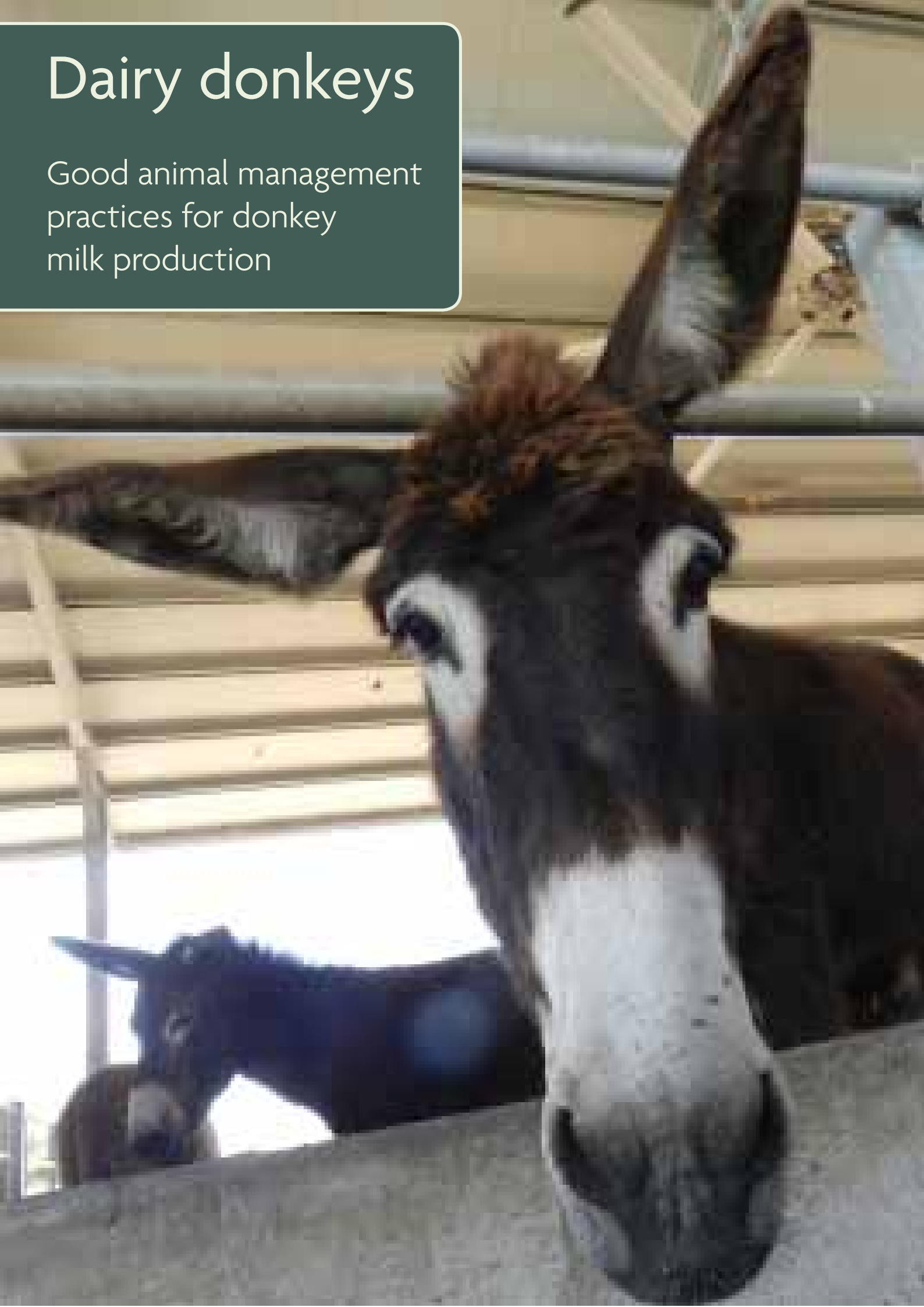
Dairy donkeys

Good animal management practices for donkey milk production



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Disclaimer

The guidelines *Dairy donkeys: good animal management practices for donkey milk production* have been designed to provide advice for anyone involved in dairy donkey farming.

This document does not replace or supersede any existing legal standards.

This document is not legally binding. Should a conflict occur, current acting legislation always has priority.

The guidelines must not be used to replace clinical advice; only a veterinarian is qualified according to the law in force in the country to verify the health status of the animals and to prescribe any drug or therapy.

The authors of the guidelines cannot be held responsible for any claim, damage or loss which may occur as a result of different application or interpretation of the information contained in this document.

The authors of the guidelines shall not be liable for any damages incurred as a result of lack of implementation of safety and biosecurity concepts.

The photos included are examples to illustrate a specific condition; these must not be considered as the only representation of animal or farm conditions.

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Acknowledgements

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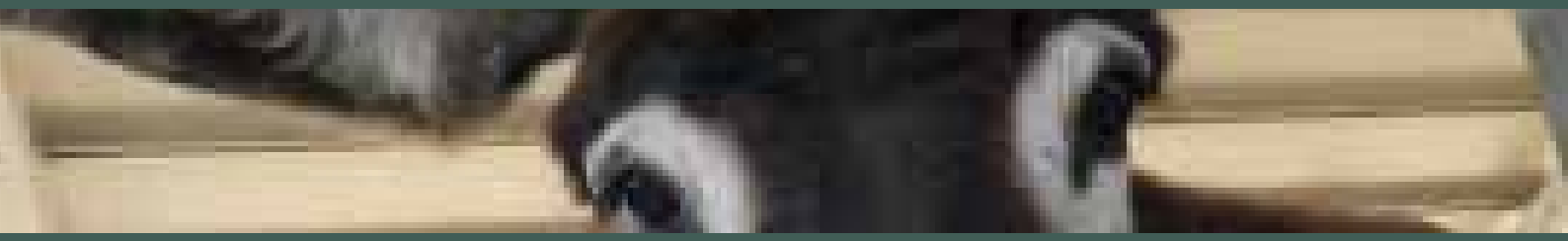

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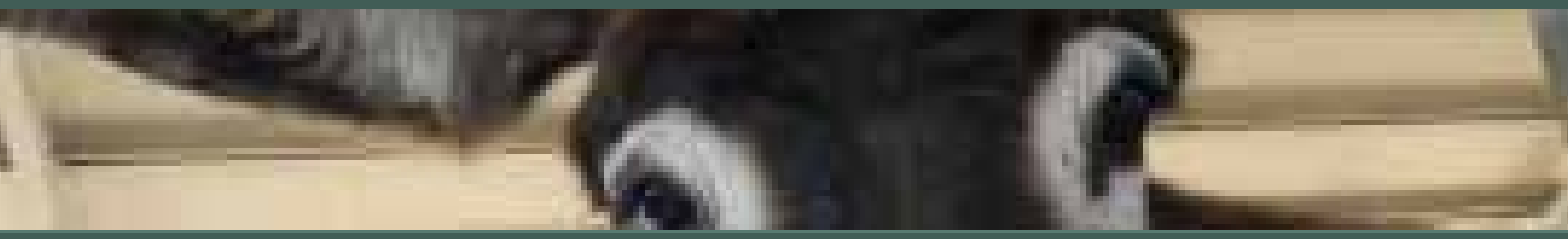
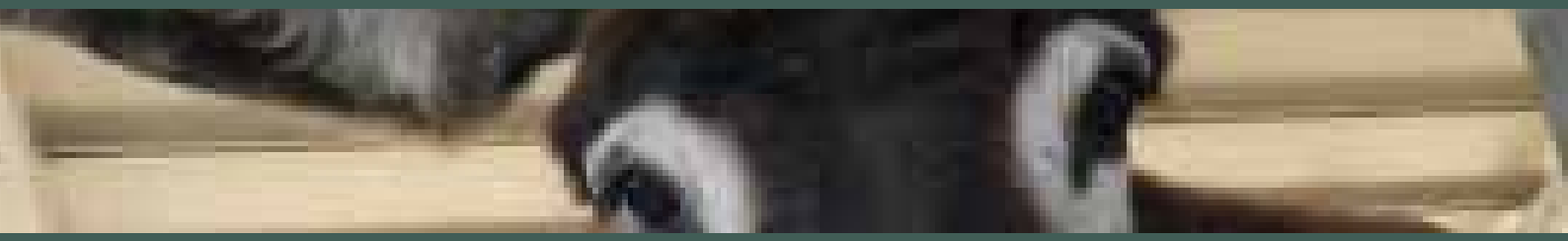




Introduction

The guidelines *Dairy donkeys: good animal management practices for donkey milk production* are designed to provide clear and helpful advice on good animal management practices for anyone interested in sustainable donkey milk production. Successful donkey milk production requires motivated and well-trained persons working with donkeys. If there is any doubt, please seek professional advice.

Adopting appropriate practices to protect animal welfare is recognised to be a key factor for increasing the sustainability of animal production.

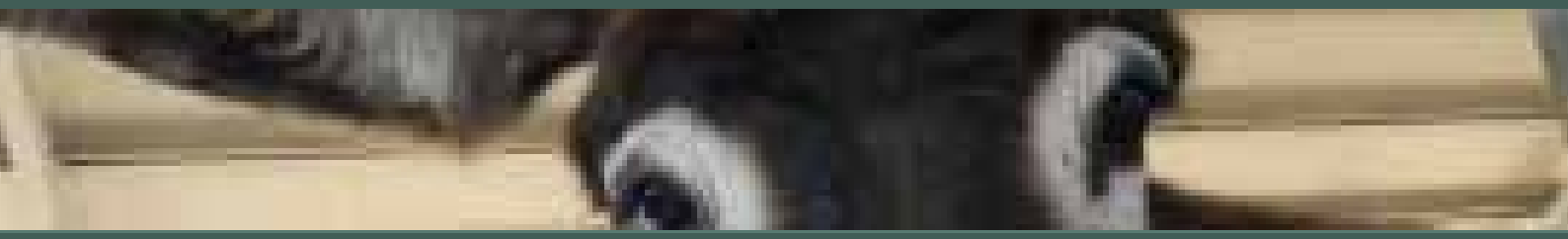
Purpose

These guidelines aim to support good animal management practices for sustainable donkey milk production and recommend practical solutions for their implementation. They are meant for all people responsible for donkeys.

Development process

The guidelines were developed by a Stakeholder platform using a considered judgement process informed by systematic reviews of the evidence for each dairy donkey welfare key issue. The Stakeholder platform included 29 experts in the field of donkey breeding, donkey welfare, veterinary medicine, industry, research and NGOs. The guidelines may be updated in the light of new knowledge.

More information can be found by accessing the website http://donkeynetwork.org.uk.

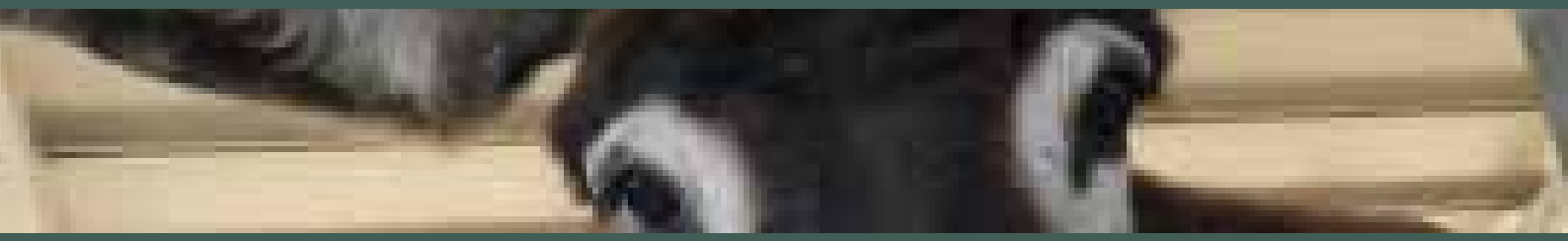


How to use the guidelines

Each section of the document covers a particular topic (e.g. water and feed, etc.) and contains the following information:

	Essential requirements The essential requirements designated in this document must be met under law for livestock welfare purposes. Jurisdictions may vary in their definition of specific terms under their animal welfare legislation. Every endeavour has been made to adopt terms that have nationwide application. Readers are urged to check the relevant definitions under the relevant legislation to their jurisdiction.
	Additional practices The additional practices to achieve desirable animal welfare outcomes are consistent with the recent scientific literature. They have no force of law, use the word 'should' and complement the essential requirements. Where appropriate science is not available, the additional practices reflect a value judgement that has to be made for some circumstances. Numbers in brackets refer to scientific papers reported in the References section at the end of the document.
	Warning Take-note topics, which could represent a serious issue for animal welfare.
	Further information Additional material (such as pictures or tables) which can be a useful practical tool to ensure animal welfare.

Interpretation of symbols



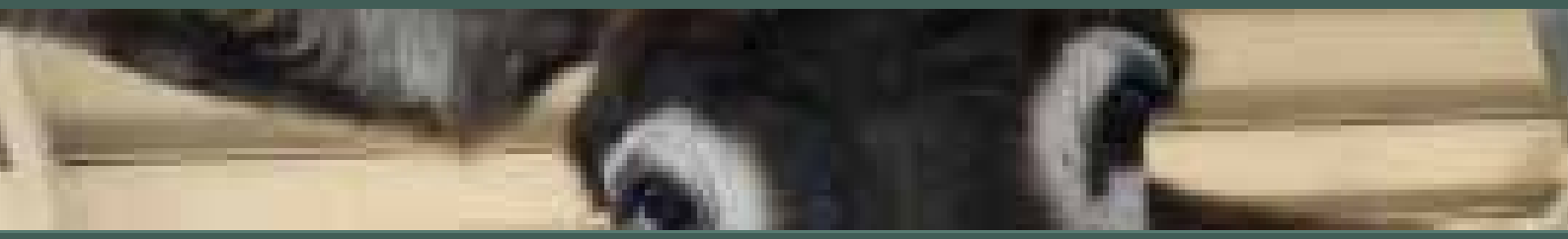
Interpretation of evidence

The following table reports symbols and definitions adopted for critical appraisal of scientific literature. No extensive scientific methodological knowledge is needed to use the guidelines.

●●●●●	Evidence obtained from meta-analysis or systematic reviews of randomised controlled trials or at least one randomised controlled trial
●●●●○	Evidence obtained from at least one controlled study without randomisation
●●●○○	Evidence obtained from at least one other type of well-designed quasi-experimental study, without randomisation
●●○○○	Evidence obtained from well-designed non-experimental descriptive studies, such as comparative studies, correlation studies and case studies
●○○○○	Evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities

Terms and definitions

- Dairy donkey: donkey kept to produce milk
- Donkey at maintenance: male or female adult donkey, not pregnant or lactating
- Jenny: female adult donkey
- Lactating jenny: female adult donkey producing milk
- Jack: male adult donkey kept for reproduction
- Foal: young donkey from birth to weaning



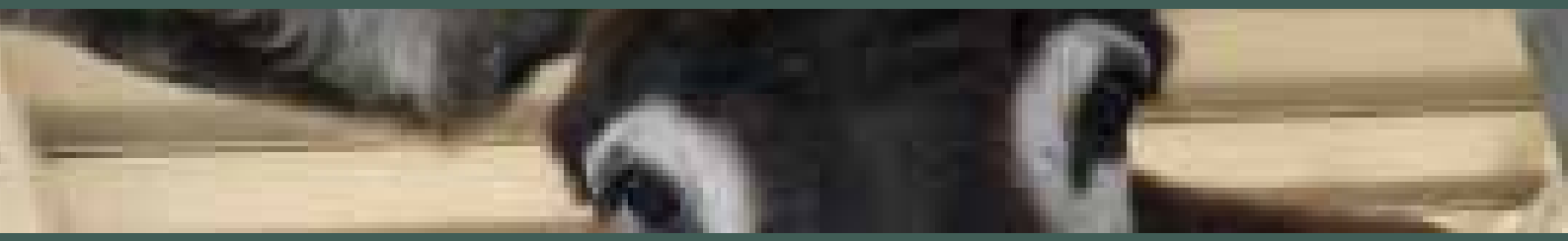
Responsibilities

Essential requirements

	The "owner" or "keeper" is any natural or legal person or persons responsible for or in charge of animals whether on a permanent or temporary basis. (Council Directive 98/58/EC)

Additional practices

		Level of evidence	Reference
	The owner and the keeper of a donkey are responsible for the welfare, control and conduct of the animal	●○○○○	[1]
	The owner and keeper must consider the behavioural and physiological needs of the donkey and provide proper accommodation, nutrition and care	●○○○○	[1]
	Animals must be cared for by people with adequate skills and competences	●○○○○	[1]



Feed and water

Feeding

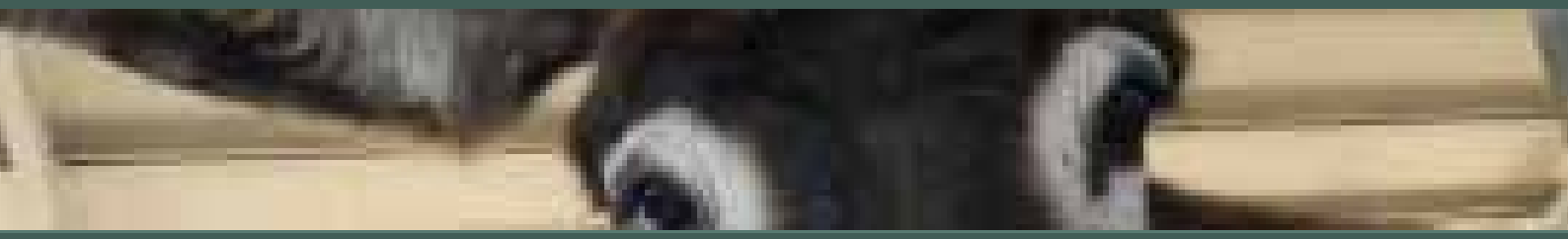
Donkeys originated in environments with sparse food supplies and have evolved as non-ruminant herbivores and hindgut fermenters. This means that donkeys are monogastric animals that digest food in one stomach. The stomach and small intestine process starch, proteins, fats, vitamins and minerals. Fibre and other undigested feed passes through the small intestine to the hindgut where fermentation occurs.

Essential requirements

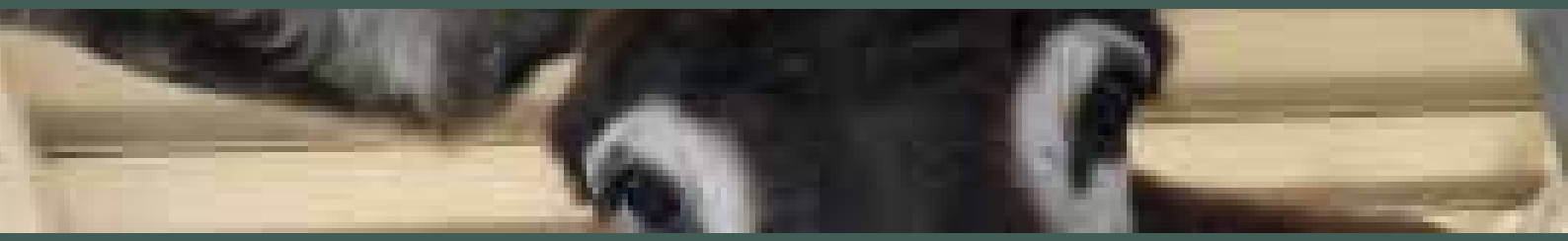
	Animals must be fed a wholesome diet which is appropriate to their age and species (Council Directive 98/58/EC).

Additional practices

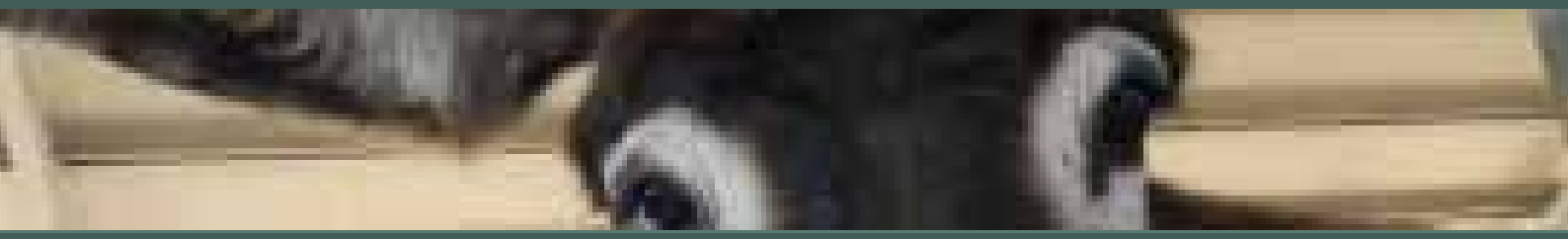
	All animals	Level of evidence	Reference
	Donkeys at maintenance should receive feedstuffs to satisfy their nutrient requirements, as related to their physiological status and productive activities in order to avoid nutritional disorders	●●○○○	[2-4]
	Donkeys at maintenance require feedstuffs with low energy values (such as cereal straw) so that they can eat enough to satisfy their natural appetite and need to forage without becoming obese	●●○○○	[2-4]
	Low energy forages (e.g. barley or wheat straw) should be available at all times if dentition allows	●●○○○	[3]



		Level of evidence	Reference
	Grazing should be permitted and properly managed; however pasture characteristics should be evaluated in order to establish if feed supplementation is necessary (poor pasture) or to be restricted (rich pasture)	●●○○○	[2, 3]
	Monthly body condition scoring is essential for a correct evaluation of the animal's nutritional status (see figure 1)	●●○○○	[2-5]
	When scoring donkeys it is essential to feel the animal: donkeys can have thick coats, which are often deceptive	●●○○○	[2-5]
	Vitamin and mineral supplementation may be required when donkeys have little access to grazing	●●○○○	[3]
	Donkeys at maintenance require low-protein-containing diets: protein requirements are fulfilled when the appetite is satisfied	●●○○○	[2, 4]
	All diets should have a non-structural carbohydrate (i.e. starch and sugars) level less than 15% and ideally should be less than 10% on a dry matter basis	●●○○○	[3, 4]

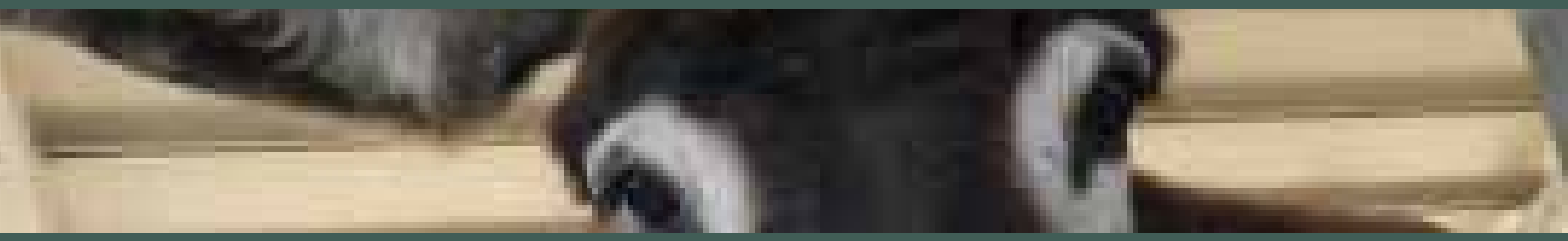


	Jennies	Level of evidence	Reference
	Pregnant jennies should be fed as normal (for maintenance) in the early stages of pregnancy with the addition of a vitamin and mineral supplement if not already being fed	●●○○○	[2]
	Energy requirements of the jenny do not increase significantly until the last trimester of pregnancy	●●○○○	[2, 3]
	During the last trimester of gestation there is 20% more energy requirement, 32% more protein requirement (see table 2) and double the maintenance requirement for calcium and phosphorous	●○○○○	[6]
	A slight increase in body condition before foaling is acceptable (BCS 3.5–4) to allow for expected weight loss in the early stages of lactation	●●○○○	[2]
	Lactating jenny rations are on average characterised (dry matter basis, DM) by a 70:30 forage-to-concentrate ratio, a protein content of 10–13 g per 100 g DM, and a digestible energy value of 8.5-10.0 MJ DE/kg-1 DM	●●○○○	[7]
	Intake of a high forage content diet is unlikely to be able to provide enough protein to meet the requirements of lactating donkeys. Concentrate supplementation improves protein intake without affecting apparent digestibility (see table 2)	●●○○○	[8]

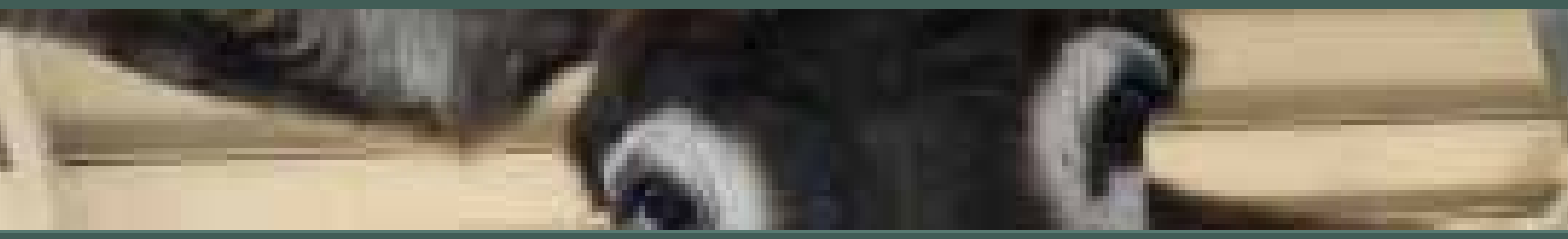


	Appetite in pregnant and lactating jennies should be closely monitored as they are at a high risk of developing hyperlipaemia	●●○○○	[3]
	The mineral profile of donkey milk is not dependent on dietary supply of microelements, when mineral requirements are fulfilled by feedstuffs in the diet	●●●●○	[9]
	Constant access to equine salt blocks is highly recommended	●●○○○	[7]

	Foals	Level of evidence	Reference
	The first feed should be within two to four hours of birth	●●○○○	[10]
	A new-born foal should receive colostrum from his/her mother within the first twelve hours of life; the recommended amount is a total of 1-2 litres	●●○○○	[10]
	In case of rejection of the foal, colostrum should be obtained from the mother or from another jenny soon after giving birth; cow colostrum is not ideal	●●○○○	[10]
	Keeping a colostrum bank on farm is recommended; colostrum can be collected and frozen at -15° to -20° in 250 ml batches	●●○○○	[10]
	If in doubt about colostrum ingestion, the IgG levels of foals can be measured 16-20 hours after birth; IgG levels should be >800 mg/dl of plasma	●●○○○	[10]

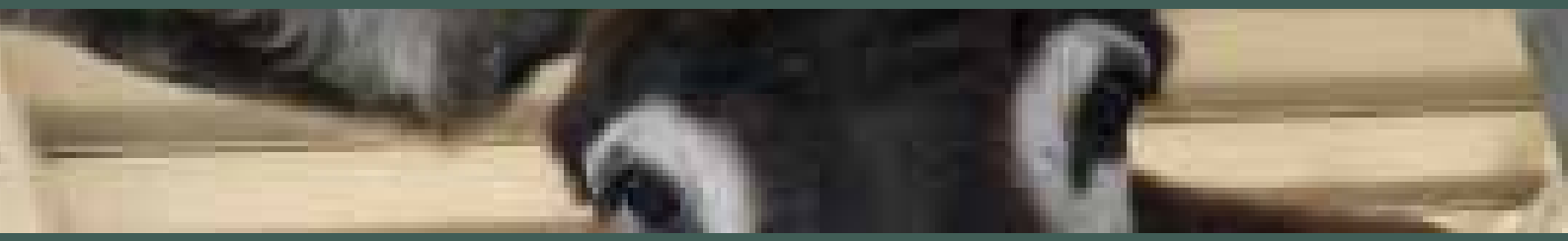


	The foal should be allowed to pick at the jenny's feed in preparation for weaning	●●○○○	[2]
	Foals of jennies who are being milked should have their diets supplemented with additional feeds to ensure nutritional requirements are met	●●○○○	[7]
	Nutritional management of the foal should also focus on fibre-rich feedstuffs	●●○○○	[3]
	Growing donkeys may be at risk of lacking calcium and phosphorous. The CA:P ratio in the diet should ideally be 2:1. Long-term feeding with bran in an unbalanced diet should be avoided	●●○○○	[3]
	Constant access to salt blocks is highly recommended	●●○○○	[7]
	During the lactation period it is advisable to monitor the foal's growth rate every two weeks (see figure 4)	●●○○○	[2]
	Weaning of donkey foals can occur at four to six months of age. Weaning at three months or earlier is not recommended unless in an emergency	●○○○○	



Warning

⚠	• Spoiled feedstuffs could contain toxins • All feedstuffs should be of good quality and free from mould • Forage evaluation requires a nutritionist and should ideally be based on chemical analysis • Within grasses or legumes the amount of nutrients change during the growing season • The time of harvest and the hay-making process affect the final quality of hay • All changes to diet should be made gradually over a period of four-six weeks • Donkeys should not be over-fed nor starved • Many significant health problems (e.g. obesity, metabolic or hormonal imbalances, hyperlipaemia, and laminitis) of donkeys result from over-provision of energy • If in any doubt owners should seek expert advice



Further information

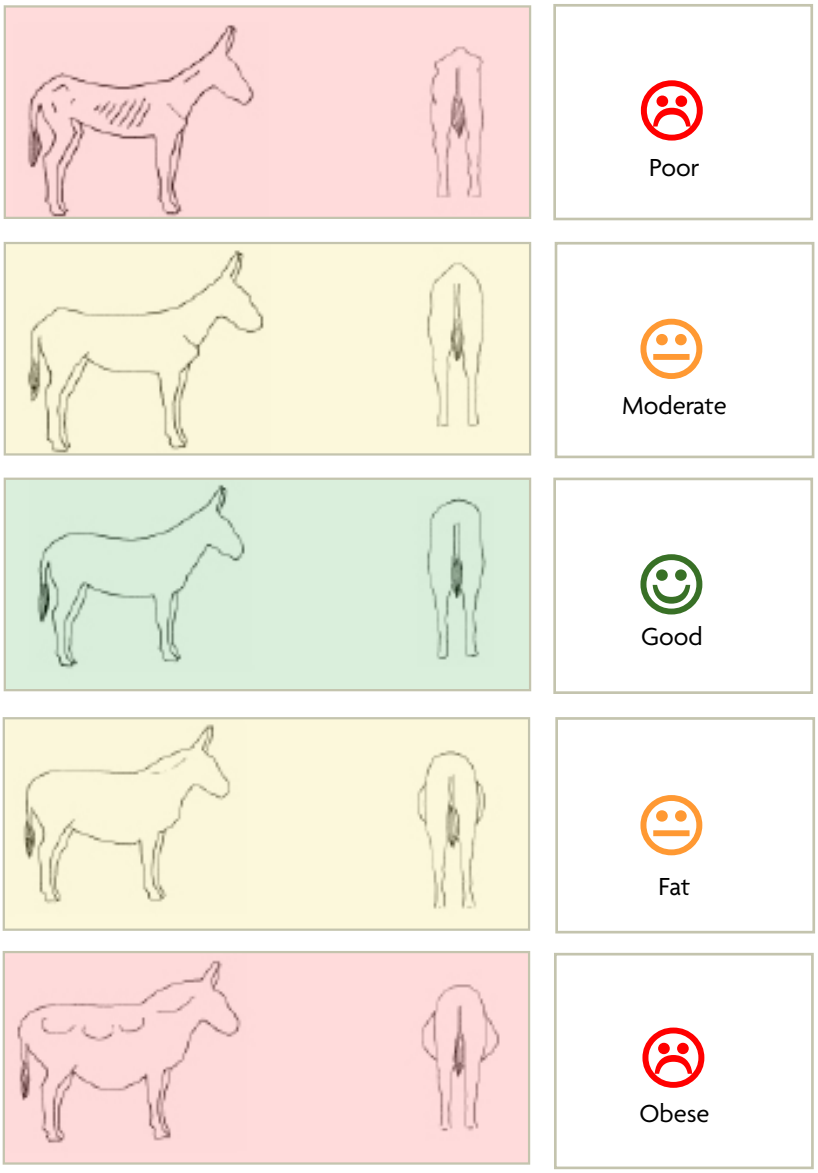
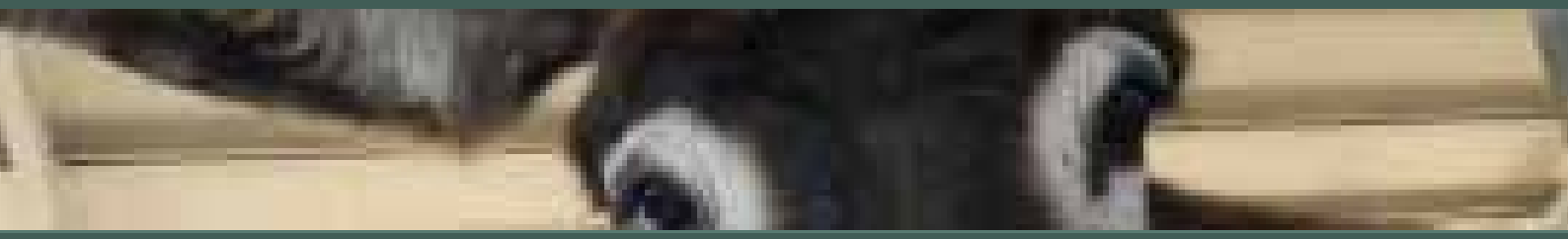


Figure 1. Donkey body condition scoring chart (modified from [2]). Areas where fat is commonly deposited include the neck, shoulders, back, rump and barrel. Body condition is assessed visually and by palpation.



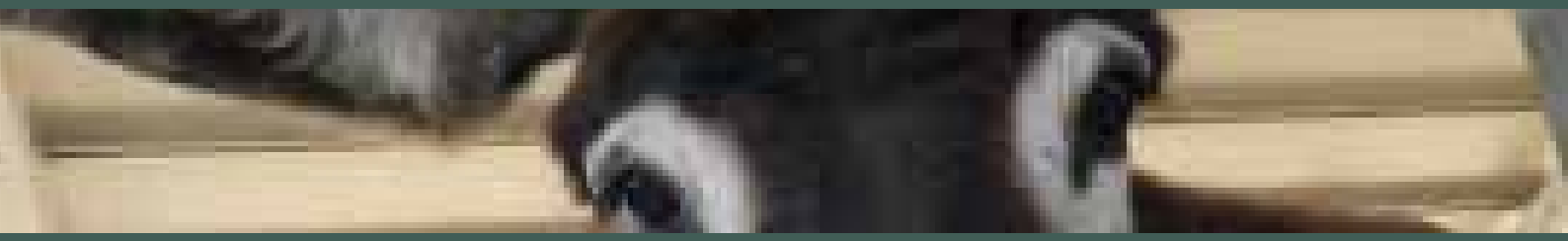
Further information

Good nutritional status

Lean animals

Fat animals

Figure 2. Donkey body condition scoring examples (pictures courtesy of The Donkey Sanctuary).



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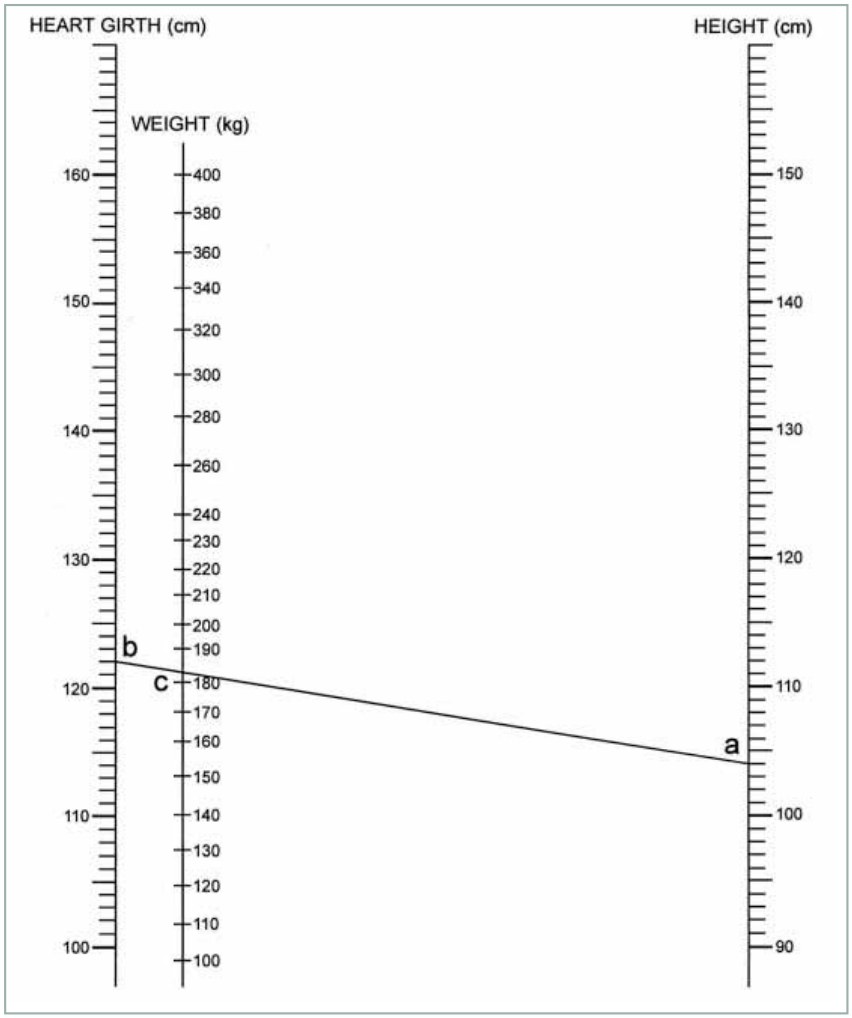
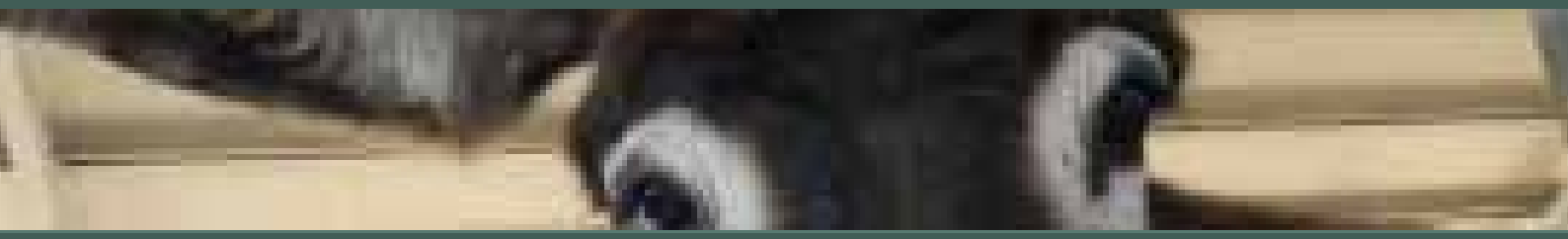


Figure 3. Donkey weight estimator [11]. To estimate a donkey's weight using the diagram mark the height and heart girth measurements on the correct axis. Then draw a line between the two. The donkey's weight is indicated by where the line crosses the weight axis. The weight estimator is accurate to within 10 kilograms.

Heart Girth (cm)	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Weight (kg)	46	47	49	51	53	55	57	59	61	63	65	67	69	71	74	76	78	81	83	86	88	91	94	96	99	102

Figure 4. Weight estimation table for donkeys under 2 years [11].



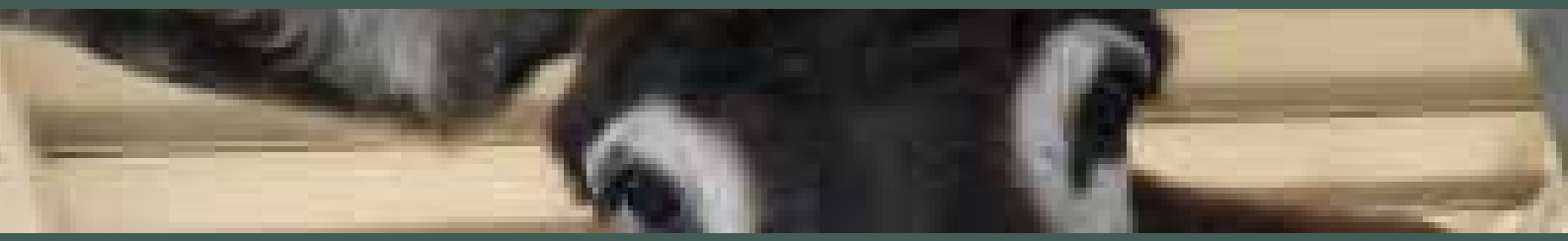
Further information

Donkey	MJ, DE/day	Daily DMI requirement	Suggested diet
180 kg donkey maintenance – summer	14.4	2.4 kg	2.1 kg barley straw (5 MJ DE/kg DM) + limited grazing or + 0.5 kg hay (8 MJ DE/kg DM)
180 kg donkey maintenance – winter	17.1	3.1 kg	3 kg barley straw (5 MJ DE/kg DM) + 0.4 kg hay (8 MJ DE/kg DM)
DE Digestible energy, DM Dry matter, DMI Dry Matter Intake			

Table 1: Example diets for mature donkeys fed on fibrous forages [2]

Stage of gestation	Suggested diet
9 months' gestation	1.1 kg barley straw (5 MJ DE/kg DM) + grazing and donkey or laminitic specific feed balancer (feeds very low in sugar and starch, i.e. no more than 10%) OR + 1.3 kg hay (8.5 MJ DE/kg DM) and donkey or laminitic specific feed balancer
10 months' gestation	0.4 kg barley straw (5 MJ DE/kg DM) + 1.8 kg hay (8.5 MJ DE/kg DM) + donkey or laminitic specific feed balancer
11 months' gestation	2.2 kg moderate hay (8.5 MJ DE/kg DM) + donkey or laminitic specific feed balancer + grazing If hay is not managed, supplement with high-fibre cubes, alfalfa chop or unmolassed sugar beet
First 3 months of lactation	2.6 kg good hay (9 MJ DE/kg DM) + grazing and laminitic balancer + 0.2kg alfalfa chaff (10 MJ DE/kg DM) and donkey or laminitic specific feed balancer
DE Digestible energy, DM Dry matter, DMI Dry Matter Intake	

Table 2. Suggested summer diets for pregnant and lactating jennies.
Energy requirements will increase in the winter, when hay should be freely available.
Diets are based on the donkey weighing 180 kg [3].



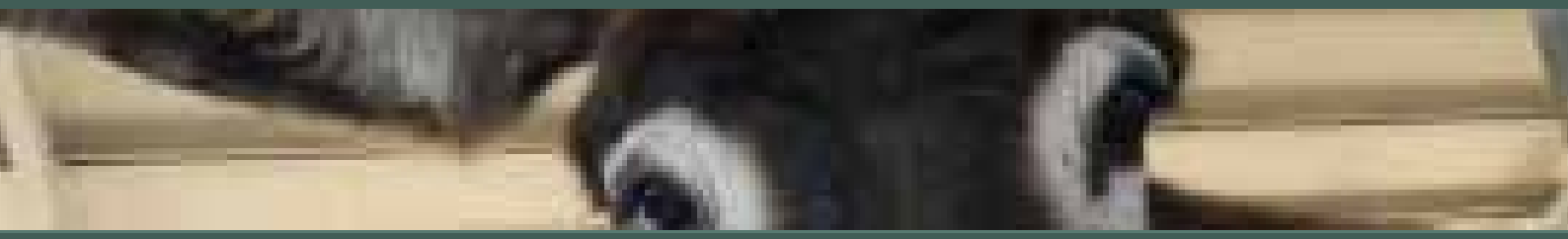
Water provision

Essential requirements

⚖	All animals must have access to a suitable water supply or be able to satisfy their fluid intake needs by other means (Council Directive 98/58/EC)

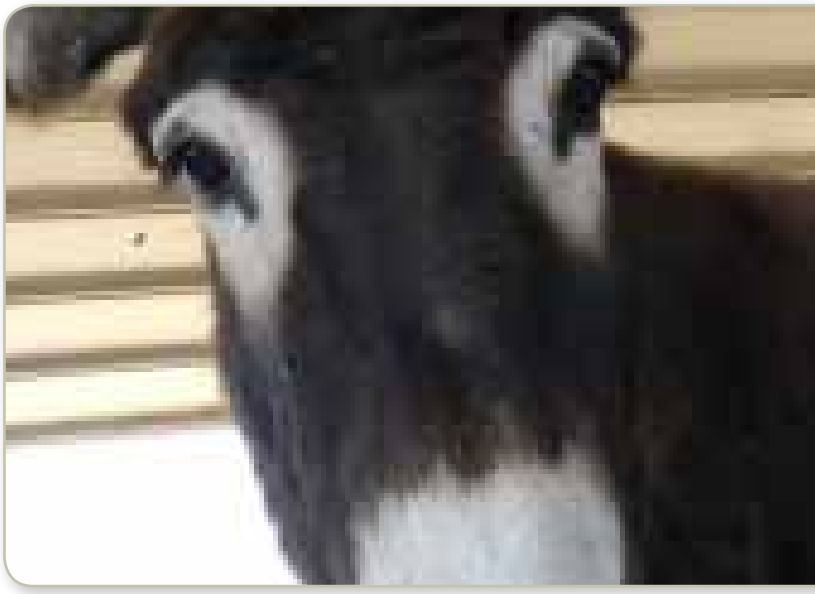
Additional practices

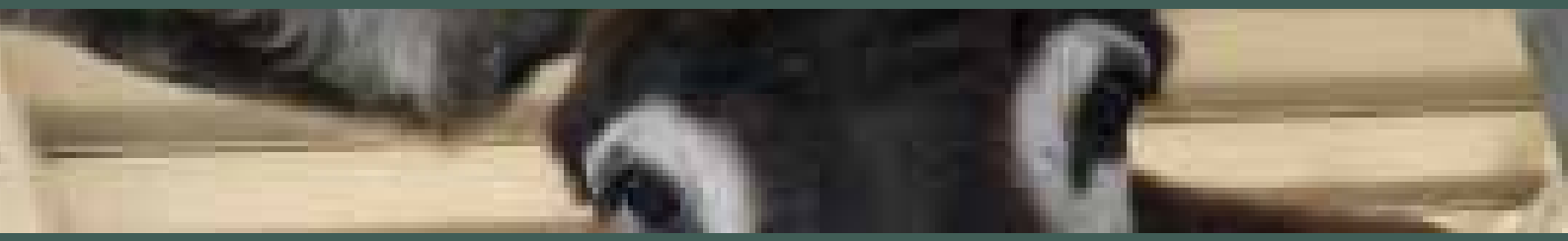
	All animals	Level of evidence	Reference
🎓	Water intake in donkeys is about 4-9% of body weight per day during rest. These requirements may vary depending on the diet and will be significantly increased during warm weather and when a donkey is lactating	●●●●●	[12]
	All donkeys should have permanent access to fresh, clean water	●●○○○	[10]
	If automatic drinkers are used, they should be regularly cleaned and checked for functioning	●●○○○	[10]



Warning

⚠	• In regions where the temperature drops below 0°, mechanical devices should be used to avoid ice build-up in troughs or drinkers where possible, otherwise steps should be made to thaw supplies regularly throughout the day • If the quality of the water is very poor (e.g. dirty, polluted) donkeys can refuse to drink, easily developing a dehydration status • Donkeys have a similar water requirement to horses to maintain health but may show less obvious signs of thirst and will maintain appetite even when dehydrated • Donkeys are more thirst-tolerant than ponies; however this short-term tolerance should not be confused with long-term requirement for water • Donkeys and their hybrids do not sweat as obviously as horses; lack of sweat marks should not be used to judge the hydration status of an animal





Further information

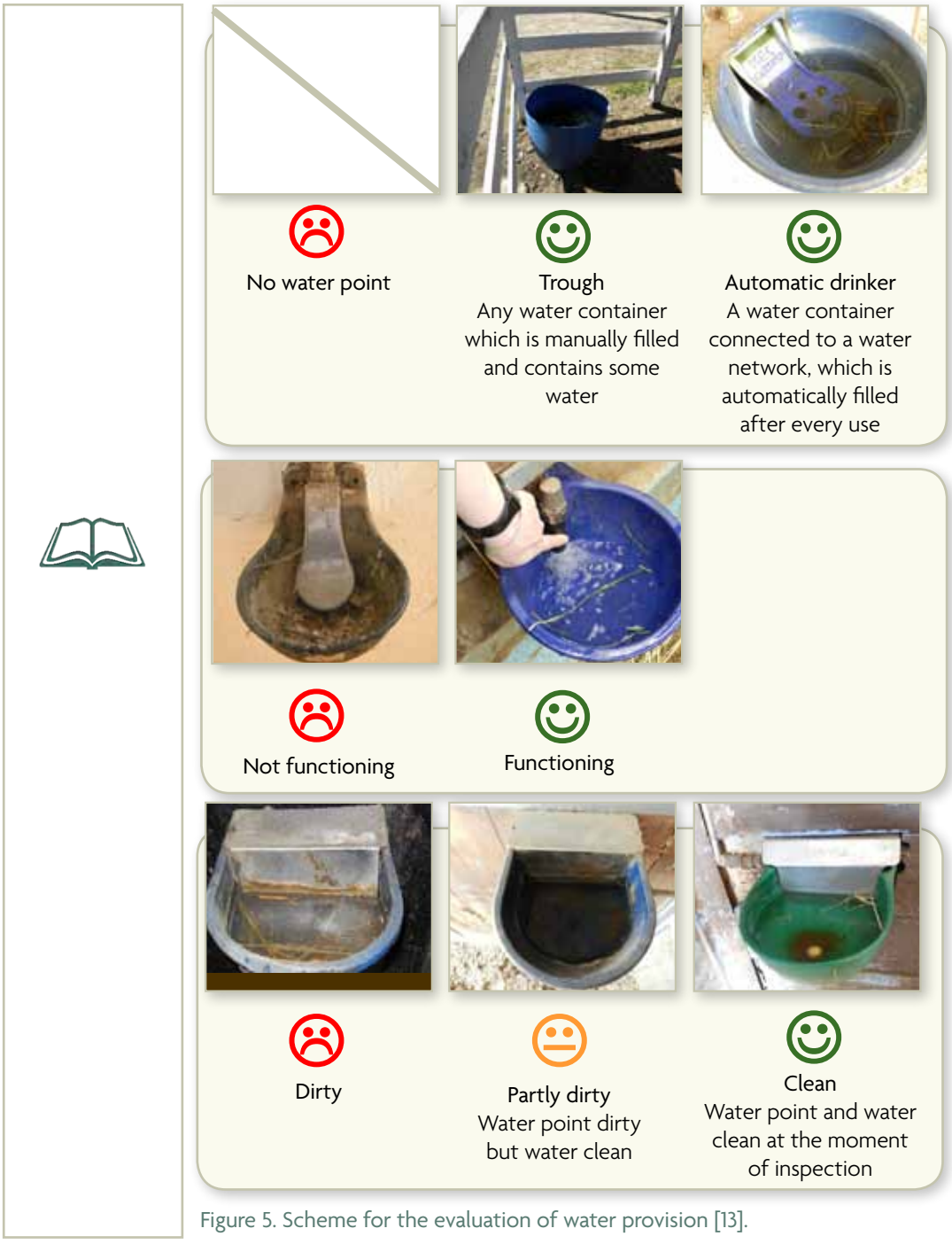
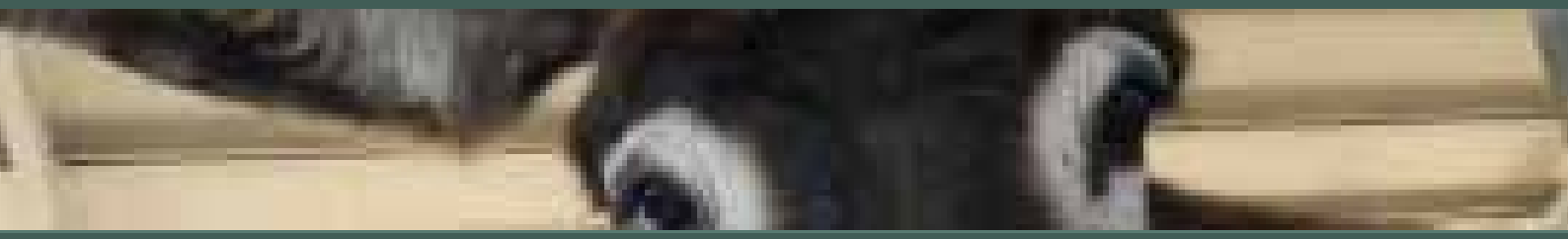


Figure 5. Scheme for the evaluation of water provision [13].



Housing and management

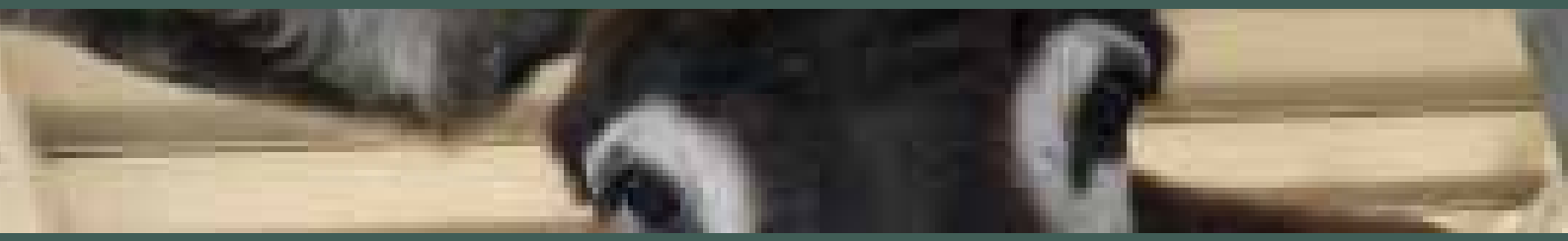
Donkey housing

Essential requirements

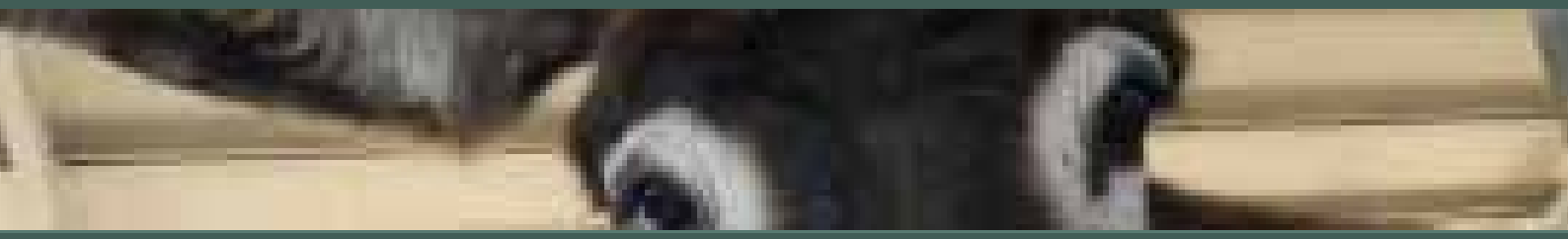
	Where an animal is continuously or regularly tethered or confined, it must be given the space appropriate to its physiological and behavioural needs in accordance with established experience and scientific knowledge. Materials to be used for the construction of accommodation, and in particular for the construction of pens and equipment with which the animals may come into contact, must not be harmful to the animals and must be capable of being thoroughly cleaned and disinfected. Animals not kept in buildings shall, where necessary and possible, be given protection from adverse weather conditions, predators and risks to their health. (Council Directive 98/58/EC)

Additional practices

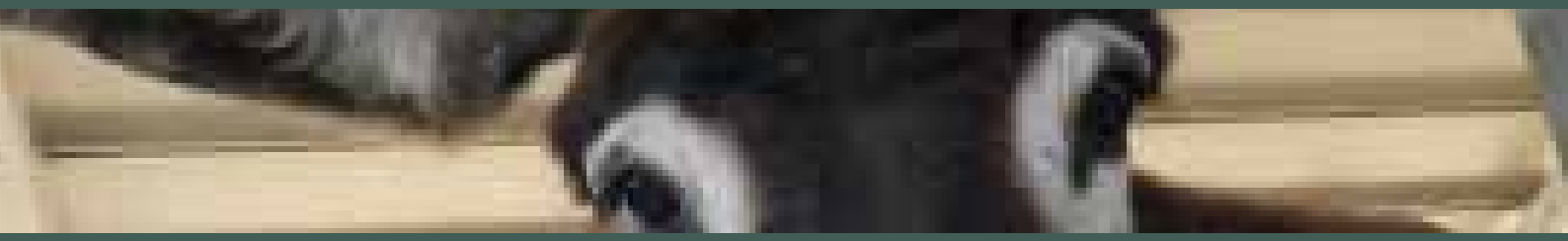
All animals	Level of evidence	Reference
Donkeys are a social species: they should be kept in groups with their own species	●●○○○	[4, 14, 15]
Access to pasture or paddock should be guaranteed to each healthy donkey in order to permit grazing and free movement	●○○○○	[4]
A shelter should be present to provide protection from adverse weather conditions	●○○○○	[16]
Shelters should be large enough to permit free movement to each donkey	●○○○○	
Clean bedding should be provided inside the shelter and should be inspected daily	●○○○○	



	Jenny and foal housing	Level of evidence	Reference
	Day and night assistance should be guaranteed to jennies who are about to give birth to ensure assistance is available in case of difficulties	●●○○○	[7]
	If jennies are housed singly close to foaling, they should be able to see, smell and interact with other donkeys	●○○○○	
	Delivery pens should be disinfected before and after each use	●○○○○	
	Delivery pens should be large enough to permit free movement of the jenny and the new-born, and to allow medical assistance if necessary	●○○○○	
	Delivery pens should have abundant clean bedding material well banked-up around the edges	●○○○○	
	During lactation, the housing in a dairy donkey farm must provide a healthy environment for jennies stabled with their foals	●●○○○	[7]
	Foals should be housed with their mothers until weaning at a suitable age	●○○○○	



	Jack housing	Level of evidence	Reference
	Jacks can be housed in a group together with jennies or singly to regulate breeding	●○○○○	[16]
	When housed singly, jacks should have access to a pasture/paddock to permit grazing and free movement	●○○○○	[16]
	When housed singly, jacks should have at least permanent visual and olfactory contact with other donkeys (see Appropriate behaviour chapter, page 55)	●○○○○	[16]
	When housed in single boxes these should be large enough to allow free movement and a comfortable resting position	●○○○○	



Further information

No bedding

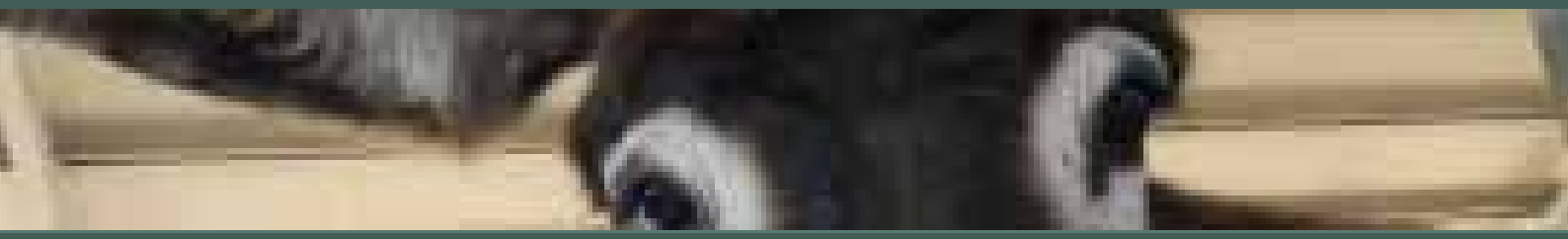
Insufficient bedding
Floor areas not covered by bedding are clearly visible

Sufficient bedding

Dirty bedding
Presence of faeces more than a day old, obviously wet

Clean bedding

Figure 6. Scheme for the evaluation of bedding [13].

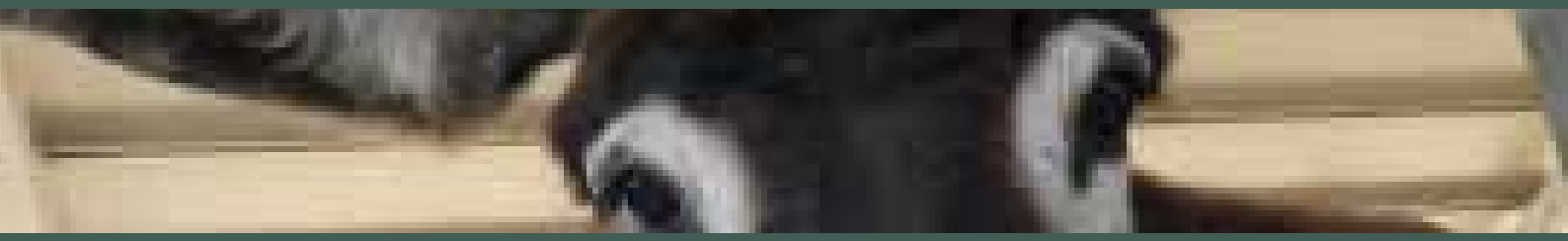


Further information

Height at the withers	Shelter area for group housing (m2 per donkey)	Single box housing (m2 per donkey)
<120 cm	5.5	5.5
120-134 cm	7	7
134-148 cm		8
148-162 cm	8	9
162-175 cm	9	10.5
> 175 cm	-	12

Table 3. Satisfactory shelter dimension (according to [17]).

Figure 7. Example of a pen for group-housed donkeys with a shelter, a manger and well-maintained fences (picture courtesy of Cyprus University of Technology).



Further information

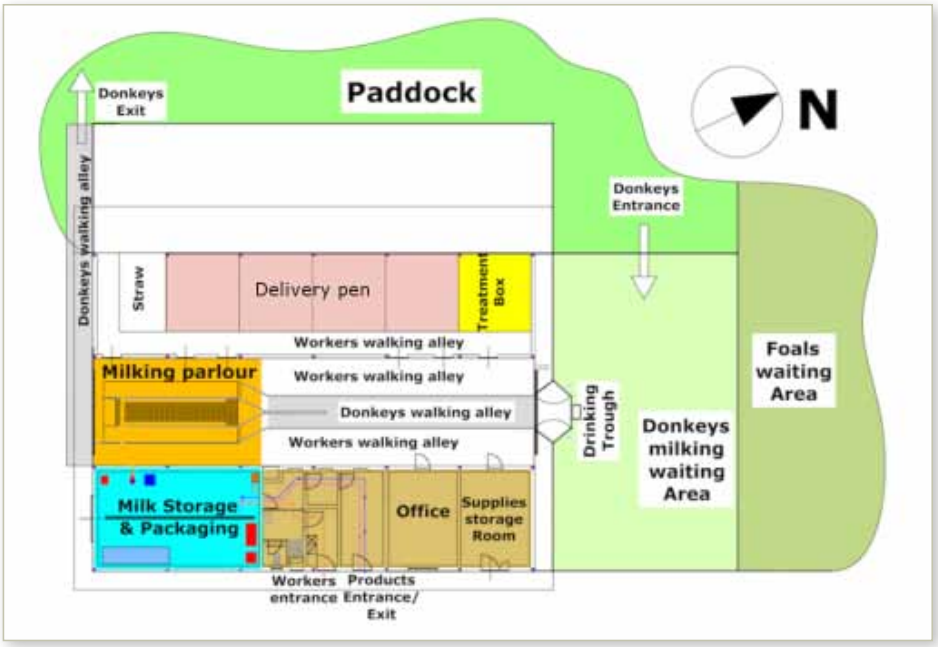
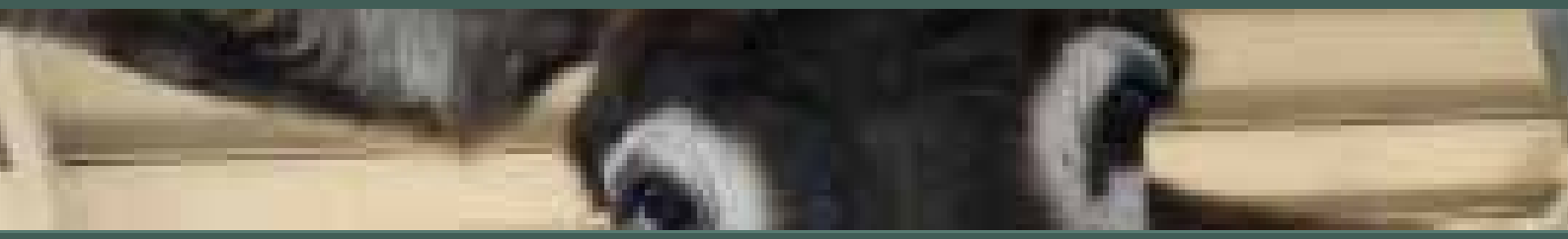


Figure 8. Example of a map of a dairy donkey farm (modified from [18]).



Handling

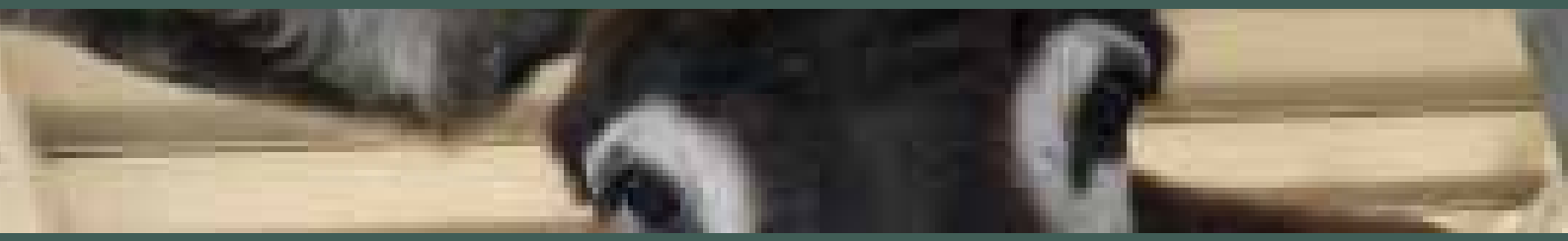
The human–animal relationship is built on interactions developed over time; both species will base their response to the other on their prior experiences of interaction [19–23]. Consistent, frequent and kind handling will reduce the level of fear an animal feels towards humans [24, 25] and will positively influence the emotional, cognitive and productive behaviour of the animal [26, 27].

Essential requirements

	Animals shall be cared for by a sufficient number of staff who possess the appropriate ability, knowledge and professional competence (Council Directive 98/58/EC)

Additional practices

	All animals	Level of evidence	Reference
	Jennies in foal should be handled frequently and sympathetically to help the development of correct behaviour towards humans	●○○○○	[28]
	Correct animal handling implies a firm but gentle approach in order to minimise stress for the animals and reduce risks to the handler. Stress during routine handling can be reduced if the animals are conditioned gradually to handling procedures	●○○○○	[29]
	Donkeys can be trained to remain calm by gradually and gently introducing them to things that may scare them. Careful, gentle habituation of the animal to strange sights and sounds can help prevent accidents	●○○○○	[29]
	Foals should be consistently handled correctly as they are growing up	●○○○○	[28]



	The behaviour of the handler could affect the temperament of the donkey	●○○○○	[28]
	All the donkeys should be trained to be caught and restrained with a head collar	●○○○○	[28]
	All the donkeys should be regularly handled in a gentle manner	●○○○○	[28]
	All the donkeys should be trained to pick up their feet and remain calm during foot trimming	●○○○○	[28]

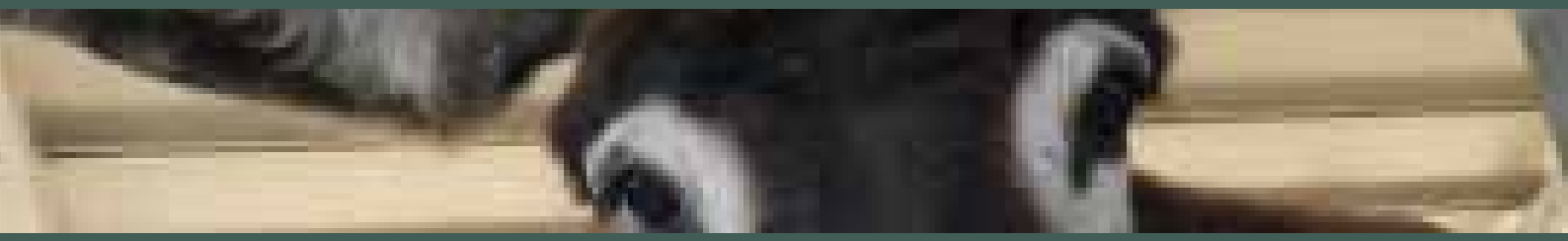
Warning

	• Donkeys could have fear reactions if not used to human contact and restraint • If donkeys have the possibility of interacting with humans only in stressful or painful situations (e.g. veterinary visits, dentistry, farriery), they could have dangerous reactions

Further information

Figure 9. Restraint of a donkey using a head collar

Figure 10. Donkey well trained to pick up the feet.

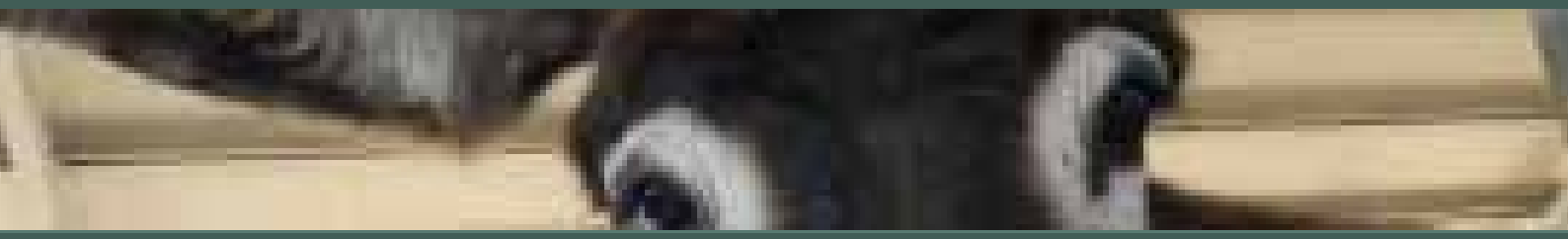


Hoof care

Under wild conditions, donkeys spend most of their waking hours (14-16 h/day) browsing and grazing, moving at walk on hard ground; this activity guarantees adequate blood circulation to the hoof, growth of good quality horn [30, 31] and regulation of hoof length. In farming conditions hooves tend to grow too long unless they are managed by human intervention.

Additional practices

	All animals	Level of evidence	Reference
	Donkeys, even with regular hoof trimming, need to have a proper amount of movement in order to guarantee adequate blood circulation to the hoof and growth of good quality horn	●●●○○	[30, 31]
	Overlong hooves should be tackled by experienced farriers and radiographs should be taken to guide trimming	●○○○○	[32]
	Hooves should be trimmed according to individual specific needs, floor characteristics, and donkeys' exercise and/or work type (as suggested by the veterinarian or the farrier)	●●●○○	[30, 32]
	Hooves should never get more than 2.5 cm (1 inch) longer than normal	●●●○○	[30]

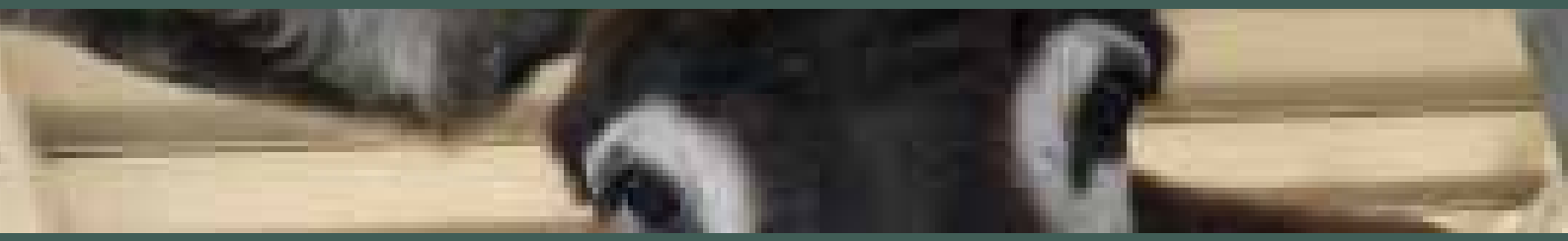


Further information

	Reference
The donkey hoof wall is at a steeper angle than in the horse and the frog is set further caudally. Values given for hoof wall angle in donkey front feet are 61.6° (standard deviation [SD], 5.24) vs. horse 50.5° (SD, 5.03). The distance between the extensor process of the third phalanx and the coronary band is given as 10.4 mm (±3.7 mm)	[32]
Donkey hooves have a different microstructure with a more open tubule structure than that of the horse hoof. This means the donkey horn contains more moisture. When kept in wet, dirty conditions, the donkey foot is predisposed to hoof problems such as white line disease and abscesses	[33, 34]

Measurements	Horses		Donkeys	
	Forelimb	Hindlimb	Forelimb	Hindlimb
Frog's length (cm)	8.31±0.71	8.30±0.68	6.30±0.81	6.03±0.67
Frog's width (cm)	5.60±0.58	6.09±0.59	5.41±0.55	5.98±0.48
Medial heel length (cm)	5.04±0.53	4.35±0.58	4.36±0.60	4.02±0.56
Lateral heel length (cm)	5.07±0.52	4.33±0.52	4.42±0.55	3.73±0.59
Toe length (cm)	8.59±0.69	8.64±0.57	7.47±0.86	7.70±0.67
Hoof angle (°)	52.46±3.00	51.30±3.13	59.38±5.10	59.81±5.78
Lateral heel angle (°)	45.63±5.37	43.08±4.25	51.00±6.69	51.75±6.57
Medial heel angle (°)	45.50±4.09	42.71±3.50	52.63±6.38	51.70±6.82
Hoof width (cm)	11.69±0.58	11.26±0.60	8.32±0.76	7.58±0.52
Hoof length (cm)	12.91±0.68	12.79±0.60	10.87±1.06	10.42±1.02
Crown circumference (cm)	33.89±1.12	33.47±1.15	29.04±1.55	28.16±1.57

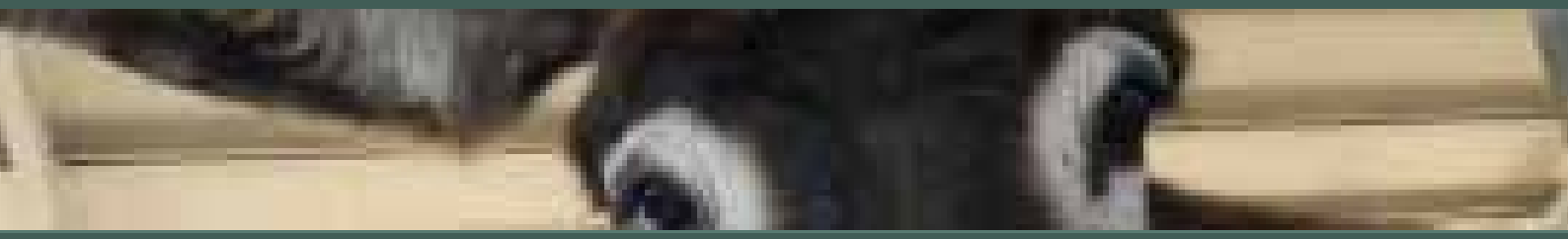
Table 4. Means and standard deviations of measurements of the hooves for fore and hindlimbs of horses from the Criollo breed (n = 20) and the Pêga breed donkeys (n = 20) (modified from [35]).



Further information

Figure 9. Normal donkey hoof (pictures courtesy of The Donkey Sanctuary).

Figure 10. Anatomic section of a normal donkey foot (picture courtesy of The Donkey Sanctuary).

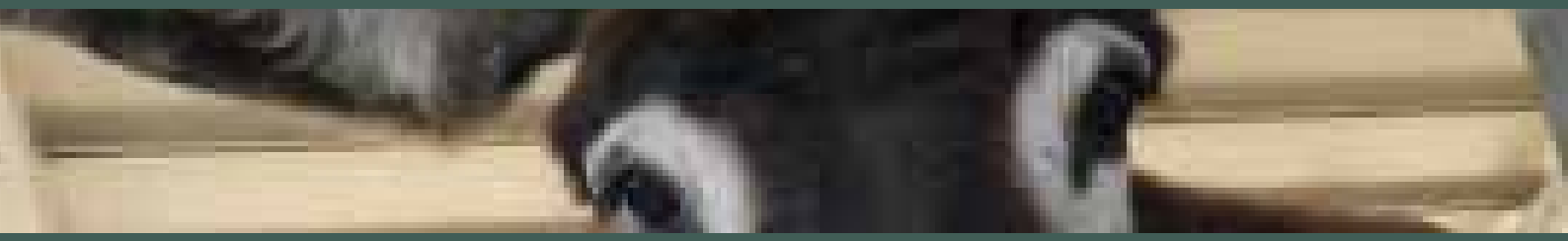


Dental care

Equids are hypsodont (with inconstantly but continually erupting teeth). Diets in domestic equids may not mimic the natural abrasiveness for grazers, due to increased feed quality [36] and the pelleting of less abrasive compound feeds used in domestic settings. Feeding pelleted compound feed may result in a reduction of the chewing movement in all three dimensions [37], which is insufficient to wear the entire grinding surface and may facilitate the development of sharp edges, a high occlusal relief, and uneven tooth wear.

Additional practices

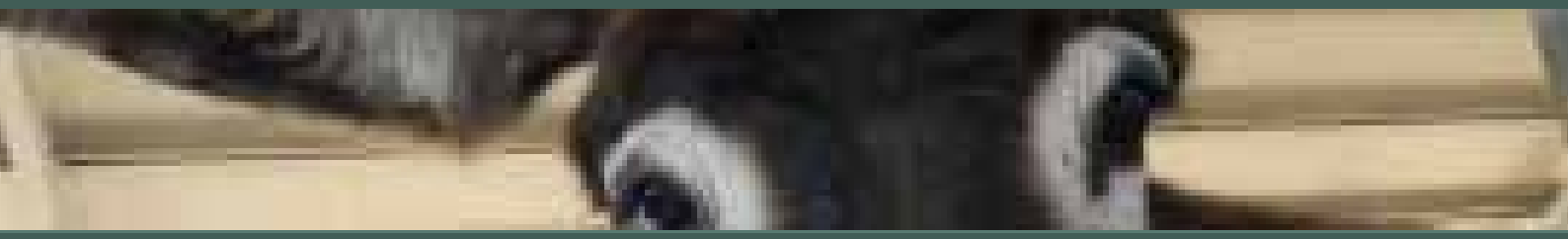
All animals	Level of evidence	Reference
Regular dental care should begin during the yearling year	●●●○○	[38-40]
Each donkey should have an annual dental examination by a veterinarian or a qualified equine dental technician	●●●○○	[2, 3, 34, 35]
Decisions regarding specific frequency of visits should be based on the individual needs of the donkey	●●●○○	[41, 42]
Dental disorders could be associated with poor BCS, weight loss and colic	●●●○○	[38, 41, 43, 44]
Feeding forage-based diets, including access to grass pasture, may lead to fewer sharp enamel points and help reduce the incidence of tooth wear problems	●●●○○	[45]
The 'smile mouth' (incisors appear curved up) is the normal appearance of donkey incisors and should not be corrected unless it is extreme or inhibiting normal mastication	●●●○○	[41]



Further information

Figure 11. Example of bilateral dental overgrowths (picture courtesy of The Donkey Sanctuary).

Figure 12. Example of “smile mouth” (picture courtesy of The Donkey Sanctuary).



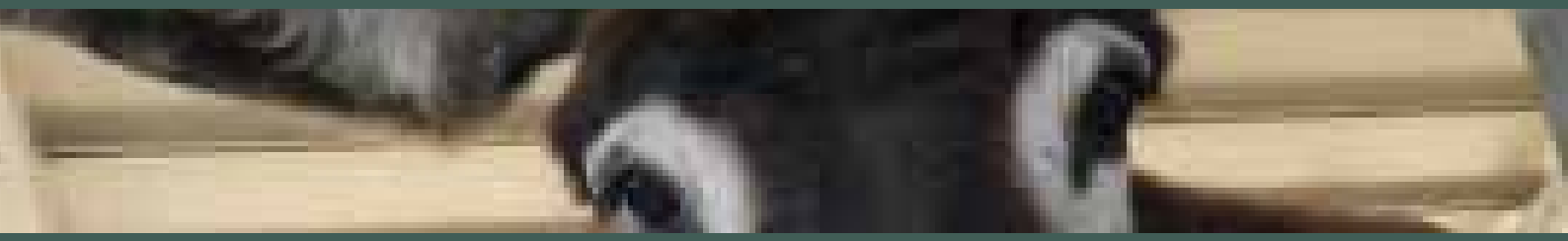
Breeding

Essential requirements

	Natural or artificial breeding or breeding procedures which cause or are likely to cause suffering or injury to any of the animals concerned must not be practised (Council Directive 98/58/EC)

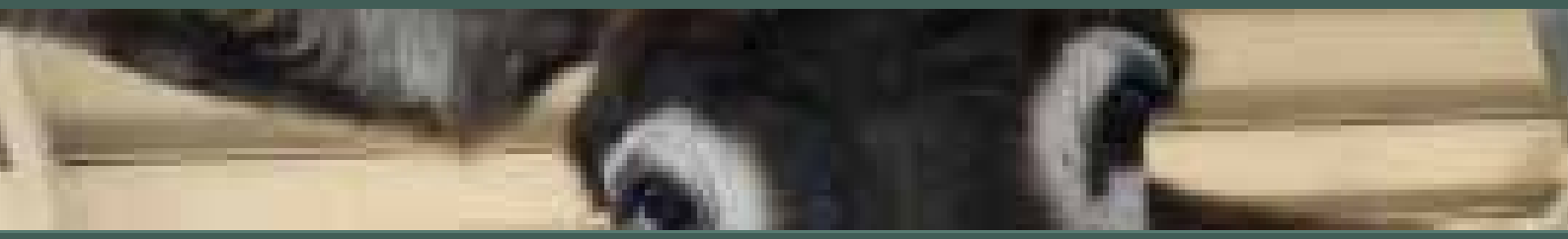
Additional practices

	Jenny and jack management during natural breeding	Level of evidence	Reference
	It is recommended not to breed jennies before 30 months of age	●●○○○	[7]
	Two strategies can be adopted: • Pasture breeding: one jack kept free in the same paddock with one or more jennies expected to enter or be in oestrus • In-hand breeding: the jack and the jenny are managed by some handlers	●●○○○	[16, 46, 47]
	Jacks are slow breeders: teasing without erection should be permitted	●●○○○	[46]
	It is suggested to keep one jack for 10-15 jennies	●●○○○	[7]
	The space and freedom of interaction between the jack and the jenny seems to be a key factor in sexual stimulation: adequate space for the retreating behaviour to take place should be provided	●●○○○	[47]



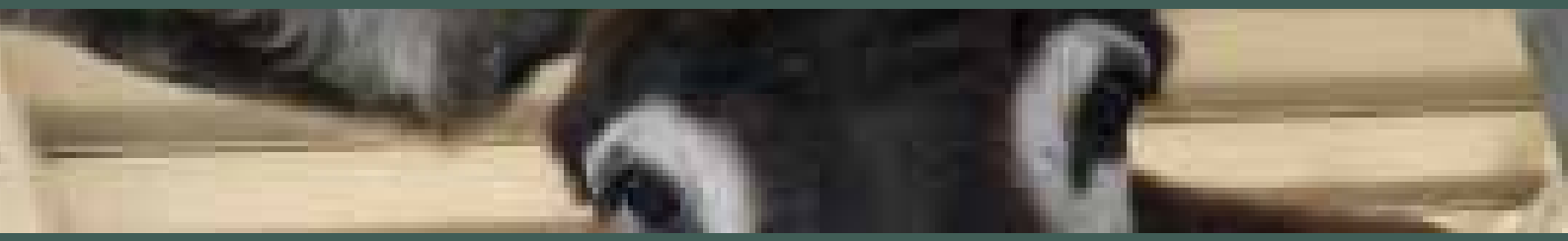
	Using two adjacent paddocks with a group of oestrous jennies enclosed in one and a single female in the other, mimicking natural sexual behaviour, can improve the efficiency of mating	●●○○○	[46]
	The presence of other jacks during breeding may distract or inhibit sexual activity	●●○○○	[47]
	Breed always in the same place with no threats of intruders, use a quiet place and a familiar handler	●●○○○	[46]
	Turn-out time and exercise improves libido in jacks	●●○○○	[46]
	Jacks are vulnerable to suppression of sexual interest as a result of rejection by females: calm jennies should be used with young jacks to avoid bad first experiences	●●○○○	[46]

	Jenny and jack management during artificial insemination	Level of evidence	Reference
	Semen collection can follow two procedures: • Use of an oestrous jenny and an artificial vagina • Use of a dummy mount	●●○○○	[46, 47]
	Jacks should be sensitively trained for semen collection	●○○○○	



Further information

Figure 13. Oestrous jennies' behaviour includes clapping mouth, ears back against the neck, rhythmic eversion of the clitoris, urination in small drops, braying vocalisation, mounting stance and mounting between females (pictures courtesy of Università degli Studi di Pisa).

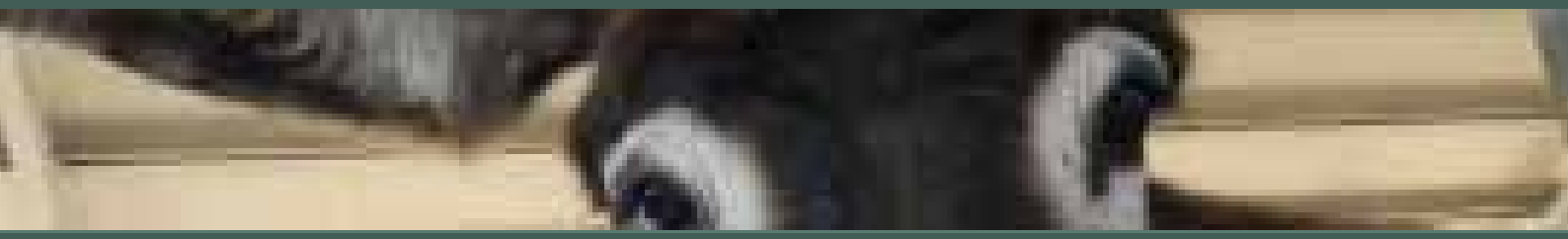


Donkey healthcare

Healthcare and veterinary checks

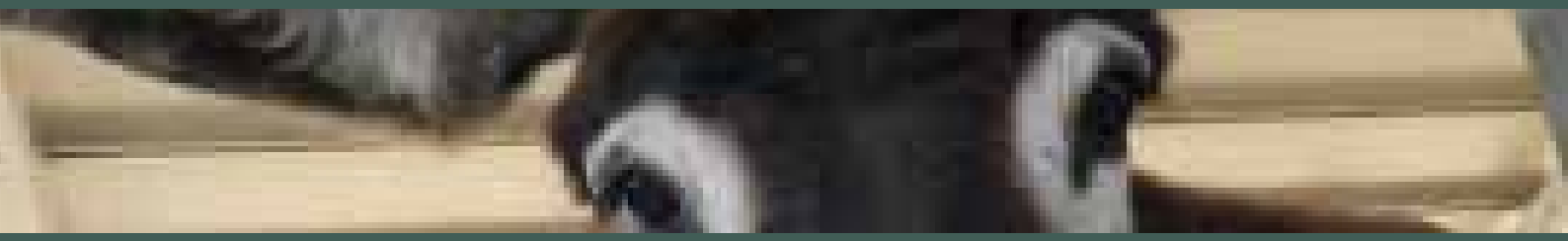
Essential requirements

⚖	Any animal appearing to be ill or injured must be cared for appropriately without delay and, where an animal does not respond to such care, veterinary advice must be obtained as soon as possible. Where necessary sick or injured animals shall be isolated in suitable accommodation with, where appropriate, dry, comfortable bedding. The owner or keeper of the animals shall maintain a record of any medicinal treatment given and of the number of mortalities found to each inspection. These records shall be retained for a period of at least three years and shall be made available to the competent authority when carrying out an inspection or when otherwise requested. (Council Directive 98/58/EC)

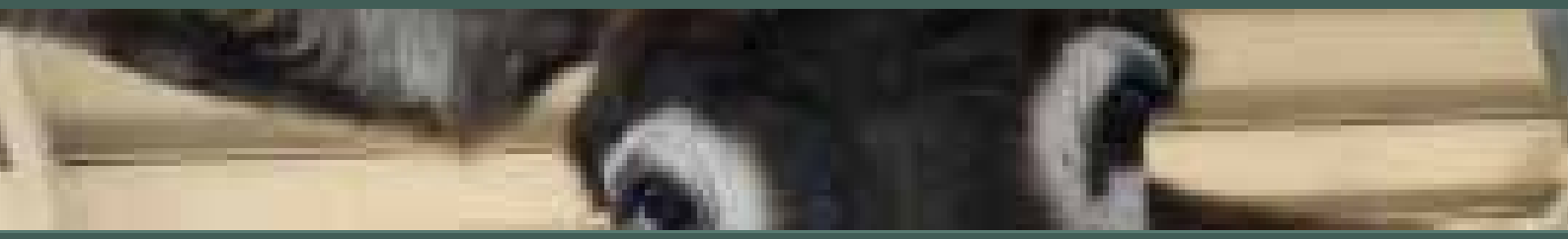


Additional practices

	Health checks	Level of evidence	Reference
	Routine health checks are the key to early recognition of any illness: 1. Behaviour: any changes in behaviour should be investigated 2. Appetite and thirst: each donkey should be checked daily for loss of appetite, inability to chew properly and appropriate water intake 3. Faeces and urine: fresh faeces and urine should be checked daily; abnormalities in faeces consistency or in urine appearance or in urinating behaviour should be investigated 4. Eyes: eyes should be bright, open and free from discharge 5. Nose and respiration: nostrils should be clean and free from discharge; normal respiration involves minimal movement of nostrils, chest and flank 6. Coat and skin: healthy coat is flat, clean, with no signs of itching, sores, abnormal lumps 7. Standing and walking: donkeys should be able to get up and down easily and move freely without limping; when standing the weight should be equally distributed on all four legs 8. Physiological parameters: temperature, pulse rate, respiratory rate. Normal ranges for physiological parameters are reported in table 5	●○○○○	[28]
	A facility for health surveillance (e.g. check-up box) should be present on farm to facilitate veterinary operations	●●○○○	[18]



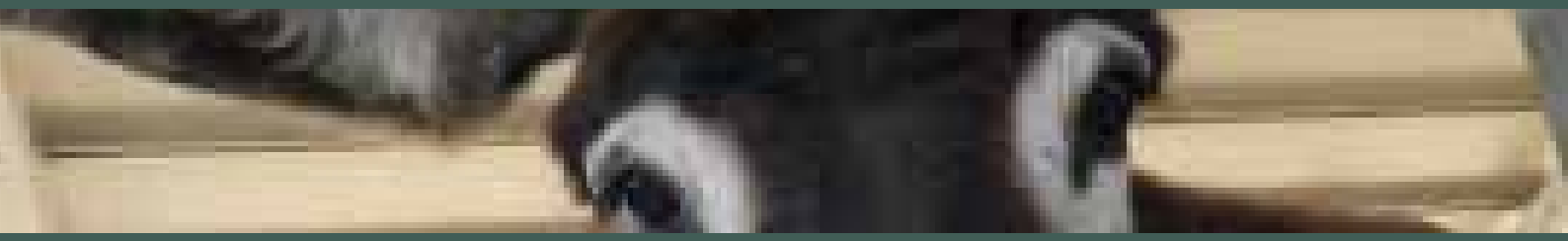
	When to call the vet	Level of evidence	Reference
	• An inappetent donkey is a veterinary emergency; such donkeys should be tempted to eat as quickly as possible to prevent them from becoming hyperlipaemic	●●○○○	[3]
	The following behaviours could be signs of pain and/or sickness: • Inappetence or anorexia or reduced appetite • Generalised dullness • Sham eating (the animal appears to mouth and swallow food but intakes none) • Lowered head carriage • Unresponsive ears (little movement in response to changes in noise) • Lowered ears • Self-isolation • Increased lying down • Decreased lying down • Weight shifting or limb guarding or pottery gait • Hypersalivation, drooling, difficulty chewing • Anhedonia (depression, an inability to respond positively to normally pleasant experiences) • Tail twitching • Excessive lacrimation, rubbing of eyes, and blinking • Lameness	●●○○○	[4]



	Dull donkeys can be in pain or affected by different pathologies (such as colic, hyperlipaemia, respiratory disease, lameness and liver disease); signs of dullness may include: • lack of normal behaviour patterns • anorexia/sham eating • reluctance to move • lying down • lowered head carriage • backwards/sideways pointing ears • self-isolation		[48]

Warning

	• If a sick donkey is hospitalised, her/his companion should be kept with her/him or close by, as separation will cause great anxiety to both parties



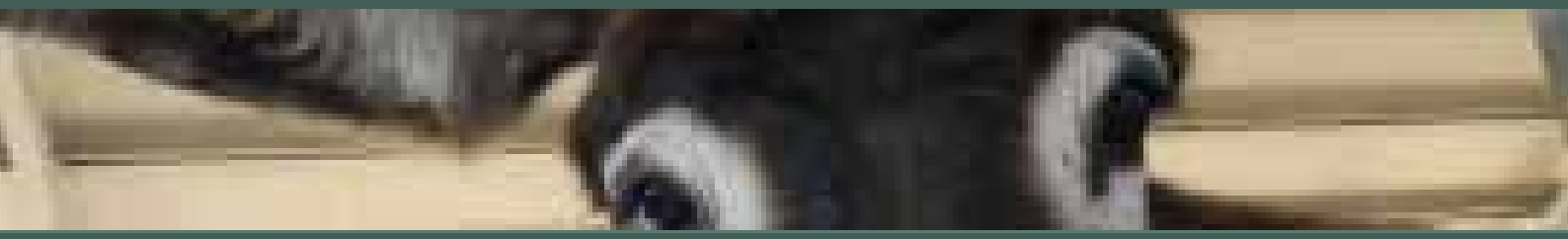
Further information

Parameter	Units	Range
Temperature	°C °F	36.5-37.7 97.7-99.9
Pulse	Beats/minute	31-53
Respiration	Breaths/minute	13-31

Table 5. Donkeys' physiological parameters [28].

Unhealthy coat condition
Dull coat in which some or all of the hair is or has matted, scabby, scurfy, scaly, dandruff, balding

Healthy coat condition
Flat, smooth, sleek coat



Further information

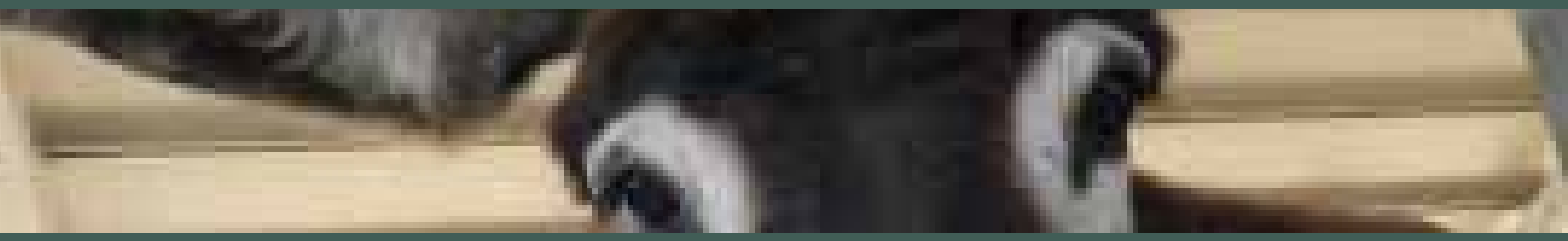
Ocular discharge
Clearly visible flow/ discharge from one or two eyes (may be watery or thick, transparent, yellow/ green or hematic)

No ocular discharge

Nasal discharge
Clearly visible flow/ discharge from one or two nostrils (may be watery or thick, transparent, yellow/ green or hematic)

No nasal discharge

Figure 14. Examples of some health signs to be evaluated [13].



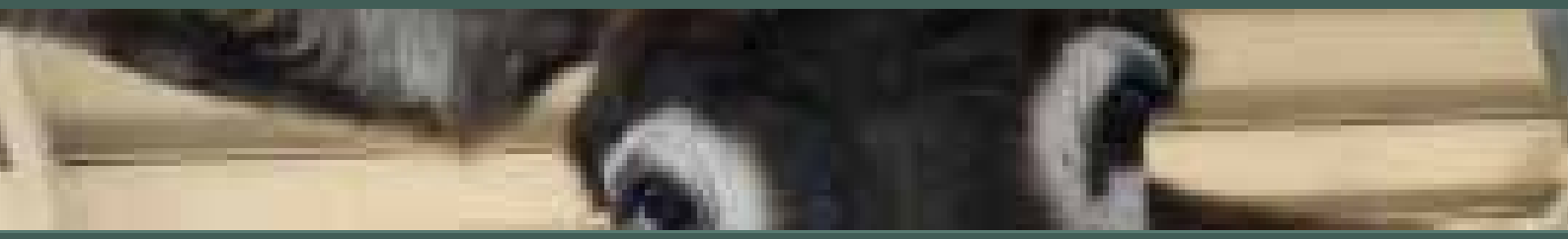
Further information

Value	Mean	Range
Red blood cell count (x1012/l)	5.5	4.4-7.1
Haemoglobin (g/l)	110	89-147
Packed cell volume (%)	33	27-42
Mean corpuscular volume (fL)	60	53-67
Triglyceride (mmol/l)	1.4	0.6-2.8
Triglyceride (mg/dl)	125	54-250

Table 6. Reference haematology and biochemistry values for donkeys [48].

Value	Range
Glucose (mmol/l)	3.4–4.5
Cholesterol (mmol/l)	1.6–2.9
Nonesterified fatty acids (mmol/l)	0.13–0.17
Total protein (g/l)	63–73
Albumin (g/l)	25–32
Urea (mmol/l)	4.1–6.2
Creatinine (µmol/l)	97–138
Zn (µg/ l)	473–906
Fe (µg/l)	597–3825
Cu (µg/l)	797–1698
Mn (µg/l)	0.05–2.75
Se (µg/l)	125–314
Co (µg/l)	0.27–2.56
I (µg/l)	13–39

Table 7. Reference plasma nutritional profile and the blood serum essential trace elements of dairy jennies [7].



Further information

Value	Range
Blood lactate concentration (mmol/L)	2.08±0.5
Blood glucose concentration (mg/dl)	93.7±24.5
WBC (K/µL)	5.9±1.5
Neutrophils (N) (K/µL)	4.2±1.6
Lymphocytes (L) (K/µL)	1.5±0.4
N:L	3.2±1.3
IgG (mg/dl)	>800

Table 8. Reference haematology and biochemistry values in new-born donkey foals (modified from [49, 50]).

Preventative medicine

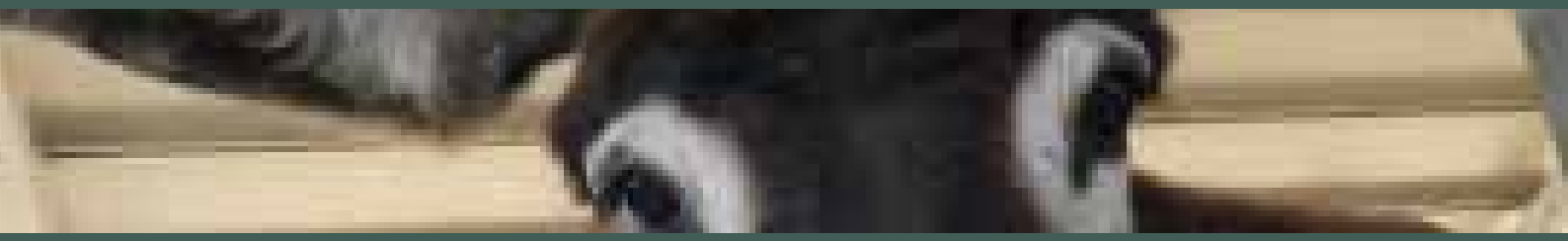
Essential requirements

	If animals are registered as livestock in the Animal Traffic Data Bank (BDTA), vaccinations should be recorded in the treatment log. National legislation should also be considered
	For dairy donkeys, withdrawal periods from drugs need to be carefully managed, in accordance with regulations 470/2009/EC and 37/2010/EC. (European Commission, 2009, 2010)

Additional practices

	Vaccinations	Level of evidence	Reference
	It is especially important to routinely vaccinate donkeys against tetanus and equine influenza	●●○○○	[16, 48, 51]
	Tetanus, in non-vaccinated donkeys, can cause fatalities and requires expensive treatment to overcome	●●○○○	[52, 53]
	Non-vaccinated donkeys suffer worse clinical signs when affected by influenza than horses	●●○○○	[54, 55]
	Vaccination against other diseases may be appropriate for donkeys that travel, are used for breeding or live in specific at-risk areas	●○○○○	[51]

	Parasite control	Level of evidence	Reference
	Parasite control should always focus on prevention: reducing environmental contamination with eggs and/or larvae in the case of endoparasites and adult and nymph stages in the case of ectoparasites	●●○○○	[4]
	Good husbandry can contribute significantly to reducing parasite infestations; low stocking densities, quarantine of new animals, regular disinfection of buildings and fomites, regular collection of dung from pasture along with correct composting	●●○○○	[4]
	Clipping long-haired animals during the summer months and then treating with an insecticide once in late autumn can control ectoparasites	●●●○○	[56]
	Grooming kits and tack should be cleaned and disinfected in the meanwhile of insecticide treatment in order to avoid re-infestation	●●○○○	[57]
	It is very important to tackle parasitic diseases correctly, by proper diagnosis and pharmacological therapy with a suitable drug dosage	●●○○○	[56, 57]
	Selective control programmes are preferable in order to reduce anthelmintic drug use and resulting anthelmintic resistance	●●○○○	[57]



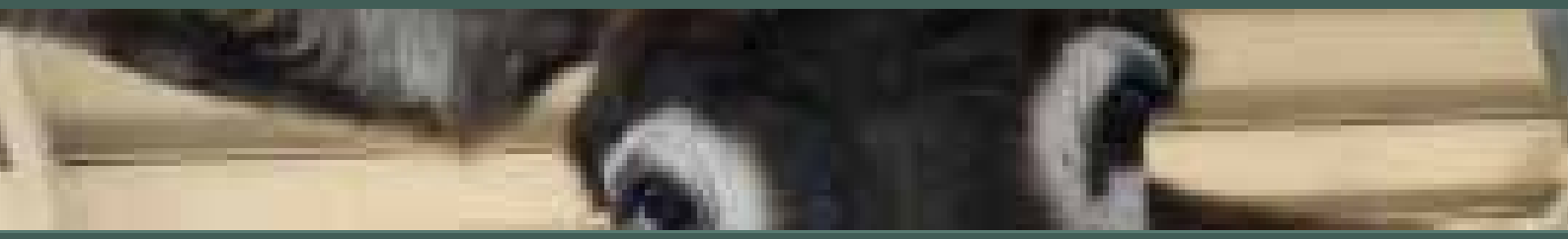
Reproductive medicine

Essential requirements

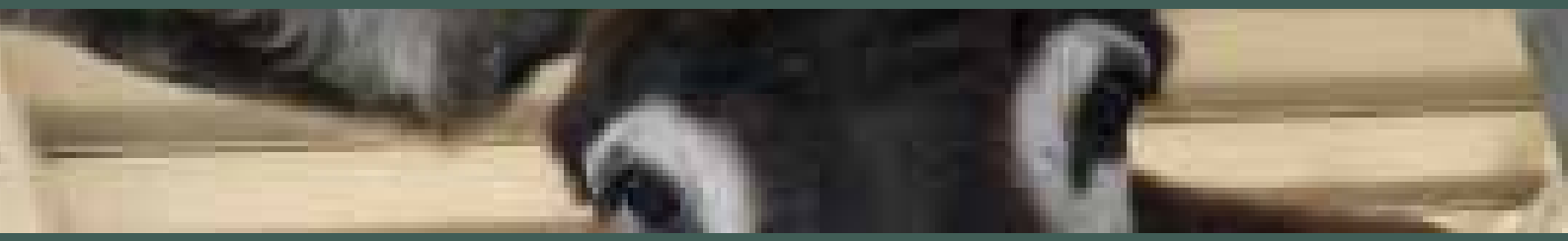
	Natural or artificial breeding or breeding procedures which cause or are likely to cause suffering or injury to any of the animals concerned must not be practised (Council Directive 98/58/EC). Equine viral arteritis is a notifiable disease in some countries (check for local legislation). The occurrence of dourine is notifiable in the European Union under legislation from the OIE.

Additional practices

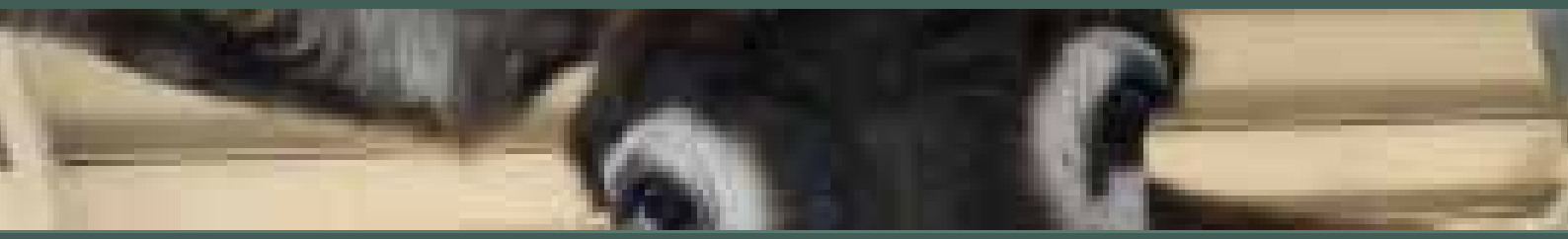
	All animals	Level of evidence	Reference
	Pregnancy rates are higher during the 2nd postpartum heat (25-32 days postpartum) than during "foal heat" (6–10 days postpartum)	●●○○○	[58]
	The donkey is a seasonal polyestrous species. However, in some latitudes small photoperiod oscillations (the period of time each day during which an organism receives illumination) between the seasons are present: jenny milk could be available throughout the year by adequately planning the breeding seasons	●●○○○	[59]
	Farmers face many decisions that require them to understand the foaling process (see table 9) and the needs of new-born foals	●○○○○	
	The recommended day for the pregnancy diagnosis in jennies is 14 days after ovulation or after the rejection of the stallion	●●○○○	[60, 61]



	Twin births are rare; the survival rate of new-born twin donkey foals is very low; the approach for this type of pregnancy should be similar to that used in mares; owners should discuss the possible actions with a veterinary surgeon	●●○○○	[47, 60, 61]
	The sex of the foetus can be evaluated by ultrasound after 60 days of gestation	●●○○○	[60, 61]
	Delivery pens can be useful to cope with difficulties that may occur before and during parturition	●●○○○	[18]
	Equine foaling complication (dystocia) is a medical emergency: birthing should be monitored (directly or video-monitoring) to verify the normal foaling stages	●○○○○	
	If any abnormalities are observed during parturition, a veterinarian should be called	●○○○○	
	Expulsion of placenta should be closely monitored; it is usually completed in one hour. A veterinary surgeon should be contacted if the placenta has not been passed after six hours	●●○○○	[47]
	Foals should be observed to ensure colostrum intake: this is crucial for the immunologic protection of donkey foals	●●●○○	[62]
	Foals should have vet checks after birth	●○○○○	



	The most important venereal diseases are: equine viral arteritis, contagious equine metritis and dourine. Animals kept for reproduction should be tested to avoid the spread of these diseases	●●○○○	[47]
	More common infectious causes of abortion are: EHV-1, Leptospira, Streptococcus equi zooepidemicus, Salmonella spp Non-infectious causes of abortion are foetal abnormalities and twinning Each abortion should be referred to a veterinary surgeon in order to detect the causes	●●○○○	[47]
	Male and female infertility should be referred to a veterinary surgeon in order to detect the cause	●○○○○	



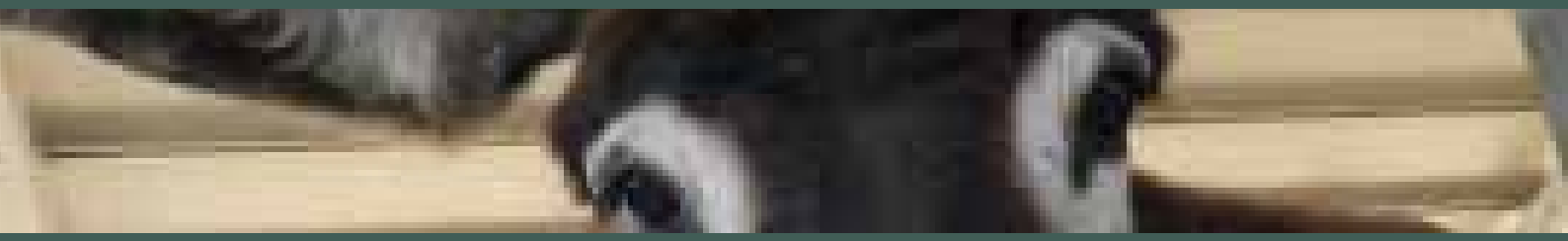
Further information

Measurements	Description	Duration (min)
1. Dilatation	Characterised by uterine contractions not visible externally with restlessness and agitation of the animal that ends with the chorioallantois rupture	65.2 ± 24.3
2. Expulsion	This stage starts with the rupture of the allantochorion and the expulsion of the allantoid fluid and finishes with the complete passage of the foetus (birth)	18.8 ± 5.5
3. Fetal membrane expulsion	The time between birth and foetal membrane expulsion	57.8 ± 45.8
4. Umbilical cord rupture time	The time between birth and spontaneous umbilical cord rupture	15.9 ± 5.2
5. Meconium expulsion time	The time between birth and the start of the meconium expulsion (the earliest stool of a new-born)	86.2 ± 34.4

Table 9. Mean (± standard deviation) duration of normal parturition phases of jennies (modified from [62]).

Event	Time after birth (min)
Sternal recumbence	3.7±1.3
Suckling reflex	9.7±4.7
Standing up	127.5±70
Nursing the mare	200±67.4

Table 10. Behaviour of new-born donkey foals (modified from [49, 50]).



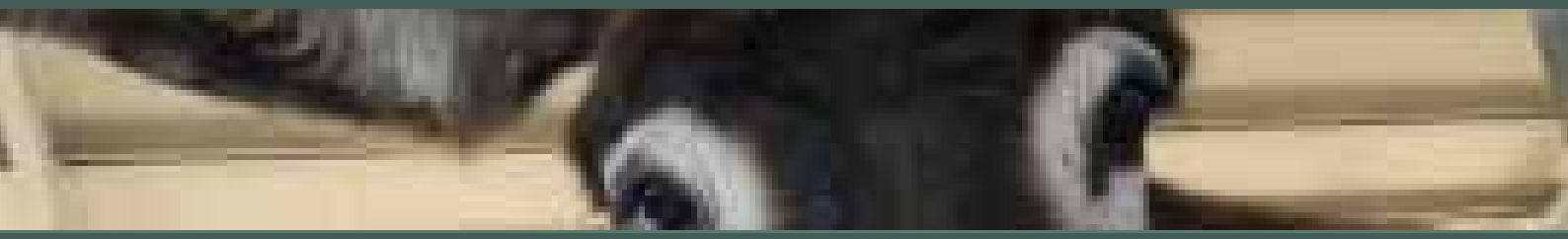
Humane killing

Essential requirements

	Animals must under no circumstances be abandoned or killed unjustifiably. Animals must not be subjected to bad treatments or to cruel acts. If it is necessary to kill an animal, it must be instantaneous, painless and cause no apprehension. A dead animal must be treated with decency. (UNESCO – Universal Declaration of Animal Rights 17-10-1978)
	According to European Regulation 1099/2009/CE: It is an ethical duty to kill productive animals which are in severe pain where there is no economically viable way to alleviate such pain. In most cases, animals can be killed respecting proper welfare conditions. However, under exceptional circumstances, such as accidents in remote locations, where competent personnel and equipment cannot reach the animals, complying with optimal welfare rules could prolong their suffering. In the case of emergency killing, the keeper of the animals concerned shall take all the necessary measures to kill the animal as soon as possible.

Additional practices

	All animals	Level of evidence	Reference
	Euthanasia should be taken into consideration in the case of serious, unmanageable suffering. Owners should promptly discuss each individual case with a veterinary surgeon	●●○○○	[63]
	In case of severe injury or severe pain, when there is no other practical possibility to alleviate it, emergency killing on farm should be taken into consideration (according to the procedures reported in European Regulation 1099/2009/CE)	●●●●●	
	Surviving companions should be permitted to stay with the body for some time post-euthanasia, in order to avoid the distress caused by sudden disappearance of a bonded companion	●●○○○	[63]



Appropriate behaviour

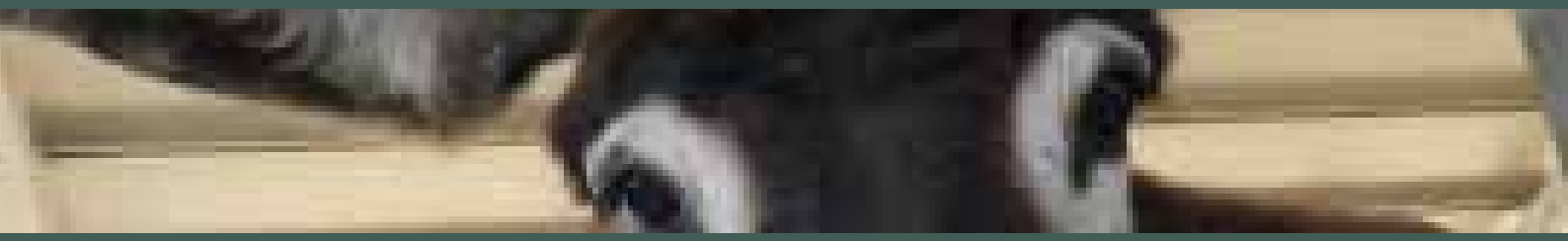
Donkey behaviour

Essential requirements

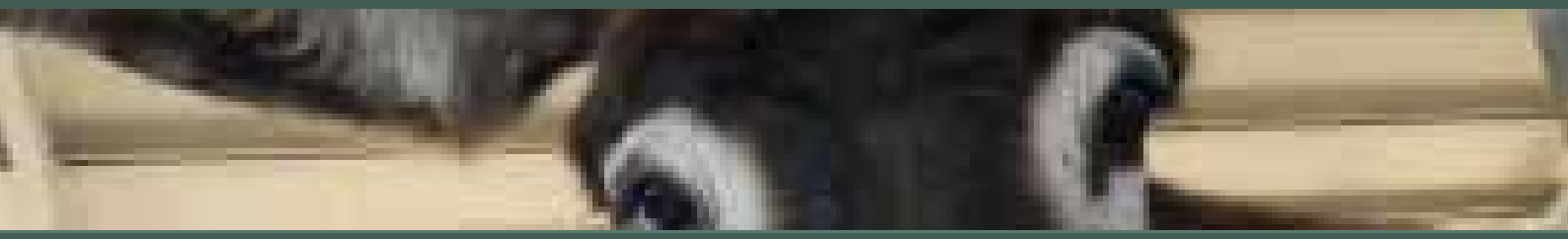
	All forms of breeding and uses of the animal must respect the physiology and behaviour specific to the species. (UNESCO - Universal Declaration of Animal Rights 17-10-1978) Animals shall be housed and provided with food, water and care in a manner which – having regard to their species and to their degree of development, adaptation and domestication – is appropriate to their physiological and ethological needs in accordance with established experience and scientific knowledge. (European Convention for the Protection of Animals kept for Farming Purposes)

Additional practices

	All animals	Level of evidence	Reference
	A healthy donkey should be alert and aware	●○○○○	[28]
	Due to their territorial attitude, domestic donkeys may display territorial behaviour when living alongside other animals; such behaviour may lead to the donkey coming into conflict with other species	●●○○○	[4]
	As herbivores with many natural predators, the donkey has evolved with a natural "flight or fight" reaction; donkeys have a natural propensity to freeze when threatened or frightened; the fight instinct of the donkey is more easily engaged than that of the horse	●●○○○	[4]
	Donkeys are naturally gregarious animals	●●○○○	[4]

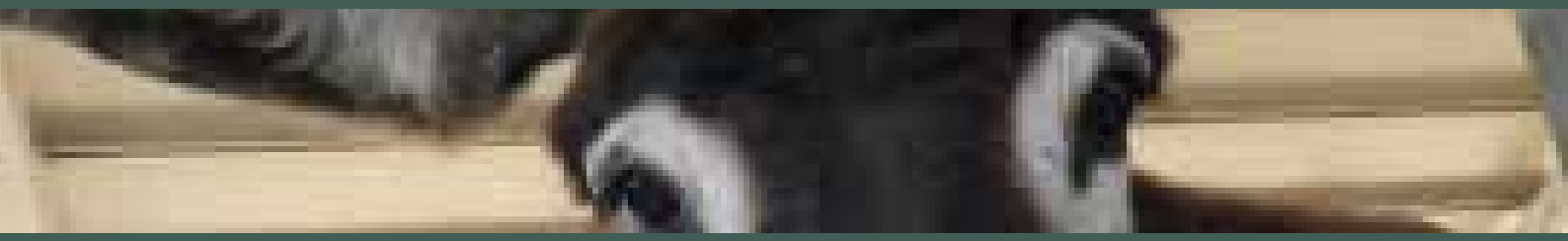


	Mental stimulation should be provided in order to avoid behavioural problems; mental stimulation can range from new training activities, additional quality time, fresh non-poisonous bark covered logs, a pile of sand, changing the paddock fencing to encourage movement, providing toys and challenges	●○○○○	[28]
	Environmental changes should be made slowly to allow the donkey to adjust without becoming stressed	●○○○○	[28]
	Donkeys on farm form groups where they are strongly associated with one another	●●●○○	[14]
	Donkeys may bond strongly with a specific member of the group; studies have shown the phenomenon of lifetime or long-term "pairbonding" in donkeys	●●●○○	[4, 14, 15, 64]
	Donkeys may become stressed and refuse food or water when removed from a bonded companion which may put them at risk of developing the potentially fatal disease hyperlipaemia	●●●○○	[4, 15, 64]
	Jacks' selection should take into consideration appropriate behaviour	●○○○○	



Warning

	• Not allowing jacks to have any social contact could lead to the development of aggressive or undesirable behaviours (see page 25) • When foals are separated from their mothers before milking, social contact should always be permitted in order to avoid extreme stressful situations (see page 55) • Even subtle changes in behaviour can be a symptom of pain or illness (see page 42)

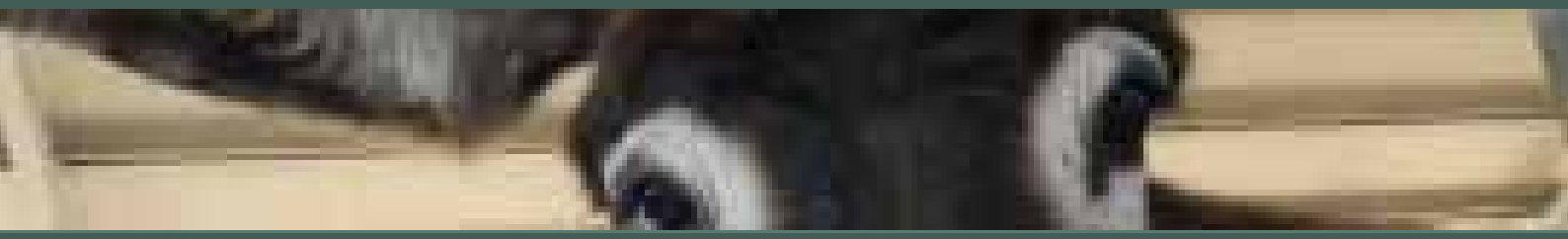


Milking procedures

Management during milking

Additional practices

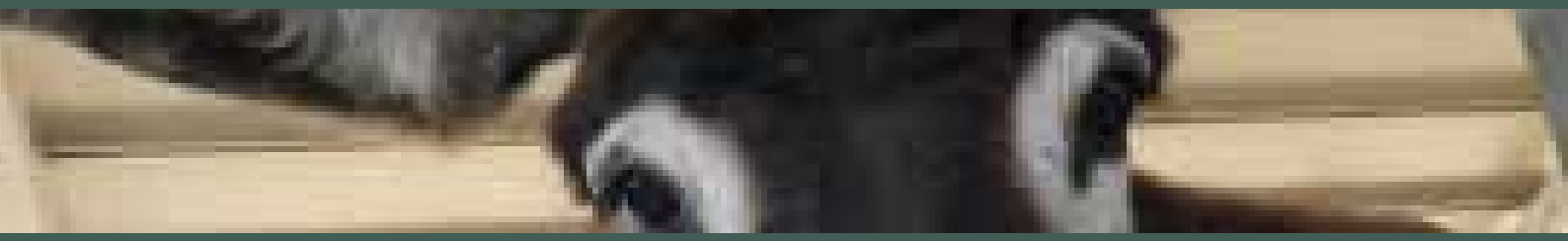
		Level of evidence	Reference
	The donkey is a follower species: donkeys maintain close and frequent contact between mother and offspring. Mother-foal separation is potentially stressful for both the jenny and the foal	●●○○○	[47, 65]
	A mother-foal separation of three hours before milking yields milk of high quality (higher fat and lactose) with better organoleptic properties	●●●○○	[66, 67]
	Jennies and foals should be habituated gradually to separation	●○○○○	
	Jennies and foals should be kept in a group when separated	●○○○○	
	Jennies and foals should have at least visual contact when separated	●○○○○	



Manual and mechanical milking

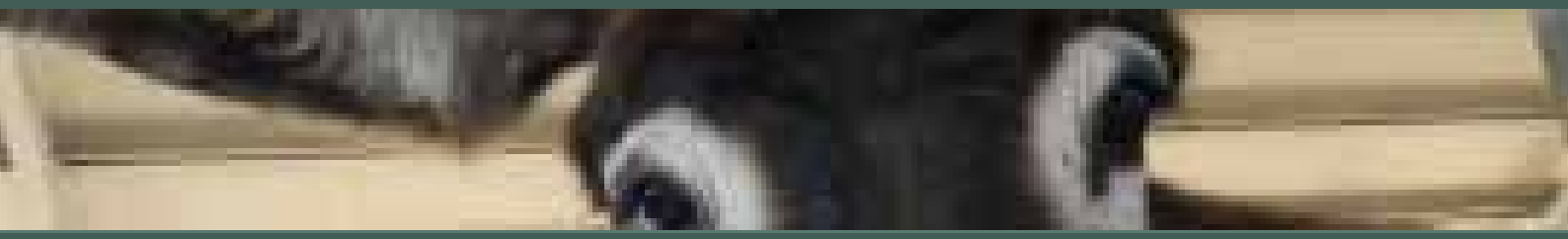
Essential requirements

	According to REGULATION (EC) No 853/2004:
	Raw milk must come from animals: (a) that do not show any symptoms of infectious diseases communicable to humans through milk; (b) that are in a good general state of health, present no sign of disease that might result in the contamination of milk and, in particular, are not suffering from any infection of the genital tract with discharge, enteritis with diarrhoea and fever, or a recognisable inflammation of the udder; (c) that do not have any udder wound likely to affect the milk; (d) to which no unauthorised substances or products have been administered and that have not undergone illegal treatment within the meaning of Directive 96/23/EC; and (e) in respect of which, where authorised products or substances have been administered, the withdrawal periods prescribed for these products or substances have been observed.
	In particular, as regards brucellosis, raw milk must come from: (iii) females of other species belonging, for species susceptible to brucellosis, to herds regularly checked for that disease under a control plan that the competent authority has approved. As regards tuberculosis, raw milk must come from: (ii) females of other species belonging, for species susceptible to tuberculosis, to herds regularly checked for this disease under a control plan that the competent authority has approved.



Additional practices

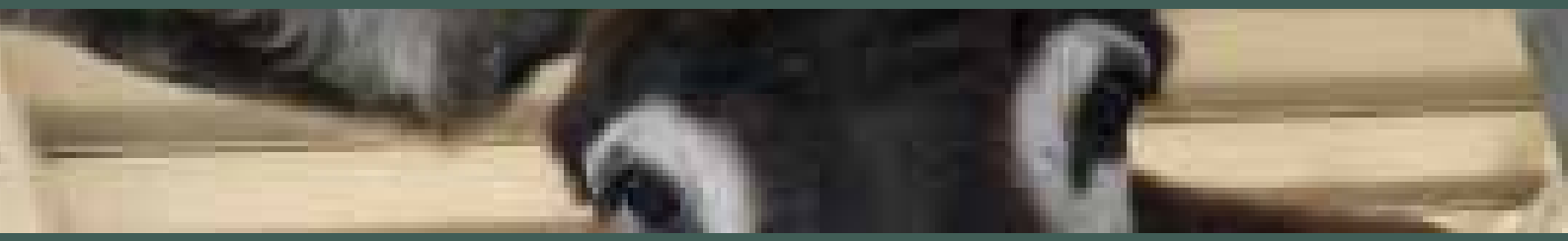
	All animals	Level of evidence	Reference
	A dairy donkey farm should have a milking waiting area, a milking parlour and a milk storage room, designed to optimise workers' and donkeys' comfort and traffic patterns and to guarantee hygiene during milking procedures	●●○○○	[18]
	Suggested machine-milking parameters: 120 cycles/min, 42 kPa of vacuum level and 50:50 pulsation ratio	●●●○○	[7, 66, 68]
	A twice-a-day milking regimen with an eight-hour interval between them results in the maximum volume of milk per day	●●●○○	[66, 67]
	In order to reduce stress during the separation time, jennies and foals should be housed in adjacent pens, allowing visual, auditory and olfactory contact	●○○○○	
	Milking should start from 20 to 90 days after foaling in order to support the neonatal growth of the foal	●●○○○	[7, 68]
	Lactation should not last more than 270 days; the dry period is essential to ensure good udder health	●●○○○	[69]



Hygiene procedures during milking

Essential requirements

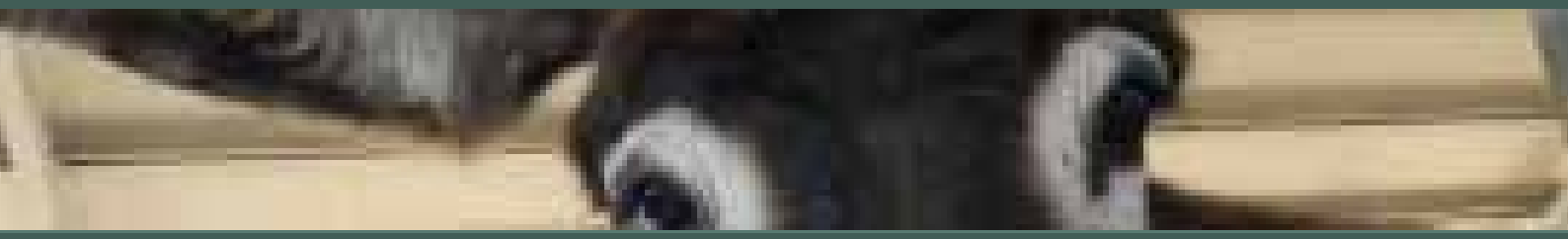
	According to REGULATION (EC) No 853/2004:
⚖	1. Milking equipment, and premises where milk is stored, handled or cooled must be located and constructed to limit the risk of contamination of milk. 2. Premises for the storage of milk must be protected against vermin, have adequate separation from premises where animals are housed and, where necessary to meet the requirements laid down in Part B of European Regulation 853/2004, have suitable refrigeration equipment. 3. Surfaces of equipment that are intended to come into contact with milk (utensils, containers, tanks, etc. intended for milking, collection or transport) must be easy to clean and, where necessary, disinfect and be maintained in a sound condition. This requires the use of smooth, washable and non-toxic materials. 4. After use, such surfaces must be cleaned and, where necessary, disinfected. After each journey, or after each series of journeys when the period of time between unloading and the following loading is very short, but in all cases at least once a day, containers and tanks used for the transport of raw milk must be cleaned and disinfected in an appropriate manner before re-use.
	Milking must be carried out hygienically, ensuring in particular: (a) that, before milking starts, the teats, udder and adjacent parts are clean; (b) that milk from each animal is checked for organoleptic or physico-chemical abnormalities by the milker or a method achieving similar results and that milk presenting such abnormalities is not used for human consumption; (c) that milk from animals showing clinical signs of udder disease is not used for human consumption otherwise than in accordance with the instructions of a veterinarian; (d) the identification of animals undergoing medical treatment likely to transfer residues to the milk, and that milk obtained from such animals before the end of the prescribed withdrawal period is not used for human consumption; and (e) that teat dips or sprays are used only if the competent authority has approved them and in a manner that does not produce unacceptable residue levels in the milk.



	Immediately after milking, milk must be held in a clean place designed and equipped to avoid contamination. It must be cooled immediately to not more than 8°C in the case of daily collection, or not more than 6°C if collection is not daily.
	During transport the cold chain must be maintained and, on arrival at the establishment of destination, the temperature of the milk must not be more than 10ºC.
	1. Persons performing milking and/or handling raw milk must wear suitable clean clothes. 2. Persons performing milking must maintain a high degree of personal cleanliness. Suitable facilities must be available near the place of milking to enable persons performing milking and handling raw milk to wash their hands and arms.

Additional practices

	Level of evidence	Reference
Milking parlour and milking machines should be cleaned and disinfected after each milking	●●○○○	[70–72]
Lysozyme's antibacterial activity in donkey milk does not guarantee food safety: the application of good hygienic milking practices is a key factor in reducing the bacterial load of raw milk	●●●○○	[71, 72]
High bulk milk total bacterial count (TBC) values are related to poor milking procedures	●●○○○	[70]
Increased somatic cell count is related to infection of the mammary gland	●●○○○	[70]
After six months of milking a significant fall in lysozyme content can be detected	●●○○○	[70]
The milk storage should have facilities for clean-up and sanitation of milking equipment, in addition to equipment for milk cooling and storage	●●○○○	[18]



Further information

Parameter	Normal range
Total bacteria count	2.5×10^{2}- 7.4×10^{5}cfu mL^{-1}
Somatic cell count	3.5 - 4.5 log point mL^{-1}

Table 11. Hygiene and mammary gland health parameters for dairy donkeys (from [70, 73–78]).

Figure 15. Example of a milking parlour with different stalls for jennies.

Figure 16. Example of a milking parlour with pit and different stalls for jennies (from [18]).

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