The assessors must remember that many infectious agents are very resistant in the environment and almost impossible to eradicate once inside the farm (e.g. *Corynebacterium pseudotuberculosis*, *Mycobacterium spp.*, *Brucella spp.*). For this reason, in order to avoid spreading diseases, the assessors should always wear disposable shoe/boot covers on safety shoes/boots.

Clean overalls and disposable shoe/boot covers are essential even if additional disinfection will be performed on the farm premises. Overalls should be of the same colour as those normally used by the farmers (e.g. dark green or blue), to avoid the goats changing their behaviour in response to novelty.

Always ask for the sanitary rules for vehicles accessing the farm.

3.4 Arriving and working

On arrival, assessors should look for the farm manager in charge of the animals and ask to briefly present the farm safety rules. This should include areas to be aware of from a hazard point of view such as vehicle paths, dangerous machinery, or guard dogs.

During this conversation, the welfare protocol should be presented, including the objectives, the approximate assessment duration, the assessor schedules and activities and the indicator collection order. This will provide the farm manager with information on where the assessors will be at any time. The assessors should keep this conversation as brief as possible, so as to avoid any subjective influence on the results. Although the flow of the welfare assessment protocol cannot be changed, the plan should be discussed so that the assessment is conducted without interfering with routine work.

When walking around the farm, assessors should be discreet. Any disturbance to people working on the farm or to the animals must be kept to the minimum possible.

Knowing how goats behave is crucial when entering the pen where animals are kept. This will not only ensure adequate assessment but will also allow the identification of aggressive, threatening or fear signs.

Other advice on how to move around and behave on the farm is:

- do not leave the gates and doors open after going through;
- avoid stepping on the feed or the feed trough even when empty;
- avoid talking too loudly and making sudden movements;
- do not leave any object within reach of the animals;
- avoid being licked on the hands;
- avoid touching the goats if it is not necessary;
- keep focused on the work at all times.

If records are to be checked, assessors should always ask for permission and, if possible, consult them in the presence of the farm manager or whoever is in charge.

3.5 Safety handling

The present welfare assessment protocol is designed for use by trained assessors. Safety and welfare are of prime importance. The assessors, the farmers, or the animals should never be put in danger.

3.6 Sampling

3.6.1 Selecting pen for first level welfare assessment

Observations will only be carried out in one pen with lactating dairy goats, even if more pens are present on the same farm. In order to increase the sensitivity of the assessment, the pen considered as presenting the potentially greatest risk for welfare will be selected. This selection will take into consideration the following aspects:

- highest density;
- lower feeding space/animal ratio;
- lower drinking place/animal ratio;
- presence of both horned and hornless goats in the same pen.

If all pens are in similar conditions, one random pen should be selected.

No buck should be present in the pen at the time of the assessment.

Infirmary, culling, quarantine or maternity pens should not be assessed.

3.6.2 Selecting pen(s) for second level welfare assessment

Assessors should retrieve information on the farm beforehand, namely the number and characteristics of pens present, in order to plan their visit.

If only one pen is present, observations will be carried out in that pen.

If the farm has two pens, both should be assessed.

For farms with three or more pens, pens will be randomly selected, according to the following scheme:

No. of pens in the farm	No. of pens to be assessed	No. of days required
1	1	1
2	2	1
3	2	1
4	2	1
5	2	1
6	2	1
7	2	1
8	3	2
9	3	2
10	3	2

If there are any bucks present in the selected pens, they should be removed before the assessment starts. Infirmary, culling, quarantine or maternity pens should never be assessed.

Two assessors will always be present for the second level welfare assessment, even if only one pen has to be assessed. This will be essential for individual assessment, as the animals have to be assessed from the front and the rear.

If there are between two and seven pens, the two assessors will assess one pen each on the same day; if there are more than seven pens, more than one day will be required for the assessment.

If more than 11 pens are present (excluding infirmary, culling, quarantine or maternity pens), 25% of the pens have to be assessed and the assessment will require two or more days.

3.6.3 Selecting goats for second level welfare assessment

In order to select the number of animals to be individually assessed, it is important to know the number of lactating goats on the farm. The number of animals to be sampled is determined from that information, according to the following scheme:

Farm size – number of lactating goats	Suggested sample*	Minimum sample**	Farm size – number of lactating goats	Suggested sample*	Minimum sample**
< 15	all animals	all animals	225-249	68	53
15-19	13	13	250-299	70	54
20-24	17	16	300-349	73	56
25-29	20	19	350-399	76	57
30-34	23	21	400-449	78	57
35-39	26	24	450-499	80	58
40-44	29	26	500-599	81	59
45-49	31	28	600-699	83	60
50-59	33	29	700-799	85	61
60-69	37	32	800-899	86	62
70-79	41	35	900-999	87	63
80-89	44	37	1000-1099	88	63
90-99	47	39	1100-1299	89	64
100-124	49	41	1300-1499	90	65
125-149	55	44	1500-1699	91	65
150-174	59	47	1700-1799	91	66
175-199	63	49	> 1800	92	66
200-224	65	51			

**Assuming a 50% prevalence, IC 95% and accuracy 10%*

***Assuming a 50% prevalence, IC 90% and accuracy 10%*

After determining the number of animals to be assessed on the farm, and the number of pens to be selected, the number of animals to assess in each pen will depend on its dimension in terms of number of lactating goats, and can be calculated following these steps:

1. calculate the proportion of lactating goats to be assessed in the selected pens:

$$P = Nt/SS$$

where P is the proportion of lactating goats to be assessed in the selected pens,
Nt is the total number of lactating goats in the selected pens,
SS is the suggested sample size;

2. calculate the number of lactating goats to be assessed in each pen:

$$S = Np/P$$

Where S is the number of lactating goats to be assessed in each pen,
Np is the number of lactating goats in the pen,
P is the proportion of lactating goats to be assessed in the selected pens.

EXAMPLE

On a farm with a total of 225 lactating goats, 68 lactating goats have to be sampled. If on this farm two pens have to be assessed, the number of animals in each pen should be taken into account. For example, if in pen 1 there are 24 lactating goats and in pen 2 there are 201 lactating goats, the number of lactating goats to be assessed should be calculated as follows:

1. P = 225/68 = 3.3

2. $S_{pen\ 1}$ = 24/3.3 = 7.3 (7 goats) and $S_{pen\ 2}$ = 201/3.3 = 60.9 (61 goats).

The assessment can be done in the pen by locking the goats at the feeding rack (not during feeding time), or in the milking parlour (either during milking or not). The goat selection should follow a systematic random sampling procedure by selecting every n^{th} animal.

The sampling interval (k) is determined by following the next step:

$$k = Nt_{pen}/SS_{pen}$$

where Nt_{pen} is the total number of lactating goats in the selected pen
SS_{pen} is the suggested sample size for the selected pen.

That would mean assessing in pen 1 and 2 roughly every three animals (pen 1 with a k = 24/7 and pen 2 with a k = 201/61).

4. AWIN WELFARE ASSESSMENT PROTOCOL FOR GOATS

4.1 Welfare indicators divided by principles and criteria

The AWIN welfare indicators for goats are listed according to WQ® principles and criteria. In order to highlight the association between welfare indicators and principles throughout the document, different colours are used to identify each principle.

Welfare Principles	Welfare Criteria	Welfare indicators
Good Feeding	Appropriate nutrition	Body Condition Score
		Hair coat condition
		Queuing at feeding
	Absence of prolonged thirst	Queuing at drinking
Good Housing	Comfort around resting	Bedding
	Thermal comfort	Thermal stress
	Ease of movement	Kneeling at the feeding rack
Good Health	Absence of injuries	Severe lameness
	Absence of disease	Abscesses
		Body Condition
		Score Faecal soiling
		Hair coat condition
		Nasal discharge
		Oblivion
		Ocular discharge
		Overgrown claws
		Udder asymmetry
	Absence of pain and pain induced by management procedures	Improper disbudding
		Severe lameness
Appropriate Behaviour	Expression of social behaviour	Queuing at drinking
		Queuing at feeding
	Expression of other behaviours	Oblivion
	Good human-animal relationship	Latency to the first contact test
	Positive emotional state	Qualitative Behaviour Assessment

As there is a logic order in which the different indicators should be collected, Sections 4.2 and 4.3 report the flow of the first and second level welfare assessment. Description, assessment and method of scoring of each AWIN welfare indicator for goats are reported in Section 4.4; it is always specified if the indicator

should be assessed at individual or group level, or if it is resource based. Some indicators provide information on more than one welfare criteria and are therefore associated to more than one colour.

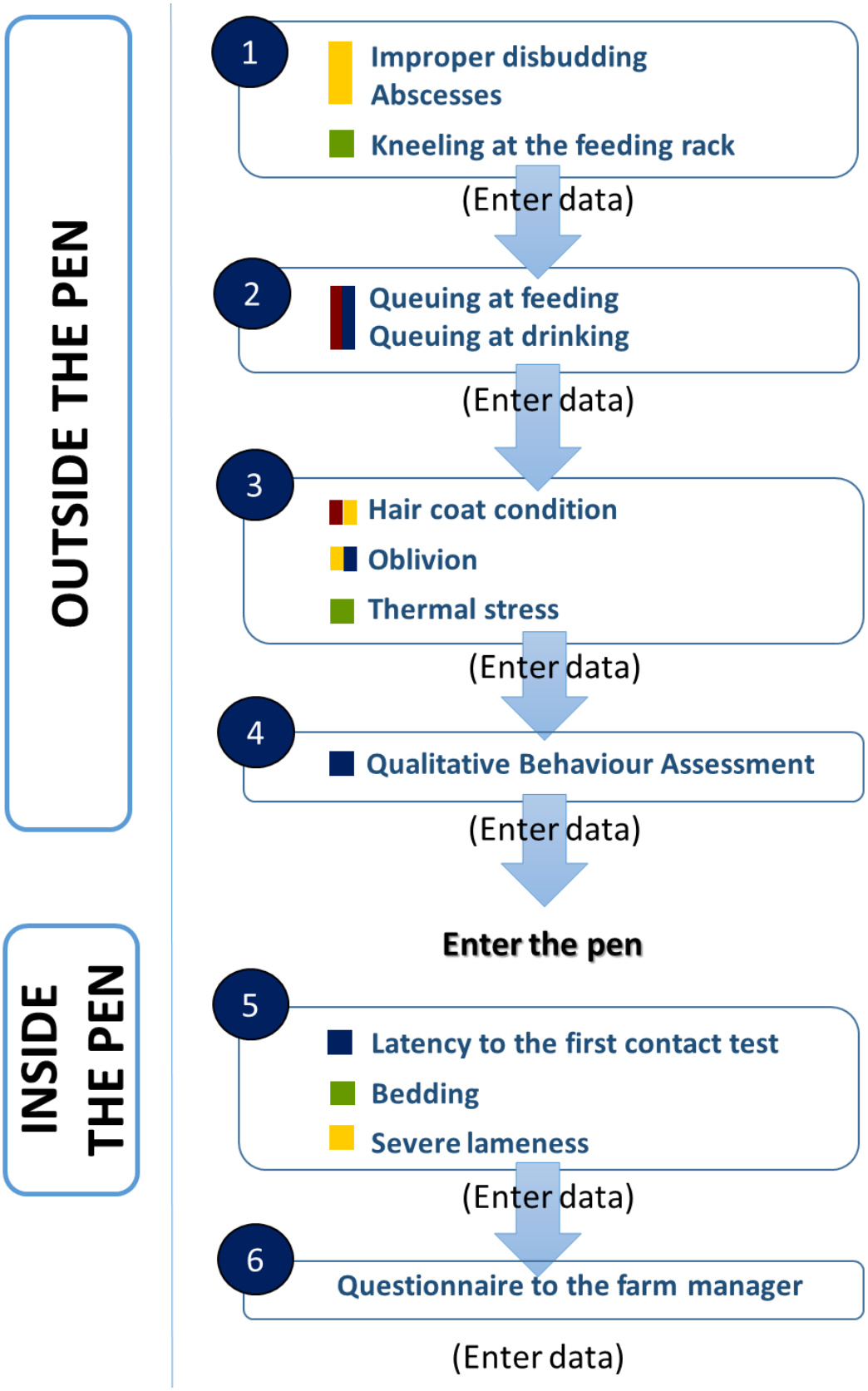
4.2 Flow of first level welfare assessment

The assessors should first become familiar with the farm and the daily routines. Having done that, they should then predict the necessary movements and locate observation points around the farm so as to follow the specific order in which the different welfare indicators should be collected.

The assessment should start at the time of feed distribution (main meal) from outside the pen and it will continue inside the pen.

After applying the protocol, the farm manager will be asked to answer a questionnaire. The aim of the questionnaire is to gather general information about the farm. It is mandatory that the farm manager is interviewed at the end of data collection, to avoid the assessor being influenced by the farm manager's attitude during the collection of the indicators.

Time needed for assessing a pen is approximately 90 min.


OUTSIDE THE PEN
1
Improper disbudding
Abscesses
Kneeling at the feeding rack
(Enter data)
2
Queuing at feeding
Queuing at drinking
(Enter data)
3
Hair coat condition
Oblivion
Thermal stress
(Enter data)
4
Qualitative Behaviour Assessment
(Enter data)
Enter the pen
INSIDE THE PEN
5
Latency to the first contact test
Bedding
Severe lameness
(Enter data)
6
Questionnaire to the farm manager
(Enter data)

4.3 Flow of second level welfare assessment

The second level welfare assessment is recommended when the conditions listed in Section 5.2 are satisfied.

In the second level welfare assessment two assessors have to be present and a more comprehensive protocol is applied.

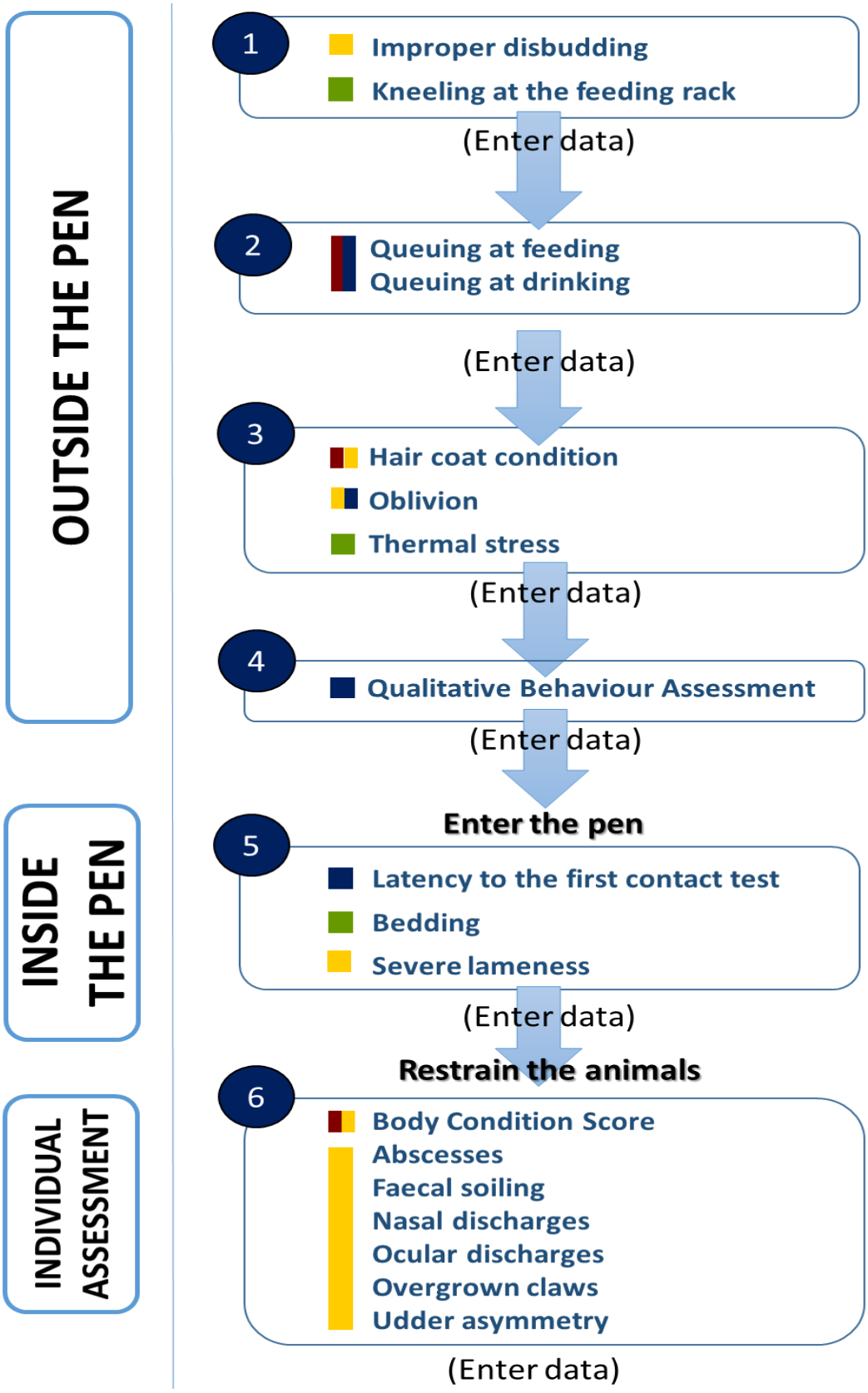
In this level, more pens should be evaluated and individual close examination is also necessary. The number of pens and animals to be examined depends on the size of the farm (see Section 3.6).

The location for individual examination of goats may vary, depending on the farm characteristics. If goats can be restrained at the feeding rack in their home pen, this is to be preferred, although the assessment should not be performed during feeding time. If this is not possible, animals can be inspected in the milking parlour, either during milking or on a different occasion. If the assessment is performed during milking time, the assessors should be sure not to interfere with an activity that is usually fast-moving and demanding for the milkers. Some goats may distrust unfamiliar people and refuse to enter, so the assessors should keep quiet and out of sight as much as possible.

During group assessment, the two assessors will evaluate one pen each, whereas during individual assessment one assessor will evaluate the front (for ocular discharges, nasal discharges and abscesses) and the other the rear part (for Body Condition Score, overgrown claws, faecal soiling, udder asymmetry and abscesses) of the goats.

Time needed for assessing one or two pens at the same time is approximately 90 min. For individual assessment, approximately 30-45 s per goat are required.

Always obtain permission from the farm manager before entering each pen or the milking parlour to start the welfare assessment.


OUTSIDE THE PEN
INSIDE THE PEN
INDIVIDUAL ASSESSMENT
1
Improper disbudding
Kneeling at the feeding rack
(Enter data)
2
Queuing at feeding
Queuing at drinking
(Enter data)
3
Hair coat condition
Oblivion
Thermal stress
(Enter data)
4
Qualitative Behaviour Assessment
(Enter data)
Enter the pen
5
Latency to the first contact test
Bedding
Severe lameness
(Enter data)
Restrain the animals
6
Body Condition Score
Abscesses
Faecal soiling
Nasal discharges
Ocular discharges
Overgrown claws
Udder asymmetry
(Enter data)

4.4 AWIN welfare indicators for goats

BODY CONDITION SCORE

GOOD FEEDING
APPROPRIATE NUTRITION
GOOD HEALTH
ABSENCE OF DISEASE

Description

Body Condition Score (BCS) is performed to estimate the nutritional and health status of goats. Only extreme conditions are included in the assessment (very thin and very fat goats), as these can be related to welfare problems.

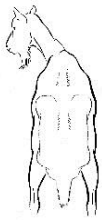
How to assess [Individual]

BCS is visually assessed by the assessor at the rear of the goat.
Evaluate each goat by positioning caudally to the animal so as to have a full view of the rump region. The goat should be standing.

How to score

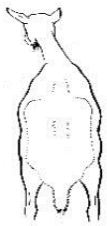
Each goat is scored in three levels.

Very thin (score -1)



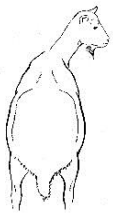
General condition: Raw or slightly raw-boned goat, with backbone and some ribs visible.
Rump region: Hip and pin bones are prominent. The line that connects the hip bone and the thurl assumes a markedly concave shape. There is little muscle and/or fat between the skin and bone structures.

Normal (score 0)



General condition: Backbone not prominent but still visible and ribs difficult to assess visually.
Rump region: Hip and pin bones still visible, but not prominent. The line that connects the hip bone and the thurl assumes a slightly concave or straight shape. It is possible to see some muscle and/or fat between the skin and bone structures.

Very fat (score 1)



General condition: Backbone and ribs not visible. Goat has a rounded appearance, sometimes with abdominal fat deposits visible.
Rump region: Hip and pin bones are difficult to identify. The line that connects the hip bone and the thurl assumes a slightly or markedly convex shape. The entire rump region is coated by muscle and fat, contributing to the rounded appearance of the goat.

HAIR COAT CONDITION

GOOD FEEDING
APPROPRIATE NUTRITION
GOOD HEALTH
ABSENCE OF DISEASE

Description

Hair coat condition is often related to health or nutritional problems or presence of endo- and/or ecto-parasites. Goats with poor hair coat condition usually present low BCS. This condition has been found to be associated with chronic diseases, such as pneumonia, or with mineral imbalances.

How to assess [Group]

Hair coat condition is visually assessed from outside the pen.
Start locating the goats with poor hair coat condition, described as: matted, rough, scurfy, uneven, shaggy hair coat, frequently longer than normal.
Assess the hair coat condition considering the whole body, with the exception of head and legs below the joints (anatomical knees and elbows). This means that the assessment is possible even if the goat is lying down.
Animals may present poor hair coat on the whole body or they may only exhibit part of the body with rough hair coat. In both cases they should be classified as having poor hair coat condition.
Take into account breed and crossbreed animals because some have naturally long hair, that should not be considered as poor hair coat condition.
Hair coat condition cannot be scored during the moulting season.

How to score

Record the number of goats with poor hair coat condition.

Normal hair coat

The hair coat is shiny and has a sheen.
The hair coat is homogeneous and adheres to the body.

Normal hair coat

The hair coat is shiny and has a sheen, even though it is dirty.
Please note that dirty hair coat is not included in poor hair coat condition.

Poor hair coat

The hair coat is matted on the whole body.
The hair coat is longer especially on hindquarters.

Poor hair coat

The hair coat is rough and scurfy on the whole body

Poor hair coat

The hair coat is longer especially on hindquarters and back line.

QUEUING AT FEEDING

GOOD FEEDING
APPROPRIATE NUTRITION
APPROPRIATE BEHAVIOUR
EXPRESSION OF SOCIAL BEHAVIOUR

Description

Queuing at feeding is a behaviour of goats that wait behind animals that are feeding (exactly like being in a queue) and it may be used to detect animals suffering from hunger, due to inadequate number of feed places or to inadequate distribution of feed along the whole feeding rack. Furthermore, goats are quite well synchronized animals and the impossibility to express the feeding behaviour with synchrony may cause (or may be caused by) altered social behaviours (e.g. low ranking position, presence of mixed groups with both horned and hornless goats).

How to assess [Group]

Queuing at feeding is visually assessed from outside the pen.
The observation period should start two min after the end of feed distribution.
Start observing the behaviour of the goats. A goat is queuing if it is standing within 50 cm behind another goat that is feeding, with its head usually oriented towards the feed barrier.
The whole feeding rack (or other feeding places) is observed at the same time, meaning that the assessor should select an observation point that allows a good view of the feeding rack. When needed, slight movements are permitted.

How to score

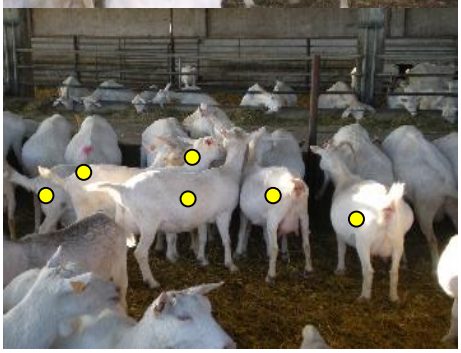
Record the number of queuing goats by using a scan sampling method during 15 min/observation (2 min/scan). With this sampling method, the behaviour (number of queuing animals) of all the animals in the pen is recorded at predetermined time intervals (every 2 min when the stopwatch rings).
Make sure goats that are queuing are differentiated from those that are transiting in the feeding alley.

Normal feeding behaviour

No goat is queuing.

Normal feeding behaviour

The goats are transiting in the feeding alley.

Queuing at feeding		A goat is queuing.
Queuing at feeding		Two goats are queuing at feeding.
Queuing at feeding		Six goats are queuing at feeding.

QUEUING AT DRINKING

GOOD FEEDING
ABSENCE OF PROLONGED THIRST
APPROPRIATE BEHAVIOUR
EXPRESSION OF SOCIAL BEHAVIOUR

Description

Queuing at drinking is a behaviour of goats that are forced to wait for their turn to drink (exactly like in a queue) and it may be used to detect animals suffering from thirst due to inadequate number of water places. Furthermore, goats are quite well synchronized animals and the impossibility to express the drinking behaviour with synchrony may cause (or may be caused by) altered social behaviours (e.g. low ranking position).

How to assess [Group]

Queuing at drinking is visually assessed from outside the pen.
Ask the farm manager which water places are functioning and only observe those. The observation period begins when the first goat starts drinking after feed distribution. If no goat starts drinking during the observation of queueing at feeding, the observation of queueing at drinking starts at the end of the observation of queueing at feeding.
The total duration of the observation of queueing at drinking will last 15 min. During this time, observe the behaviour of goats. A goat is queuing if it is standing within 50 cm behind another goat that is drinking (or queuing), with its head usually oriented towards the water place.

How to score

The assessor should select an observation point that allows a good view of the water place(s). When needed, slight movements are permitted.
Record the number of queuing goats by using a scan sampling method during 15 min/observation. With this sampling method, the number of queuing animals in the pen is recorded at predetermined time intervals (every 2 min, when the stopwatch rings). All the functioning water places are assessed at the same time (e.g. water place A: two queuing goats + water place B: three queuing goats = five total queuing goats).
Be aware of goats drinking together from the same water place. They are not queuing, as they are both able to drink at the same time.

Normal drinking behaviour

A goat is drinking.

Normal drinking behaviour		Two goats are drinking together.
Queuing at drinking		Two goats are drinking together, one goat is queuing.
Queuing at drinking		Three goats are queuing.

BEDDING

GOOD HOUSING
COMFORT AROUND RESTING

Description

Goats are usually housed on deep straw bedding. The quality and quantity of bedding is strictly related to comfort during resting: scarce, wet and dirt bedding is less comfortable to lie on and goats generally do not rest on wet floors.

How to assess [Resource-based]

Bedding is visually assessed from inside the pen.
Walk around the pen evaluating the quantity and cleanliness of the bedding.

How to score

Evaluate the quantity of the bedding material

Sufficient

The bedding is soft and abundant. The floor is fully covered by bedding.

Insufficient

Floor areas not covered by bedding are clearly visible or the layer of bedding is too thin.

Evaluate the cleanliness of the bedding material

Clean

The bedding is clean and dry.

Dirty and/or wet

Presence of faeces clearly visible scattered in the bedding area and/or of wet areas.

THERMAL STRESS

Description

Thermal stress may affect health, welfare and production in goats.
The presence of heat stress signs is associated with high temperature/humidity index. Heat stress may reduce feed intake and production efficiency.
Although goats are frequently described as rustic or highly adaptable animals, they may suffer from low temperatures, especially if combined with wind and rain.

How to assess [Group]

Thermal stress is visually assessed from outside the pen.
Start looking at all the animals in the pen.
Heat stress signs: focus on the respiration of the goats. Goats suffering from heat stress frequently have an accelerated respiration rate with open-mouth and excessive salivation.
Make sure animals with abnormal respiration sounds (e.g. rales, wheezes, stertor or stridor) and coughing are not included as they may be suffering from respiratory disease not related to heat stress.
Cold stress signs: focus on hair coat on the back, postures and movement of the body. Goats suffering from cold frequently have bristling hair on their backs (horripilation) and, in severe cold stress occasions, they shiver and may assume a posture with arched back and head lowered.
Make sure animals involved in agonistic interactions are not included, as they frequently raise the hair on their backs.

How to score

Record the number of goats with signs of thermal stress.

Absence of heat stress

Normal respiration: the mouth is closed, the flank moves regularly (only slightly visible). The legs are frequently drawn into the body.

Presence of heat stress

Elevated respiration rate and/or panting: from slight/moderate panting with mouth closed to heavy/severe open-mouthed panting, accompanied by protruding tongue. Drooling saliva may be present. The body posture is appropriate to heat loss, e.g. the neck is frequently extended, the legs may be held away from the body.

Absence of cold stress		Hair coat is flat on the back, no signs of cold stress are visible.
Absence of cold stress		The hair on the back of this goat is bristly, due to agonistic interaction.
Absence of cold stress		The hair on the back of this goat is bristly and long, due to poor hair coat condition.
Presence of cold stress		The hair is bristly on the back. Additionally, the body may be stiff or the arched back and head down posture may be assumed. Extremely cold conditions may cause goats to shiver.

KNEELING AT THE FEEDING RACK

GOOD HOUSING
EASE OF MOVEMENT

Description

Kneeling at the feeding rack is a posture that consists of goats standing on their hind limbs and on their carpal joints when feeding. This posture indicates discomfort due to inappropriate housing conditions (e.g. feeding floor too high compared to the feeding trough, feeding trough not properly designed), but also difficulty in accessing feed due to overcrowding.

How to assess [Group]

Kneeling at the feeding rack is visually assessed from outside the pen.
When the feed is distributed and goats enter the feeding rack, the assessor moves along the feeding rack, at a distance of 1.5 m from the feeding rack, and at the speed of 2 m/s. Locate the goats on their knees at the feeding rack.
Goats in this posture are easily identifiable: the front legs are flexed, and the rear is up compared to the other goats at the feeding rack.

How to score

Record the number of goats that are kneeling at the feeding rack.

Kneeling

This goat is in kneeling position.

Kneeling

The goat in evidence is kneeling at the feeding rack.

SEVERE LAMENESS

Description

Lameness is a behavioural indicator of pain characterized by abnormal locomotion. The degree of lameness may range from slight to severe. However, due to husbandry constraints and diversity of management and resources at dairy goat farms, it is impossible to follow a standard protocol to identify slight and moderate cases of lameness. Therefore, the identification of only the most severe cases of lameness is suggested.

How to assess [Group]

Severe lameness is visually assessed from inside the pen. Lameness assessment is based on the simultaneous observation of different lameness signs that contribute to a final score.
The most valuable key-points in the process of lameness assessment are:
Abnormal gait: severe lameness can be described as goats having an irregular gait in time and space, sometimes leading to situations such as not bearing weight on one or more legs, “goose” walking (limbs stretched), or moving on their knees (kneeling).
Head nodding: severe lameness is characterised by accentuated up and down movements of the head while walking, whereas the head of non-lame goats remains steady when walking.
Spine curvature: severe lameness is characterised by goats with an accentuated arched rump region, whereas on non-lame goats no, or just a slight, arched rump area can be noticed.
Only severe lameness is assessed. Walk slowly, at a speed of 2 m/s, around the pen, making sure all animals are in sight. Sometimes it may be necessary to stop and observe the goats that are crossing from one side of the pen to the other. All goats lying down should be forced to stand and walk at least a few steps. If a goat does not stand up and it is impossible to determine whether this is caused by some claw or limb injury or disease (e.g. the claws or limbs do not show any visible sign of injury and are not swollen and with high temperature) it should not be recorded as severely lame.

How to score

Record the number of severely lame goats.

Non-lame, slightly or moderately lame goats	Regular or slight to moderate irregular gait in time and space. Inexistent or slight to moderate head nodding and arched rump.
Severely lame goats	A goat should be considered severely lame if any of these signs is present: o extremely irregular gait in time and space, that sometimes leads to situations such as not bearing weight on one or more legs; o pronounced “goose” walking (limbs stretched); o moving on knees (kneeling); o severe head nodding; o accentuated arched rump.

ABSCESSES

GOOD HEALTH
ABSCENCE OF DISEASE

Description

The presence of abscesses is most often associated with a chronic contagious disease called Caseous Lymphadenitis that is caused by bacteria (*Corynebacterium pseudotuberculosis*). These abscesses usually coincide with superficial lymph nodes. Other less common causes of abscesses in goats are infected wounds or injection sites.

How to assess [Group]

In the first level welfare assessment, front abscesses are visually assessed from outside the pen. When the feed is distributed and goats enter the feeding rack, move along the feeding rack, at a distance of 1.5 m from the feeding rack, and at the speed of 2 m/s.
The assessor should be able to observe head, neck and shoulders of each goat (blue areas; Fig. 1), carefully checking for the presence of abscesses.

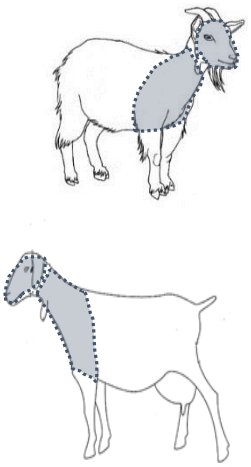


Figure 1

How to assess [Individual]

In the second level welfare assessment, abscesses are visually assessed at the same time by two assessors: one from a position in front of the goat and the other at the rear of the same goat. The assessor at the front checks for the presence of abscesses in head, neck and shoulders areas (blue areas); the assessor at the rear checks for abscesses in hindquarters and udder areas (orange areas; Fig. 2). Flanks are excluded from the assessment, because they are not clearly visible in all situations.

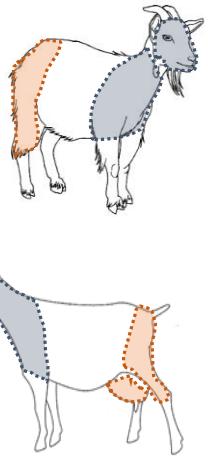


Figure 2

How to score [Group]

Record the number of goats that present external abscesses.
No distinction exists between ruptured and non-ruptured abscesses; scars are not considered.

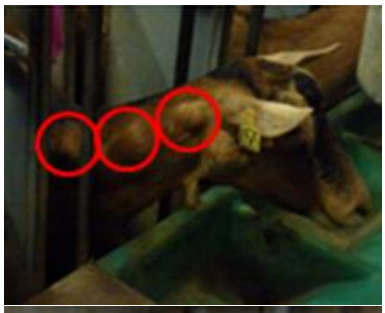
How to score [Individual]

Each goat is scored in two levels, depending on the presence (score 1) or absence (score 0) of abscesses. The presence of abscesses either in the front or rear area of the body or in both areas is a sufficient condition for scoring 1.
No distinction exists between ruptured and non-ruptured abscesses; scars are not considered.

Absence of frontal abscesses

Score 0

Presence of frontal abscesses



Score 1

FAECAL SOILING

GOOD HEALTH
ABSCENCE OF DISEASE

Description

Faecal soiling is defined as the presence of manure below the tail head. Goat's manure is generally dry, therefore the presence of soft to liquid faecal matter is a sign of disease (infectious or parasitic) or inadequate diet.

How to assess [Individual]

Faecal soiling is visually assessed by the assessor at the rear of the goat.
Check for the presence of faecal soiling observing the area around the anus under and on both sides of the tail.

How to score

Each goat is scored in two levels.

Score 0

Absence of faecal soiling. The areas under and on both sides of the tail show absence of soft to liquid faecal matter.

Score 1

Presence of faecal soiling. The areas below and on both sides of the tail show the presence of soft faecal matter.

NASAL DISCHARGE

GOOD HEALTH
ABSCENCE OF DISEASE

Description

Nasal discharge is defined as any mucous or purulent discharge from the nose, due to inadequate environment or to disease. If discharge is from only one nostril, it may be a sign of nasal disease or lesion; if discharge is from both nostrils, it may be caused by diseases of the lower respiratory tract.

How to assess [Individual]

Nasal discharge is visually assessed by the assessor observing the goat from the front.
Discharges to be considered should be white or yellowish (mucous or purulent). Serous discharge (transparent and watery like) should not be considered for this assessment. Nasal discharge is observed around the nostrils or hanging from the nose.

How to score

Each goat is scored in two levels. Nasal discharge from one nostril is sufficient condition for scoring a goat with presence of nasal discharge.

Score 0

Absence of any nasal discharge.

Score 1

Presence of discharge from two nostrils.

OBLIVION

GOOD HEALTH
ABSCENCE OF DISEASE
APPROPRIATE BEHAVIOUR
EXPRESSION OF OTHER BEHAVIOURS

Description

In goats, oblivion is a sign of poor health (e.g. pain caused by lameness, severe disease) or of inability to express a normal social behaviour. Goats are generally herd-living, gregarious and well synchronized animals, so individuals rarely exclude themselves from the group.

How to assess [Group]

Oblivion is visually assessed from outside the pen.
An oblivious goat generally tries to isolate itself from the group, standing (sometimes lying) immobile for long time, frequently facing the wall or other parts of the housing structure, sometimes with ears down. As to behaviour, it is apathetic, inattentive, absent, depressed, unaffected by external stimuli and shows no interactions with its conspecifics during the whole observation period.
Start observing the animals on arriving at the farm and locate goats that seem either physically or mentally isolated:
physical isolation → a goat detaches itself from the rest of the group, especially during synchronized activities (e.g. feeding, resting);
mental isolation → a goat may be detached, or not, from the group. Even if it is close to the group, it does not take part in synchronized activities and does not react to external stimuli. Due to the high animal density in intensive farms, sometimes goats are not able to physically isolate themselves. Posture, behaviour and localization compared to the rest of the group are the most important items to be considered.
During the whole observation period from outside the pen (which includes the time for assessing improper disbudding, abscesses, kneeling at the feeding rack, queueing at feeding, queueing at drinking, hair coat condition and thermal stress; approximately 30 min) check if the goats with the previously described characteristics (physical or mental isolation) maintain (or not) this behaviour and then confirm (or not) the identified animals as oblivious.

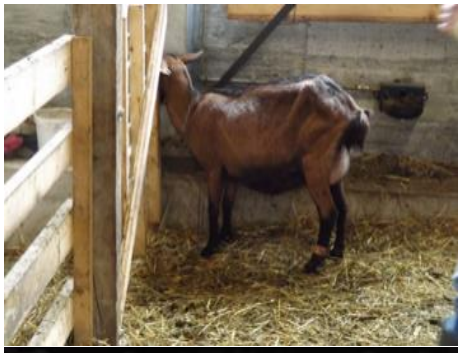
How to score

Record the number of oblivious individuals.
Make sure animals are not simply resting, sleeping or ruminating (both standing and lying).

Oblivion

This goat is isolated from the rest of the group during a social activity (feeding time). It is standing immobile, facing the wall.

Oblivion



This goat is trying to isolate itself in a corner. It is standing immobile, facing the wall.

Oblivion

The goat lying in the middle of the picture is trying to isolate itself. It is inactive compared to the rest of the group and shows a mental indifference. The ears are down and the animal shows no reaction to external stimuli, although it is at the core of a group.

OCULAR DISCHARGE

GOOD HEALTH
ABSCENCE OF DISEASE

Description

Ocular discharge is defined as a clearly visible flow from the eye, possibly due to inadequate environments (e.g. dusty, presence of draughts) or to infectious diseases. Discharge can be from one eye only (usually trauma or local infection) or from both (normally respiratory or systemic disease).

How to assess [Individual]

Ocular discharge is visually assessed by the assessor observing the goat from the front.
Appearance can vary from just wet hair in the lateral canthus of the eye to copious purulent discharge running down the face. Discharge may be watery or thick, transparent or whitish.

How to score

Each goat is scored in two levels. Ocular discharge from one eye is sufficient condition for scoring a goat with presence of ocular discharge.

Score 0

Absence of any ocular discharge.

Score 1

Presence of clearly visible discharge from both eyes.

OVERGROWN CLAWS

GOOD HEALTH
ABSENCE OF INJURIES

Description

Overgrown claws are those that, due to lack of wear and insufficient frequency of trimming, have excess horn tissue and/or are deformed.

How to assess [Individual]

Overgrown claws are visually assessed by the assessor at the rear of the goat. Only rear claws should be evaluated.
If the bedding material does not allow a good visualization of claw length, it should be moved aside in order to get a better view, or in extreme cases the limb should be carefully lifted for close examination, avoiding stress or injury to the animal.
A claw is considered overgrown when it exceeds the normal length and/or width leading to a loss of the common triangular profile.

How to score

One overgrow claw is sufficient condition for scoring a goat with overgrown claws.
Each goat is scored in two levels.

Score 0

Normal claw: perfectly healthy claw, right size and shape. Claws can have different sizes depending on the breed, so the important thing is to verify if it exhibits the regular triangular shape (in red).

Score 0

Claw with moderate overgrowth (acceptable): this claw is evidence of an excess of horn tissue, but the profile is not lost. This is not considered an overgrown claw.

Score 1

Overgrown claws: wall presents an excess of horn tissue so that the triangular shape is totally lost, leading to a completely deformed claw.

UDDER ASYMMETRY

GOOD HEALTH
ABSENCE OF INJURIES

Description

Asymmetry is the most prevalent udder problem in dairy goat farms and is related to infection and inflammation of the mammary gland. It is often associated with high somatic cell count, so it is likely that it may be a result of past intra-mammary infections, with subsequent fibrosis and gland atrophy. It is also associated with pain and discomfort.

How to assess [Individual]

Udder asymmetry is visually assessed by the assessor at the rear of the goat.
Evaluate each goat by positioning caudally to the animal so as to have a full view of the udder region. The goat should be standing.
Asymmetric udders are those in which one half is at least 25% longer than the other (excluding the teats).

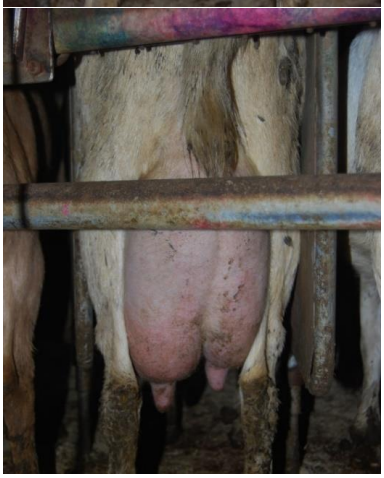
How to score

Each goat is scored in two levels.

Score 0

The udder is normal, because the two halves have the same size.

Score 0



The left half is longer than the right half, but it is not 25% longer than the right one (excluding the teats), therefore this is not an asymmetric udder.

Score 1

The right half is more than 25% longer than the left half. This is an asymmetric udder.

IMPROPER DISBUDDING

GOOD HEALTH
ABSENCE OF PAIN AND PAIN INDUCED BY MANAGEMENT PROCEDURES

Description

Improper disbudding is shown by the presence of residual horns (scurs) on the head of adult goats that were disbudded when kids. Scurs can press against the head or eye, causing lesions and pain. Scurs may be caught in fences and pen partitions, causing injuries and stress.

How to assess [Group]

Improper disbudding is visually assessed from outside the pen. When the feed is distributed and goats enter the feeding rack, the assessor moves along the feeding rack at a distance of 1.5 m from the feeding rack at the speed of 2 m/s. The assessor should be able to observe the head of each goat. Animals are “improperly disbudded” if they have been disbudded, but horn tissue of any type is still visibly present even without head manipulation.
If goats are not routinely disbudded, this indicator will not be collected.

How to score

Record the number of animals that are improperly disbudded.

Properly disbudded

No evidence of horn tissue on the goat’s head

Improperly disbudded

Presence of deformed scurs on the goat´s head

LATENCY TO THE FIRST CONTACT TEST

Description

The latency to the first contact test is applied to evaluate the quality of the human-goat relationship. Gently handled animals are more inclined to approach people and consequently suffer less stress related to handling procedures.

How to assess [Group]

Latency to the first contact test is assessed from inside the pen.
Approach the gate of the pen, wait for 30 s and then enter.
Walk to a pre-determined starting place inside the pen. The place chosen should be midway along the longest side of the pen, possibly by the wall, but if not by the feeding rack.
The test begins when the assessor, having arrived at the starting place, remains there and starts the stopwatch. During the test, the assessor should stand motionless, back against the wall.
Timing is stopped and the test finishes when the first goat nuzzles or touches any part of the assessor's body (including clothes, boots, stopwatch, hair, etc.). If no goat touches the assessor, the test is capped at 300 s.
During the test, the assessor should not stare directly at any of the goats, but should lower their gaze or look around the pen. Arms and hands should be kept alongside the body or behind the back. If the assessor holds a binder or a tablet, they should hold it still, for example, against the chest.
The test should be conducted when males are not in the pen with female goats (e.g. not during the breeding season) or, if they are present, they should be taken out during the execution of the test.

How to score

Check the stopwatch and record the time in seconds to the first contact between a goat and the assessor.

QUALITATIVE BEHAVIOUR ASSESSMENT

APPROPRIATE BEHAVIOUR
POSITIVE EMOTIONAL STATE

Description

The Qualitative Behaviour Assessment (QBA; Wemelsfelder 2007 Anim. Welfare, 16, 25-31) relies on the ability of humans to integrate perceived details of behaviour, posture, and context into the summarization of an animal's style of behaving, or "body language", using descriptors such as "relaxed", "tense", "frustrated" or "content". Such terms have an expressive, emotional connotation, and provide information that is directly relevant to animal welfare and may be a useful addition to information obtained from quantitative indicators.

How to assess [Group]

QBA is visually assessed from outside the pen. The assessment should not be performed on individual animals, but on the group; in the first level assessment the unit is the pen, in the second level is the farm, considering all pens with lactating goats, excluding infirmary, culling, quarantine or maternity pens.
Select the suitable observation points and, consequently, the timing of the observations. The selection of these points should reflect the different structures of the pen environment (e.g. deep straw pen, outside field). Each observation point should allow to have a good view of all animals in that area. The number of observation points depends on the complexity of the housing environment.
Observation sessions may last from 10 to 20 min, with the time spent at each observation point ranging from 2.5 (8 points) to 10 min (1 or 2 points), according to the following scheme:

Number of observation points	Duration of observation from each point (min)	Total observation time (min)
1	10	10
2	10	20
3	6.5	19.5
4	5	20
5	4	20
6	3	18
7	2.5	17.5
8	2.5	20

The assessment takes place during activity periods of goats, when different behavioural expression may be exhibited. Perform the assessment at least 30 min after feed distribution.

How to score

At the end of the observation period, find a quiet spot and score the list of descriptors (see below) using the visual analogue scale (VAS). The group will not be scored during the observation, and only one integrative assessment will be made per pen (in the first level) or per farm (in the second level) (integrate the information from each observation point).
Each VAS is 125 mm and is defined by its left "minimum" and right "maximum" point. "Minimum" means that, at this point, the expressive quality indicated by the term is completely absent in the whole group under observation. "Maximum" means that, at this point, this expressive quality is dominant across all observed animals. Intermediate scores depend on:

- number of animals showing that descriptor (e.g. how many goats showed an aggressive attitude during the observation period);
- intensity of the descriptor (e.g. the gravity of the level of aggressiveness);
- interactions with the rest of the group (e.g. to what extent the presence of the aggressive attitude of some goats can affect the emotional state of other goats in the pen).

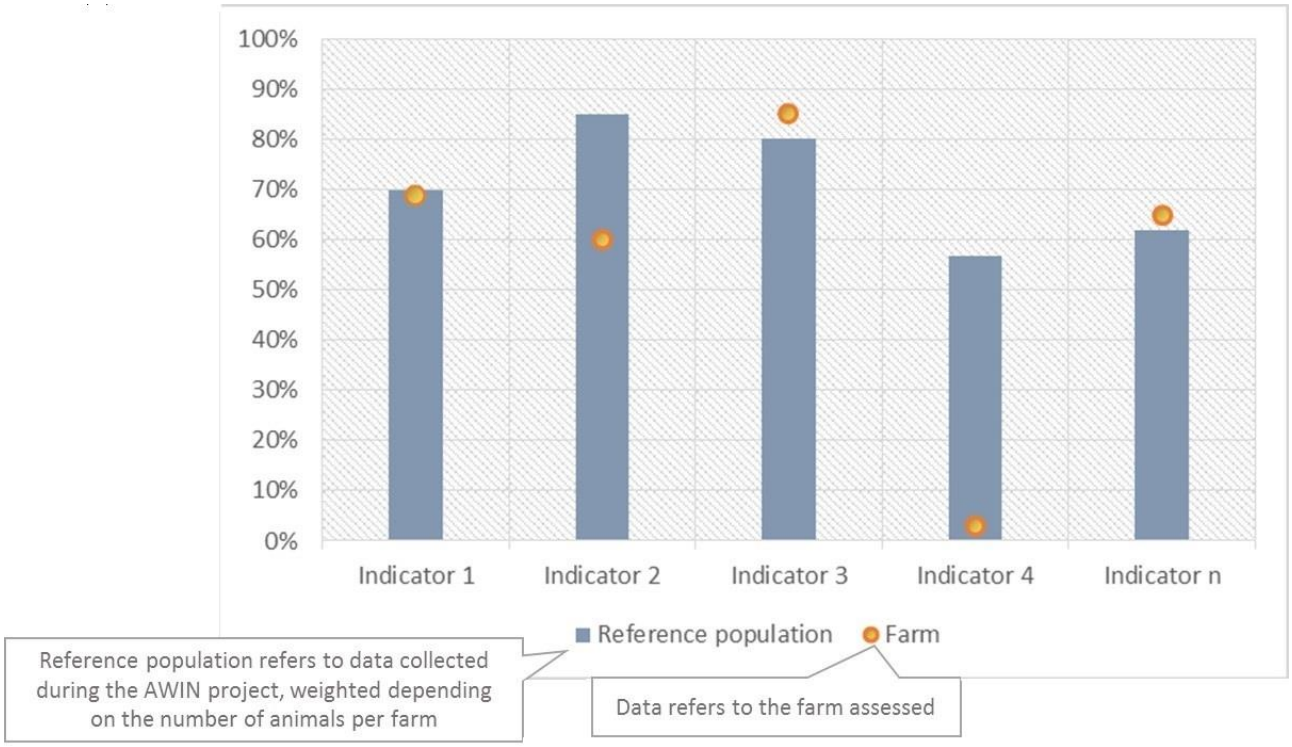
The measure for that descriptor is the distance in mm from the minimum point to the point where the VAS is ticked. It is important not to skip any descriptor and to follow the predefined order.

Descriptors

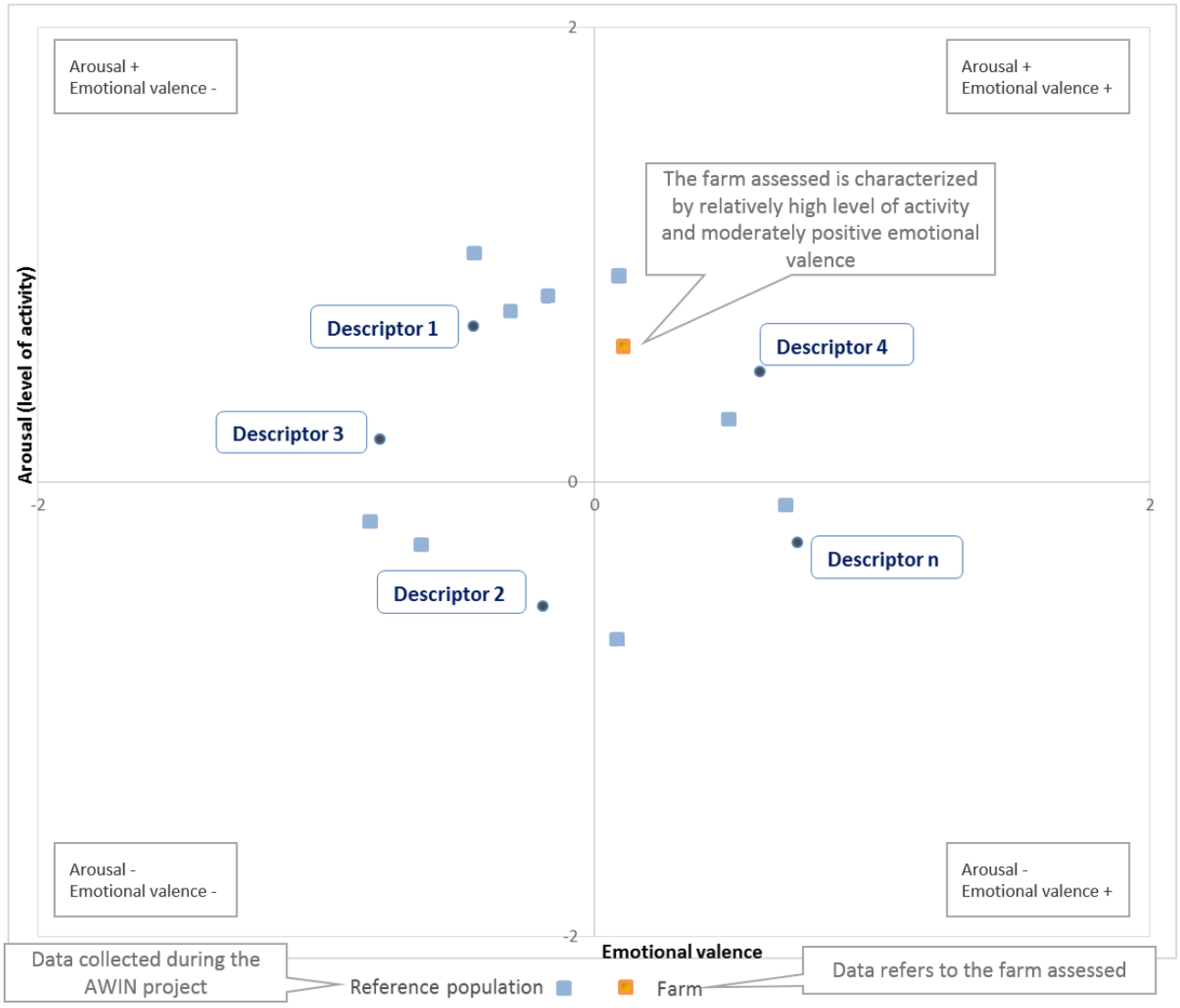
Aggressive	An aggressive goat bites other goats (especially the ears), voluntarily attacks or threatens other goats with the intention of hurting or disturbing them, butts the belly or the head of other goats. It is intentionally harmful to other goats. The aggressive behaviour can be related to dominance, fear or resource protection.
Agitated	An agitated goat is restless, not at ease, highly susceptible to stimuli, it can move her ears, vocalize or nervously move around.
Alert	An alert goat is on guard against danger, watchful and ready to react to a potential source of peril (e.g. sounds, person, object, animal). It can emit acoustic or visual alarm signals (e.g. vocalizations, snorts, stamping, ears in upright position, stiff body). It often stands motionless, directing its attention towards the potentially negative stimulus.
Bored	A bored goat is wearied, dull, or is uninterested in the surrounding environment (low reactivity); lack of stimulation; it may be looking for something to do.
Content	A content goat is appeased, gratified, happy, comfortable, at ease, satisfied about its environment, playful. It may jump, play and make noise with objects, climb or try to climb.
Curious	A curious goat is reactive, engaged in exploratory behavior, positively intrigued by something, attracted by the surrounding environment and by novelties (e.g. people, goats in oestrus, objects). It looks around but often concentrates its gaze in a specific direction or towards signal, which attracts its interest.
Fearful	A fearful goat is a scared and shy animal. It may look for shelter or for a way out and crouches down or may tend to hide in the middle of the group. There may be a whole group running around.
Frustrated	A frustrated goat is annoyed and impatient because it is prevented from achieving something (e.g. queuing at the feeding rack or at the water places, passive behaviour).
Irritated	An irritated goat is bothered or annoyed by something (e.g. flies, pruritus, noise, another goat) that can disturb, upset, trouble, or exasperate it.
Lively	A lively goat is active, busy and positively engaged in different activities, full of life and expressing energy.
Relaxed	A relaxed goat is at ease in the surrounding environment.
Sociable	A sociable goat is friendly to other goats. It has affiliative (e.g. grooming, sniffing, resting in pairs) and playful contacts with other goats.
Suffering	A suffering goat is enduring pain, often with contracted muscles, possibly in antalgic postures. It frequently shows little or no movement or reaction to stimuli and often remains isolated from the group.

5. OUTCOME OF WELFARE ASSESSMENT

After the assessment, welfare data should be entered into a data set and an objective descriptive output should be generated. The aim of the output is to give a visual feedback on the welfare of the animals on the farm, to highlight positive conditions and enable comparison with a reference population. Currently, the reference population displayed in the output refers to data collected during the AWIN project (30 Italian and 30 Portuguese intensive dairy goat farms). All the indicators are displayed in this output and the position of the assessed farm is highlighted in comparison to the median value of the reference population. All data used to calculate the proportion of each indicator is weighted according to the number of goats on the farm. An example is given below:



QBA could be considered as an additional indicator that is a valuable tool when discussing the general demeanour of the animals with the farm manager. In the QBA output, a Principal Component Analysis (PCA) plot is generated from the data of the reference population and farm values are included with those of the reference population and shown in a different colour. An example is given below:



5.1 First level welfare assessment

First level indicators are expressed as follows:

Welfare indicator	How to report data in the output
Hair coat condition	proportion of goats that have normal hair coat condition
Queuing at feeding	proportion of goats that are not queuing, considering only the scan when the highest proportion of goats was queuing
Queuing at drinking	proportion of goats that are not queuing, considering only the scan when the highest proportion of goats was queuing
Bedding	proportion of conditions (quantity and cleanliness) that are satisfied: 100% if bedding is sufficient and clean; 50% if bedding is sufficient but dirty; 50% if bedding is insufficient but clean; 0% if bedding is insufficient and dirty
Thermal stress	proportion of goats that show no sign of thermal stress
Kneeling at the feeding rack	proportion of goats that are not kneeling at the feeding rack
Severe lameness	proportion of goats that are not severely lame
Abscesses	proportion of goats without abscesses
Oblivion	proportion of goats that are not oblivious
Improper disbudding	proportion of goats that are properly disbudded
Latency to the first contact test	elapsed time in seconds (min 0 – max 300)*
Qualitative Behaviour Assessment	PCA plot

**This variable can be treated as time in survival analysis and thus the Kaplan Meier estimator is used to represent its distribution on each farm.*

The app for entering and analysing data of the first level welfare assessment is available on Google Play Store and App Store.

5.2 From first to second level welfare assessment

Performance of the second level assessment is recommended when there is a noncompliance with the current legislation or at least one of the following conditions is present for the any of the following indicators:

Welfare indicator	Condition
Abscesses, Improper disbudding, Hair coat condition, Severe lameness	the within-farm proportion of animals is lower than the proportion of animals observed in the worst 5% of the farms of the reference population
Queuing at feeding, Queuing at drinking	the within-farm proportion of animals is lower than the proportion of animals observed in the worst 5% of the farms of the reference population, considering only the scan when the highest proportion of goats was queuing
Latency to the first contact test	no goats touch the assessor during the 300 s of the test

5.3 Second level welfare assessment

Second level indicators are expressed as follows:

Welfare indicator	How to report data in the output
Body Condition Score	proportion of goats in normal body conditions (score 0)
Hair coat condition	proportion of goats that have normal hair coat condition
Queuing at feeding	proportion of goats that are not queuing, considering only the scan when the highest proportion of goats were queuing
Queuing at drinking	proportion of goats that are not queuing, considering only the scan when the highest proportion of goats were queuing
Bedding	proportion of conditions (quantity and cleanliness) that are satisfied: 100% if bedding is sufficient and clean; 50% if bedding is sufficient but dirty; 50% if bedding is insufficient but clean; 0% if bedding is insufficient and dirty
Thermal stress	proportion of goats that show no sign of thermal stress (score 0)
Kneeling at the feeding rack	proportion of goats that are not kneeling at the feeding rack
Severe lameness	proportion of goats that are not severely lame
Overgrown claws	proportion of goats with acceptable claws
Faecal soiling	proportion of goats without faecal soiling
Nasal discharge	proportion of goats without nasal discharge
Ocular discharge	proportion of goats without ocular discharge
Abscesses	proportion of goats without abscesses
Oblivion	proportion of goats that are not oblivious
Improper disbudding	proportion of goats that are properly disbudded
Latency to the first contact test	elapsed time in seconds (min 0 – max 300)*
Qualitative Behaviour Assessment	PCA plot

**This variable can be treated as time in survival analysis and thus the Kaplan Meier estimator is used to represent its distribution on each farm.*

TERMS AND DEFINITIONS

Animal-based indicator
Indicator that is taken directly from the animal.

Assessor
Person in charge of collecting data using the welfare assessment protocol developed by AWIN on a flock of animals.

Buck
Male goat. Typically refers to a breeding age male.

Crossbreed
The offspring resulting from mating a buck and a doe of different breeds

Dehorning
Removal of already formed horns.

Disbudding
Removal of horn buds (usually by cauterizing with a disbudding iron) from young goats to prevent horns from growing.

Farm
General designation for place/enterprise dedicated to animal production.

Farm manager
Person in charge of the planning and daily management of the farm (usually also the owner).

Infirmary pen
A pen for sick or injured animals.

Lactating goat
Female goat during the period of milk production.

Management-based indicator
Indicator which refers to husbandry procedures or decisions carried out by the farm manager or farmer.

Milking parlour
Place where the goats are milked.

Pen
Fenced or otherwise enclosed area where individuals or relatively small groups of animals are kept.

Quarantine pen
A pen housing newly acquired animals separately (to ensure that disease is not brought onto the farm), before they are mixed with existing animals.

Reference population
Reference population is defined by the geographic area where the assessment occurred and/or the time period when the assessment occurred and/or the type of animals covered by the assessment. Throughout this document, the term “reference population” refers to data collected during the AWIN project (30 Italian and 30 Portuguese intensive dairy goat farms).

Resource-based indicator
Indicator related to the environment or diet to which the animals are subjected.

Scan sampling
An observation strategy where a group of animals is scanned at set time intervals, and whatever each individual in the group is doing at the moment the scan is made (Martin & Bateson 2007 Measuring Behaviour: An Introductory Guide. Cambridge University Press, Cambridge, UK).

Scur
Odd-shaped horn resulting from improper disbudding or delayed disbudding.

Welfare assessment protocol
A welfare assessment protocol is a description of the procedures and requirements for the overall assessment of welfare.

Welfare criterion
A welfare criterion represents a specific area of welfare, which indicates an area of welfare concern (WQ®).

Welfare indicator
An observation, a record or a measurement used to obtain information on animal welfare.

Welfare principle
A welfare principle is a collection of criteria associated with one of the following areas: feeding, housing, health and behaviour (WQ®).

Units of measure are abbreviated according to standard International System of Units usage.

APPENDIX A – FIRST LEVEL WELFARE ASSESSMENT RECORDING SHEET (GROUP ASSESSMENT)

Background information

Date:	Assessor:	Farm:
Country:	Region:	Town:
Number of pens:	Pen ID:	Number of lactating goats in the assessed pen:

Welfare assessment

Improper disbudding	Number of improperly disbudded goats: ☐ NA	
Abscesses	Number of goats with abscesses (only head, neck and shoulder): ☐ NA	
Kneeling at the feeding rack	Number of goats in kneeling position at the feeding rack: ☐ NA	
Queuing at feeding	Number of queuing goats at feeding ☐ NA	
	Scan1:	
	Scan2:	
	Scan3:	
	Scan4:	
	Scan5:	
	Scan6:	
	Scan7:	
	Scan8:	
Queuing at drinking	Number of queuing goats at drinking ☐ NA	
	Scan1:	
	Scan2:	
	Scan3:	
	Scan4:	
	Scan5:	
	Scan6:	
	Scan7:	
	Scan8:	
Hair coat condition	Number of goats with poor hair coat condition: ☐ NA	
Oblivion	Number of oblivious goats: ☐ NA	
Thermal stress	Number of goats showing heat stress signs: Number of goats showing cold stress signs: ☐ NA	
QBA	*(see specific recording sheet below)* ☐ NA	
Latency to the first contact test	Time (s): ☐ NA	
Bedding	Quantity ☐ Insufficient ☐ Sufficient ☐ NA	Cleanliness ☐ Dirty ☐ Clean ☐ NA
Severe lameness (including kneeling in the pen)	Number of severely lame goats: ☐ NA	

NA = Not applicable

Qualitative Behaviour Assessment

AGGRESSIVE

AGITATED

ALERT

BORED

CONTENT

CURIOUS

FEARFUL

FRUSTRATED

IRRITATED

LIVELY

RELAXED

SOCIABLE

SUFFERING

APPENDIX B1 – SECOND LEVEL WELFARE ASSESSMENT RECORDING SHEET (GROUP ASSESSMENT)

Background information

Date:	Assessor:	Farm:
Country:	Region:	Town:
Number of pens:	Pen ID:	Number of lactating goats in the assessed pen:

Welfare assessment

Improper disbudding	Number of improperly disbudded goats: ☐ NA	
Kneeling	Number of goats in kneeling position at the feeding rack: ☐ NA	
Queuing at feeding	Number of queuing goats at feeding ☐ NA	
	Scan1:	
	Scan2:	
	Scan3:	
	Scan4:	
	Scan5:	
	Scan6:	
	Scan7:	
	Scan8:	
Queuing at drinking	Number of queuing goats at drinking ☐ NA	
	Scan1:	
	Scan2:	
	Scan3:	
	Scan4:	
	Scan5:	
	Scan6:	
	Scan7:	
	Scan8:	
Hair coat condition	Number of goats with poor hair coat condition: ☐ NA	
Oblivion	Number of oblivious goats: ☐ NA	
Thermal stress	Number of goats showing heat stress signs: Number of goats showing cold stress signs: ☐ NA	
QBA	*(see specific recording sheet below)* ☐ NA	
Latency to the first contact test	Time (s): ☐ NA	
Bedding	Quantity ☐ Insufficient ☐ Sufficient ☐ NA	Cleanliness ☐ Dirty ☐ Clean ☐ NA
Severe lameness (including kneeling in the pen)	Number of severely lame goats: ☐ NA	

NA = Not applicable.

Qualitative Behaviour Assessment

AGGRESSIVE

AGITATED

ALERT

BORED

CONTENT

CURIOUS

FEARFUL

FRUSTRATED

IRRITATED

LIVELY

RELAXED

SOCIABLE

SUFFERING

APPENDIX B2 – SECOND LEVEL WELFARE ASSESSMENT RECORDING SHEET (INDIVIDUAL ASSESSMENT)

Background information

Date:	Assessor:	Farm:
Country:	Region:	Town:
Number of pens:	Pen ID:	Number of lactating goats in the assessed pen:

Individual assessment

Goat ID	BCS (-1/0/1/NA)	Faecal soiling (0/1/NA)	Overgrown claws (0/1/NA)	Abscesses (0/1/NA)	Udder asymmetry (0/1/NA)	Ocular discharge (0/1/NA)	Nasal discharge (0/1/NA)

Goat ID: Identification; **BCS:** -1 - Very thin, 0 - Regular, 1 - Very fat, NA - Not applicable; **Faecal soiling:** 0 - Absence, 1 - Presence, NA - Not applicable; **Overgrown claws:** 0 - Absence, 1- Presence, NA - Not applicable; **Abscesses:** 0 - Absence, 1 - Presence, NA - Not applicable; **Udder asymmetry:** 0 - Absence, 1 - Presence, NA - Not applicable; **Ocular discharge:** 0 - Absence, 1 - Presence, NA - Not applicable; **Nasal discharge:** 0 - Absence, 1 - Presence, NA - Not applicable.

APPENDIX C – GENERAL ASSESSMENT QUESTIONNAIRE

Assessment of management- and resource-based indicators for lactating dairy goats[3]

I. Background information

Date:	Assessor:	Farm:
Country:	Region:	Town:

Weather condition	☐ Sunny ☐ Partially cloudy ☐ Cloudy ☐ Foggy ☐ Rainy ☐ Thunderstorm ☐ Snow
Wind	☐ Absent ☐ Light wind ☐ Strong wind
Indoor temperature (T°):	
Indoor relative humidity:	

II. Details of the farm manager

Age of farm manager (years):	
Sex of farm manager	☐ Male ☐ Female

III. Resource-based check-list

Breeds	Number of adult Saanen: Number of adult Alpine: Number of adult crossbreeds: Other breeds (specify:_____)

Number of pens with lactating goats:

Pen	Number of lactating goats	Length (m)	Width (m)	Number of feeding spaces*	Total length of feed trough(s) (m)	Number of functioning water places**	Total length of water trough(s) (m)***	Presence of horned and dehorned goats (Y/N)
1								
2								
3								
4								
5								
6								
7								

** to be filled only if there is a feeding rack with partitions*
*** to be filled in case of buckets or automatic drinkers*
**** to be filled in case of linear water troughs*

[3]*The answers to this questionnaire will not be included in the final outcome, but they can be used for identifying risk factors and understanding the underlying reasons for any welfare problem that may arise from the protocol.*

Flooring material	☐ Concrete ☐ Soil ☐ Wood ☐ Rubber ☐ Other (specify: _____)		
Bedding material	☐ Straw ☐ Wood shavings ☐ No bedding ☐ Other (specify:_____)		
Presence of outdoor grazing or exterior pen	☐ Yes ☐ No	If Yes,	How many days/year?:____ How many hours/day?:____
Type of milking parlour	☐ Manual ☐ Automatic		
Number of milking points:			
Number of replacement goats per year:			

IV. Management-based questionnaire

Pen grouping strategy	☐ No specific strategy ☐ Production level ☐ Days in milking ☐ Goats' age ☐ Breed ☐ Out-of-Season Breeding ☐ Health reason
Is regrouping done?	☐ Yes ☐ No
If yes, how often?	☐ Daily ☐ Once a month ☐ Once a year ☐ Twice a year ☐ Three times a year ☐ Out of season breeding
How often is new bedding replaced?	☐ Once/week ☐ Twice/month ☐ Once/month ☐ Every two months ☐ Every three months ☐ Twice/year ☐ Once/year ☐ When necessary
How often is new bedding added?	☐ Everyday ☐ Three times/week ☐ Twice/week ☐ Once/week ☐ Twice/month ☐ Once/month ☐ When necessary
Number of feed deliveries/day	☐ Once ☐ Twice ☐ Three times ☐ Four times
Frequency of claw trimming	☐ No routine, done whenever necessary ☐ Every three months ☐ Every six months ☐ Every year
Age of goats at first kidding (months):	

Are all goats subjected to a dry period?	☐ Yes ☐ No	
If Yes, for how long are the goats dry?		If No, which percentage of goats is not dried?
Is disbudding done routinely?	☐ Yes ☐ No	
Pain management in disbudding	☐ Yes ☐ No	
Age of the animals at disbudding (days):		
Is dehorning done routinely?	☐ Yes ☐ No	
Pain management in dehorning	☐ Yes ☐ No	
Are sick goats isolated (presence of infirmary?)	☐ Yes ☐ No	
How important do you think it is to touch the goats gently?	☐ Not important ☐ Little important ☐ Partially important ☐ Rather important ☐ Very important	
How important do you think it is to talk to the goats during milking?	☐ Not important ☐ Little important ☐ Partially important ☐ Rather important ☐ Very important	
Do you use a stick when you enter the pen?	☐ Yes ☐ No	
If Yes, why?	☐ Moving the animals ☐ Beating the animals ☐ Safety tool	
When you enter the pen, what do most goats do?	☐ They approach you ☐ They stay still ☐ They go away	
How much do you think pain matters to goats?	☐ Very little ☐ Little ☐ Sufficiently ☐ Much ☐ Very much	

V. Data-driven indicators (overall farm, referred to the previous year)

Average age of lactating goats (months):		
Mean parity:		
Annual mean Somatic Cell Count:		
Herd average annual milk yield (kg):		
Annual mean milk content	Fat (%):	Protein (%):
Mortality	Adults (% of animals):	Kids (% of animals):
Culling strategy:	☐ Age of the animals ☐ Diseases or injuries ☐ Low milk production	

AWIN CONSORTIUM

	AWIN partners	Country
SRUC	Scotland's Rural College, Edinburgh	Great Britain
NORWEGIAN UNIVERSITY OF LIFE SCIENCES	Norwegian University of Life Sciences, Ås	Norway
UNIVERSITÀ DEGLI STUDI DI MILANO	Università degli Studi di Milano, Milan	Italy
neiker tecnalia	Neiker-Tecnalia, Vitoria-Gasteiz	Spain
UNIVERSIDADE POSITIVO	Universidade Positivo, Curitiba	Brazil

UNIVERSITY OF CAMBRIDGE	University of Cambridge, Cambridge	Great Britain
FACULDADE DE MEDICINA VETERINÁRIA	Universidade de Lisboa, Lisbon	Portugal
INDIANA UNIVERSITY	Indiana University, Bloomington	USA
VÝZKUMNÝ ÚSTAV ŽIVOČIŠNÉ VÝROBY, v.v.i. INSTITUTE OF ANIMAL SCIENCE	Institute of Animal Science, Prague	Czech Republic
PFERDEKLINIK HAVELLAND	Pferdeklinik Havelland, Equine Clinic, Beetzsee-Brielow	Germany
UNIVERSIDADE DE SÃO PAULO FACULDADE DE MEDICINA VETERINÁRIA E ZOOTECNIA	Universidade de São Paulo, Pirassununga	Brazil

Colophon

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