KRMIVA

COMPARISON OF WELFARE OF DAIRY COWS UNDER TETHER AND FREE HOUSING CONDITIONS

USPOREDBA DOBROBITI KRAVA MUZARA U VEZANOM I SLOBODNOM UZGOJU

Dragica Ornik, M. Volk, M. Brus, M. Janžekovič

Original scientific paper – Izvorni znanstveni članak
Received – Primljeno: 26. november – studeni 2010

SUMMARY

Milk production on Slovenian farms is an important economic activity that underwent essential changes after the introduction of the European Union standards. Sound state of health and welfare of dairy cows remain the essential conditions for the quality of milk and dairy products, as well as important public health aspects. This paper presents the currently applicable welfare standards for farm animals, the European priority activities in the field of welfare of farm animals, and the results of inquiry into the state of play in dairy cow housing systems in the narrower north-eastern territory of Slovenia. Ten free housing system dairy farms and ten tether system dairy farms were inspected, compared and assessed according to the Austrian method of the Animal Needs Index (ANI) for cattle. ANI is a relevant criterion for assessing the adequacy of husbandry systems, based on graded point system. The five areas of influence impacting animal welfare were assessed, including: affording movement ('Locomotion'), affording social interaction ('Social interaction'), type and condition of flooring ('Flooring'), light and air conditions ('Light and Air'), including ventilation and noise level, and quality of care for the animals ('Stockmanship'). Adequacy of housing conditions was evaluated and compared between the free housing and tether systems for dairy cows. The paper further presents the state of health of animals examined and the scope of diseases detected, including technopathies and injuries, reasons for culling dairy cows and herd structure by the end of 2009, in either of the two husbandry systems. The advantages and disadvantages of the method used for assessing the adequacy of each husbandry system are presented as well.

Key words: animal welfare, dairy cows, ANI

Dragica Ornik, Assistant, Dr., University of Maribor, Faculty of Agriculture and Life Sciences, Department for Livestock-Breeding, Pivola 10, 2311 Hoče-Slivnica; M. Volk, M. Janžekovič Adjunct Professor, Dr., same establishment; M. Brus, MSc. of Agriculture, same establishment.

INTRODUCTION

Public interest has recently been more and more focused on the welfare of dairy cows on account of impacts on animal health and productivity, and consequently, on the production of quality milk and dairy products. Introduction of the EU standards into Slovenian legislation has brought about changes in milk production. The number of dairy farms and dairy cows has been decreasing, whilst the average herd size per farm has been increasing, along with the increased milk yield and milk quality. By the end of 2008 there were 457,818 active bovine animals registered at 38,559 farms (cows representing 37.2 % of all the animals) in the Central Database of Bovine Animals (CDBA) of the Agricultural Institute of Slovenia (AIS). An average Slovenian farm kept 12.5 cows, and farms with suckler cows kept only 2.8 cows. In the period 2002 - 2008, the proportion of dairy farms keeping 20 to 100 cows was increasing, whilst the number of dairy herds of up to 20 cows had been decreasing. At first, the cows of the striped and brown breeds prevailed on dairy farms. More recently, the number of cows of the black-and-white breed was increasing, and constituted 30.7 % of the dairy cow population in 2008. In 2008, the average milk yield in standard lactation of all the cows under control of 6,043 kg of milk was assessed at 80,669 lactation dry-offs. In 1980, the average milk yield was much lower and amounted to only 3,982 kg at assessed 32,418 lactation dry-offs (Božič, 2009).

In the past, the principal focus in dairy cow selection was on milk quantity. However, increased milk quantity is counter-proportionate to the extent of milk production cycle. High yielding cows experience more health and fertility problems, which may consequently lead to an earlier culling of the cow and to a lower economic efficacy. Most frequent health problems include the incidences of mastitis (49 %) and limb and hoof diseases (26 %). Most frequent fertility disorders include the failure of conception (61 %) and silent heats (37 %) (Perpar *et al*., 2005).

AIS is monitoring the longevity data of dairy cows. Longevity analysis includes cows after the first calving from farms included in milk control. Basic differences between breeds become apparent on completion of the third year after the first calving, and tend to increase with every following completed year. Thus, a group of cows that had calved for the first time in 2004 reached in the fifth year after the first calving 39.0 % in case of the brown breed, 26.0 % in case of the black-and-white breed, 33.8 % in case of the striped breed, and 34.7 % in case of striped crossbred cattle. A high percentage in case of the brown breed shows that this breed is well adapted to husbandry conditions in Slovenia (Jenko *et al*., 2010). Adaptation to environmental conditions significantly impacts the state of health and welfare of the animals. *Animal welfare* is defined as the capability of a sentient animal to avoid situations that cause suffering, and to maintain a good state of health (Webster, 2005). Nevertheless, the ability of an animal to adapt to environmental conditions is rather limited. Requirements for providing animal-friendly husbandry conditions have been increasing. Legislative commitment to observing animal welfare within the EU was instituted by the Amsterdam Treaty of 1997 that defines animals as sentient beings and not as agricultural good any more. This is the case also under the Lisbon Treaty, which has applied as of December 2009, and is requiring the compliance with the animal welfare provisions. Basic provisions are laid down in the European convention on the protection of animals kept for breeding purposes (No. 87, 1976 and No. 145, 1992). The European Community approved the Convention in Council Decision 78/923/EEC. In order to abolish differences between national legislations on the protection of farm animals, which could distort the conditions of competition, and to ensure the regular operation of the common market, the Council of the European Union adopted Directive 98/58/EC. In the Directive, the Council laid down the minimum conditions for the protection of animals kept for breeding purposes, and required the compliance with the animal welfare provisions. Basic provisions in Slovenian national legislation are laid down in the Protection of Animal Act (PAA, 2007), and in the Livestock-Breeding Act (LBA, 2002). The more detailed provisions are laid down in a pertaining implementing regulation. General provisions point out the responsibilities of the public for the protection of animals, their lives, health and welfare. Animal owner is responsible for the

animal(s). He/she shall have the required knowledge on the animal species that he/she is breeding, provide the animal(s) with appropriate feed, water and care, ensure the optimum living conditions, prevent the development of disease, and provide for the veterinary assistance, wherever necessary. Housing conditions shall be such as to enable every cow to have its lying space and to move around. Dairy cows shall be provided with clean and dry lying area, adapted to the size, form and weight of the animal. According to provisions of the Swiss law on the protection of animals, the cubicles situated adjacent to walls shall be at least 2.40 m long, whilst the head to head cubicles shall be at least 2.20 m long and at least 1.20 m wide. Partitions between the lying areas shall be designed so as to enable the animals to lie down and rise without injuring themselves (Schweizer. Tierschutzgesetz, 1978, cited according to Rist, 1989). If the animals are tethered or kept in closed units, they shall be provided with adequate space, in compliance with their physiological and ethological needs. A research study comparing the technologies of tether systems and of tether systems in conjunction with pasture has shown a number of differences in ethological characteristics, demonstrating that a 7-hour outdoor pasture is an important enrichment of environment for dairy cows (Senica *et al*., 2001). Free housing system is in principle friendlier to the animals as they are afforded more space for movement and for expressing locomotory behaviour according to their behavioural needs. It is important, however, that in addition to outdoor activity and pasture the animals are provided with adequate indoor living conditions in the housing units.

A research study assessing the welfare of dairy cows in the free housing systems has shown that none of the farms under study provides the animals with an adequate indoor floor area. Cubicle floor areas are too short, too narrow and restrictive to movements, steps between cubicles and activity areas are several centimetres high, and slatted flooring with too large gap width hinders the cows in the lying down, comfortable lying, and rising behaviours, which all causes abrasions and injuries to the animals (Ornik *et al*., 2009). Understanding animal welfare is based on *five freedoms*, defined by the *Farm Animal Welfare Council* of the United Kingdom. These include: provision of drinking water and feed to the animals, adequate environment that offers shelter and comfortable resting area, prevention of pain, injury and disease by preventive measures, diagnosis and treatment of diseases, prevention of fear and discomfort by humane handling, and provision of living conditions, where the animals may express normal behaviour, and presence of companion animals (Broberg, 2006). Animal keeper is obliged to provide all of the above. Persons responsible for conducting the programme that includes animal welfare standards are obliged to implement effective control. In providing for animal welfare, the condition and feelings (and emotions) of every particular animal shall be observed. Further to assessing the provision for the animals in all its aspects, the control shall verify also the effects of such provision, by monitoring the condition of the animals. The principle of the five freedoms constitutes the basis of effective control of provision for the animals and of its effects (Webster, 2005). Based on new developments in ethology, every housing system can be improved. Enriched environment enables the animals to express the species-specific behaviour and normal physiological procedures. Animals are thus in a better state of health and yielding optimum performance. Animal keepers are aided in managing prosperous husbandry systems by being well familiarised with the ethological rules (Štuhec, 2009).

The main objective of the EU is intensive livestock farming. In 2007, the European Commission adopted a targeted and harmonised approach to animal health protection within a 6-year period (EC, COM/539/2007). This strategy under the principle of "Prevention is Better than Cure" is in line with the animal health protection and welfare action plan of 2006-2010 (EC, SEC/65/2006). The strategy includes most important objectives: securing public health and food safety, stimulating animal health protection and preventing/decreasing the occurrence of diseases, improving the competition by ensuring the free flow of goods and animals, and stimulating the good agricultural practice and animal welfare.

The actions envisaged include in particular the upgrading of the existing minimum animal protection and welfare standards in compliance with the new scientific developments and evidence, and laying

down the minimum standards for animal species and fields which have as yet not been covered by the EU legislation, instituting the standardised and measurable animal welfare indices, and including them into the legislation.

A new legislative instrument for the validation of animal husbandry systems may also be expected to be introduced, which will apply higher standards in the field of animal protection and welfare than the existing minimum standards, taking into account the rules set by the World Trade Organization (WTO).

In practice, animal welfare is assessed in the light of two different aspects, the first being the aspect of the animals, and the other the aspect of the environment. The aspect of the environment includes parameters as characteristics of lying areas, flooring, feeding troughs and watering facilities, floor area per animal, bedding quality, movement space per animal, and pasture. Assessment of parameters of the environment is relatively uncomplicated and quick, and enables high repeatability.

Methods involving animals measure the responses of animals to specific environments. Here, the parameters such as animal behaviour, animal health, and physiological indices are monitored, assessing for instance the level of stress hormones, aggression, anxiety, behavioural anomalies, and the level of morbidity and mortality (Johnsen *et al*., 2001, cited according to Siard, 2003). In order to assess animal behaviour, an ethogram shall be constructed, which shall include a catalogue of the stereotyped behaviour typically employed by a particular animal species. In assessing animal welfare it is crucial not to take into account as basis the individual criteria only, as there may arise contrarieties between the different criteria in their interpretation, and in particular on account of the individual differences between the particular animals (Kos and Dobeic, 2002). Several animal welfare assessment methods have been established. Most often proposed methods are based on the evaluation of animal housing systems and equipment.

In 2004, a 5-year research programme commenced, called Welfare Quality®, which was funded by the EU and assessed animal welfare on the basis of measurements obtained by clinical and behavioural observations of animals. New Welfare Quality® methods will aid the farmers and industry in the endeavours of improving the welfare of farm animals throughout the production chain (Cozzi *et al*., 2008). The method has been known as the Bristol Protocol, and has been the result of a combination of the breeders' assessments, observations and data obtained from the records. The highest ranged criteria include monitoring the prevalence of lameness, disease and mastitis, studying of the state of health, behaviour of the animals, assessment of animal condition and animal husbandry, monitoring the lying behaviours of animals, studying animal performance, and monitoring skin lesions (Webster, 2005). A method already applied in the Republic of Slovenia in organic farming is the Animal-Needs-Index (Bavec *et al.*, 2009), known and established in Austria as the Tiergerechtheitsindex (TGI). In case of bovine animals, ANI 35 L/2000 – cattle (Bartussek *et al*., 2000) has been in use and applies to husbandry systems intended for bovine animals, with the exception of calves intended for breeding. The method is always applied for a concrete husbandry system, and thus, ANI is verified for every animal group separately, even if animals are housed in the same facility, where the animals differ among themselves as to the husbandry technology (dairy cows, young stock, or beef cattle). The ANI method takes into account five areas of influence which are important from the welfare point of view. All the five areas of influence are evaluated on the basis of tables, and values obtained in particular columns are finally summed up. In theory, the overall sum of points may range between -9.0 and + 45.5 points, constituting the ANI-score (as an index). The higher the score, the better are animal housing conditions. Verification is conducted in a most unfavourable season of the year. All the animals are entitled to adequate housing conditions, and it is thus not possible to establish the average condition of a bovine herd, but the condition of the quarter of the herd that is most affected, which means that the condition of the 25 % of the worst affected animals shall be taken as criterion.

MATERIALS AND METHODS

In the narrower north-eastern territory of Slovenia we inspected in the spring and summer

seasons 10 free housing farms with 491 dairy cows in total, and 10 tether system farms with 215 dairy cows in total (conventional breeding of animals in both systems). Individual free housing farms are identified in tables with capital letters of the alphabet, and tether system farms with small letters of the alphabet. At every farm, we gathered data by the graded point system according to the ANI method for the five areas of influence.

Data for the Area of Influence I ('Locomotion') were assessed by points on the basis of animal keeper's data on the size of areas for the movement of animals outside the housing units, and on the number of days in the year on which the animals are kept in the outdoor yard or pasture. We measured the floor areas within the housing units intended for the movement and lying down of animals. We measured the length and width of lying areas, the feeding areas, including their height, and assessed the design and position of restrictions constituted by the neck rails, partitions, tethers and steps. In free housing systems we took into account the total floor area with unrestricted locomotion of the animals and feeding areas accessible at all times, and one half of the lying area. Where horned animals are kept in free housing systems, an additional area of 1 m^2 available for movement shall be required in order to be awarded the same score of points as in the case of dehorned animals. In assessing the Area of Influence I, the minimum score of points was 0, and the maximum score of points was 10.5.

Data for the Area of Influence II ('Social Interaction') were mostly obtained from animal keepers, including the total area intended for the movement of animals, herd structure, husbandry system, and days of access of animals to outdoor yards or pasture in a year. In free housing systems, the entire cubicle lying area was taken into account. In assessing this area of influence, the minimum score of points was -1, and the maximum score of points was 10.0.

Data for the Area of Influence III ('Flooring') were obtained by awarding points on the basis of inspection, measurement and testing slipperiness of the floor in lying areas, activity areas, and along corridors and passage ways. We measured the width of walking areas and of gaps in slatted flooring, and inspected the ground in outdoor exercise yards and pastures. In assessing this area of influence, the minimum score of points was -2.5, and the maximum score of points was 8.

Data for the Area of Influence IV ('Light and Air', including ventilation and noise) were obtained by awarding points on the basis of inspection of housing facilities, and of information provided by animal keepers. We assessed the daylight, air quality, ventilation of animal houses, the air flow/draught in lying areas, the noise in animal houses, and the quality of outdoor exercise yards and pastures. No measurement devices were used. The minimum score of points was -2.0, and the maximum score of points was 9.5.

Data for the Area of Influence V ('Stockmanship') were obtained by inspecting the lying areas, watering facilities, feeding areas, animal house equipment, and the animals. At inspection of animals we established the condition and health status of the skin and coat, the cleanliness, the condition of hooves, and any possible injuries. The health status of animals was assessed by establishing the proportion of animals affected relative to the total number of animals, by subjective evaluation. In compliance with the ANI method instructions, we ranged the evaluation as: very good (up to 5 %), good (up to 10 %), medium (up to 30 %), bad (up to 50 %), and very bad (above 50 %). We also took into account the entries made in the farm register by the farm veterinarian. In assessing this area of influence, the minimum score of points was -3.0, and the maximum score of points was 8.0.

Every area of influence was assessed by points, and the points thus obtained were summed up. Data on the reasons for culling dairy cows and herd structure by the end of 2009, of every particular farm were obtained from the summed-up data maintained by AIS (www.govedo.si).

RESULTS AND DISCUSSION

Within the research study we processed the data collected at 10 free housing dairy farms and at 10 tethered system dairy farms. According to the ANI method, the highest score of points, ranging from 38.5 to 34, reached 3 free housing farms (A, B, C) which provide animals with $\geq 8 m^2$/animal weight unit (AWU) of areas accessible for movement throughout

the year. At further 7 free housing farms animals do not have the possibility of outdoor area for movement throughout the year, and indoor areas amount to < 5 m^2/AWU. At 5 farms (D, E, F, G, H), ranging from 29.5 to 19.5 points, animals are provided with outdoor movement and/or pasture in dry weather, and at remaining 2 farms (I, J), ranging from 13 to 6.5 points, there is no outdoor activity area or pasture available.

Tether system dairy farms are smaller by the number of animals, and reached up to 25.5 points at the maximum, and up to 8.5 points at the minimum. Eight tether system dairy farms provide the animals with pasture in the pasture season, and with periodic outdoor movement, and 2 farms, reaching the minimum number of points, do not provide the animals with pasture or outdoor movement. Table 1 shows data on the number of animals during the investigation, and the sum of points collected according to the ANI method.

Most points in the Area of Influence I were reached by the free housing dairy farms where animals have access to outdoor exercise areas for movement throughout the year, and least points

Table 1. Data on the number of dairy cows during the investigation, and the ANI-score of points in the five ANI areas of influence at farms under study

Tablica 1. Podaci o broju krava muzara za vrijeme istraživanja i ukupni broj bodova u pet područja ANI na istraživanim farmama

Farm/Number of dairy cows Farma/Broj muzara	ANI areas of influence - ANI utjecajno područje					
	Locomotion Sloboda kretanja	Social interaction Socijalni kontakt	Flooring Stanje podova	Light and air, including ventilation and noise Svijetlost, zračnost i buka	Stockmanship Intenzitet opskrbe	ANI-score Vrijednost ANI
A/22	8	9.5	5.5	9.5	6	38.5
B/39	8	7.5	5	9.5	4.5	34.5
C/40	8	9	5.5	8	3.5	34.0
D/23	5	7.5	3.5	9	4.5	29.5
E/52	4	6.5	3.5	8.5	5	27.5
F/23	2.5	5	4.5	7	5	24.0
G/43	3	4.5	4	7	3.5	22.0
H/115	3.5	4	3	7	2	19.5
I/61	0.5	2	3	4.5	2.5	12.5
J/73	0.5	3.5	-1	3.5	0	6.5
a/28	4	4	5	8	4.5	25.5
b/24	3	2.5	6.5	7	5.5	24.5
c/19	2	3	3.5	7.5	7	23.0
d/13	2	3	5	8	5	23.0
e/25	1.5	2.5	4.5	8	6	22.5
f/40	3	3.5	4	7	5	22.5
g/17	2	3	5.5	6	6	22.5
h/18	3	3.5	4	5	4	19.5
i/9	0.5	1.5	3	6	4.5	15.5
j/22	0.5	1.0	2	2.5	2.5	8.5

were reached by the farms without pasture and outdoor exercise areas. By identical ANI-score, horned animals require a greater area for movement. At free housing dairy farms under study, the animals are mostly dehorned, and at 1 farm (A) only, one half of animals are horned, whilst at 2 other farms only few animals are horned. According to statements by breeders, no animal injuries take place at such farms. In tether system farms with tethered animals, almost all the animals are horned. Dehorning is not authorised in organic farming, unless necessary for the safety, health improvement, hygiene and welfare of the animals, and by approval of the competent authority (Regulation 889/2008/EC).

At all farms under study, animals are restricted in the lying down and rising behaviours. At free housing dairy farms we assessed the lying down and rising behaviours of animals on account of insufficient length of lying areas, inadequate design of side partitions, steps, insufficient head space, and neck rails, as referred to above, by awarding 0.5 or 0 points in the most restrictive cases.

insufficient length of tether and, measuring length-wise and across the tether, 0 points were assigned at < 40/30 cm, and 0.5 points at < 60/40 cm.

Lying areas as measured were compared with the measurements of comfortable lying areas (Bartussek *et al*., 2000) and presented in Table 2.

As evident from Table 3 and Table 4, none of the farms investigated provided the animals with lying areas regarded as comfortable.

These hindrances prevent the dairy cows in performing the species-specific lying down, comfortable lying and rising behaviours. As a consequence, technopathies developing in the characteristic animal body parts were observed in particular in animals kept under the free housing conditions. As lying areas were insufficient in length, animal hindquarters extended beyond the lying area back-end kerb while in lying position. In free housing systems, certain animals prefer lying in the activity area. In a lying area of insufficient length, animals cannot assume the physiological upright posture. In a bent posture,

Table 2. Minimum measurements of comfortable cubicles for 600/700 kg cows
Tablica 2. Minimalne mjere ugodnih ležajnih boksova (LB) za muzare 600/700 kg

Breed Pasmina	Weight (kg) Težina (kg)	Length of cubicle (cm) (cubicle adjacent to wall/head to head cubicles) Dužina LB (cm) stjenke	Height of cubicle partition (cm) Visina pregrade (cm)	Available space for head (cm) Mjesto za glavu (cm)	Position of neck rail (cm) Tjemenska pregrada (cm)	Width of cubicle (cm) Širina LB (cm)
Simmental	600	244 / 211	110	39	157	119
	700	252 / 217	114	40	162	122
Holstein Frisian	600	256 / 221	116	41	165	125
	700	262 / 227	117	41	170	126
Brown Swiss	600	250 / 216	114	40	160	123
	700	255 / 220	116	41	164	125

In tether system dairy farms with animals tethered we assessed the movement of animals as restricted, by awarding 0 points. Restrictions include an inadequate length of tether, inadequate slatted flooring at the back of the stall or along the manure alley, high and rigid trough walls, and neck rail. Animal movement is rather restricted on account of

the animals stand with forequarters in the lying area and with hindquarters on the slatted floor or on the kerb of the cubicle. In free housing systems, animals are additionally restricted in the rising and lying down behaviours by the insufficient head space, the neck rail, and by the wall in cubicles situated adjacent to walls.

Table 3. Measurements of cubicles at investigated free housing farms

Tablica 3. Mjere ležajnih boksova (LB) na istraživanim farmama u slobodnom uzgoju

Farm Farma	Breed Pasmina	Length of cubicle (cm) (cubicle adjacent to wall/head to head cubicles) Dužina LB (cm) (stijenski/suprotnih)	Height of cubicle partition (cm) Visina pregrade (cm)	Position of neck rail (cm) Tjemenska pregrada (cm)	Width of cubicle (cm) Širina LB (cm)	Other hindrances* Druge prepreke
A	Simmental, crossbreed	230/230	110	no restriction bez ograničenja	120	step (15) stepenica (15)
B	Holstein	260/260	112	160	108	step (17), automatic alley scraper stepenica (17), automatski strugač
C	Simmental, Holstein, Brown, crossbreed	210/210	110	160	120	two steps (7+7), slatted floor (15+4) dvije stepenice (7+7), rešetkasti pod (15+4)
D	Simmental, Holstein, Brown, crossbreed	220/220	110	120	110-115	step (12), slatted floor (15+4) stepenica (12), rešetkasti pod (15+4)
E	Simmental, Holstein, Brown, crossbreed	230/230	115	140	120-125	step (18), slatted floor (10+3,4) stepenica (18), rešetkasti pod (10+3,4)
F	Holstein	230/230	120	145	115	step (6), slatted floor (14+4) stepenica (6), rešetkasti pod (14+4)
G	Holstein	210/210	106	160	110	step (20), slatted floor (10+4) stepenica (20), rešetkasti pod (10+4)
H	Holstein	240/240	120	180	110	step (29), slatted floor (14+4,5) stepenica (29), rešetkasti pod (10+4)
I	Holstein	225/225	113-115	125	108	step (14), slatted floor (13+4) stepenica (14), rešetkasti pod (13+4)
J	Holstein	260/240	113-115	160-180	110-120	step (14), slatted floor (10+4) stepenica (14), rešetkasti pod (10+4)

* In case of slatted floor, the first digit represents the slat width and the latter digit the gap width. In case of steps and manure alleys, the digit represents their height.

* Kod gredica prvi broj predstavlja širinu hodnog dijela, drugi širinu razmaka. Broj kod stepenica i kanala predstavlja visinu.

Table 4. Measurements of cubicles at investigated tether housing farms
Tablica 4. Mjere ležajnih boksova (LB) na istraživanim farmama u vezanom uzgoju

Farm Farma	Breed Pasmina	Length of cubicle (cm) (cubicle adjacent to wall/head to head cubicles) Dužina LB (cm) (stijenski/suprotnih)	Height of cubicle partition (cm) Visina pregrade (cm)	Position of neck rail (cm) Tjemenska pregrada (cm)	Width of cubicle (cm) Širina LB (cm)	Other hindrances* Druge prepreke
a	Holstein	165/165	90	155	105	slatted floor (2+4), feeding trough (30) rešetkasti pod (2+4), valov (30)
b	Simmental	160/160	90	150	115	slatted floor (3+4), feeding trough (35) rešetkasti pod (3+4), valov (35)
c	Simmental, Holstein	150/150	90	150	105	slatted floor (2+4), feeding trough (32) rešetkasti pod (2+4), valov (32)
d	Simmental, crossbreed	185/185	85	150	110	alley (18), feeding trough (35) kanal (18), valov (35)
e	Simmental, crossbreed, Holstein	150/150	80	150	105	slatted floor (2+4), feeding trough (20) rešetkasti pod (2+4), valov (20)
f	Holstein	175/175	90	150	105	alley (20), feeding trough (30) kanal (20), valov (30)
g	Simmental, crossbreed, Holstein	150/150	90	150	105	slatted floor (2+4), feeding trough (35) rešetkasti pod (2+4), valov (35)
h	Simmental, crossbreed, Holstein	170/170	90	150	105	alley (20), feeding trough (35) kanal (20), valov (35)
i	Simmental	160/160	90	160	110	slatted floor (2+4), feeding trough (35) rešetkasti pod (2+4), valov (35)
j	Simmental, crossbreed	180/180	90	140	115	alley (20), feeding trough (23) kanal (20), valov (23)

* In case of slatted floor, the first digit represents the slat width and the latter digit the gap width. In case of steps, feeding troughs and manure alleys, the digit represents their height.

* Kod gredica prvi broj predstavlja širinu hodnog dijela, drugi širinu razmaka. Broj kod stepenica, valova i kanala predstavlja visinu.

In tether system farms, animals are restricted by the Grabner tether, which was present in all the farms investigated. Tether of insufficient length restricts the animals in moving the neck along the longitudinal axis of the stall, and parallel to the feeding trough. In assessing lying areas we also took into consideration the type of side partitions, and of the neck rail.

In free housing systems, we noticed abrasions in the upper neck area of some animals on account of the neck rail. Side partitions in tether system farms are shorter and more appropriate forms of tethering that do not cause injuries to the animals. Side partitions between cubicles in free housing systems were made of tubular steel frames, and of wooden boards in a

single farm, and almost entirely divided the lying areas. At all the free housing farms investigated, side partitions were inadequate in form. At a farm (J), where by length and width the cubicles resemble most the dimensions defined as comfortable cubicles, the space between the lying area and the lower side partition edge is more than 80 cm above the floor. Thus, in lying position, the hind part of animal body extends beyond the partition into the adjoining cubicle and, while rising, the animal strikes against the lower partition edge. In a greater number of animals (30 - 50 %), we established injuries to the rump, hip and ischial tuberosity. Assessment of space required according to the ANI method for rising and lying down is therefore inadequate in our opinion and should, in the light of animal welfare, at least be assessed with minus points.

In assessing the Area of Influence II ('Social interaction'), activity areas for the movement of animals, herd structure, husbandry system, and the availability of outdoor areas or pasture play an important role. In free housing systems, we fully took into account the lying areas as surfaces intended for the movement of animals. In assigning points in free housing systems there is no difference between the horned and dehorned animals, though horned animals are given certain priority in this area of influence because of an important social function of the horns as such. In tether system farms, we invariably assigned 0.5 points. At all the 10 free housing farms, animals are segregated into stable age or production groups, dairy cows, heifers, and young stock. Farms mostly breed their own stock, and only 2 farms partially buy-in young stock. At 2 free housing farms, the herds of heifers include a breeding bull that is exchanged every two years, whilst cows are subjected to artificial insemination. All the tether system farms inspected, where herd structure was assigned 0 points in accordance with instructions, provide for their own breeding.

Area of Influence III ('Flooring') was assigned a maximum score of points in farms with a year-round access to outdoor areas and/or pasture. A maximum score of points for lying area was assigned to a free housing farm (A), where lying areas consisted of solid dry floor, with bedding of wood shavings and straw. A minimum score of points was assigned to a free housing farm (J), where lying areas consisted of worn-down wooden slats, which had severe technical defects in places of highest wear and tear, and with differences in height of up to 20 cm. In other 18 farms, lying areas consisted of concrete ('Hlevit'), with bedding of straw in 4 farms (B, C, d, e), of wood shavings in 4 farms (D, H, J, j), and of rubber matting in 3 farms (E, G, b). Layers of straw and wood shavings were up to 3 cm thick. Cleanliness and slipperiness of lying areas were assessed as medium in all the farms. In 8 free housing farms, activity areas consisted of slatted flooring, and in 2 free housing farms they consisted of solid floor (A, B). At inspection of a farm with solid floor and automatic alley scraper (B), the floor was wet and covered by a thin layer of slurry, despite the operation of automatic alley scraper several times a day. Slatted flooring in free housing systems was single or double, and triple in 1 farm only, and inadequate in all the farms. At the time of inspection, such slatted flooring was soiled and slippery.

In tether system farms, the lying area extended into the slatted area in 6 farms (a, b, c, e, g, i). In 5 farms, the slatted area consisted of metal slats, with 4 cm gaps and 2 cm slats. In 1 farm (b), the flooring consisted of plastic slats, with a strong point that slats were wider and without sharp edges, and with a weak point that such flooring wears down rather quickly. Animals stand with hindquarters on slatted floor, unless the tethers enable them to move forward to the feeding trough, so as to stand on solid flooring of the lying area.

At farms with an outdoor activity area, the flooring of the area was solid and with good grip in 3 farms, whilst in other farms, the flooring of the area was slippery and soiled. In 3 farms, pasture was on level ground, whilst the other farms had gently sloping pasture.

Area of Influence IV ('Light and Air', including ventilation and noise) was found adequate in all the farms inspected. All these farms have open fronted housing, and certain farms have an additional possibility of opening the houses in the rear, at the end of feed-delivery passage.

As inspections were conducted in pasture season, animal houses were mostly empty and

open. All the facilities have adequate daylight and optimum air quality. Slight draught could be perceived in the open facilities. On cold days, the lying areas in these facilities may be slightly draughty on account of ventilation through the roof ridge vents, open windows and slatted flooring. Noise was not perceived during inspection. Artificial ventilation was observed at 1 farm only. Farms with daily outdoor activity of more than 2 hours and pasture were assigned points according to instructions.

In the Area of Influence V ('Stockmanship'), the minimum score of points was assigned to farms without outdoor areas or pasture. In tether system farms, the cleanliness of lying areas and of watering and feeding areas was better than in free housing farms. Technical condition of free housing farms was assessed as medium or insufficient on account of inappropriate partitions. The condition and health status of skin and coat was assessed as good in all the farms. Cleanliness of animals was found better in tether system farms with lying areas extending into slatted floor areas. In animal houses fitted with a manure alley and in free housing, animals were soiled in the area of hindquarters, the lower abdomen and the udder. Assessment was conducted in compliance with instructions.

In farms, where animals had access to outdoor areas or pasture, their hooves were in good condition, whilst in other farms in free housing or tether systems, we found certain animals with neglected hooves. According to breeders, hooves were trimmed at least once a year in all the farms. Several technopathies in characteristic spots were observed in animals kept in free housing systems. In 1 farm (J), the proportion of affected animals ranged up to 30 - 50 %, with injuries in characteristic spots, caused by inadequate lying areas consisting of worn wooden slats, by side partitions, activity areas and steps. Technopathies were established in the areas of the hips, ischial tuberosity, the rump, the hooves, and the tarsal and carpal joints. In two farms (H, I), milder technopathies were observed in 10 - 30 % of animals. In farms with year-round outdoor area or pasture, isolated technopathies were observed in individual older animals only. Hoof diseases and injuries were observed in most farms with slatted flooring. Other authors report of technopathies caused by inadequate stockmanship. According to a research study (Kaemmer, Tschanz, 1975, cited according to Rist, 1989), in 30 % of animals in loose housing farms in Switzerland with cubicles in use at the time of the study, abrasions (the coxal tuberosity, the ischium), scrapes (the rump, hip, hock joint, coronary band) and lacerations (upper femoral area) in different animal body parts were observed.

In a research study (Mavsar, 2003) conducted in 17 dairy farms, where different husbandry systems were applied, with or without pasture, and with a total of 3173 animals, injuries in different animal body parts, with more and the most severe ones in the tarsal joints (55.7 %), in the hind limb hooves (44.7 %), in the heels (32.5 %), carpal joints (29 %), in the forelimb hooves (20.8 %), the sternum (10 %), the proximal phalanx (6.2 %), at withers (4.6 %), and in other places were observed.

Hoof and limb diseases with lameness as a consequence pose a principal problem in dairy farms. A research study conducted in 53 farms in the United Kingdom established lameness in 23 % of the animals. In the same group of animals, the breeders estimated a lower proportion of only 20 % of lame animals. Data on lame animals obtained within the research study did not tally with the data on lame animals obtained from animal breeders. Similar discrepancy was established within our research study. Likewise, a high correlation between lameness and other hindquarter injuries was observed within the aforementioned research study (Webster, 2005).

Table 5 shows data on reasons for culling dairy cows. In farms under study, in 2009, most dairy cows were culled on account of diseases and injuries of the udder, of fertility disorders, and of hoof and limb diseases (AIS, 2009).

Table 6 shows that the dairy herd in farms investigated consisted of young animals, as the proportion of dairy cows above lactation 5 is rather low. This as well is the reason why stockmanship mistakes, and animal diseases and injuries are not so obvious and do not affect the performance of the herd (AIS, 2009).

Table 5. Reasons for culling dairy cows in farms investigated in 2009

Tablica 5. Uzroci za izlučivanje krava muzara na istraživanim farmama u 2009. godini

Farm Farma	Culling reasons (number of dairy cows, %) Razlozi izlučenja (broj muznih krava, %)								Culled in total (%) Ukupno izlučenih (%)
	Diseases / injuries of the udder Bolesti / oštećenje vimena	Fertility disorders Smetnje reprodukcije	Diseases / hoof and limb injuries Bolesti / oštećenja papaka i nogu	Metabolic diseases Metaboličnebolesti	Death – cause unknown Uginuće, uzrok nepoznat	Slaughter Klanje	Sale Prodaja	Other Drugo	
A	1 (16.7)	1 (16.7)	-	-	-	1 (16.7)	3 (50)	-	6 (22.2)
B	2 (25.0)	2 (25.0)	1 (12.5)	-	-	-	-	3 (37.5)	8 (14.6)
C	-	1 (6.3)	1 (6.3)	-	1 (6.3)	5 (31.3)	5 (31.3)	3 (18.8)	16 (28.1)
D	2 (40.0)	1 (20.0)	-	-	-	-	2 (40.0)	-	5 (17.9)
E	5 (35.7)	1 (7.1)	1 (7.1)	-	-	-	5 (35.7)	2 (14.2)	14 (21.9)
F	-	2 (66.7)	-	-	1 (33.3)	-	-	-	3 (10.0)
G	-	6 (37.5)	2 (12.5)	1 (6.3)	4 (25.0)	-	-	3 (18.9)	16 (28.5)
H	5 (13.9)	5 (13.9)	13 (36.2)	3 (8.3)	-	-	-	10 (27.8)	36 (19.3)
I	-	6 (37.5)	-	3 (18.8)	4 (25.0)	1 (6.1)	-	2 (12.6)	16 (21.6)
J	14 (36.9)	4 (10.5)	4 (10.5)	-	10 (26.3)	-	-	5 (15.8)	38 (31.7)
a	3 (37.5)	-	1 (12.5)	1 (12.5)	1 (12.5)	-	-	2 (25.0)	8 (22.2)
b	-	-	1 (25.0)	-	1 (25.0)	1 (25.0)	1 (25.0)	-	4 (14.3)
c	2 (66.7)	1 (33.3)	-	-	-	-	-	-	3 (13.0)
d	-	-	-	-	-	-	1 (100)	-	1 (6.7)
e	1 (100)	-	-	-	-	-	-	-	1 (5.6)
f	-	8 (80.0)	-	-	2 (20.0)	-	-	-	10 (20.0)
g	-	2 (50.0)	-	-	-	-	2 (50.0)	-	4 (19.1)
h	-	2 (33.3)	-	-	1 (16.7)	1 (16.7)	-	2 (33.4)	6 (24.0)
i	-	1 (50.0)	-	1 (50.0)	-	-	-	-	2 (18.2)
j	3 (37.5)	1 (12.5)	1 (12.5)	-	-	-	-	3 (37.5)	8 (26.7)

Table 6. Herd structure in farms investigated by the end of 2009
Tablica 6. Sastav stada na istraživanim farmama do kraja 2009 godine

Farm Farma	Herd structure (%) - Sastav stada (%)						
	Heifers Junice	Lactation 2 2. laktacija	Lactation 3 3. laktacija	Lactation 4 4. laktacija	Lactation 5 5. laktacija	Lactation 6 and higher 6. laktacija i više	Number of cows Broj krava
A	6 (28.6)	2 (9.5)	4 (19.1)	2 (9.5)	3 (14.3)	4 (19.1)	21
B	16 (34.0)	14 (29.8)	7 (14.9)	7 (14.9)	2 (4.3)	1 (2.1)	47
C	12 (30.0)	10 (25.0)	8 (20.0)	1 (2.5)	7 (17.5)	2 (5.0)	40
D	6 (26.1)	2 (8.7)	5 (21.7)	5 (21.7)	1 (4.4)	4 (17.4)	23
E	12 (24.0)	12 (24.0)	11 (22.0)	3 (6.0)	6 (12.0)	6 (12.0)	50
F	4 (14.8)	10 (37.0)	2 (7.4)	3 (11.1)	1 (3.7)	7 (25.9)	27
G	18 (46.2)	11 (28.2)	4 (10.3)	3 (7.7)	2 (5.1)	1 (2.5)	39
H	48 (32.0)	50 (33.3)	22 (14.7)	17 (11.3)	5 (3.3)	8 (5.4)	150
I	18 (31.0)	14 (24.1)	13 (22.4)	6 (10.3)	3 (5.2)	4 (6.9)	58
J	35 (43.8)	20 (25.0)	13 (16.3)	7 (8.8)	2 (2.5)	3 (3.8)	80
a	11 (39.3)	8 (28.6)	4 (14.3)	2 (7.1)	2 (7.1)	1 (3.6)	28
b	8 (33.3)	6 (25.0)	4 (16.7)	5 (20.8)	0	1 (4.2)	24
c	4 (20.0)	4 (20.0)	3 (15.0)	2 (10.0)	3 (15.0)	4 (20.0)	20
d	1 (7.1)	2 (14.3)	3 (21.4)	3 (21.4)	1 (7.1)	4 (28.6)	14
e	7 (41.2)	2 (11.8)	1 (5.9)	3 (17.7)	2 (11.8)	2 (11.8)	17
f	11 (27.5)	10 (25.0)	8 (20.0)	3 (7.5)	4 (10.0)	4 (10.0)	40
g	3 (17.7)	3 (17.7)	5 (29.4)	2 (11.8)	2 (11.8)	2 (11.8)	17
h	5 (27.8)	5 (27.8)	2 (11.1)	6 (33.3)	0	0	18
i	6 (66.7)	1 (11.1)	1 (11.1)	0	0	1 (11.1)	9
j	5 (22.7)	4 (18.2)	7 (31.8)	1 (4.6)	2 (9.1)	3 (13.6)	22

CONCLUSIONS

Responsible animal management, food safety and quality, and protection of the environment are gaining importance from day to day. A preliminary condition for milk quality and for the quality of dairy products is a sound state of health and welfare of dairy cows.

Responsibility for animals lies with animal owner, who shall provide the animals with such an environment, where they are able to perform the species-specific behaviours. Permanent training of animal keepers is imperative, so that they may familiarise themselves with the behavioural and other needs of dairy cows. Existing animal houses need to be renovated and adapted to animals of ever greater proportions.

Either the free housing or the tether system has certain advantages and shortcomings. They are both deficient as regards the floor surfaces.

In free housing system, lying areas are insufficient in length and width, side partitions and neck rails are inadequate, lying area is divided from activity area by a step of several centimetres in height, and slatted floor with too large gap width, restricting the animals in performing the normal lying down, lying, rising and walking behaviour, which all leads to technopathies developing in the characteristic body parts of most animals.

Though tether systems cause fewer injuries to the animals, they are exposed to greater stress on account of restrictions caused by tethers which are insufficient in length, by slatted floor with gaps too wide at the back of the stall, or by the manure alley.

Animal breeders decrease the proportion of affected animals by speeding up the repopulation.

The ANI method gives precedence to farms with the availability of year-round outdoor area or pasture. However, the ANI method does not envisage awarding minus points for the restricted and highly restricted lying down and rising behaviours of the animals. The method does not envisage awarding less than -0.5 points for technical defects that are causing hoof injuries, for slatted floor, manure alleys or steps. Likewise, in assessing the Area of Influence V, the ANI method does not envisage awarding less than -0.5 points for a very bad condition of the hooves, which is a rather frequent technopathy, and for a very poor health status. Area of Influence V does not take into account the age of animals. By speeding up the repopulation of animals, by inclusion of heifers and by culling the affected animals, the breeders are decreasing the proportion of affected animals in the herd. This is contrary to ethical principles, to the EU legislation and strategy, and to the EU principle of "Prevention is Better than Cure", which is focused on animal health and welfare, and which shall be based on animal disease prevention. Higher standards will need to be enforced and a more effective system of control instituted. Though facilitating the rapid assessment of adequacy of animal husbandry systems, the ANI method does have certain deficiencies, which should be rectified.

LITERATURE

1. Agricultural Institute of Slovenia / Kmetijski inštitut Slovenije. Reports Summary 2009 / Sumarnik 2009. Ljubljana, 2009 (www.govedo.si).
2. Bartussek, H., Leeb, Ch., Held, S. (2000): Animal needs index for cattle, ANI 35 L/2000 - cattle. Federal Research Institute for Agriculture in Alpine Regions. Vienna, 20p.
3. Bavec, M., Robačer, M., Repič, P., Štabuc, Starčevič, D. (2009): Resources and guidelines for organic farming /Sredstva in smernice za ekološko kmetijstvo. University of Maribor, Faculty of Agriculture and Life Sciences and Institute for Organic Agriculture. Maribor, 76-79.
4. Božič, A., Sadar, M., Perpar, T. (2009): Results of Milk Production Control in Slovenia / Rezultati kontrole prireje mleka v Sloveniji. Collection of Lectures / Zbornik predavanj, Radenci, 18, 351-361.
5. Broberg, B. (2006): Farming and rearing. In: Animal Welfare. Ethical Eye. Strasbourg, Council of Europe, 41-54.
6. Commission of the European Communities. Communication from the Commission to the European Parliament and the Council on a Community Action Plan on the Protection and Welfare of Animals 2006-2010. SEC (2006) 65.
7. Commission Regulation (EC) No 889/2008 of 5 September 2008 laying down detailed rules for the implementation of Council Regulation (EC) No 834/2007 on organic production and labelling of organic products with regard to organic production, labelling and control. Off J EC, L 250, 2008: 1-101.
8. Council Directive 98/58/EC of 20 July 1998 concerning the protection of animals kept for farming purposes. Off J EC, L 221, 1998: 23-27.
9. Council Decision 78/923/EEC of 19 June 1978 concerning the conclusion of the European Convention for the protection of animals kept for farming purposes. Off J EC, L 323, 1978: 12 -13.
10. Cozzi, G., Brscic, M., Gottardo, F. (2008): Animal welfare as a pillar of a sustainable farm animal production. Acta agric. Slov., supl. 2, Domžale, 23-31.
11. European convention for the protection of animals kept for farming purposes. No. 87. Strasbourg: Council of Europe, 1976.
12. European Commission. A new Animal Health Strategy for the European Union (2007-2013) where "Prevention is better than cure". COM 539 (2007) final. Luxembourg, 2007.
13. Jenko, J., Ivanovič, B., Perpar, T., Glad, J. (2010): Dairy cow longevity report, Slovenia 2009 / Poročilo o dolgoživosti krav molznic, Slovenija 2009. Agricultural Institute of Slovenia / Kmetijski inštitut Slovenije, Ljubljana, 6.
14. Kos, U., Dobeic, M. (2002): Animal Welfare / Dobrobit živali. Collection of Lectures / Zbornik referatov. Portorož, 135-139.
15. Livestock-Breeding Act / Zakon o živinoreji, (UL RS 18/02).
16. Mavsar, N. (2003): Welfare Assessment of Domestic Animals: Construction in Livestock-Breeding Farms. / Ocenjevanje počutja domačih živali: Gradnje na živinorejskih kmetijah. Collection of Lectures / Zbornik predavanj. Velenje, 30-35.

17. Ornik, D., Volk, M., Brus, M., Janžekovič M. (2009): Animal Protection and Welfare in Milk Production / Zaščita in dobro počutje živali v prireji mleka. Collection of Lectures / Zbornik predavanj. Radenci, 18; 351-361.
18. Perpar, T., Verbič, J., Babnik, J. (2006): Census of Farms of 2005. / Popis kmetij 2005. Situation on Bovine Farms with Herds Included in Milk and Meat Production Control. / Stanje na govedorejskih kmetijah s čredami v kontroli prireje mleka in mesa. Agricultural Institute of Slovenia, Ljubljana, Kmetijski inštitut Slovenije, Ljubljana, (www.govedo.si/files/ /knjižnica/predstavitve/radgona_2006 (Predstavitev_ _anketa_2005_GR.pdf).
19. Protection of Animals Act / Zakon o zaščiti živali (ZZZiv-UPB2), (UL RS 43/07).
20. Protocol of amendment to the European convention for the protection of animals kept for farming purposes. No 145. Strasbourg: Council of Europe, 1992.
21. Rist, M. (1989): Artgemäβe Nutztierhaltung: Ein Schritt zum wesensgemäβen Umgang mit der Natur. Stuttgart, 10-33.
22. Senica, M., Štuhec, I., Rezar, V. (2001): Dairy Cow Keeping according to Ethological Principles / Reja krav molznic po etoloških načelih. Collection of Lectures, Biotechnical Faculty of Ljubljana, Ljubljana 78 (1): 43-56.
23. Siard, N. (2003): Ethological Aspects of Appropriate Animal Housing: Construction in Livestock-Breeding Farms. / Etološki vidiki primerne uhlevitve živali: Gradnje na živinorejskih kmetijah. Collection of Lectures / Zbornik predavanj. Velenje, 24-29.
24. Štuhec, I. (2009): Ethology and Successful Animal Husbandry. / Etologija in uspešna živinoreja. Collection of Lectures / Zbornik predavanj. Radenci, 18; 237-246.
25. The Treaty of Amsterdam. Amending The Treaty on European Union, The Treaties Establishing The European Communities And Related Acts. Off J EC, C 340, 10 November 1997.
26. The Treaty of Lisbon amending the Treaty on European Union and the Treaty establishing the European Community, signed at Lisbon, 13 December 2007. Off J EC, C 306.
27. Webster, J. (2005): The assessment and implementation of animal welfare: theory into practice. In: Animal welfare: Global issues, trends and challenges. OIE. Revue scientifique et technique, vol. 24, no. 2, 723-734.

SAŽETAK

Proizvodnja mlijeka na privatnim farmama goveda u Sloveniji je značajna gospodarska djelatnost, koja je zbog uvođenja evropskih propisa doživjela značajne promijene. Zdravlje i dobrobit krava predstavljaju osnovne uvjete za kakvoću mlijeka i mliječnih proizvoda a uz to su i značajni činjenici zdravlja čovjeka. U radu su predstavljeni aktualni standardi o dobrobiti domaćih životinja, značajne europske aktivnosti na području dobrobiti i rezultati analiziranog stanja na užem području sjeverno-istočne Slovenije. Praćeno je i analizirano 10 privatnih farmi sa slobodnim uzgojem krava muzara i 10 s uzgojem na vezu. Ocijenjena je kvaliteta uzgoja prema austrijskoj metodi ANI, koja predstavlja mjerilo za ocjenu primjerenosti uzgoja na temelju sustava bodova. Ocijenjeno je svih pet utjecajnih područja značajnih za dobrobit životinja i to: sloboda kretanja, socijalni kontakti, stanje podova, osvjetljenje, ventilacija, buka te kvaliteta skrbi za životinje. Ocijenjena je adekvatnost uzgoja i napravljena usporedba između slobodnog i vezanog načina uzgoja. Analizirano je zdravstveno stanje pregledanih životinja i predstavljen opseg bolesti, tehnopatija i ozljeda, uzroci za izlučivanje krava muzara i sastav stada na istraživanim farmama krajem 2009 godine. Predstavljene su prednosti i nedostaci metode za ocjenjivanje kvalitete uzgoja životinja.

Ključne riječi: dobrobit, krave muzare, ANI indeks