

Protocol for Scoring the Welfare Status of Dromedary Camels

Barbara Padalino, Laura Menchetti, Tanja Schmidt



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA
DEPARTMENT OF
AGRICULTURAL AND FOOD SCIENCES



ANIMALS' ANGELS

we are there with the animals

**IMPRINT:**

Publisher: Animals' Angels e.V., Rossertstr. 8, 60323 Frankfurt, Germany, www.animals-angels.de, kontakt@animals-angels.de
Authors: Barbara Padalino (Division of Animal Sciences, Department of Agricultural and Food Sciences, University of Bologna, Bologna, Italy), Laura Menchetti (Division of Animal Sciences, Department of Agricultural and Food Sciences, University of Bologna, Bologna, Italy), Tanja Schmidt (Animals' Angels) **Layout:** Ute Vogt Kommunikationsdesign, www.utevogt.com
Photos: Animals' Angels e.V., Barbara Padalino, Davide Monaco **Print:** Druckerei Bender GmbH, Hauptstraße 27, 35435 Wettenberg, Germany *Printed on 100% recycled paper*

Foreword**Camel welfare, a new challenge for camel farming**

For the general public, large camelids are associated with the image of the animal from large spaces, adapted to arid zones with extreme climatic conditions, which allows it to survive where many other domestic species are unable to feed, reproduce, or simply resist to the most hostile elements of the environment (heat, sandstorm, scarcity of resources...). This ability has made the camel, the famous "ship of the desert" sung by Arab poets and bards of the ancient trans-Saharan trade routes. Faced with such hostile environment, the concept of "well-being" appears somewhat off-set, the living conditions of this animal being inherently difficult and independent of man.

However, camel breeding has been undergoing rapid change in recent decades. Even if this concerns for the moment only a fringe of the world's camel population, these radical changes in the mode of farming, summarized under the very imprecise name of intensification, are not without consequences on the physiology, metabolism, and comfort of the animal. From the desert to the barn, from the incessant search for diverse desert grasses to monotonous feeds distributed at best twice a day, from permanent mobility in search of pasture and water to forced settlement, from episodic contact with his camel farmer to an increased submission to the requirements of modern animal husbandry, here is our animal adapted to large spaces reduced to a homely lifestyle. Therefore, the question of his well-being arises in different terms, even if life in the desert is not devoid (far from it) of major constraints.

The authors of this document must be credited with doing pioneering work, for it is nothing else than laying the foundations for quantifying well-being in these new conditions. In this new breeding method, how to respect, observe and assess the living conditions of our camels? Shall we reach their nutritional and water requirements? Do they have access to sufficient space? Do we know how to protect them from extreme conditions? Are we taking sufficient care of them? Are we able to identify their suffering, their anxieties, and their stresses? These are all questions that this document attempts to answer by providing the keys to analyze as objectively as possible the level of well-being of our "desert ship" now docked.

Dr Bernard Faye
 Camel expert
 Chairman of ISOCARD

1. Table of Contents	2		
2. Introduction	6		
3. Aim	6		
4. Preliminary information	6		
4.1. Contact the farm manager and/or pen caretaker	7		
4.2. Equipment	7		
4.3. Biosecurity	7		
4.4. Arriving and working	7		
4.5. Safe handling	8		
4.6. Sampling	8		
4.7. Selecting animals/pens for assessment	8		
5. Welfare protocol for dromedary camels	9		
5.1. Assessment levels: Caretaker, Herd and Animal Level	9		
5.2. Procedure	10		
Caretaker Level	10		
Herd Level	11		
Animal Level	11		
6. Welfare protocol of dromedary camels	12		
6.1. Welfare indicators on the Caretaker Level	12		
6.2. Welfare indicators at Herd Level	13		
Good Feeding	13		
Water availability	13		
Food supply	15		
Good Housing	17		
Freedom of movement, dimensions, shaded areas, and condition of the pen	17		
Good Health	20		
Classification	20		
Injury	21		
Sickness/Disease	21		
Pain	21		
Injuries sustained from halters, tethering or other management procedures, camels with cauterization or nose rings	22		
Cauterization	23		
Appropriate Behaviour	24		
Classification	25		
6.3. Welfare indicators on the Animal Level	26		
Good Feeding	26		
BCS	26		
Bucket test	28		
Good Housing	29		
Shade	29		
Insects	29		
Tethering and hobbles: Equipment for handling camels	29		
		Resting behaviour	32
		Good Health	32
		Presence of diseases and injuries	33
		Swollen joints	34
		Lameness	35
		Skin disease	36
		External parasites	38
		Discharges	39
		Nasal discharge	39
		Eye discharge	39
		Vulva discharge	40
		Diarrhoea	40
		Abnormal udder	41
		Abnormal breathing	41
		Coughing	42
		Pain	42
		Other clinical signs	42
		Swelling	43
		Prolapse	44
		Appropriate Behaviour	44
		Approaching test	45
		7. Scoring system	46
		7.1. Scoring of measures	46
		7.2. Calculation of Partial Indices (PI)	48
		7.3. Calculation of Level Aggregate Indices (LAIs)	48
		7.4. Calculation of Principle Aggregate Indices (PAIs)	49
		7.5. Calculation of the Total Welfare Index (TWI)	50
		7.6. Classification of camel unit	50
		8. Disclaimer and legal aspects	51
		9. Appendix	52
		Annex 1. Scoring system: An example of recording sheets for scoring the measures	52
		Annex 2. Scoring system: Highest possible total score of each principle and assessment level (whether all measures can be scored)	56
		Annex 3. Scoring system: Examples of Partial Indices (PI) calculation	57
		Annex 4. Scoring system: An example of Level Aggregate Indices (LAIs) calculation	59
		Annex 5. Scoring system: An example of Principle Aggregate Indices (PAIs) calculation	59
		Annex 6. Scoring system: An example of Total Welfare Index calculation	59
		Annex 7. Pen Classification: An example of pen classification according to Principle Aggregate Indices	60
		10. Table of figures	61
		11. List of tables	62

2. Introduction

Despite increasing interest in camel rearing, little is known about the welfare of camels, as both scientific research and legislative regulations are lacking. Recent bibliometric research¹ has pointed out that, although the scientific interest in the camel species has grown, little attention has been paid to camel welfare issues. Significant knowledge gaps remain concerning camel physiology and behaviour, as well as the impact of different housing systems and the camel-human relationship.

Padalino and Menchetti² were the first to apply an assessment protocol in camels kept in intensive system and develop a model considering overall welfare indices and classifying pens in which camels are kept according to their welfare level. This assessment protocol is based on their model. The protocol provides practical tools to assess the care and housing of camels with regard to their welfare. Both the animals and the stakeholders will benefit from this animal welfare assessment instrument. The assessment scheme makes it possible to compare different housing systems with each other. It focuses on critical aspects of farming that could negatively impact camel welfare as indicated by the Five Freedoms paradigm: thirst, hunger, discomfort, pain, distress, and abnormal behaviours³.

This is the first version of the evaluation protocol. With increasing experience and new scientific findings, the protocol will be updated and developed continuously.

3. Aim

The aim of this booklet is to describe a recently published camel welfare assessment method in an accessible manner. The method can be applied to intensive and semi-intensive housing systems and implements both animal welfare and environmental measures. The measures described allow us to calculate a Total Welfare Index, to identify possible hazards and to suggest corrective measures in order to enhance the welfare of camels. In order to develop an official and standard scoring system valid for each type of camel reared in a specific husbandry system, the protocol would need to be applied at several farms in different countries. Until then, some of the scorings serve as an example.

4. Preliminary information

The purpose of this section is to ensure that assessors know how to organise a visit, how to behave on a camel holding and how to address the pen manager or caretaker.

Before approaching the pen manager or caretaker, assessors should be sure that they have a good understanding of

- how the protocol works,
- possible limitations of the protocol.

¹ Pastrana CI, González FJN, Ciani E, Capote CJB, Bermejo JVD. Effect of research impact on emerging camel husbandry, welfare and social-related awareness. *Animals* (2020) 10: doi:10.3390/ani10050780

² Padalino B, Menchetti L. The First Protocol for Assessing Welfare of Camels. *Front Vet Sci.* 2021 Jan 28;7:631876. doi: 10.3389/fvets.2020.631876

³ Farm Animal Welfare Council Five Freedoms. *Farm Anim Welf Counc;* (2009) 5 Available online at: Manteca X, Mainau E, Temple D. What is animal welfare? (2012). www.fawec.org/media/com_lazypdf/pdf/fs1-en.pdf (accessed November 02, 2021)

4.1. Contact the farm manager and/or pen caretaker

Be sure to contact the farm manager and/or the pen caretaker and schedule an appointment for the visit.

During the interview with the farm manager/camel caretaker, the assessors should

- clarify the objectives and schedule of their visit,
- discuss any methods that will be applied,
- discuss the nature of the caretakers' involvement as well as the duration of their involvement,
- ask for permission to enter the camel pens,
- emphasise that the welfare assessment is not dangerous to either the camels or the people involved,
- explain that the procedures carried out as part of the welfare assessment are non-invasive and are comparable to the routine procedures that any camel caretaker would carry out as part of their daily checks,
- clarify that no special arrangements will be made, and changes in the daily routine will be kept to a minimum.

4.2. Equipment

The application of the protocol requires weather stations, meters, thermometers, anemometers, photo cameras, video cameras for further behavioural analysis, evaluation/recording sheets (provided in the booklet), pens, markers, stop-watches, buckets, and water. Behavioural software (e.g. Observer[®]) could be useful for analysing behaviours.

4.3. Biosecurity

Biosecurity is an important issue. Welfare assessor should not become a potential source for spreading disease. If a camel shows signs of an infectious disease (e.g. discharge, diarrhoea), the animal must not be touched.

Clean clothing, shoes/boots, and hygienic work practices are essential.

4.4. Arriving and working

When arriving, assessors should look for the camel owner and/or caretakers responsible for the animals and ask about any safety rules that may be in place. They should also inquire whether any of the animals require special handling.

The sequence of the animal assessment protocol should be explained in detail so that the assessment can be carried out without disrupting the work routine.

When walking around the site, assessors should be discreet. Any disturbance to people and animals must be kept to a minimum.

When entering the pen, it is important to know how the camels will behave. This not only ensures appropriate assessment but also enables the identification of aggressive, threatening or fearful behaviour, thereby minimising the risk of injuries to the assessors.

Further points should be considered while on the premises:

- Do not leave gates and doors open after passing through
- Avoid talking too loudly and making sudden movements
- Do not leave objects within reach of the animals
- Avoid being licked on the hands
- Avoid touching the camels unless necessary

If records are to be checked, assessors should always ask permission and, if possible, consult with the owner or person in charge.

4.5. Safe handling

This welfare assessment protocol is intended for use by trained assessors. Safety and welfare are of great importance. Assessors, caretakers or animals should never be put in danger. The assessment must be stopped if a camel exhibits behaviour that may be dangerous to the people involved or to the animal itself.

4.6. Sampling

This welfare protocol has been developed for assessing the welfare of dromedary camels kept in intensive and semi-intensive systems. The protocol will be adapted according to the needs of other camels in different types of housing systems.

4.7. Selecting animals/pens for assessment

A selection of camel stalls/pens to be assessed may be applied following the rules suggested by the AWIN protocol for goats (Awin, 2015⁴) and stratifying according to the category of animals kept in the pens (young, adults, pregnant, and lactating). The pens should be selected randomly, excluding the pens used as an infirmary, for culling, and quarantine. Namely, if <2 pens are present at the farm, all pens will be assessed; if the farm has 3-7 pens, two pens (i.e. paddocks or stables) will be assessed; if the farm has 8-10 pens, three pens would be assessed; finally, if the farm has more than 10 pens, 25% of the pens would be assessed.

Table 1: Number of pens to be assessed

N° pens* in the farm	N° pens to be assessed
1-2	All pens
3-7	2 pens
8-10	3 pens
>10	25% of the pens

* paddock/housing facilities

The number of animals to be assessed should be chosen according to the rules proposed by AWIN for goats' selection⁴, assuming a 50% prevalence, a confidence interval of 95%, and an accuracy of 10%. However, to minimise the impact on camels, non-restrictive criteria, such as a level of confidence of 90% or less, or rules of thumb could be adopted.

Table 2: Number of camels to be assessed

N° camels at the farm	N° camels to be assessed
<15	All animals
15-29	13-19
30-49	21-28
50-99	29-39
100-149	41-44

* The sample size is calculated for an expected variation of 0.5, at a 0.9 confidence level and a precision estimate (δ) of 0.1.

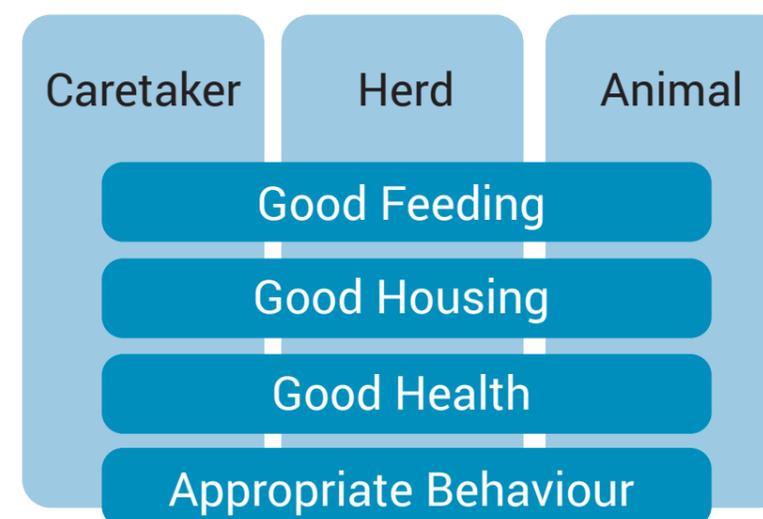
⁴ AWIN. Goats AWIN welfare assessment protocol. (2015) doi:10.12120/AWIN_GOATS_2015

5. Welfare protocol for dromedary camels

5.1. Assessment levels: Caretaker, Herd and Animal Level

This protocol includes a combination of animal-, resource- and management-based measures, which are assessed at three levels: the Caretaker Level (face-to-face interview), the Herd Level (inspection of the herd and housing facilities), and the Animal Level (examining the behaviour and health status of individual camels) (see Figure 1).

Figure 1: The welfare principles of "Good Feeding", "Good Housing", "Good Health" and "Appropriate Behaviour" are evaluated at three levels: the Caretaker Level, the Herd Level, and the Animal Level (modified after Padalino and Menchetti⁷).



The proposed measures were presented for each animal welfare principle according to the Welfare Quality⁵ and AWIN⁶ methods. The protocol is designed to evaluate camel welfare⁷ and to classify camel husbandry in terms of welfare (see Table 3). It guides assessors through each welfare principle at all three levels. A scoring method is applied, taking the animal welfare principles into account at all three levels (see Table 15, page 57).

⁵ Welfare Quality®. Welfare Quality® assessment protocol for cattle. Welfare Quality® Consortium Lelystad, The Netherlands, 2009: pp. 1–142.

⁶ AWIN. Welfare Assessment Protocol for Horses. Available online: <https://air.unimi.it/retrieve/handle/2434/269097/384836/AWINProtocolHorses.pdf>. (accessed on 15 June 2020)

⁷ Padalino B, Menchetti L. The First Protocol for Assessing Welfare of Camels. Front Vet Sci. 2021 Jan 28;7:631876. doi: 10.3389/fvets.2020.631876

Table 3: Camel welfare indicators were selected by researchers for the principles of Good Feeding, Good Housing, Good Health and Appropriate Behaviour.

Welfare Principle	Level of Investigation		
	Caretaker	Herd	Animal
Good Feeding	<ul style="list-style-type: none"> • Feed and water management 	<ul style="list-style-type: none"> • Feed and water locations • Feed and water availability • Feed and water quality • Feed and water space per animal • Salt availability • Feeding, drinking and ruminating camels 	<ul style="list-style-type: none"> • Body Condition Score • Thirst Index
Good Housing	<ul style="list-style-type: none"> • Caretaker's work experience • Number of animals handled by the caretaker in the busiest week • Exercise/pasture duration in hours (if any) 	<ul style="list-style-type: none"> • Space per camel • Shaded areas • Fence condition • Bedding • Waste • Hobbled/tethered camels 	<ul style="list-style-type: none"> • Resting behaviour • Location (in the sun/shade) • Insects (quality, quantity) • Tethered • Hobbled
Good Health	<ul style="list-style-type: none"> • Diseases observed in the past • Camel health check • Medical treatments 	<ul style="list-style-type: none"> • Camels suffering from a disease • Physical injuries • Scars from hobbles, cauterization, nose-ring • Camels in pain 	<ul style="list-style-type: none"> • Diseases • Physical injuries • Locomotory disorders • Skin disorders, discharge, mastitis or abnormal udder • Respiratory disorders • pain
Appropriate Behaviour	<ul style="list-style-type: none"> • Experience in camel handling • Skills in identifying distress • Reported behavioural problems 	<ul style="list-style-type: none"> • Camels resting, standing quietly, aggressive • Camels displaying behavioural disorders and other abnormal behaviour 	<ul style="list-style-type: none"> • Social interaction • Behavioural disorders • Abnormal behaviour • Feeding and rumination • Approaching test

5.2. Procedure

The on-site welfare assessment will be carried out outside as well as inside the stall/pen where the animals are kept (see Figure 2). The protocol consists of the three levels mentioned above. At each level, the animal welfare principles of "Good Feeding", "Good Housing", "Good Health", and "Appropriate Behaviour" are applied. As a first step, please contact the camel farm manager or caretaker.

The farm welfare assessment should be carried out at a scheduled time, for example, 10:00 a.m., respecting the farm's routine practices and using the recording sheets provided in this booklet.

Caretaker Level

This level includes a friendly, face-to-face interview with the caretaker. Therefore, it is important that the assessor speaks the language of the caretaker or that a translator is present. The initial questions are designed to gain information on caretaker details. Other specific questions are related to each welfare principle. The interview can be held anywhere, whilst a comfortable environment is of course preferable.

Herd Level

To assess the herd, the assessor must have a profound understanding of camel behaviour and health. Ideally, the assessment is carried out by an experienced veterinarian. The Herd Level entails a herd and environment check (i.e. stall/pen).

It includes robust and feasible indicators requiring no or minimal handling. Resource- and management-based indicators were chosen for the "Good Feeding" and "Good Housing" criteria, while mainly animal-based indicators were chosen for the "Good Health" and "Appropriate Behaviour" criteria.

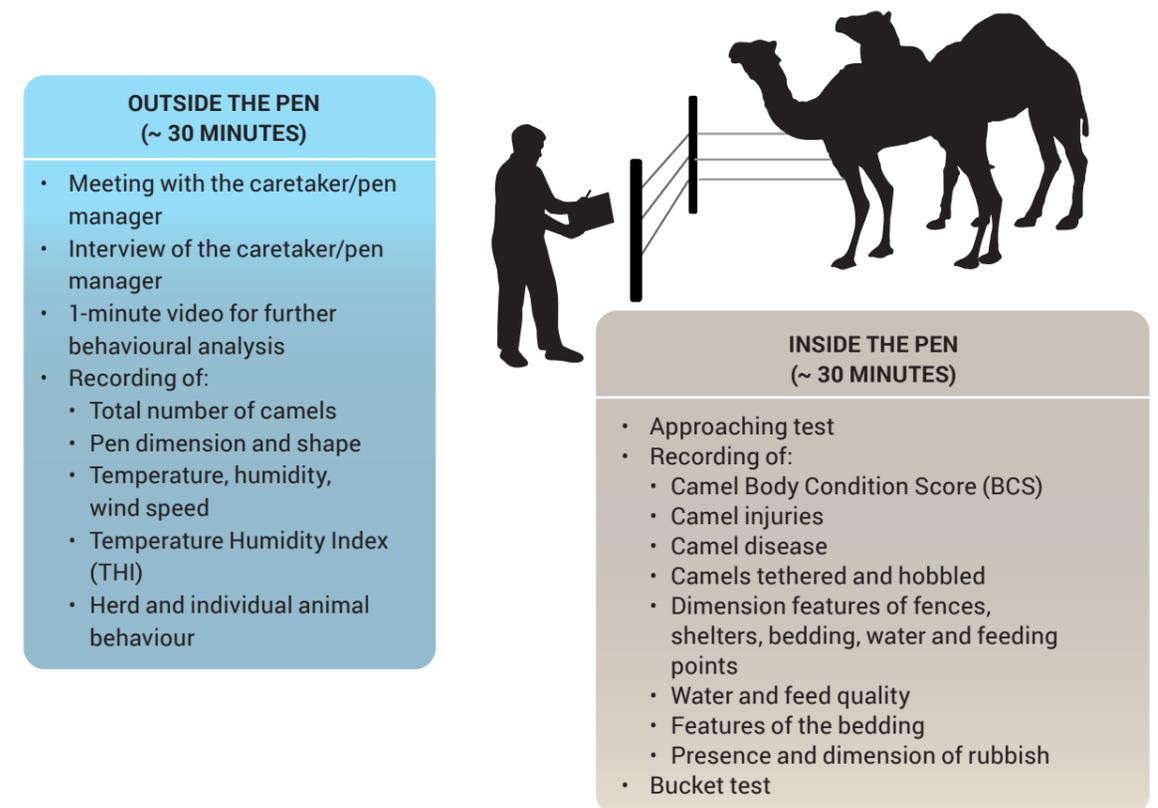
When collecting data at Herd Level, the assessor moves closer to the pen, but aims to attract as little attention as possible. Remaining outside of the pen, the assessor should observe the animals, obtaining a first impression of the camels' attitudes and behaviours. A video could also be made for the behavioural observations. It is necessary to enter the pen when collecting further data.

Animal Level

In order to assess the individual animal, the assessor must also possess in-depth knowledge of camel behaviour and health. Therefore, it would be ideal to have an experienced veterinarian evaluate the animal.

To assess the animal at this level, the selected camel should be observed standing outside of the pen. This is followed by a closer assessment inside the pen. The caretaker's consent should be obtained before entering the pen, and the assessor should inquire about possible dangers and aggressive animals. Depending on the size of the herd, a certain number of camels are selected, and their data is included in the assessment (see Table 1 and Table 2).

Figure 2: Camel welfare assessment: Protocol steps proposed by Padalino and Menchetti²



6 Welfare protocol of dromedary camels

6.1. Welfare indicators on the Caretaker Level

A caretaker's experience in handling and caring for camels plays a significant role in the camels' welfare. The caretaker is responsible for recognising the needs of the camels and providing for them in the best possible way. Especially health care, feeding, and the recognition of diseases and pain play an essential role. Menchetti et al.⁸ have found a correlation between the caretaker's experience and several indicators such as injury and disease.⁹

Table 4: Camel welfare recording sheet at Caretaker Level

	Date _____	Assessor _____	Farm _____	ID caretaker _____
Good Feeding	How often do you feed the camels?	_____ time(s)/day	<input type="checkbox"/> Ad libitum	
	How often do you water the camels?	_____ time(s)/day	<input type="checkbox"/> Ad libitum	
Good Housing	How long have you worked with camels?	_____ years		
	Please estimate how many camels are reared at the farm during your busiest week of the year.	_____ camels		
	Do you keep other animal species at the farm?	<input type="checkbox"/> Yes (specify) _____	<input type="checkbox"/> No	
	What is the rearing purpose of your camels?	<input type="checkbox"/> Meat <input type="checkbox"/> Milk <input type="checkbox"/> Other		
	Are the camels exercised?	<input type="checkbox"/> Yes <input type="checkbox"/> No		
Good Health	Do you change the management/housing according to season?	<input type="checkbox"/> Yes <input type="checkbox"/> No		
	Who assesses the camels' health?	<input type="checkbox"/> Vet <input type="checkbox"/> Non Vet <input type="checkbox"/> Not conducted		
	Who treats the camels when they are sick?	<input type="checkbox"/> Vet <input type="checkbox"/> Non Vet <input type="checkbox"/> Not conducted		
	Who administers vaccinations to the camels?	<input type="checkbox"/> Vet <input type="checkbox"/> Non Vet <input type="checkbox"/> Not conducted		
	Who administers endoparasite treatments to the camels?	<input type="checkbox"/> Vet <input type="checkbox"/> Non Vet <input type="checkbox"/> Not conducted		
	Who administers ectoparasite treatments to the camels?	<input type="checkbox"/> Vet <input type="checkbox"/> Non Vet <input type="checkbox"/> Not conducted		
	Which health problems have you observed in the camels over the last year?	<input type="checkbox"/> None <input type="checkbox"/> Colic <input type="checkbox"/> Injuries (e.g. cuts, bruises) <input type="checkbox"/> Muscular problems <input type="checkbox"/> Skin problems <input type="checkbox"/> Respiratory problems <input type="checkbox"/> Diarrhoea <input type="checkbox"/> Other _____ <input type="checkbox"/> Overheating/sunstroke		
Appropriate Behaviour	How many years of camel handling experience do you have?	_____ Years		
	Do your camels show behavioural problems?	<input type="checkbox"/> Yes <input type="checkbox"/> No		
	If yes, what type of behavioural problems do the camels show?	<input type="checkbox"/> Aggression <input type="checkbox"/> Biting <input type="checkbox"/> Kicking <input type="checkbox"/> Anxiety or escaping from the pen <input type="checkbox"/> Other _____		
	How would you rate your ability to identify a camel in distress/pain?	<input type="checkbox"/> Low <input type="checkbox"/> Some <input type="checkbox"/> Moderate <input type="checkbox"/> Very High <input type="checkbox"/> High		
	Which criteria do you use to identify a camel in pain or distress?	_____		

⁸ Menchetti L, Faye B, Padalino B: Associations between new animal based measures and welfare outcomes in camels kept in intensive system (under revision);

⁹ Menchetti L, Padalino B. 2021. New animal-based measures to assess welfare in camels. SISVET Congress 2021. June 23-25, 2021. Virtual edition.

6.2. Welfare indicators at Herd Level

In this section, the description, evaluation, and assessment method of the individual welfare indicators for camels are listed and illustrated with examples. The recording sheets provided are divided according to the welfare principles.

Good Feeding

Table 5: Camel welfare recording sheet for indicators of "Good Feeding" collected at Herd Level

		Water	Feed		
Good Feeding	Trough number	_____	_____		
	Availability	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
	Trough dimension*	Length	_____ meters	_____ meters	
		Width	_____ meters	_____ meters	
	Trough material*	_____	_____		
	Trough position*	<input type="checkbox"/> In the sun <input type="checkbox"/> In the shade	<input type="checkbox"/> In the sun <input type="checkbox"/> In the shade		
	Quality*	Water temperature	_____	Type of food	
		Cleanliness	Clean	<input type="checkbox"/> 	<input type="checkbox"/> 
			Partly dirty	<input type="checkbox"/> 	<input type="checkbox"/> 
	Dirty	<input type="checkbox"/> 	<input type="checkbox"/> 		
Number of animals		Feeding: _____ camels Ruminating: _____ camels			

*For each water/feeding point.

Water availability

Background

Assessing water availability not only includes availability as such, but also water quality, water temperature and cleanliness. The type of drinking trough, its condition, and location must also be considered. Access to water plays a significant role in the health and welfare of the camels.

Evaluation

The assessor remains outside the pen and determines the water points. The location, cleanliness and condition of the watering points (i.e. in the sun or shade) should be checked. The water's temperature should be noted. The water troughs are measured from inside the pen. The length and width of the trough must be measured carefully so that the area can be calculated. If there are several water troughs in the pen, the respective areas should be added. The result is divided by the number of animals that may access the water point (expressed in m²/camel).

Classification

The **number** of water points may be classified as "Adequate", "Not adequate" and "Troughs not present". The threshold between the categories "Adequate" and "Not adequate" should be established from time to time based on the type of farm and the environmental conditions, as well as the size of the pen and animal density.

The water point can be classified as "Small", "Medium" and "Large" according to their size (length x width). The threshold values to classify this variable in categories may vary depending on the type of farm assessed, based on the literature or calculated using statistical binning.

An example of the categories, calculated for a market using statistical binning, can be seen below:

- Small: $\leq 0.45 \text{ m}^2$
- Medium: $0.46\text{-}0.50 \text{ m}^2$
- Large: $> 0.50 \text{ m}^2$

The **water area per animal** (= (length x width)/number of camels in the pen) can be classified into the following categories: "Limited", "Regular" and "Ample". The threshold values to classify this variable in categories may vary depending on the type of farm assessed based on the literature or calculated using statistical binning.

An example of the categories, calculated for a market using statistical binning, can be seen below:

- Limited: $\leq 0.060 \text{ m}^2/\text{camel}$
- Regular: $0.061\text{-}0.160 \text{ m}^2/\text{camel}$
- Ample: $> 0.160 \text{ m}^2/\text{camel}$

The **location** of the troughs, "In the sun" or "In the shade", may also be specified.

The available water can be classified according to **temperature**: "Cool", "Lukewarm" and "Warm". The threshold values to classify this variable into categories may vary depending on the type of farm assessed, based on the literature or calculated using statistical binning.

An example of the categories, calculated for a market using statistical binning, can be seen below:

- Warm: $> 37.5 \text{ }^\circ\text{C}$
- Lukewarm: $34.6\text{-}37.5 \text{ }^\circ\text{C}$
- Cool: $\leq 34.5 \text{ }^\circ\text{C}$

The **cleanliness** of the water points should be classified as "Dirty" if the water contains an abundance of organic or inorganic materials such as faeces or debris, "Partly dirty" if the facilities are only partially contaminated, or "Clean".

Finally, as an animal-based measure, the number of animals **drinking** may be noted and expressed in proportion to the total number of animals present in the pen (percentage = number of camels drinking/total number of camels).

Food supply**Background**

Camels are highly adapted to the consumption of dry, harsh forage. Feeding camels is, of course, essential for their survival. The type of feed and its protein content has a decisive influence on the camel's performance, health and welfare. Depending on the camel's purpose, the feed may vary in composition.

Evaluation

The assessor remains outside the pen and evaluates the camel's feeding behaviour (number of animals feeding and ruminating; Table 9). Once inside the pen, the assessor checks whether feed is available to the animals, whether it is clean, he/she assesses the condition of the troughs as well as their location (i.e. in the sun or in the shade). It should be noted whether a salt lick is available to the camels. The feeding troughs are measured from inside the pen. The length and width of the trough are multiplied in order to calculate the area. If there are several troughs in the pen, the areas of the troughs should be added. The result is divided by the number of animals that may access the feed (expressed in m²/camel).

Classification

The **number** of feeding points may be classified as "Number more than sufficient", "At least one trough", and "No troughs". The threshold between the categories "Number more than sufficient" and "At least one trough" should be defined from time to time. These definitions may be based on the type of farm, the environmental conditions, pen size, and the number of animals per pen.

The feeding points may be classified as "Small", "Medium", and "Large" according to their **size** (length x width). The threshold values to classify this variable may vary depending on the type of farm assessed.

An example of the categories, calculated for a market using statistical binning, can be seen below:

- Small: $\leq 1.50 \text{ m}^2$
- Medium: $1.51\text{-}2.50 \text{ m}^2$
- Large: $> 2.50 \text{ m}^2$

The **feeding space per animal** (= (length x width)/number of camels in the pen) may be classified into the categories "Limited", "Regular", and "Ample". The threshold values to classify this variable may vary, as mentioned before.

An example of the categories, calculated for a market using statistical binning for a market, can be seen below:

- Limited: $\leq 0.40 \text{ m}^2/\text{camel}$
- Regular: $0.41\text{-}1.10 \text{ m}^2/\text{camel}$
- Ample: $> 1.10 \text{ m}^2/\text{camel}$

The **location** of the troughs, classified as "In the sun" or "In the shade" (Figure 3 and Figure 4), should be noted and additional information on the **feed** (type and salt content) may be recorded.

The **cleanliness** of feeding points should be classified as "Dirty" if the feed contains an abundance of organic or inorganic materials, such as faeces or debris, "Partly dirty" if the facilities are partially contaminated, or "Clean".

The number of animals **eating** and **ruminating** may be expressed as follows (percentage = number of eating and ruminating camels/total number of camels).

Examples



Figure 3: Feeding trough under a shelter



Figure 5: Availability of a salt lick



Figure 4: Feeding trough in the sun

Good Housing

Table 6: Camel welfare recording sheet for indicators of "Good Housing" collected at Herd Level

Good Housing	Camel	Total _____ camels
		Hobbled/tethered _____ camels
	Environment	Temperature _____ Humidity _____ Wind speed _____ THI* _____
	Pen/box	Shape _____ Dimension: Length: _____ meters Width: _____ meters
	Shade	Presence <input type="checkbox"/> Yes <input type="checkbox"/> No Dimensions of shelter Length: _____ meters Width: _____ meters Number of animals in the shade: _____ camels
	Fence	Material _____ Condition <input type="checkbox"/> Broken <input type="checkbox"/> Unbroken
		Presence <input type="checkbox"/> Yes <input type="checkbox"/> No Type: _____
		<input type="checkbox"/> Clean 
	Bedding	<input type="checkbox"/> Partly dirty 
		<input type="checkbox"/> Dirty 
Rubbish	Dimension <input type="checkbox"/> No rubbish <input type="checkbox"/> Small (e.g. ropes, syringes, cans) <input type="checkbox"/> Medium (e.g. plastic bags, broken troughs) <input type="checkbox"/> Large (e.g. broken beds, furniture) Type _____	

*Temperature Humidity Index

Freedom of movement, dimensions, shaded areas, and condition of the pen

Background

Camels in non-nomadic holding systems spend most of their lives in pens. Therefore, it is of great importance to adapt the camels' housing to their needs, to minimise the risk of injuries sustained from broken equipment, rubbish or ingesting foreign bodies. As camels prefer the shade when temperatures exceed their thermoneutral zone¹⁰, the outdoor facilities should provide shelter (see Figure 7 and Figure 10). Also, each camel should have enough space to move around and rest comfortably.

¹⁰ Zappaterra M, Menchetti L, Nanni Costa L, Padalino B. Do Camels (*Camelus dromedarius*) Need Shaded Areas? A Case Study of the Camel Market in Doha. *Animals (Basel)*. 2021 Feb 11;11(2):480. doi: 10.3390/ani11020480. PMID: 33670415; PMCID: PMC7917598.

Evaluation

Remaining outside the pen, the assessor may count the camels and calculate the pen's size. Once inside the pen, the assessor may gain an impression of the camels' movements, space to move in and the shaded area's size. In addition, the bedding should be assessed, and any rubbish may be recorded. To calculate the base areas of the pen and the shelter's roof, the length is multiplied by the width. In order to calculate the space available to each animal, the result is divided by the number of camels (expressed in m²/camel).

Classification

As stated above, the number of animals **hobbled/tethered** may be recorded and then expressed as a proportion of the total number of animals held in the pen.

The **space allowance per camel** (= (length of pen x width of pen)/number of camels in the pen) and the **shaded area per camel** (= (length of shelter x width of shelter)/number of camels in the pen) may be classified into the following categories "Limited", "Regular" and "Ample". As mentioned before, the threshold values to classify this variable may vary depending on the type of farm assessed.

An example of the space allowance categories, calculated for a market using statistical, can be seen below:

- Limited: ≤19.0 m²/camel
- Regular: 19.1-40.0 m²/camel
- Ample: >40.0 m²/camel

An example of the shaded area categories, calculated for a market using statistical, can be seen below:

- Limited: ≤2.50m²/camel or no shade
- Regular: 2.51-7.00 m²/camel
- Ample: >7.00 m²/camel

Bedding **cleanliness** may be classified as "Dirty", "Partly dirty", or "Clean", depending on the presence of faeces or unsuitable material.

Rubbish may be classified according to the dimensions and type or, more simply, as presence/absence (Figure 13, Figure 14).

Examples



Figure 6: High-density pen. Not all camels have the opportunity to feed (please see red arrows for feeding trough)



Figure 7: All camels have a place to rest in the shade



Figure 8: Although there is a shelter to protect the camels from the sun, not all camels have access to it



Figure 9: No shelter available



Figure 10: A camel tries to find shade for its head behind a container



Figure 11: Camel-friendly fencing



Figure 12: Broken fence: Partly collapsed fencing risking injury. The camels may escape.



Figure 13: Rubbish in the pen



Figure 14: Rubbish in the pen. The camels may ingest the rubbish.

Good Health

Table 7: Camel welfare recording sheet for indicators of "Good Health" collected at Herd Level

Good Health	Injury	<input type="checkbox"/> Type: _____	_____ camels
	Number of Animals	Sick	_____ camels
		In pain	_____ camels
		Injuries from halters or tethering	_____ camels
		With cauterizations	_____ camels
		With nose ring	_____ camels
	Disease	<input type="checkbox"/> Type: N° _____	N° _____ affected camels
		<input type="checkbox"/> Type: _____	N° _____ affected camels

Background

For an animal to be in good condition, it needs to be pain-, injury-, and disease-free.

Evaluation

During the assessment at Herd Level, the assessor should visually check the animals' health and note the number of camels showing injuries, disease, or pain. The visual check may begin outside the pen. However, the assessor should approach the animals in order to assess their health status more closely. This task should always be conducted by experienced veterinarians. It is also important to record the type of injuries and diseases in order to identify possible risk factors and provide preventative suggestions.

Classification

The number of animals affected by each health problem should be noted. The relative frequency may then be calculated (percentage = number of affected camels/total number of camels).

Injury

Shallow and severe injuries should be recorded (see Figure 15, Figure 36, Figure 37, Figure 38).

Sickness/Disease

Different symptoms may be indicative of a disease. More information can be found in the Animal Level section of the "Good Health" chapter. (see Figure 16).

Pain

Camels may display pain very differently or not at all¹¹. Unfortunately, the literature does not offer any validated camel pain scales. The assessment of pain thus requires further research. (see Figure 17).

Examples



Figure 15: Injured left hind leg



Figure 16: The camel is unable to get up.

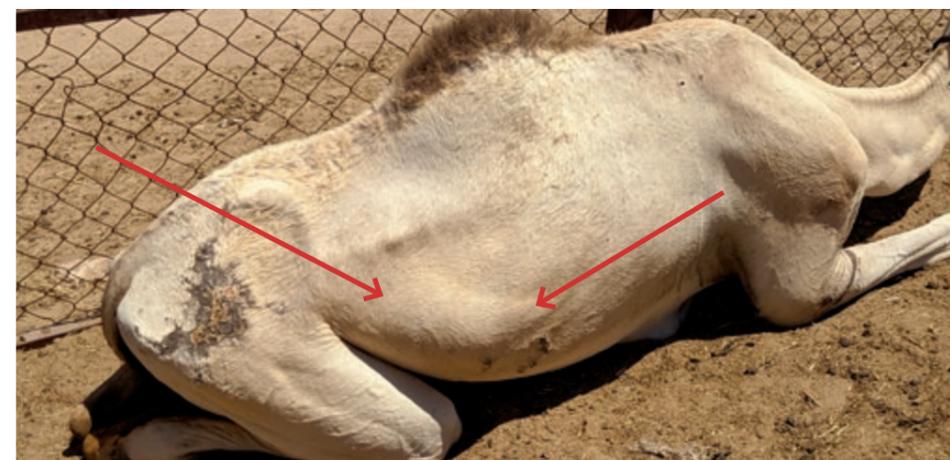


Figure 17: Camel with a tense, painful abdomen (see red arrows), indicating colic.

¹¹ Previti A, Guercio B, Passantino A. Protection of farmed camels (*Camelus dromedarius*): welfare problems and legislative perspective. *Anim Sci J.* (2016) 87:183–9. doi: 10.1111/asj.12446

Injuries sustained from halters, tethering or other management procedures, camels with cauterization or nose rings

Many livestock breeding systems continue to apply management procedures that cause the animals pain. Unsuitable halter or shackle materials and misapplication can cause injuries (see Figure 18, Figure 19). Attaching a nose ring to the camel's sensitive nasal area is common practice but also leads to a significant amount of pain.

Examples



Figure 18: Chain cutting into the skin on the bridge of the nose



Figure 19: Hobbles cutting into the skin of the fetlock



Figure 20: Nose ring in the left nostril

Cauterization

Background

Veterinarian and non-veterinarian camel staff treat various conditions, including traumatic conditions, mastitis and inflammation¹² by means of cautery. However, this method has been proven to be painful for the animals and should thus be avoided.

Examples



Figure 21: Several cauterizations on the lateral front-left fetlock joint



Figure 22: Cauterization around the left eye



Figure 23: Cauterization on the right shoulder

¹² Volpato, G., Lamin Saleh, S.M. & Di Nardo, A. Ethnoveterinary of Sahrawi pastoralists of Western Sahara: camel diseases and remedies. *J Ethnobiology Ethnomedicine* 11, 54 (2015). <https://doi.org/10.1186/s13002-015-0040-4>

Appropriate Behaviour

Table 8: Camel welfare recording sheet for indicators of “Appropriate Behaviour” collected at Herd Level

Appropriate Behaviour	Numbers of Animals	Resting (i.e. sternal/lateral decubitus)	_____ camels
		Standing quietly	_____ camels
		Displaying social behaviour	_____ camels
		Displaying aggressive behaviours	_____ camels
		Displaying stereotypies	_____ camels
		Displaying other abnormal behaviours	_____ camels

Background and evaluation

Assessing behaviour, emotional state, and the human-animal relationship is an important aspect of any welfare assessment. This protocol thus includes the evaluation of several behaviours and behavioural responses. The assessors should be trained before conducting the evaluation, and they should be able to recognize the behaviours described in the table below. The scan sampling method may be used to attribute behavioural states to each animal of the herd. Behavioural observation should be conducted outside the pen without disturbing the animals.

Table 9: An ethogram of the behaviours reported in the recording sheets for camel welfare assessment can be seen below. Some behaviours are identified at the Herd Level and others at the Animal Level.

Behaviour	Definitions
Resting	The camel has positioned itself in sternal or lateral recumbency.
Standing quietly	The camel is standing on all four feet and appears calm and relaxed.
Social behaviour	The camel is making physical contact (e.g. touches, sniffs, allo-grooming) with other camels.
Feeding	The camel is ingesting feed (hay or concentrate), chewing and swallowing it.
Rumination	The camel regurgitates its food, chews and swallows it again.
Aggressive behaviour	The camel is behaving aggressively towards another camel by threatening, biting, pushing or kicking.
Stereotypic behaviour	The camel is displaying a stereotypy such as pacing in a circle, head-shaking, self-mutilation or bar-mouthing. ¹³
Other abnormal behaviours	The camel is displaying other “abnormal” behaviours, including signs of fear, frustration, uneasiness or anxiety (e.g. avoidance, over-reaction to minor environmental changes, motor inhibition, restlessness, violent escape reactions).

¹³ Padalino B, Aubé L, Fatnassi M, Monaco D, Khorchani T, Hammadi M, Lacalandra GM. Could dromedary camels develop stereotypy? The first description of stereotypical behaviour in housed male dromedary camels and how it is affected by different management systems. PLoS One (2014) 9: doi:10.1371/journal.pone.0089093

Classification

The number of animals displaying each behaviour may be recorded and then converted into a relative frequency (see above).

Examples

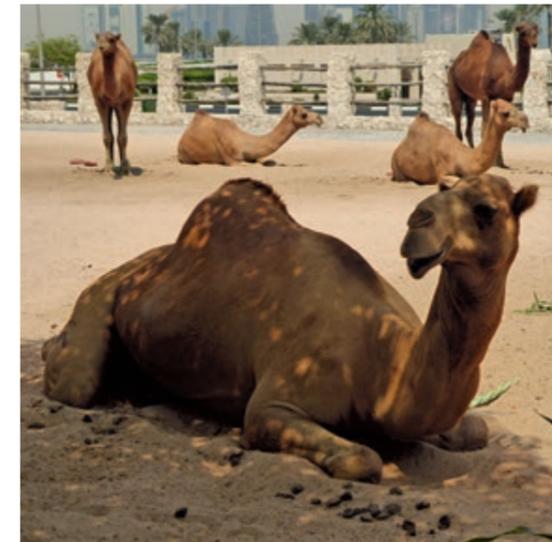


Figure 24: Resting



Figure 25: Standing quietly

Positive social interactions



Figure 26: Social behaviour: the camels are in physical contact.

Stereotypies

Background

Animals kept in artificial habitats encounter various environmental challenges. In captivity, animals can develop stereotypic behaviours.¹⁴ These are further defined as repetitive, unchanging and seemingly functionless patterns of behaviour.¹⁵ The cause of these behaviours is usually seen in the context of suboptimal housing conditions.¹⁶ That is why they have often been used to evaluate animal welfare in different species.¹⁷

Locomotor stereotypy¹⁸

- **Head-shaking:** The camel quickly raises and lowers its head vertically (up to 90°).
- **Pacing in a circle:** The camel walks back and forth within the pen. In doing so, it always follows the same circular path. The camel repeats this movement several times without clear motivation.

Oral stereotypy¹⁹

- **Self-biting or self-mutilation:** The camel bites different parts of its front legs.
- **Bar-Mouthing:** Licking, biting or playing with the bars of pen's gate.

6.3. Welfare indicators at Animal Level

In this section, the description, evaluation, and assessment method of the individual welfare indicators for camels are listed and illustrated with examples. The criteria refer to the individual animal (Animal Level). As mentioned before, the camels should be selected randomly.

Good Feeding

Body Condition Score (BCS)

Background

The Body Condition Score (BCS) is a tool used to assess the fat storage of an animal. It is an excellent method for critically examining the nutritional status of the camel and can also be useful in managing health and reproductive aspects.

Evaluation

The BCS is assessed on a scale of 0 to 5 based on visual examination and palpation of the camel's ribs, ischial and coxal tuberosities, hollow of the flank, and the recto-genital zone²¹.

Classification

Camel's BCS could be further categorized into 3 groups:
 Good body condition: BCS = 3
 Moderate body condition: BCS = 2 or 4
 Poor body condition, lean or obese: BCS = 0-1 or 5

¹⁴ Il MJ, Rennie LJ, Bowell VA, Wemelsfelder F, Lawrence AB (2003) Onfarm assessment of the effect of management and housing type on behaviour and welfare in dairy cattle. *Animal welfare* 12: 553–556

¹⁵ Mason GJ (1991) Stereotypy: a critical review. *Animal Behaviour* 41: 1015–1038.

¹⁶ Mills DS (2005) Repetitive movement problems in the horse, in: McDonnell editor, *The Domestic Horse, The Origins, Development and Management of its Behaviour*, Cambridge University Press, Cambridge, pp 212–227.

¹⁷ Broom DM (1991) *Animal welfare: concepts and measurement*. *Journal of Animal Science* 69: 4167–4175.

Table 10: Camel welfare recording sheet for indicators of "Good Feeding" collected at the Animal Level

Good Feeding	0		Cachexia; individual ribs are visible; ischium, hip bone and shoulder very prominent; hollow of the flank visible and concave; rectogenital zone caved in
	1		Ribs are visible; ischium, hip bone and shoulder very prominent; hollow of the flank visible; rectogenital zone caved in
	2		Ribs visible; ischium, hip bone and shoulder prominent; hollow of the flank slightly visible; rectogenital zone caved in
	3		Ribs slightly visible; ischium, hip bone and shoulder slightly prominent; hollow of the flank slightly visible; rectogenital zone slightly caved in
	4		Ribs are well covered; ischium, hip bone and shoulder barely visible; hollow of the flank not visible; rectogenital zone not caved in
	5		Ribs buried; ischium, hip bone and shoulder not visible; hollow of the flank not visible; rectogenital zone fattened
	Bucket test	Latency time _____ sec Ingested water _____ liters	

*BCS, Body Condition Score²⁰

¹⁸ Padalino B, Aubé L, Fatnassi M, Monaco D, Khorchani T, et al. (2014) Could Dromedary Camels Develop Stereotypy? The First Description of Stereotypical Behaviour in Housed Male Dromedary Camels and How It Is Affected by Different Management Systems. *PLOS ONE* 9(2): e89093.

¹⁹ Padalino B, Aubé L, Fatnassi M, Monaco D, Khorchani T, et al. (2014) Could Dromedary Camels Develop Stereotypy? The First Description of Stereotypical Behaviour in Housed Male Dromedary Camels and How It Is Affected by Different Management Systems. *PLOS ONE* 9(2): e89093.

²⁰ Faye B, Bengoumi M, Cleradin A, Tabarani A, Chilliard Y. Body condition score in dromedary camel: a tool for management of reproduction. *Emirates J Food Agric.* (2001) 13:1–6. doi: 10.9755/ejfa.v12i1.5193

²¹ Faye B, Bengoumi M, Cleradin A, Tabarani A, Chilliard Y. Body condition score in dromedary camel: a tool for management of reproduction. *Emirates J Food Agric.* (2001) 13:1–6. doi: 10.9755/ejfa.v12i1.5193

Bucket test

Background

The bucket test can be used to determine the thirst index. It is an important indicator of the camel's welfare criterion "absence of thirst". It is based on the bucket test validated for horses²².

Evaluation

The bucket test is conducted as follows: A bucket is filled with 5 l of fresh, clean water and placed about 1 meter away from the camel. The assessor remains at a distance of approximately 3 meters. The time it takes for the camel to approach the bucket ("latency", in seconds) is measured with a stopwatch, and the amount of water ingested (in litres) is recorded (see Figure 27). If the camel does not drink within 60 seconds, the bucket is removed. This continuous categorization is proposed to create a point-based index, called the Thirst Index, which indicates the animal's thirst.

Classification

Latency time and ingested water may be translated into scores according to the following table. The latency points are added to the ingested water points to determine the Thirst Index (TI).

Table 11: Bucket test calculation table:

Parameter	Criteria	Points
Latency time	≥ 30 s	0
	< 30 s	1
Ingested water	< 1 l	0
	1-4 l	1
	> 4 l	2
Thirst index	Latency time + water ingested	0-3

Example



Figure 27: A camel drinks during the bucket test

²² AWIN Welfare assessment protocol for horses. 2015, 1–80.

Good Housing

Table 12: Camel welfare recording sheet for indicators of "Good Housing" collected at the Animal Level

Good Housing		YES	NO
	Shade	<input type="checkbox"/>	<input type="checkbox"/>
	Insects	<input type="checkbox"/> Only a few <input type="checkbox"/> Some on a particular region <input type="checkbox"/> The animal is covered	<input type="checkbox"/>
	Tethered	<input type="checkbox"/> Length of rope _____ cm	<input type="checkbox"/>
	Hobbled	<input type="checkbox"/> Material _____	<input type="checkbox"/>
	Resting behaviour	<input type="checkbox"/> Sternal decubitus <input type="checkbox"/> Lateral decubitus	<input type="checkbox"/>

Shade

More information can be found in the section "Herd Level" in the chapter "Good Housing".

Insects

Classification

The presence of insects can be classified according to their quantity or, more simply, as the presence or absence of insects.

Tethering and hobbles: Equipment for handling camels

Background

Different equipment is used to handle camels. Here, attention must be paid to the material and the attachment. The equipment must be designed and used in such a way that the camel is not harmed. The most commonly used types of equipment are halters, nose rings, and leg hobbles.

Evaluation

Check each animal as follows:

- Is any equipment used? Halters, hobbles or nose ring?
- What kind of material is used?

Classification

Evaluate the presence of hobbles and the length of the rope.

Resting behaviour

Classification

Camel resting behaviour may be indicated by the presence and position of the pressure sores.

Examples



Figure 28: Ideally, no equipment is placed on the camel unless the camel is handled directly.



Figure 29: Isolated male camel with hobbles on the front legs and an additional attachment to the ground

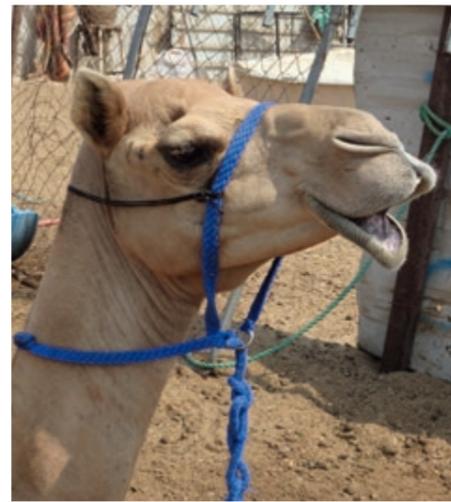


Figure 30: Halter made of soft material



Figure 31: Fitted, padded hobbles on the front legs that do not scratch or cut into the skin



Figure 32: Hobbles are too tight, cutting into the skin



Figure 33: Rope hobbles that slipped down the fetlock, increasing the risk of injury. Visible scarring from previous hobbles.



Figure 35: Halter, nose-ring and rope



Figure 34: Rope hobbles attached to the ground

Good Health

Table 13: Camel welfare recording sheet for indicators of Good Health collected at the Animal Level

		YES	NO	
Good Health	Disease	<input type="checkbox"/>	<input type="checkbox"/>	
		Type _____		
	Injury	<input type="checkbox"/>	<input type="checkbox"/>	
		Type _____		
	Swollen joint	<input type="checkbox"/>	<input type="checkbox"/>	
	Lameness	<input type="checkbox"/>	<input type="checkbox"/>	
	Hair/coat	Skin disease Ectoparasites (e.g. tick)	<input type="checkbox"/>	<input type="checkbox"/>
	Discharge	Nasal discharge Eye discharge Vulva discharge	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
	Diarrhoea		<input type="checkbox"/>	<input type="checkbox"/>
	Abnormal udder		<input type="checkbox"/>	<input type="checkbox"/>
	Breathing	Abnormal breathing Coughing	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
Evident pain		<input type="checkbox"/>	<input type="checkbox"/>	

Background

“Absence of injuries”, “Absence of disease,” and “Absence of pain and pain induced by management procedures” are the criteria assigned to the principle of “Good Health”^{23,24}. The remarkable resistance and adaptability of the camel can represent serious biases in the evaluation of its health. Several reports testify that camels are susceptible to many diseases and can manifest more severe clinical symptoms than other animals^{25,26,27}. Some of these diseases mainly occur in certain periods of the year, e.g. during breeding season, and may not be noticed during the assessment. The other critical issue is related to their remarkable ability to bear and mask pain. Camels are able to continue working without displaying any signs of suffering, and, therefore, medical interventions are often left too late²⁸. In this context, early diagnosis, the ability of the handlers to carry out correct evaluations, and the frequency of checks assume considerable importance in guaranteeing the principle of “Good Health”. Ad hoc indicators were included in our protocol. However, further considerations are needed. Further research on pain assessment in camels is required.

²³ AWIN. AWIN Welfare Assessment Protocol for Horses. AWIN (2015). p. 1–80. doi: 10.13130/AWIN_HORS-ES_2015

²⁴ Welfare Quality R. Welfare Quality R Assessment Protocol for Cattle. Lelystad: Welfare Quality R Consortium (2009).

²⁵ Agab H, Abbas B. Epidemiological studies on camel diseases in eastern Sudan. World Anim Rev. (1999) 92:42–51.

²⁶ Sazmand A, Joachim A. Parasitic diseases of camels in Iran (1931-2017)—A literature review. Parasite. (2017) 24:21. doi: 10.1051/parasite/2017024

²⁷ Abbas B, Omer OH. Review of infectious diseases of the camel. Vet Bull. (2005) 75:1N–16N.

²⁸ Previti A, Guercio B, Passantino A. Protection of farmed camels (Camelus dromedarius): welfare problems and legislative perspective. Anim Sci J. (2016) 87:183–9. doi: 10.1111/asj.12446

Presence of diseases and injuries

Background

Several different clinical signs may indicate a disease or an anatomical anomaly. Only a selection is described in the following chapter. There is no claim to completeness. The type of disease should be noted. Diagnostic testing requiring invasive sampling is not considered feasible during a welfare assessment. Consequently, the correct diagnosis is not required, but only the presence/absence of evident clinical signs. Certain health issues may be treated with the support of a veterinarian (please see examples below).

Injuries

Both shallow and deep wounds should be considered as injuries. Shallow wounds only affect the superficial layers of skin. The tissue underneath is still intact. Deep wounds affect the deeper tissue.

Examples



Figure 36: Camel displaying an old injury near the mouth



Figure 37: Fresh injury on the right side of the thorax



Figure 38: Purulent infection



Figure 39: Injury on the left side of the abdomen



Figure 40: Pressure ulcer on the right front leg

Swollen joints

Background

Swollen joints are caused by an increased accumulation of fluid around the joint and can be very painful. They can indicate various pathological conditions such as infections, injuries, chronic joint alterations (arthritis), fissures and fractures.

Evaluation

The assessor should begin with a general inspection of the camel's body (both sides). He/she should pay particular attention to the front and hind limbs, determining whether there is swelling in the shoulder, elbow, carpal joint, fetlock, knee, and/or hocks.

Classification

The observations are classified as presence/absence of swollen joints.



Figure 41: Severe swelling of the right carpal joint



Figure 42: Severe swelling of the right carpal joint

Lameness

Background

Camels move predominantly by walking, falling into pace or gallop when moving faster.

Lameness describes a disturbance in the course of movement. A lame animal cannot bear weight on a limb. Thus, an evident relief of the limb is visible during movement. This is caused by pain or tenderness of the sole, which may be caused by pathological conditions or unfavourable ground.

Evaluation

Observe whether the camel can bear weight wholly and evenly. If it can only stand up with help or not at all and cannot bear weight on one leg or shows a relieving posture, assessing the camel in motion will not be necessary. A veterinarian should be consulted for further diagnosis and treatment.

Classification

Evaluate the camel's gait and classify as presence/absence of lameness.

Examples



Figure 43: The camel is unable to stand, cannot bear weight on one leg or is unwilling to take a step forward. Assessing the camel in motion is not required.

Examples

Lameness



Figure 44: The camel's gait is disturbed, but it can walk. Its head lifts when pressure is applied to the lame foot. The pelvis lifts when the lame hind leg touches the ground.

Not Lam



Figure 46: The camel can bear weight evenly on all limbs at rest and when walking.

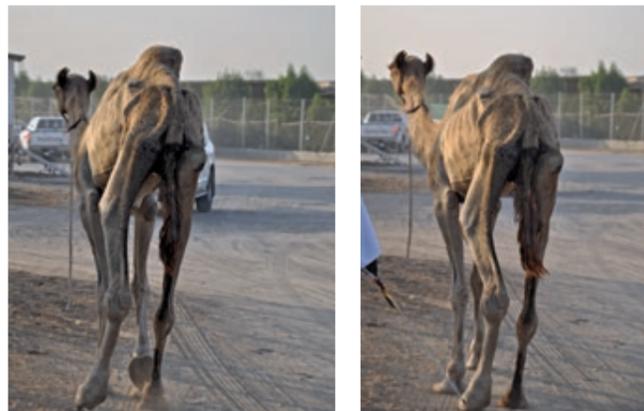


Figure 45: A camel with a severely swollen left hind leg. The camel is not putting any weight on the leg.



Figure 47: The camel distributes weight evenly on all four legs when standing.

Skin disease

Background

When the coat is in good condition, it is indicative of good general health and grooming. Conversely, poor coat condition may indicate various pathological conditions, poor nutrition, or neglect.

Alterations of the integument occur when the skin is functionally impaired in one or more places. This manifests itself in hairless areas or any other clinical signs associated with skin disease. Causes include trauma, fighting with other animals, use of inappropriate/poor quality equipment, beating, parasitic infections and other diseases.

Evaluation

Start with a general inspection of the camel's body (both sides). It is important to inspect every area of the body closely.

Classification

Skin disease may be classified as present or absent.

Examples

Alopecia

Hairless areas caused by hair loss or scars



Figure 48: Hairless area to the right of the sacroiliac joint



Figure 49: Multiple hairless areas on the right side of the neck



Figure 50: Multiple hairless patches all over the body



Figure 51: Isolated hairless patches on the left side of the body (possibly dermatomycosis)



Figure 52: Large hairless scaly areas on the head and neck

External parasites

Background

Ticks are the most common external parasites found on camels. These arachnids are visible to the naked eye and feed their host's blood. They are considered vectors and can transmit a variety of pathogens.

Evaluation

Start with a general inspection of the camel's body (both sides). It is important to inspect every area of the body closely. The best way to do this is to divide the body into regions.

Classification

Assess the presence of ticks and classify as presence or absence.

Discharges

Background

Discharge from natural orifices (nose, eyes, vulva, udder or penis) may be a symptom of localised or generalised disease.

Evaluation

Visually assess the nose, eyes, vulva, udder and penis. The assessor looks at both sides of the head and compares them. Do not touch the camel if possible.

Classification

Classify as presence/absence of nasal, eye, and vulva discharge.

Examples

Nasal discharge

Visible discharge from one or both nostrils (watery or thick, transparent, white, yellow/green or haematic).

Eye discharge

Visible discharge from the eye (watery or thick, transparent, white, yellow/green or haematic).

Examples



Figure 53: Ticks on the udder

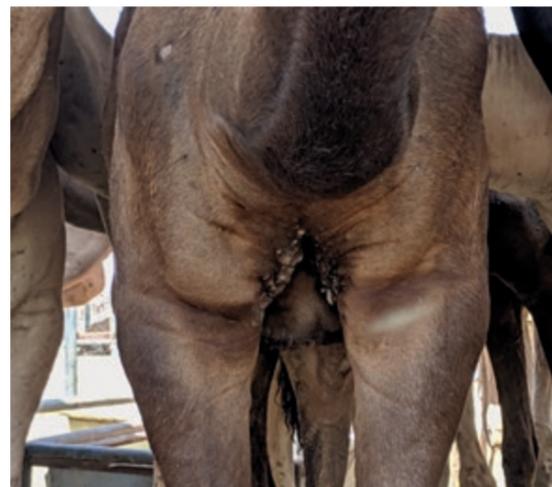


Figure 54: Ticks in the axillary area



Figure 55: Tick on the left eyelid

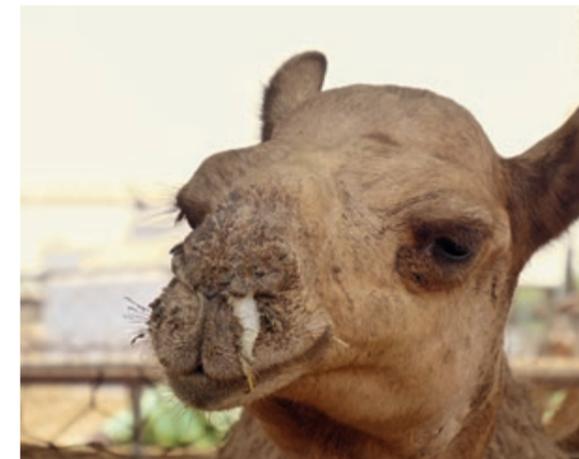


Figure 56: Thick and white nasal discharge with an encrusted rhinarium



Figure 58: Thick yellow discharge from the right eye with skin lesions around the eye



Figure 57: Thick and white/transparent nasal discharge



Figure 59: Watery transparent discharge from the eye

Vulva discharge

Visible discharge from the vulva (watery or thick, transparent, white, yellow/green or haematic).

Examples



Figure 60: Yellow vulva discharge

Diarrhoea

Background

The consistency of the manure is influenced by the amount of water ingested and the size of the digested plant parts. Normal camel faeces are pelleted (see Figure 61). Abnormal manure consistency may indicate gastrointestinal problems, poor feed quality or an insufficient water supply. Diarrhoea is defined as the increased frequency of more loose or liquid stools.

Evaluation

Visually check the consistency of fresh manure and lightly press on it. In addition, the anus area and the hind legs of the camels should be examined to see if manure particles can be found on the coat or skin.

Classification

Classify as presence/absence of diarrhoea.

Examples



Figure 61: Pelleted faeces of a camel

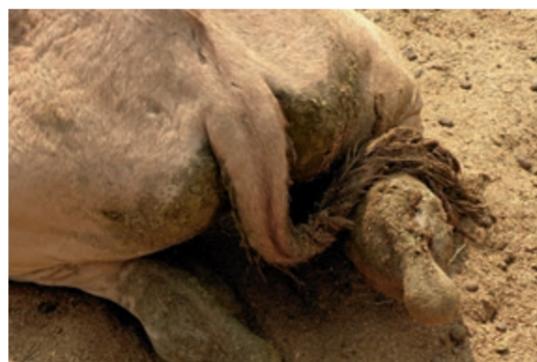


Figure 62: A camel with diarrhoea. Its coat is covered in manure.

Abnormal udder

Background

An abnormal udder can result from various causes: congenital, traumatic or inflammation (acute or chronic).

Evaluation

The udder should be inspected, and any abnormalities should be recorded.

Examples



Figure 63: Hypertrophic teats



Figure 64: Swollen udder; suspected acute mastitis

Abnormal breathing

Background

Abnormal breathing is characterised by an exaggerated effort to breathe, indicated by a tightened abdomen and/or audible sound upon each breath. Under normal climatic conditions and at rest, abnormal breathing may not only be caused by respiratory issues but may result from a variety of health problems.

Evaluation

Observe the camel for at least 2 minutes and listen to each breath. Inspect the nostrils and abdomen during each breath. The breathing rate should be 5-8 breaths per minute in cool weather and 10-12 breaths in warm weather.

Classification

Classify as the presence/absence of abnormal breathing. The presence of abnormal breathing can be indicated by inspiratory or expiratory sounds, increased breathing frequency, or abdominally emphasised breathing (i.e. the camel breathes with increased use of the abdominal muscles (see Figure 65, red arrow)).

Examples

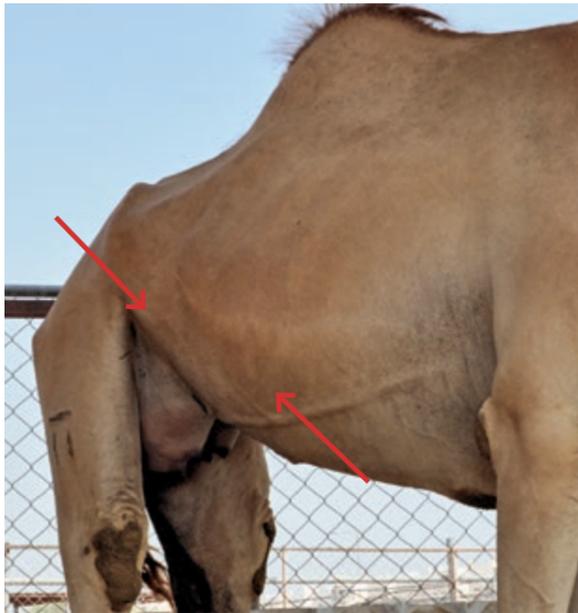


Figure 65: Abdominally emphasised breathing (see red arrow)



Figure 66: Normal breathing. The camel breathes calmly and regularly

Coughing

Background

A cough is described as a reaction to irritated airways characterised by abrupt expiration produced by the respiratory muscles. A specific sound is generated. Coughing may be caused by various pathogens, foreign bodies or pollutants, among other things.

Evaluation

The assessor is conducting the visual inspection and should record whether the animal coughs.

Classification

Classify as the presence/absence of coughing.

Pain

Background

As mentioned above, the literature does not provide a validated pain scale specific to camels. Therefore, although relevant, this aspect cannot be evaluated currently. Further research and the development of such a pain scale are necessary.

Other clinical signs

Health problems not specifically described in the sheet can be recorded. Examples of common camel health problems can be found below.

Swelling

Background

Swelling is described as an increase in size or a change in the shape of tissue. This includes proliferation, hernias, and abscesses but not the swelling of joints. Causes of swelling include trauma, tissue rupture, accumulation of fluid in the tissues due to infection, inflamed lymph nodes and neoplasia.

Evaluation

Begin with a general inspection of the camel's body (both sides). It is important to inspect all areas of the body.

Classification

Specify in the section "Type" of disease.

Examples

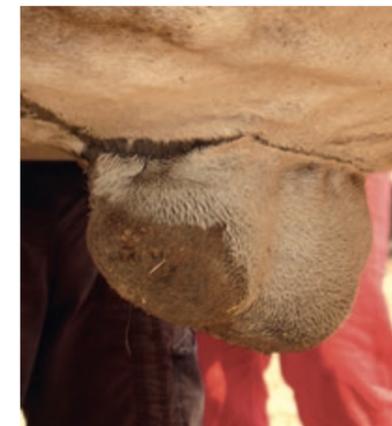


Figure 67: Swelling along the abdominal line; suspected hernia umbilicalis

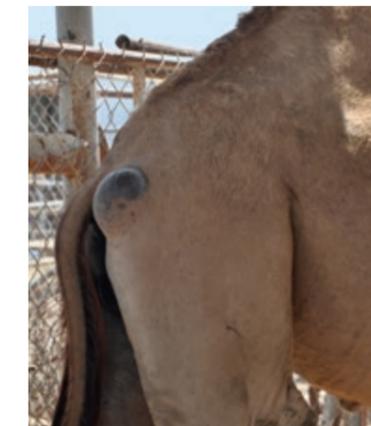


Figure 68: Swelling on the right hind limb; suspected abscess



Figure 69: Proliferation of tissue around the mouth



Figure 70: Swelling on the left side of the neck; suspected abscess



Figure 71: Small multiple swollen areas on the right side of the abdomen leading up to the shoulder

Prolapse

Background

A prolapse is defined as an internal organ protrusion through a natural opening. Protrusions of the uterus, vagina or rectum can occur in camels.

Evaluation

The assessor should ask if it is possible to inspect the camel more closely and secure the assistance of a second person. This person can carefully fixate the camel by bending the tail to the side, if necessary. Caution is advised as camels are able to kick with both their hind and front legs. Visually assess the vulva and anus.

Classification

Specify in the section "Type" of disease.

Examples

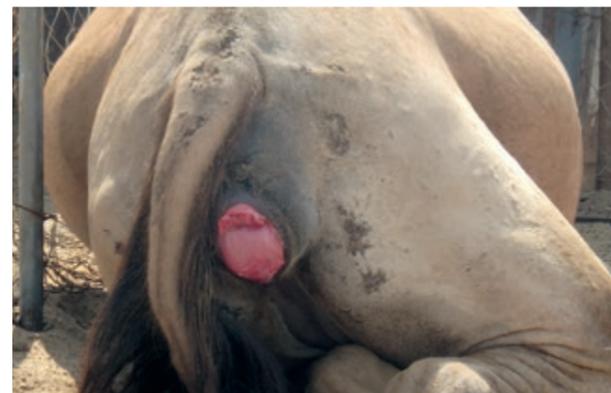
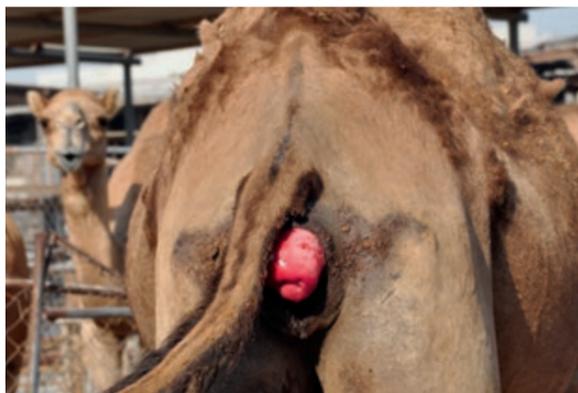


Figure 72: Rectal prolapse

Figure 73: Vaginal prolapse

Appropriate Behaviour

Table 14: Camel welfare recording sheet for indicators of "Appropriate Behaviour" collected at the Animal Level

Appropriate Behaviour	YES	NO
	Positive social interactions	<input type="checkbox"/>
Stereotypies	<input type="checkbox"/>	<input type="checkbox"/>
Feeding	<input type="checkbox"/>	<input type="checkbox"/>
Ruminating	<input type="checkbox"/>	<input type="checkbox"/>
Aggressive behaviours	<input type="checkbox"/>	<input type="checkbox"/>
Approaching test	<input type="checkbox"/>	<input type="checkbox"/>
Negative response	<input type="checkbox"/>	<input type="checkbox"/>
Neutral response	<input type="checkbox"/>	<input type="checkbox"/>
Positive response	<input type="checkbox"/>	<input type="checkbox"/>

Background and evaluation

Before the inspection, each animal should be observed from outside the pen while ensuring that it is not disturbed. The camel's behaviour should be recorded in the ethogram (see Table 14: Camel welfare recording sheet for indicators of "Appropriate Behaviour" collected at the Animal Level).

Approaching test

Background

This test is used to determine the human camel relationship.

Evaluation

The assessor should slowly approach the camel from the side, one step at a time. Carrying out slow and calm movements, the assessor may extend his/her arm and hand, thereby moving towards the camel slowly. The assessor may speak to the camel in a calm and quiet tone. The camel's reaction to the assessor should be recorded.

Classification

The camel's behavioural responses may be classified as "Positive," "Neutral," or "Negative".

Negative response

Negative responses include defensive, anxious, avoidant or aggressive behaviour.

Neutral response

The camel remains calm and relaxed and pays no further attention to the test person.

Positive response

The camel approaches the test person and shows positive interest while sniffing. The test person is able to touch or pet the camel.

Examples



Figure 74: Camel displaying a negative response



Figure 75: Neutral response



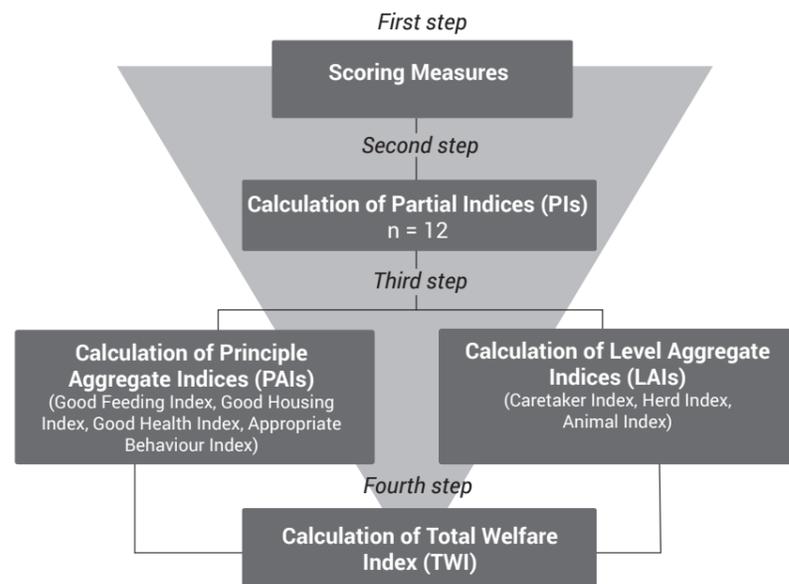
Figure 76: Positive response

7. Scoring system

A 4-step process of scoring and aggregation apply to the camel welfare assessment protocol. As a first step, the measures collected during the welfare assessment are scored. During the second step, the scores are aggregated according to principle and assessment levels and converted to a scale of 0 (worst) to 100 (best) to obtain 12 partial indices (PIs). Thirdly, the PIs are combined into weighted sums to obtain 4 indices aggregated at principle level (PAIs) and 3 indices aggregated at assessment level (LAIs). As a fourth step, the Total Welfare Index (TWI) is obtained by the linear combination of 4 PAIs or 3 LAIs and expressed on the same 0–100 scale.

Examples of calculations and aggregations are shown in the annexes.

Figure 77: Four-step process of scoring and aggregation (modified after Menchetti et al.²⁹)



7.1. Scoring of measures

The measures collected during the welfare assessment are scored using a 0–2 scale where 2 is the worst condition. For welfare measures expressed as a binary response (e.g., presence/absence), only the scores 0 (good welfare) and 2 (unacceptable welfare) are used. However, not all of the measurements collected with the recording sheets can be scored. Some can provide a general description of the farm and the environmental context, or they may be used to evaluate possible risk factors (e.g. temperature, containment system materials). Furthermore, certain measures may not be applicable to all environmental contexts, or data may be missing. Therefore the total number of scored measures may vary. It may also be noted that validated welfare standards for intensive, semi-intensive, and extensive camel farming are currently lacking. Consequently, the classification of quantitative variables (e.g. trough size and number, space allowance) needs to be adapted to different contexts, and universally valid limits cannot be provided yet. The following table, therefore, only presents generic scoring criteria, while Annex 1 proposes recording sheets as an example of how they may be applied.

²⁹ Menchetti L, Zappaterra M, Nanni Costa L, Padalino B. Application of a Protocol to Assess Camel Welfare: Scoring System of Collected Measures, Aggregated Assessment Indices, and Criteria to Classify a Pen. *Animals (Basel)*. 2021 Feb 13;11(2):494. doi: 10.3390/ani11020494. PMID: 33668569; PMCID: PMC7918070.

Table 15: A scoring system developed for the measures included in the camel welfare protocol

Measure	Criteria	Scores
Who carries out the health assessment or medical treatment	A veterinarian	0
	A non-veterinarian	1
	Not conducted	2
Years of caretaker's experience	>10 years	0
	6-10 years	1
	0-5 years	2
Camels reared at the farm in the busiest week	0-10 camels	0
	11-30 camels	1
	>30 camels	2
Are the camels exercised?	Yes	0
	No	2
Changes of management/housing according to season	Yes	0
	No	2
Caretaker's ability to identify a camel in distress/pain	High - Very high	0
	Moderate	1
	Low - Some	2
Food/water distribution	Ad libitum	0
	Rationed	2
Food/water position ¹	In the shade	0
	In the sun	2
Dimensions of troughs and pen, space, trough space, shaded space ¹	Large/Ample	0
	Medium/Regular	1
	Small/Limited	2
Water temperature ¹	Cool	0
	Medium	1
	Hot	2
Number of troughs ²	Number more than sufficient	0
	At least one trough is present	1
	Troughs not present	2
Cleanliness of facilities ¹	Clean	0
	Partially Dirty	1
	Dirty	2
Presence of salt lick, shelter, shade, bedding	Yes	0
	No	2
Presence of rubbish, broken fences, insects	Yes	0
	No	2
Body Condition Score	3 (good body condition)	0
	2, 4 (moderate body condition)	1
	0-1, 5 (poor body condition, lean or obese)	2
Thirst Index	0	0
	1	1
	2-3	2
Disease, physical injuries, tethering/hobbles, cauterization, nose ring, pain or behaviours indicating poor welfare ³	Animal Level	
	No Yes	0 2
Herd Level	Percentage of animals displaying disease/injury/pain/behaviour	0 (0%) – 2 (100%)
	Presence of behaviours indicating good welfare ⁴	
Animal Level	Yes No	0 2
	Herd Level	Percentage of animals displaying the behaviour	0 (100%) – 2 (0%)
Tethered/Hobbled	No Yes	0 2
	Responses during the approaching test	Positive	0
Neutral		1
Negative		2

¹When more than one trough was present in the pen, the score was attributed to the largest one ²Water and feeding points. The scoring must be adapted to the type of farm and the environmental conditions, as well as the size of the pen and number of animals ³Aggressive behaviours, stereotypies, and other abnormal behaviours ⁴Resting, standing quietly, positive social behaviours, feeding, drinking, rumination

7.2. Calculation of Partial Indices (PI)

The aggregation of the scored measures for each assessment level and each welfare principle produces the partial indices (PI). As part of the PI calculation, the 0-2 scale is converted into a 0-100 scale where 0 is the lowest and 100 is the highest value. PIs should be calculated for each assessment level *i* and each principle *j* as follows:

$$PI_{ij} = 100 - \left(\frac{\sum_{m=1}^{n_j} (\text{Score of measure})_m \times 100}{k_{ij}} \right)$$

i = Assessment level *i*

j = Principle level *j*

n = Number of measures included in the *j* principle of the *i* level

k = Highest possible total score of each principle *j* within each assessment level *i*.

The PIs for "Animal Level" should be obtained, averaging the scores of the camels evaluated per pen. The highest possible total scores for each assessment level and principle (*k*) are listed in Annex 2, while Annex 3 provides calculation examples.

Twelve PIs should be calculated for each of the farms/pens assessed.

Figure 78: Calculation of Partial Indices (PI) (modified after Menchetti et al.³⁰)



7.3. Calculation of Level Aggregate Indices (LAIs)

The PIs should then be combined to obtain three indices aggregated at the assessment level (Level Aggregate Indices, LAIs) regardless of the welfare principles. Each pen should thus be scored at the "Caretaker" (i.e. Caretaker Index), "Herd" (i.e. Herd Index), and "Animal Level" (i.e. Animal Index) on a scale of 0–100.

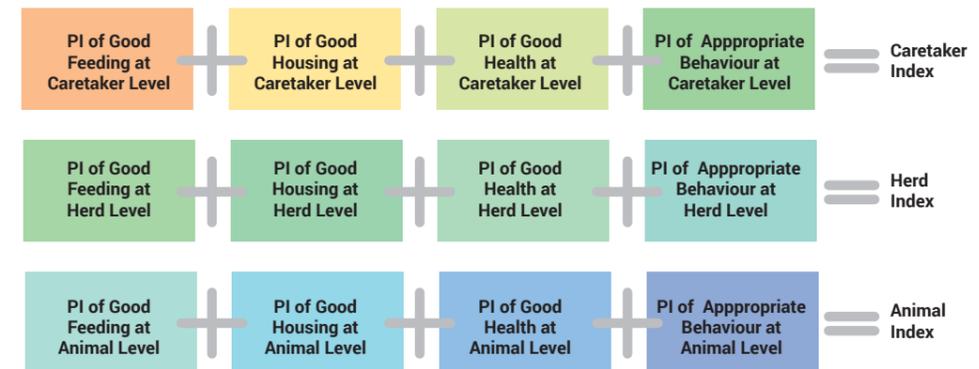
The LAIs express the overall assessment of a pen assessed at each level, including the four welfare principles, which are weighted equally. The LAI for each assessment level *i* can be calculated as follows:

$$LAI_i = (PI_{i, \text{Good Feeding}} \times 0.25) + (PI_{i, \text{Good Housing}} \times 0.25) + (PI_{i, \text{Good Health}} \times 0.25) + (PI_{i, \text{Appropriate Behaviour}} \times 0.25)$$

i = Assessment level *i*

^{30, 31, 32} Menchetti L, Zappaterra M, Nanni Costa L, Padalino B. Application of a Protocol to Assess Camel Welfare: Scoring System of Collected Measures, Aggregated Assessment Indices, and Criteria to Classify a Pen. *Animals (Basel)*. 2021 Feb 13;11(2):494. doi: 10.3390/ani11020494. PMID: 33668569; PMCID: PMC7918070.

Figure 79: Calculation of Level Aggregate Indices (LAIs) (modified after Menchetti et al.³¹)

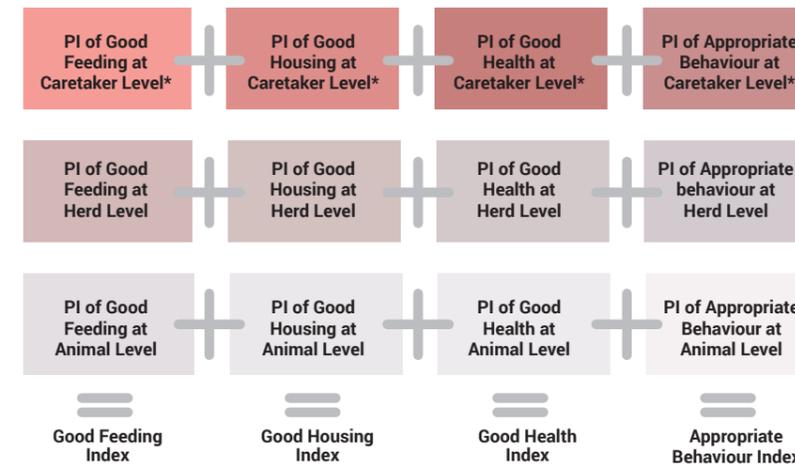


See Annex 4 for an example of practical application.

7.4. Calculation of Principle Aggregate Indices (PAIs)

The PIs should then be combined into weighted sums to obtain four indices aggregated at the welfare principle level (Principle Aggregate Indices, PAIs). Thus, each pen was scored for "Good Feeding" (i.e. Good Feeding Index), "Good Housing" (i.e. Good Housing Index), "Good Health" (i.e. Good Health Index), and "Appropriate Behaviour" (i.e. Appropriate Behaviour Index) regardless of the assessment level.

Figure 80: Calculation of Principle Aggregate Indices (PAIs) (modified after Menchetti et al.³²)



*lower weight (20%)

They could always range from 0 (worst) to 100 (best). The PAIs express the overall assessment obtained by a pen for each welfare principle, including the scores obtained at the three levels of investigations with differential weights. In particular, a lower weight (20%) was attributed to the PIs of Caretaker Level as they were based on information reported by the caretaker and not directly collected by the assessor ("questionnaire bias").

The PAI for each principle *j* can be calculated as follows:

$$PAI_j = (PI_{Caretaker, j} \times 0.20) + (PI_{Herd, j} \times 0.40) + (PI_{Animal, j} \times 0.40)$$

See Annex 5 for a practical application.

7.5. Calculation of the Total Welfare Index (TWI)

During the fourth step, the aggregate indices are combined into a weighted sum to obtain the Total Welfare Index (TWI). A single TWI, including all measures, may be calculated for each pen. The TWI expresses the overall assessment obtained by a pen regardless of the assessment level and welfare principle. The TWI can therefore be obtained by combining the 3 LAIs or the 4 PAIs.

In order to calculate the TWI using the 3 LAIs, differential weights must be attributed as follows:

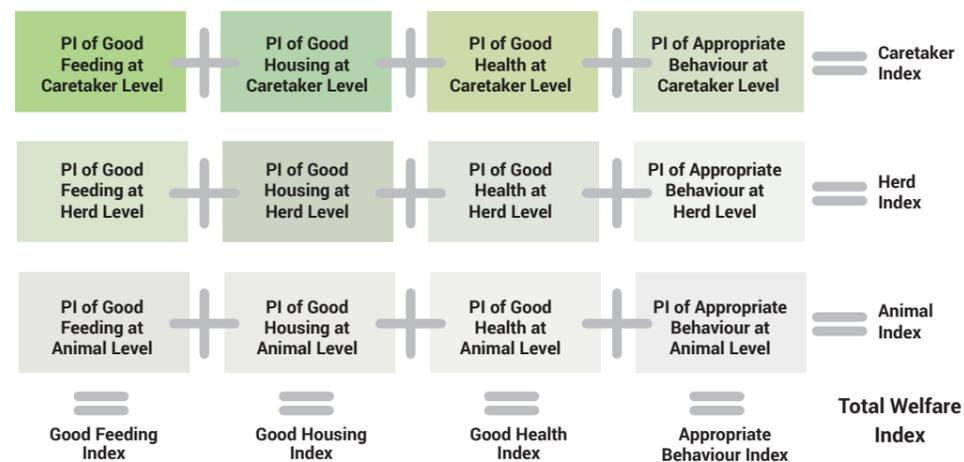
$$TWI = (Caretaker\ Index \times 0.20) + (Herd\ Index \times 0.40) + (Animal\ Index \times 0.40)$$

The TWI of a pen may range from 0 (poor welfare condition) to 100 (best possible welfare condition).

In order to calculate the TWI using the 4 PAIs, all PAIs were combined and weighted the same (i.e. 25%) as follows:

$$TWI = (Good\ Feeding\ Index \times 0.25) + (Good\ Housing\ Index \times 0.25) + (Good\ Health\ Index \times 0.25) + (Appropriate\ Behaviour\ Index \times 0.25)$$

Figure 81: Calculation of the Total Welfare Index (TWI) (modified after Menchetti et al.³³)



See Annex 6 for a practical application.

7.6. Classification of camel unit

The PAIs can be used to classify the pen by applying a hybrid rule system. This system compares the pen's PAIs scores with predefined reference profiles. Thus, four welfare classes were identified (Table 3), and the following thresholds were adopted: "excellent", if the pen scored >60 for each PAI and >80 for at least 2 of them; "satisfactory", if the pen scored >30 for each PAI and >60 for at least 3 of them; "unsatisfactory", if the pen scored >20 for each PAI and >30 for at least 3 of them; "unacceptable", if either criterion is not met.

See Annex 7 for a practical application.

Table 16: Scoring system of Principle Aggregate Indices

Parameter	Criteria	Welfare Classes
Principle Aggregate Indices	>60 for each principle and >80 for 2 principles >30 for each principle and >60 for 3 principles >20 for each principle and >30 for 3 principles Failure to meet the above requirements	Excellent Satisfactory Unsatisfactory Unacceptable

8. Disclaimer and legal aspects

The authors cannot be held responsible for any claim, damage or loss occurring due to different interpretations of the information contained in this guide.

This guide should not be used to make a diagnosis. Only veterinarians are qualified to verify the health state of animals.

The guidelines are intended to provide an accurate and complete impression. Note that this guide is not a legal document and is, therefore, not legally binding.

The guidelines are designed to complement existing legislation and DO NOT replace legal obligations.

The authors cannot be held liable for any claims, damages or losses that may result from any other application or interpretation of the information contained in the protocol. Using the methods and information in a different manner is the direct personal responsibility of the user.

Photographs illustrate some of the conditions described in the text to make the guidelines more accessible. These are merely examples and should not be considered as the only representation of an animal condition.

³³ Menchetti L, Zappaterra M, Nanni Costa L, Padalino B. Application of a Protocol to Assess Camel Welfare: Scoring System of Collected Measures, Aggregated Assessment Indices, and Criteria to Classify a Pen. *Animals (Basel)*. 2021 Feb 13;11(2):494. doi: 10.3390/ani11020494. PMID: 33668569; PMCID: PMC7918070.

9. Appendix Annex 1. Scoring system: An example of recording sheets for scoring the measures

Table 17: Scoring system to evaluate the protocol

Level	Principle	Measure	Criteria	Scores	Observed score	
Caretaker Level	Good Feeding	Water distribution	Ad libitum	0		
			Rationed	2		
		Food distribution	Ad li bitum	0		
			Rationed	2		
	Total Observed Score: Caretaker Level – Good Feeding					
	Good Housing	Years of experience in working with camels	>10 years	0		
			6-10 years	1		
			<5 years	2		
		Camels reared at the farm in the busiest week	0-10 camels	0		
			11-30 camels	1		
			>30 camels	2		
		Are the camels exercised?	Yes	0		
			No	2		
		Changes of management/housing according to season	Yes	0		
			No	2		
	Total Observed Score: Caretaker Level – Good Housing					
	Good Health	Who assesses the camels' health?	A veterinarian	0		
			A non-veterinarian	1		
			Not conducted	2		
		Who treats the camels when they are sick?	A veterinarian	0		
			A non-veterinarian	1		
			Not conducted	2		
		Who administers the camels' vaccinations?	A veterinarian	0		
			A non-veterinarian	1		
			Not conducted	2		
		Who administers the camels' endoparasite treatments?	A veterinarian	0		
			A non-veterinarian	1		
Not conducted			2			
Who administers the camels' ectoparasite treatments?		A veterinarian	0			
		A non-veterinarian	1			
	Not conducted	2				
Health problems have been observed in camels over the last year	No	0				
	Yes	2				
Total Observed Score: Caretaker Level – Good Health						
Appropriate Behaviour	Do your camels show behavioural problems?	No	0			
		Yes	2			
	Caretaker's ability to identify a camel in distress/pain	High - Very high	0			
		Moderate	1			
		Low - Some	2			
	How would you rank your understanding of animal welfare?	High - Very high	0			
Moderate		1				
Total Observed Score: Caretaker Level – Appropriate Behaviour						
Total Observed Score: Caretaker Level						

Level	Principle	Measure	Criteria	Scores	Observed score
Herd Level	Good Feeding	Number of water points	More than sufficient	0	
			At least one trough	1	
			Troughs not present	2	
		Water availability ¹	Yes	0	
			No	2	
		Water point dimensions ¹	Large	0	
			Medium	1	
			Small	2	
		Water position ¹	In the shade	0	
			In the sun	2	
		Water temperature	Cool	0	
			Lukewarm	1	
			Warm	2	
		Water space per animal	Ample	0	
			Regular	1	
			Limited	2	
		Water quality/ Cleanliness of water trough	Clean	0	
			Partially Dirty	1	
			Dirty	2	
		Proportion of drinking camels ²	0 (100% animals drinking) – 2 (0% animals drinking)	0–2	
		Number of feeding points	More than sufficient	0	
			At least one trough	1	
			Troughs not present	2	
		Feed availability	Yes	0	
			No	2	
		Feeding point dimensions ¹	Large	0	
			Medium	1	
Small	2				
Feeding point position ¹	In the shade	0			
	In the sun	2			
Feeding space per animal	Ample	0			
	Regular	1			
	Limited	2			
Feed quality/ Cleanliness of feed trough ¹	Clean	0			
	Partially Dirty	1			
	Dirty	2			
Presence of salt lick	Yes	0			
	No	2			
Proportion of camels eating ²	0 (100% animals eating) – 2 (0% animals eating)	0–2			
Proportion of camels ruminating ²	0 (100% animals ruminating) – 2 (0% animals ruminating)	0–2			
Total Observed Score: Herd Level – Good Feeding					

[continue Herd level]

Level	Principle	Measure	Criteria	Scores	Observed score	
Herd Level	Good Housing	Proportion of camels tethered/hobbled ²	0 (0% camels tethered/hobbled) – 2 (100% camels tethered/hobbled)	0-2		
		Space allowance	Ample	0		
			Regular	1		
			Limited	2		
		Presence of shade	Yes	0		
			No	2		
		Shaded space allowance	Ample	0		
			Regular	1		
			Limited	2		
		Fence condition	Unbroken	0		
			Broken	2		
		Bedding presence	Yes	0		
	No		2			
	Bedding cleanliness	Clean	0			
		Partially dirty	1			
	Presence of rubbish	Dirty	2			
		No	0			
	Total Observed Score: Herd Level – Good Housing					
	Good Health	Percentage of injured camels ²	0 (0% camels) – 2 (100% camels)	0-2		
		Percentage of diseased camels ²	0 (0% camels) – 2 (100% camels)	0-2		
		Percentage of camels in pain ²	0 (0% camels) – 2 (100% camels)	0-2		
		Percentage of camels injured by halters or tethering ²	0 (0% camels) – 2 (100% camels)	0-2		
		Percentage of camels with cauterizations ²	0 (0% camels) – 2 (100% camels)	0-2		
		Percentage of camels with nose ring ²	0 (0% camels) – 2 (100% camels)	0-2		
	Total Observed Score: Herd Level – Good Health					
	Appropriate Behaviour	Percentage of camels resting ²	0 (100% camels) – 2 (0% camels)	0-2		
		Percentage of camels standing quietly ²	0 (100% camels) – 2 (0% camels)	0-2		
		Percentage of camels displaying social behaviour ²	0 (100% camels) – 2 (0% camels)	0-2		
Percentage of camels displaying aggressive behaviour ²		0 (0% camels) – 2 (100% camels)	0-2			
Percentage of camels displaying stereotypies ²		0 (0% camels) – 2 (100% camels)	0-2			
Percentage of camels displaying other abnormal behaviours ²		0 (0% camels) – 2 (100% camels)	0-2			
Total Observed Score: Herd Level – Appropriate Behaviour						
Total Observed Score: Herd Level						

¹ If there is more than one trough in the pen, the score from the largest trough is used. ² Normalize the proportion in the range 0-2

Level	Principle	Measure	Criteria	Scores	Observed score	
					Camel ID 1 | Camel ID 2	
Animal Level	Good feeding	Body Condition Score	BCS=3 (good body condition)	0		
			BCS=2 or BCS=4 (moderate body condition)	1		
			BCS=0-1 or BCS=5 (poor body condition, learn or obese)	2		
		Thirst Index (bucket test)	0	0		
			1	1		
			2-3	2		
	Total Observed Score: Animal Level – Good Feeding					
	Good Housing	Shade	Yes	0		
			No	2		
		Presence of insects	No	0		
			Yes	2		
		Tethered	No	0		
			Yes	2		
	Hobbled	No	0			
		Yes	2			
	Resting behaviour	Yes	0			
		No	2			
	Total Observed Score: Animal Level – Good Housing					
Good Health	Presence of disease	No	0			
		Yes	2			
	Presence of injury	No	0			
		Yes	2			
	Presence of swollen joints	No	0			
		Yes	2			
	Presence of lameness	No	0			
		Yes	2			
	Presence of skin disorders	No	0			
		Yes	2			
	Presence of discharge (nose, eye, vulva)	No	0			
		Yes	2			
Presence of diarrhoea	No	0				
	Yes	2				
Presence of abnormal udder	No	0				
	Yes	2				
Presence of respiratory disorders	No	0				
	Yes	2				
Presence of evident pain	No	0				
	Yes	2				
Total Observed Score: Animal Level – Good Health						

[continue Animal level]

Level	Principle	Measure	Criteria	Scores	Observed score	
					Camel ID 1	Camel ID 2
	Appropriate Behaviour	Positive social interactions	Yes	0		
			No	2		
		Stereotypies	No	0		
			Yes	2		
		Feeding or rumination	Yes	0		
			No	2		
		Approaching test	Positive	0		
			Neutral	1		
			Negative	2		
		Total Observed Score: Animal Level – Appropriate Behaviour				
Total Observed Score: Animal Level						

Annex 3. Scoring system: Examples of Partial Indices (PI) calculation

The following tables provide collected measure scoring examples and Partial Indices calculation.

Table 19: Example 1, PI calculation at Caretaker Level.

Level	Principle	Measure	Criteria	Scores	Observed score
Caretaker	Good Health	Who assesses the camels' health?	A veterinarian	0	1
			A non-veterinarian	1	
			Not conducted	2	
		Who treats the camels when they are sick?	A veterinarian	0	1
			A non-veterinarian	1	
			Not conducted	2	
		Who administers the camels' vaccinations?	A veterinarian	0	2
			A non-veterinarian	1	
			Not conducted	2	
		Who administers the camels' endoparasite treatments?	A veterinarian	0	2
			A non-veterinarian	1	
			Not conducted	2	
		Who administers the camels' ectoparasite treatments?	A veterinarian	0	1
			A non-veterinarian	1	
			Not conducted	2	
Health problems have been observed in camels over the last year	No	0	2		
	Yes	2			
Total Observed Score: Caretaker Level – Good Health					9
<i>(Highest possible total score = 12)</i>					

Calculating the PI: the example if Total Observed Score of Good Health at Caretaker level= 9

PI of Good Health at Caretaker Level

$$= 100 - \left(\frac{\text{Total observed score of Good Health at Caretaker Level} \times 100}{\text{Highest possible total score of Good Health at Caretaker Level}} \right)$$

$$= 100 - \left(\frac{9 \times 100}{12} \right) = 100 - 75 = 25 \text{ (0 - 100 score)}$$

Annex 2. Scoring system: Highest possible total score of each principle and assessment level (if all measures can be scored)

Table 18: Highest possible total score of each principle and assessment level

Level	Principle	Highest Possible Total Score*
Caretaker	Good Feeding	4
	Good Housing	8
	Good Health	12
	Appropriate Behaviour	6
Herd	Good Feeding	34
	Good Housing	16
	Good Health	12
	Appropriate Behaviour	12
Animal	Good Feeding	4
	Good Housing	10
	Good Health	20
	Appropriate Behaviour	8

* If all measures are scored

Table 20: Example 2, PI calculation at Herd Level.

Level	Principle	Measure	Criteria	Scores	Observed score
Herd	Good Health	Percentage of injured camels	0 (0% camels) – 2 (100% camels)	0 – 2	0.4
		Percentage of diseased camels	0 (0% camels) – 2 (100% camels)	0 – 2	0.5
		Percentage of camels in pain	0 (0% camels) – 2 (100% camels)	0 – 2	0.0
		Percentage of camels injured by halters or tethering	0 (0% camels) – 2 (100% camels)	0 – 2	0.0
		Percentage of camels with cauterizations	0 (0% camels) – 2 (100% camels)	0 – 2	1.0
		Percentage of camels with nose ring	0 (0% camels) – 2 (100% camels)	0 – 2	2.0
Total Observed Score: Herd Level – Good Health (Highest possible total score = 12)					3,9

Calculating the PI:

PI of Good Health at Herd Level

$$= 100 - \left(\frac{\text{Total observed score of Good Health at Herd Level} \times 100}{\text{Highest possible total score of Good Health at Herd Level}} \right)$$

$$= 100 - \left(\frac{3.9 \times 100}{12} \right) = 100 - 32.5 = 67.5 \text{ (0 - 100 score)}$$

Table 21: Example 3, PI calculation at Animal Level (2 camels observed in the pen).

Level	Principle	Measure	Criteria	Scores	Observed score	
					Camel ID 1	Camel ID 2
Animal	Appropriate Behaviour	Positive social interactions	Yes	0	0	2
			No	2		
		Stereotypies	No	0	0	2
			Yes	2		
		Feeding or rumination	Yes	0	2	0
			No	2		
		Approaching test	Positive	0	1	2
			Neutral	1		
Negative	2					
Total Observed Score: Animal Level – Appropriate Behaviour: Mean score of the two camels = 4.5 (Highest possible total score = 8)					3	6

Calculating PI (2 camels observed in the pen):

PI of Appropriate behaviour at Animal Level

$$= 100 - \left(\frac{\text{Total Observed Score of Appropriate Behaviour at Animal Level} \times 100}{\text{Highest possible total score of Appropriate Behaviour at Animal Level}} \right)$$

$$= 100 - \left(\frac{4.5 \times 100}{8} \right) = 100 - 56.25 = 43.75 \text{ (0 - 100 score)}$$

Annex 4. Scoring system: An example of Level Aggregate Indices (LAIs) calculation

Table 22: Example of PIs and their use to compute the LAIs

Level	Partial Indices	PI observed
Herd	Good Feeding at Herd Level	50.0
	Good Housing at Herd Level	20.0
	Good Health at Herd Level	67.5
	Appropriate Behaviour at Herd Level	85.5

Herd Index Calculation:

$$LAI_{Herd} = (PI_{Herd, Good Feeding} \times 0.25) + (PI_{Herd, Good Housing} \times 0.25) + (PI_{Herd, Good Health} \times 0.25) + (PI_{Herd, Appropriate Behaviour} \times 0.25)$$

$$= (50.0 \times 0.25) + (20.0 \times 0.25) + (67.5 \times 0.25) + (86.5 \times 0.25) = 55.75$$

Annex 5. Scoring system: An example of Principle Aggregate Indices (PAIs) calculation

Table 23: Example of PIs and their use to compute a PAIs

Principle	Partial Indices	PI observed
Good Feeding	Good Feeding at Caretaker	100
	Good Feeding at Herd	75
	Good Feeding at Animal	53

Good Feeding Index calculation:

$$PAI_{Good Feeding} = (PI_{Caretaker, Good Feeding} \times 0.20) + (PI_{Herd, Good Feeding} \times 0.40) + (PI_{Animal, Good Feeding} \times 0.40)$$

$$= (100 \times 0.20) + (75 \times 0.40) + (53 \times 0.40) = 71.2$$

Annex 6. Scoring system: An example of Total Welfare Index (TWI) calculation

Table 24: Example of PAIs and their use to compute the TWI

Principle	Principle Aggregate Index observed
Good Feeding Index	75
Good Housing Index	25
Good Health Index	80
Appropriate Behaviour Index	95

TWI calculation:

$$TWI = (\text{Good Feeding Index} \times 0.25) + (\text{Good Housing Index} \times 0.25)$$

$$+ (\text{Good Health Index} \times 0.25) + (\text{Appropriate Behaviour Index} \times 0.25)$$

$$= (75 \times 0.25) + (25 \times 0.25) + (80 \times 0.25) + (95 \times 0.25) = 68.75$$

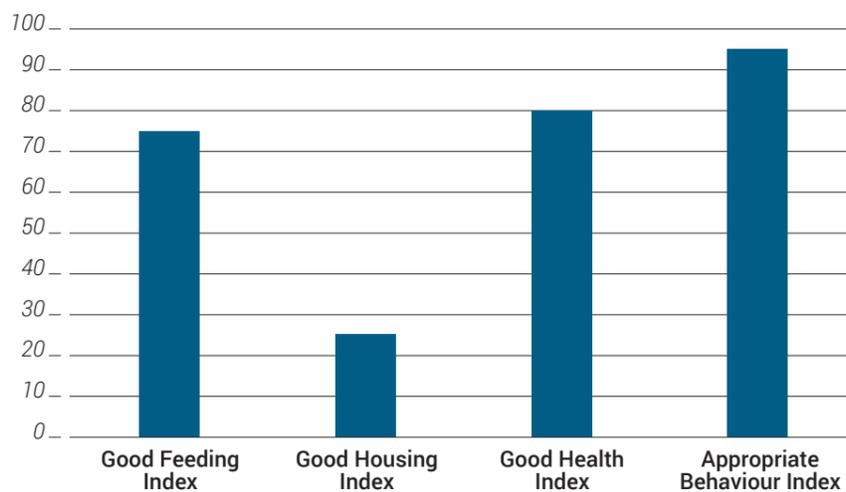
Annex 7. Pen Classification: An example of pen classification according to Principle Aggregate Indices

Table 25: PAIs are used to classify the pen

Principle	Principle Aggregate Index observed
Good Feeding Index	75
Good Housing Index	25
Good Health Index	80
Appropriate Behaviour Index	95

This farm could be classified as "Unsatisfactory" (>20 for each principle and >30 for 3 principles), as not all the principles are rated >30 (see Table 25). The figure shows the representation of the PAI, highlighting that the measures scoring the lowest were those included in the Good Housing principle. Recommendations on how to improve the camels' housing should be made, and a second assessment should be planned.

Figure 82: PAI profiles: The measures scoring the lowest were those included in the Good Housing principle



10. Table of figures

Page

- 9 Figure 1: The welfare principles of Good Feeding, Good Housing, Good Health and Appropriate Behaviour are evaluated at three levels: the Caretaker Level, the Herd Level, and the Animal Level.
- 11 Figure 2: Camel welfare assessment: Protocol steps proposed by Padalino and Menchetti [22]. BCS = Body Condition Score Page XX
- 16 Figure 3: Feeding trough under a shelter
- 16 Figure 4: Feeding trough in the sun
- 16 Figure 5: Availability of a salt lick
- 18 Figure 6: High-density pen. Not all camels have the opportunity to feed (please see red arrows for feeding trough)
- 19 Figure 7: All camels have a place to rest in the shade
- 19 Figure 8: Although there is a shelter to protect the camels from the sun, not all camels have access to it
- 19 Figure 9: No shelter available
- 19 Figure 10: A camel tries to find shade for its head behind a container
- 19 Figure 11: Camel-friendly fencing
- 19 Figure 12: Broken fence: Partly collapsed fencing risking injury. The camels may escape.
- 20 Figure 13: Rubbish in the pen
- 20 Figure 14: Rubbish in the pen. The camels may ingest the rubbish.
- 21 Figure 15: Injured left hind leg
- 21 Figure 16: The camel is unable to get up.
- 21 Figure 17: Camel with a tense, painful abdomen (see red arrows), indicating colic.
- 22 Figure 18: Chain cutting into the skin on the bridge of the nose
- 22 Figure 19: Hobbles cutting into the skin of the fetlock
- 22 Figure 20: Nose ring in the left nostril
- 23 Figure 21: Several cauterizations on the lateral front-left fetlock joint
- 23 Figure 22: Cauterization around the left eye
- 23 Figure 23: Cauterization on the right shoulder
- 25 Figure 24: Resting
- 25 Figure 25: Standing quietly
- 25 Figure 26: The camels are in physical contact and enjoy being close to each other.
- 28 Figure 27: A camel drinks during the bucket test
- 30 Figure 28: Ideally, no equipment is placed on the camel unless the camel is handled directly.
- 30 Figure 29: Isolated male camel with hobbles on the front legs and an additional attachment to the ground
- 30 Figure 30: Halter made of soft material
- 30 Figure 31: Fitted, padded hobbles on the front legs that do not scratch or cut into the skin
- 31 Figure 32: Hobbles are too tight, cutting into the skin
- 31 Figure 33: Rope hobbles that slipped down the fetlock, increasing the risk of injury. Visible scarring from previous hobbles.
- 31 Figure 34: Rope hobbles attached to the ground
- 33 Figure 35: Halter, nose-ring and rope
- 33 Figure 36: Camel displaying an old injury near the mouth
- 33 Figure 37: Fresh injury on the right side of the thorax
- 33 Figure 38: Purulent infection
- 34 Figure 39: Injury on the left side of the abdomen
- 34 Figure 40: Pressure ulcer on the right front leg.
- 34 Figure 41: Severe swelling of the right carpal joint
- 34 Figure 42: Severe swelling of the right carpal joint
- 35 Figure 43: The camel is unable to stand, cannot bear weight on one leg or is unwilling to take a step forward. Assessing the camel in motion is not required.
- 36 Figure 44: The camel's gait is disturbed, but it can walk. Its head lifts when pressure is applied to the lame foot. The pelvis lifts when the lame hind leg touches the ground.
- 36 Figure 45: A camel with a severely swollen left hind leg. The camel is not putting any weight on the leg.
- 36 Figure 46: The camel can bear weight evenly on all limbs at rest and when walking.
- 36 Figure 47: The camel weighs down all four legs evenly when standing.
- 37 Figure 48: Hairless area to the right of the sacroiliac joint
- 37 Figure 49: Multiple hairless areas on the right side of the neck
- 37 Figure 50: Multiple hairless patches all over the body
- 37 Figure 51: Isolated hairless patches on the left side of the body (possibly dermatomycosis)
- 37 Figure 52: Large hairless scaly areas on the head and neck
- 38 Figure 53: Ticks on the udder
- 38 Figure 54: Ticks in the axillary area
- 38 Figure 55: Tick on the left eyelid
- 39 Figure 56: Thick and white nasal discharge with an encrusted rhinarium
- 39 Figure 57: Thick and white/translucent nasal discharge
- 39 Figure 58: Thick yellow discharge from the right eye with skin lesions around the eye
- 39 Figure 59: Watery transparent discharge from the eye
- 40 Figure 60: Yellow vulva discharge
- 40 Figure 61: Pelleted faeces of a camel
- 40 Figure 62: A camel with diarrhoea. Its coat is covered in manure.
- 41 Figure 63: Hypertrophic teats
- 41 Figure 64: Swollen udder; suspected acute mastitis
- 42 Figure 65: Abdominally emphasised breathing (see red arrow)
- 42 Figure 66: The camel breathes calmly and regularly
- 43 Figure 67: Swelling along the abdominal line; suspected hernia umbilicalis
- 43 Figure 68: Swelling on the right hind limb; suspected abscess
- 43 Figure 69: Proliferation of tissue around the mouth
- 43 Figure 70: Swelling on the left side of the neck; suspected abscess
- 43 Figure 71: Small multiple swollen areas on the right side of the abdomen leading up to the shoulder
- 44 Figure 72: Rectal prolapse
- 44 Figure 73: Vaginal prolapse
- 45 Figure 74: Camel displaying a negative response
- 45 Figure 75: Neutral response
- 45 Figure 76: Positive response
- 46 Figure 77: 4-step process of scoring and aggregation
- 48 Figure 78: Calculation of Partial Indices (PI)
- 49 Figure 79: Calculation of Level Aggregate Indices (LAIs)
- 49 Figure 80: Calculation of Principle Aggregate Indices (PAIs)
- 50 Figure 81: Calculation of the Total Welfare Index (TWI)
- 60 Figure 82: PAI profiles: The most deficient measures were those included in the Good Housing principle

11. List of tables

Page

8	.....	Table 1:	Number of pens to be assessed
8	.....	Table 2:	Number of camels to be assessed
10	.....	Table 3:	Camel welfare indicators were selected by researchers for the principles of Good Feeding, Good Housing, Good Health and Appropriate Behaviour.
12	.....	Table 4:	Camel welfare recording sheet at Caretaker Level
13	.....	Table 5:	Camel welfare recording sheet for indicators of "Good Feeding" collected at Herd Level
17	.....	Table 6:	Camel welfare recording sheet for indicators of "Good Housing" collected at Herd Level
20	.....	Table 7:	Camel welfare recording sheet for indicators of "Good Health" collected at Herd Level
24	.....	Table 8:	Camel welfare recording sheet for indicators of "Appropriate Behaviour" collected at Herd Level
24	.....	Table 9:	An ethogram of the behaviours reported in the recording sheets for camel welfare assessment can be seen below. Some behaviours are identified at the Herd Level and others at the Animal Level.
27	.....	Table 10:	Camel welfare recording sheet for indicators of "Good Feeding" collected at the Animal Level
28	.....	Table 11:	Bucket test calculation table
29	.....	Table 12:	Camel welfare recording sheet for indicators of "Good Housing" collected at the Animal Level
32	.....	Table 13:	Camel welfare recording sheet for indicators of Good Health collected at the Animal Level
44	.....	Table 14:	Camel welfare recording sheet for indicators of "Appropriate Behaviour" collected at the Animal Level
47	.....	Table 15:	A scoring system developed for the measures included in the camel welfare protocol
51	.....	Table 16:	Scoring system of Principle Aggregate Indices
52	.....	Table 17:	Scoring system to evaluate the protocol
56	.....	Table 18:	Highest possible total score of each principle and assessment Level
57	.....	Table 19:	Example 1, PI calculation at Caretaker Level.
58	.....	Table 20:	Example 2, PI calculation at Herd Level
58	.....	Table 21:	Example 3, PI calculation at Animal Level (2 camels observed in the pen).
59	.....	Table 22:	Example of partial indices and their use to compute the Level Aggregate Index
59	.....	Table 23:	Example of partial indices and their use to compute a Principle Aggregate Index
59	.....	Table 24:	Example of Principle Aggregate Indices and their use to compute the Total Welfare Index
60	.....	Table 25:	Principle Aggregate Indices are used to classify the pen



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA
DEPARTMENT OF
AGRICULTURAL AND FOOD SCIENCES



ANIMALS' ANGELS

we are there with the animals