



Better Science for Better Animal Welfare

Conference Proceedings

1st Regional Animal Welfare Conference

10th – 11th March 2020



Hotel Capsis, Thessaloniki, Greece

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Welcome to our Conference!

Dear Colleagues and Friends!

We would like to welcome you in Thessaloniki, Greece for the first ever RAWC regional animal welfare conference. The theme of the Conference is 'Better Science for Better Animal Welfare'.

The Regional Animal Welfare Centre was founded in 2013 with the support of the RSPCA with the aim to strengthen links between academia, stakeholders and competent authorities in the Balkan region in order to improve the implementation of legislation, standards and best practice in the field of animal welfare. The most important role of the RAWC is to provide scientific and technical advice to national bodies and to disseminate research findings and technical innovations.

Since its foundation, RAWC has a tradition of organising regional workshops, training events and seminars, and with this conference (with intention to be held every second year) we are bringing the regional scientists and experts together to exchange and debate the regional topics and promote animal welfare through better science in wider Balkan region.

This Conference is planned as a two-day meeting featuring talks and posters from scientists mainly linked to the South East Europe Region. At the end, our special gratitude goes to our Keynote speakers and Sponsors as their engagement and support of this - the first ever RAWC Conference really gave us the additional boost to make this Conference what we trust a successful and fruitful event!

Regards,

For the Organising and Scientific Committee

Evangelia Sossidou & Vlatko Ilieski

Foreword

Dear all,

Firstly, we would like to thank all of you who contributed to the Conference, as speakers or poster presenters. This Book of Abstracts is, as well as the Conference itself, divided into four main sections:

- Animals in communities,
- Human-animal relationship,
- Animals and the environment, and
- Animals in food production.

Each submitted manuscript has been peer reviewed by two members of the Scientific Committee, and we would like to thank all members of the Scientific Committee who reviewed over 50 abstracts submitted for the Conference.

Animal welfare science is still young and dynamic, and in South East Europe is even younger. This is why the goal of the Conference was to give special attention to participation of young researchers from the region, which, hopefully, we accomplished.

In future, RAWC will continue to cherish contribution of young regional researchers as their active role will contribute towards establishing of a more stable and wider network of animal welfare scientists in this Region.

Sincerely,

Editors

Tomislav Mikuš & Mario Ostović

CONFERENCE PROGRAM

DAY ONE
10th March 2020

Opening of the conference		
PRESENTER		
Katerina Marinou	The role of Ministry of Rural Development and Food in promoting animal welfare principles and legislation to stakeholders	09.00 – 09.15
SESSION 1 - Animals in communities		
Donald Broom KEY NOTE	Animal welfare in relation to human welfare and sustainability	09.15 – 10.00
Theodora Papavasili	The stray animals in Greece: Legal framework and management implications	10.00 – 10.15
Elena Gobbo	Risk factors for contexts-based dog biting incidents	10.15 – 10.30
Dunja Kovač	Most common behavioural problems in adopted dogs with unknown backgrounds	10.30 – 10.45
Ugur Ozenturk	The past, present and the future of the stray animals in Turkey	10.45 – 11.00
Q&A SECTION		11.00 – 11.15
COFFEE BREAK 30'		
SESSION 2 - Human-animal relationship		
Marijana Vučinić KEY NOTE	When the first of 5Fs goes wrong for dog welfare – Who is responsible?	11.45 – 12.30
Mario Ostović	Veterinary student attitudes towards and knowledge about exotic non-mammal pet animals and their welfare	12.30 – 12.45
Gergana Nikolova Balieva	Public awareness on animal cruelty, influenced by personal attitudes to animals	12.45 – 13.00
Ivana Sabolek	Regional differences in the attitudes of veterinary students in Croatia towards welfare of farm and companion animals	13.00 – 13.15
Q&A SECTION		13.15 – 13.30
LUNCH BREAK 1h15' (Poster session)		
SESSION 3 - Animals and the environment		
Rebeca Garcia Pinillos KEY NOTE	The relevance of the One Welfare Framework on animals and the environment	14.45 – 15.30
Viktor Jurkovich	Heat stress in dairy calves	15.30 – 15.45
Maria-Anastasia Karatzia	Monitoring and managing cow heat stress	15.45 – 16.00
Christos Zafeiridis	Religious slaughter: Evaluation of current practices in Greece	16.00 – 16.15
Round table discussion for future challenges in animal welfare science and research in the south east Europe region		16.15 – 17.15
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THESSALONIKI SIGHTSEEING 18.15 – 19.45 (finishing in restaurant for group dinner)		
WELCOME DINNER 20.00 – 00.00		

DAY TWO
11th March 2020

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PRESENTER		
Jeremy Marchand-Forte KEY NOTE	The art and science of measuring behavior in the assessment of animal welfare	09.15 – 10.00
Anna Dedousi	Does housing system, hybrid and phase of production cycle affect the plumage condition of laying hens?	10.00 – 10.15
Lina Lauko	Exposure of pullets to different sources of Vitamin D3 and its effect on keel bone damage and outdoor behaviour	10.15 – 10.30
Vlatko Ilieski	Differences and similarities of animal welfare assurance schemes and its practical applications to support welfare risk management	10.30 – 10.45
Katarina Nenadović	Effect of extensive systems on behavior of autochthonous sheep breed Vlašićka zackel	10.45 – 11.00
Q&A SECTION		
COFFEE BREAK 30'		
Tomislav Mikuš	Can life experience reduce the stress of early weaning in cows?	11.45 – 12.00
Egzon Zhitia	Animal welfare assessment and short-term impact of improvement strategy in dairy cattle	12.00 – 12.15
Elena Irimia	Evaluation of health disorders incidence in Romanian Black Spotted dairy calves	12.15 – 12.30
Miroslav Kjosevski	Associations between the attributes and social interactions using social network analysis in lactating dairy cows	12.30 – 12.45
Marta Drcic	Animal welfare challenges in the modern dairy sector	12.45 – 13.00
Q&A SECTION		
13.00 – 13.15		
LUNCH 1h15' (Poster session)		
Birte Nielsen KEY NOTE	The role of Precision Livestock Farming (PLF) technologies in animal welfare monitoring	14.30 – 15.15
Sokol Duro	On-farm assessment of the health and welfare of pregnant sows on pig farms in Kosovo and Albania	15.15 – 15.30
Egzon Zhitia	Survey on the health and welfare conditions of the weaners and fatteners in commercial pig farms in Kosovo and Albania	15.30 – 15.45
Manja Zupan Šemrov	A practice-led approach for starting with intact pigs in Slovenia	15.45 – 16.00
Dimitar Nakov	Inter-observer reliability for Quality Behavioural Assessment in growing pigs	16.00 – 16.15
Q&A SECTION		
16.15 – 16.30		
CLOSING REMARKS & BEST POSTER PRESENTATION AWARD		16.30 – 16.40

The role of Ministry of Rural Development and Food in promoting animal welfare principles and legislation to stakeholders

Katerina Marinou & Spyridon Ntountounakis

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Introduction

European legislation on animal welfare requires in many legal texts that staff involved with the breeding, transporting and killing farm animals should have the appropriate ability, knowledge and professional competence to care for animals. Furthermore, nongovernmental organizations and laypersons request for qualitative training of all professionals involved in all aspects of animal welfare. Consequently, vocational training is the most popular means of fulfilling legal provisions, social demand and, of course, improving the quality of animal products.

Training of professionals for animal welfare during transport

Compromised welfare often occurs due to lack of education and training, in contrast with the perception that it is deliberate or due to negligence on behalf of professionals involved. Assembly centers play an important role in the transport of some farm species. Therefore, they should ensure that European Union legislation on the protection of animals during transport is known and respected by their staff.

Therefore, training should be a prerequisite for any person handling animals during transport. The Central Competent Authority, according to the Ministerial Decision No. 314754 /2009, which delivers 3-day training courses to professional drivers and assembly centers' employees, provides training in Greece. The participants are subject to written examinations, followed by the delivery of a certificate of competence in case of success. The training content of the courses complies with the provisions of Annex IV of Regulation 1/2005/EC. Since 2016 9 training courses have been delivered by the Greek Central Competent Authority with the participation of 350 drivers and assembly center employees.

Training of professionals for animal welfare in pig farms

Animal welfare level in farms is strongly correlated with the level of knowledge, experience and behavior of all staff involved in the handling of animals in the farm, including official veterinarians. Therefore, proper treatment of animals is definitely a matter of civilized conditions in farms, better quality of animal products and compliance with legislation. One of the means that the latter can be guaranteed is training provided under the coordination of competent authorities.

The European Commission provides training of official veterinarians in all fields of animal welfare including animal welfare in pig farms. The aim of training is to ensure that they implement the legislation

of the European Union adequately and that official inspections are carried out in a uniform, objective and adequate manner in all Member States. In Greece φθρτηρ the central competent authority provides national training of veterinarians.

The Greek Central Competent Authority also performs training of pig farm personnel. The content includes both general competencies, as well as information on targeted areas such as risk analysis for aggressive behavior of pigs with a view to reduce the percentage of tail biting and tail docking as routine procedure. Enough time should be allocated for addressing questions of the participants.

Discussion and Conclusions

The prioritization of professional training in animal welfare at a high goal level is very important and facilitates communication with other ministries, training organizations and regional services, as well as the participants themselves. The aim of this presentation is to present the evaluation results of the abovementioned education and training programs of the Greek Central Competent Authority. Proposals for improvement will also be presented.

The Greek Ministry of Rural Development and Food has acknowledged this need and will soon expand its activities to training for broiler and equine welfare.

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Section 1 - Animals in communities



Photo by Mikuš, T.

KEYNOTE LECTURE

Animal welfare in relation to human welfare and sustainability

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What should we change in the future? As a consequence of the one health, one welfare and one biology concepts, for most of our decisions a sharp distinction between humans and other species is not justifiable. We should be less human-centred if we want our species and other species to survive. Are humans special? Not as much as many people think. People in all countries consider that we have moral obligations to animals that we use and to the sustainability of systems. A system or procedure is sustainable if it is acceptable now and if its expected future effects are acceptable, in particular in relation to resource availability, consequences of functioning and morality of action. Consumers increasingly demand that systems used in all production and other activities be sustainable. They may refuse to buy unacceptable products and pressurise retail companies and governments to ensure that they are not sold. Systems are most often considered unsustainable because of poor welfare of people, poor welfare of other animals, genetic modification, or harmful environmental effects. Most of the public now think of farm and companion animals as sentient beings and have concerns about their welfare.

Since there are many components of sustainability, people who consider only one aspect may not advocate the best solution. If the focus is entirely on: animal welfare, other harms associated with: preservation of rare wildlife species, maximising local biodiversity or minimising greenhouse gas production may occur. However, some actions that improve animal welfare may also have positive environmental effects and each aspect can be measured. When an agricultural or other product is considered, life cycle analysis of the product takes account of every contributory factor. Every externality of the system should be evaluated and the value of each balanced. Some topics considered include: straw use; which animals to keep as pets; stray dogs; free-roaming cats; feed-lots; silvopastoral systems; free-range cattle; preserving land for hunting; land-sparing or land-sharing; zoos and conservation; and cell-culture of meat.

The stray dogs in Greece: Legal framework and management implications

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Introduction

Despite the existing European and National legal framework, the fact that, for a long time stray animals were treated as a less important problem, not requiring drastic solutions, has led to their uncontrolled reproduction and overcrowding. Stray pets consists an ethical but also a public health issue that we cannot ignore. The European Union estimates that there are about 100,000,000 stray pet animals in Europe (500,000 stray dogs in Greece) (ESDAW-EU, 2014 - 2019). Stray animals, often experience poor health and welfare, related to a lack of resources or provision of care necessary to safeguard each of their five freedoms. Furthermore, they can pose a significant threat to human health through their role in disease transmission (WSPA and RSPCA International (2006 - 2007)). One the other hand, stray control methods vary greatly between Member States but also within different regions in the same country. The aim of this paper is to present the legal framework and management implications for the protection of stray animals in Greece. The ultimate purpose is to conclude with some novel strategies towards the effective management of the problem taking into account the administrative, economic and social particularities in the country.

Legal framework and management implications for the protection of stray animals in Greece

Article 24 of the 1975 Greek Constitution regulates the protection of the natural environment (including animals). Law 2017/1992 strengthened the legislation that followed N. 1197/1981 on the protection of animals, by incorporating the European Convention for the Protection of Pets. With a series of regulations, Greece ratified international conventions and applied Community regulations and directives on animals in its national legislation. The first Law 3170/2003 on the protection of pets was amended and improved by Law 4039/2-2-2012 concerning domestic and stray pets while protecting animals from exploitation and avoiding their use for profit. Law 4235/11-2-2014 amended the previous law on aggression or danger of the dog, while Law 4483/2017 designates the responsible authorities for monitoring infringements and imposing fines. In the effort to reduce the overcrowding of stray dogs, the role of Local Authorities (OTAs) in Greece is currently active. Despite their poor financial resources, they have both human and financial resources to control the obligations of pet owners, as well as the welfare and protection of stray animals. However,

they must play a leading role both in informing the Greek citizens about the problems caused by the abandonment of pets and in applying the provisions on pets. The Panhellenic Animal Welfare and Environmental Federation and other animal welfare organizations withdrew the draft law that went into consultation on 22/3/2018 following intense protests. They argue that the draft law targets both animals and people who take care of strays, while at the same time pointing out that Municipalities lack the necessary infrastructure and financial resources and thus cannot respond to stray care. However, there are a few local shelters or local veterinary centers, while many OTA are implementing stray pet management programs. Despite the common goal, cooperation between municipalities and animal volunteer organizations is still under consideration. Finally, citizen awareness programs to cultivate 'responsible ownership' awareness and promote the 'adopt a stray' campaign are being implemented in several OTA while at the same time are implementing (mainly in schools) the World Animal Health Organization (WHO) campaign entitled 'Be His Hero', with the aim of raising awareness against dog abandonment in Balkans to reduce the overcrowding of stray dogs in the area.

Discussion and Conclusions

In Greece, the management of the overcrowding of stray dogs is in responsibility of the local authorities. The ever-increasing number of stray dogs raise both ethical and health arguments between citizens and has often led to movements against those animals. The problem is multidimensional, making it imperative to find a single solution. The school's contribution and its cooperation with the Local Authorities are needed to cultivate feelings of zoos in children and understand what 'responsible' pet ownership means. Most important, new management strategies have to be developed taking into account the administrative, economic and social environment of their practical application.

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Risk factors for contexts-based dog biting incidents

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Introduction

Aggression, especially when it is directed towards owners or other people, is one of the most common and dangerous behavior problems in dogs. There is a large body of evidence on post-bite implication for the victims and dogs or basic characteristics of the dogs involved, although most of these studies lack a thorough description of the contexts in which dog biting incidents occur and they rarely assess the potential risk factors. Current data suggest the majority of dog bites occur during a direct contact with the dog, such as while petting or playing with the dog, however, it was previously reported that in some cases there was no interaction with the dog before the bite occurred. In these cases, the victims do not have an opportunity to assess the behavior of the dog and are therefore more difficult to prevent, as compared to bites during direct contact. The aim of the present study was to determine the potential risk factors for dog biting incidents in different contexts, using information about the characteristics of the dogs involved, precise description of the contexts and dog-human interaction at the time.

Materials and Methods

A total of 400 self-reported victims of dog bites (77.5% females; aged between 18 and 86 years, mean 32.7 ± 12.5) responded to the online questionnaire (composed using OneClick survey software), available online from December 2017 until February 2018. The link to the questionnaire, shared through Facebook and various faculties' electronic mailing lists, included a short presentation of the aims of the study, inclusion criteria stating that respondents had to be 18 years of age or older and previously bitten by a dog, and consent for usage of the information for research purposes. The questionnaire contained six open and 23 closed questions divided into four sections. Questions touched on victim demographics, information about the dog, information about the incident and post-bite implications for the dog. Statistical analyses was performed using the statistical software IBM SPSS Statistics for Windows, version 22. Categorical variables were presented as frequencies. Associations between different categorical variables were assessed using nondirectional chi-square tests with calculated odds ratios (OR) and 95% confidence intervals (CI). A binary logistic regression model was used to estimate potential risk factors for bites with or without prior interaction. Variables for the final models were selected using backward elimination until all the main effects were significant. Statistical significance was accepted if $P < 0.05$.

Results

The majority of the respondents were bitten when they were younger than 19 years old ($n = 271, 67.8\%$). They mainly knew the attacking dog prior the attack, but only a few were owners ($n = 33, 8.3\%$) or cohabitants ($n = 21, 5.3\%$) of the dog. The remaining respondents stated they knew the dog from their family

members, friends, neighbors or they were acquainted with the dog (e.g., from walks) (n = 219, 54.8%). The dogs involved in the attack were primarily male (n = 270, 67.5%), aged between 2 and 10 years (n = 279, 69.8%), large in size (n = 190, 47.5%), most commonly German Shepherds (n = 80, 20%), with history of aggression ($\chi^2 = 6.4$; OR = 1.8; 95% CI = 1.1-2.7; P = 0.011) and moving freely before the attack (n = 271, 69.7%). The most common location of the incident were the road or street (n = 113, 29.0%) and inside or outside someone else's property (n = 69, 17.4%), however the bites more likely happened on a private property than public property ($\chi^2 = 3.9$; OR = 1.5; 95% CI = 1.0-2.3; P = 0.049). Half of the victims were in a direct contact with the dog (n = 180, 48.3%), the other half stated they had no interaction with the dog before the bite occurred (n = 187, 50.1%). The most common context were bites during petting (n = 31, 8.3%), attempting to pet (n = 44, 11.8%), entering dog's personal space (e.g., walked past the dog) (n = 83, 22.3%), fast movements near the dog (e.g., running) (n = 35, 9.4%) and unprovoked attacks (n = 62, 16.6%).

Regarding risk factors, during incidents with prior interaction, dogs with a history of aggression were more likely to bite as compared to dogs without a history of the behavior, and unneutered dogs were more likely to bite as compared to neutered dogs. During incidents without prior interaction, bites were more likely to occur in public spaces than in private spaces. Purebred dogs were likely to be involved in bites as compared to mixed-breed dogs. Dogs with no history of aggression were less likely to bite as compared to dogs with a history of aggressive behavior (Table 1).

Table 1. *Significant predictors for dog bites with and without prior interaction*

Interaction before the bite	Predictor	Wald Chi-Square	P	Odds Ratios (OR)	95% CI for Odds Ratio	
					Lower	Upper
Yes	Public space	6.026	0.014	0.362	0.161	0.815
	Neutered dog	5.128	0.024	0.362	0.152	0.873
	History of aggression	4.954	0.026	2.519	1.117	5.683
No	Public space	18.190	0.000	4.495	2.253	8.969
	Pure-breed dog	11.401	0.001	3.033	1.255	7.328
	No history of aggression	7.004	0.008	0.391	0.195	0.784

Discussion and Conclusions

The basic profiles of the biting dogs and their victims were consistent with the previous studies, involving mainly children bitten by an adult, a male, large, previously known dog that was moving freely. Both, bites that occurred during prior interaction with the dog (e.g., while petting or playing) and those occurring when the victim did not seek any direct interaction with a dog were explored. Most common contexts of dog bites were bites during petting, attempting to pet, entering dog's personal space, fast movements near the dog and unprovoked attacks. The most important and novel result of our study were the risk factors, that were, for bites during direct interaction, revealed to be unneutered dogs with a history of aggression. On the other hand, pure-breed dogs with history of aggression were associated with biting incidents without prior interaction. Based on our results, we believe that bites without prior interaction and risk factors are in need of further research as they are more difficult to prevent, since the evaluation

of dog behavior by the victim or recognition of warning signs and the appropriate alteration of behavior is more difficult when the interaction with the dog is not expected.

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Most common behavioural problems in adopted dogs with unknown backgrounds

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Introduction

Undesirable behaviours are common in the domestic dog population. A possible reason being that there is an increase in the companion animal population, and dogs are being kept as pets, not merely for practical reasons such as hunting, guarding or sledding. In addition, the relationships between dogs and owners have become stronger and more personal. The popularity of dogs as companions also brings with it a negative aspect namely the homeless dog populations. The domestic dog can exhibit a wide variety of behaviours that owners find annoying. These range from relatively minor problems such as tail chasing or pulling on the lead, to more serious ones such as aggression or destructiveness. The chances of a dog developing a behavioural problem may be dependent upon a number of factors including, for instance, its breed, age, sex, castration status, diet, relationship with owner etc. When a dog is adopted, either from the street, or from a shelter or a foster home, his history and background is mostly unknown. This makes it more difficult to determine the cause of the behavioural problem, as well as when the problem first started and how long it lasts. The aim of this research is to determine which behavioural problems are adopted dogs more prone to, in order to avoid repetitive relinquishment by preventing them as soon as the dog is adopted.

Materials and Methods

The research was carried out on 50 dogs. The owners came to a clinic for a consult when they noticed changes in their dog's behaviour. The consult starts with a history and a health exam in order to exclude any health concerns as a possible primary cause of a behavioural problem. After no health issues are found, more detailed questionnaire is carried out for gathering information on how the dog was adopted, age, sex, breed, castration status, as well as the overall relationship with the owner, habits, activities and detailed description of the problem. The consult usually lasts for one hour. Acquired information is crucial for making the right diagnosis of a behavioural problem so that the right behaviour modification treatment plan can be created. For the purpose of this research, the dogs were divided into three groups: dogs adopted from the street (n= 30), dogs adopted from a shelter (n=6) and dogs adopted from a foster home (n=14). Statistical analysis was done using software Graph Pad Prism. For determining statistical difference between adopted dogs with unknown backgrounds Chi-squared (χ^2) test was used.

Results

Based on the results, we can see that the highest percentage of dogs aged 0-1 years was adopted from the shelter 33.33% (2/6), dogs from the street were most adopted at the age of 1-5 years 73.33%

(22/30) while dogs in the age group 5-10 years were the most adopted from foster home 28.57% (4/14). Dogs older than 10 years the owners did not adopt (Table 1). The highest percentage of females 66.67% (20/30) was adopted from the street, while the highest percentage of males 66.67% (4/6) was adopted from shelters. Dogs that were adopted from the shelter were castrated 100% (6/6) compared to 80% (24/30) of dogs from the street and 64.28% (9/14) dogs from foster home. The highest percentage of pure breed dogs 21.43% (3/14) came from foster home while only two dogs (6.67%) were adopted from the street and only one pure breed dog was adopted from the shelter. Most mixed breed dogs were adopted from the street 93.33%, followed by 83.33% (5/6) mixed breeds adopted from the shelter, and 78.57% (11/14) adopted from a foster home (Table 1).

Table 1. *Characteristics of dogs from the street, from a shelter and from a foster home*

Parameter	Dogs from the street n=30		Dogs from a shelter n=6		Dogs from a foster home n=14		χ^2	P
	N	%	N	%	N	%		
0-1 yrs	3	10	2	33.33	0	0	5.28	0.07
1-5 yrs	22	73.33	4	66.67	10	71.43	0.11	0.95
5-10 yrs	5	16.67	0	0	4	28.57	2.41	0.30
> 10 yrs	0	0	0	0	0	0	/	/
Females	20	66.67	2	33.33	6	42.86	3.62	0.16
Males	10	33.33	4	66.67	8	57.14	4.27	0.12
Spayed/neutered	24	80	6	100	9	64.28	3.29	0.19
Pure breed	2	6.67	1	16.67	3	21.43	2.11	0.35
Mixed breed	28	93.33	5	83.33	11	78.57	2.12	0.34

n= total number of dogs; N= number of the dogs with certain characteristics

In relation to behavioural problems, a significant difference ($P<0.05$) was found in the prevalence of leash reactivity with the highest prevalence in shelter dogs of 33.33% (2/6) and in territorial aggression with the highest prevalence in dogs adopted from the street 13.33% (4/30). In dogs from foster homes, individual cases of resource guarding, leash reactivity, food aggression, pica, redirected aggression and poor recall were recorded. Separation anxiety was highest in dogs adopted from shelters 50% (3/6) while fear aggression, fears and phobias and poor recall was observed in dogs adopted from the street 6.67% (2/30), 23.33% (7/30), 13.33% (4/30). Biting incidents were mostly recorded in foster dogs 21.43% (3/14) (Table 2).

Discussion and Conclusions

The results of this research indicate that the two most common behavioural problems are leash reactivity and territorial aggression. Shelter dogs, mostly neutered males, exhibit most leash reactivity, which suggests lack of socialization in shelter environment, as well as poor adoption rates since the smallest number of dogs in this research came from the shelters. Isolation in shelters and lack of human contact may be the reason for post-adoption separation anxiety issues. Territorial aggression was mostly observed in dogs adopted from the street, which are mostly spayed females, as well as fears and phobias. Poor recall was also observed in this group, mostly in dogs that were adopted after one year of age. Dogs that came from the foster home showed most aggression resulting in biting, which can indicate that the

bite history was probably the reason for putting the dog up for adoption, being that most of the dogs in this group were around five years old. The new owners did not have any clear information from a foster whether the dog had a bite history. Moreover, foster dogs exhibited more versatile behavioural problems that can be linked with changing one or two foster homes. The majority of the dogs in this research came from the street, which indicates high empathy in certain individuals, as well as in fosters, but more effort has to be made in providing the right education as to what an adopting and rescuing a dog really mean in order to manage potential behavioural problem more efficiently.

Table 2. *Behavioural problems in dogs from the street, from a shelter and from a foster home*

Behavioural problems	Dogs from the street n=30		Dogs from a shelter n=6		Dogs from a shelter home n=14		χ^2	P
	N	%	N	%	N	%		
Separation anxiety	5	16.67	3	50	5	35.71	3.84	0.15
Leash reactivity	8	26.67	2	33.33	1	7.14	7.82	0.02*
Fear aggression	2	6.67	0	0	0	0	4	0.13
Inappropriate urination	0	0	0	0	0	0	/	/
Fears/phobias	7	23.33	1	16.67	3	21.43	5.09	0.08
Territorial aggression	4	13.33	0	0	0	0	8	0.02*
Resource guarding	0	0	0	0	1	7.14	2	0.37
Food aggression	0	0	0	0	1	7.14	2	0.37
Pica	0	0	0	0	1	7.14	2	0.37
Redirected aggression	0	0	0	0	1	7.14	2	0.37
Poor recall	4	13.33	0	0	1	7.14	5.2	0.07
Biting incident	3	10	0	0	3	21.43	2.11	0.35
Total	33	110	6	100	17	121.41		

* $P < 0.05$; n= total number of dogs; N= number of dogs with behavioural problem

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The past, present and the future of the stray animals in Turkey

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Introduction

Stray animals are domestic species that spend whole life in the city or towns, together with human. It is necessary to restrict the numbers of the population and keep under control of the animals for the health and welfare of the human, animal and environment. It is estimated that, about 8 million stray animals live in the streets of Turkey's towns. There have been many animal shelters and rehabilitation centers built for street animals throughout the country. In these centers, vaccination, sterilization, medical treatment, marking, hospitalization services are carefully performed. In the present study, difficulties in practice and solutions for the improvement of stray animal management are analyzed.

Materials and Methods

Republic of Turkey's current laws, legislations, scientific articles and news written about the stray animals, examples of public events, actual implementations and vision are reviewed in this article.

Results

In Turkey, on-going welfare problems regarding stray animals can be summarized as follows:

- Deficiency in implementation of the legislation, insufficient penal codes, lack of governance,
- Limited awareness of the public on the stray animals,
- Coordination, organization and cooperation problems among legal offices,
- Excess numbers of stray animals and wide geographical location of the country.

Discussion and Conclusions

Solutions for the improvement of the welfare of stray animals in Turkey can be summarized as follows:

- Upgrade of the current legislation, increase of the penalties,
- Raising of the public concern on animal welfare,
- Increasing the number of the technical staff and the rehabilitation centers, where needed.

In Turkish society, it has been important to protect the creatures within the framework of the religion, traditions, customs and legal regulations, from past to present. In the future, it is estimated that by the elimination of the deficiencies, targets regarding welfare of the animals will be achieved.

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Section 2 – Human-animal relationship



Photo by Matan, R. V.

KEYNOTE LECTURE

When the first of 5Fs goes wrong for the welfare of dogs – Who is responsible?

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The importance of nutrition for the welfare of dogs is highlighted in this review. Malnutrition can be the cause of many health disorders, including behavioral disorders. On the other hand, dietary interventions and modifications and nutritional enrichment can be used for treatment of certain health problems and improving welfare in dogs. The paper focuses on data collected from literature on omissions in the diet of dogs for which owners, food producers and animal welfare activists are responsible. Manufacturers are responsible for the composition, quality and safety of commercially available dog food. They are also responsible for the clarity of the instructions feeding guidelines that are provided on the labels. Owners are expected to know what type of food is most suitable to their dogs in terms of any particular allergies or intolerances they may have, as well as quality and quantity of food they should feed their dogs. They should also know how to prepare a complete and balanced dog meal at their home. It is especially important for owners to be aware of the risks of using raw food in dog nutrition. Due to the special social status that dogs have in their owners' families, owners are increasingly interested in the quality and safe nutrition of their companions. This should be a challenge for veterinarians to master the necessary knowledge of pet nutrition and to develop and provide advice and consulting services in this area within their practice. Owners' interest in quality and safe dog nutrition should also be a challenge for animal welfare societies to include information on nutrition to general dog ownership education.

Veterinary student attitudes towards and knowledge about exotic non-mammal pet animals and their welfare

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Introduction

Non-traditional or exotic pets are becoming increasingly popular worldwide referring generally to animals that are either non-native to a region or non-domesticated. The trade in and keeping of exotic pets raise a number of ethical concerns, including issues of animal welfare, biodiversity conservation, and public health and safety, therefore, presenting new challenges for the veterinary profession and requiring future veterinarians to have knowledge and skills in this part of veterinary medicine as well, especially in exotic non-mammal pet animals. We believe this is the first study attempting to investigate the attitudes and knowledge of veterinary students regarding exotic pets and their welfare.

Materials and Methods

A total of 589 (87%) veterinary students from first to sixth year of integrated undergraduate and graduate study programme, University of Zagreb, Zagreb, Croatia, were surveyed in the autumn semester of the academic year 2019–2020. A written questionnaire contained a set of Likert type questions (1 for 'fully disagree' through 5 for 'fully agree') designed to assess student attitudes towards and knowledge about exotic pet animals and their welfare. The questionnaire was focused on exotic non-mammal pets, i.e. birds, reptiles, amphibians and fish. The SPSS v. 21.0 statistical software was used on all analyses. Differences in student responses according to pet species observed were tested by Kruskal-Wallis test and Mann-Whitney *U*-test.

Results

Study results are summarized in Table 1 and expressed as mean (\pm SEM) student responses. Students agreed that biological functioning and natural living were important for the welfare of pet birds, reptiles, amphibians and fish. They also agreed that emotional states were an important component in bird, reptile and amphibian welfare, but were not so convinced in case of fish. Students believed that birds were capable of thinking and having emotions, were not sure about it for reptiles and amphibians, and stated that fish had no such abilities. Students were not sure whether keeping birds, reptiles, amphibians and fish as pet animals was acceptable and whether their owners had collected adequate information on such pets before getting them, which, according to students' opinion, may have compromised welfare. Students believed that keeping birds, amphibians and fish as pet animals did not present a risk for health and safety of other animals and humans, whereas they were not so convinced in case of reptiles. They also agreed that none of these species as pet animals presented environmental risk. On average, students stated they had inadequate knowledge about housing, feeding, health and behaviour of amphibians, while in case of those other species they were mostly not sure. Although expressing neutral attitudes, students considered keeping birds and fish as pet animals significantly more acceptable ($P < 0.05$) as compared with reptiles and amphibians. They considered keeping reptiles to pose a significantly higher risk ($P < 0.05$) for health and safety of other animals and humans, and keeping fish a significantly lower risk ($P < 0.05$) including environmental risk as compared with other species. In almost all other statements, the student attitude score was significantly higher ($P < 0.05$) for birds as compared with other species.

Table 1. *Veterinary student (N=589) responses to statements referring to pet birds, reptiles, amphibians and fish*

Statement	Birds	Reptiles	Amphibians	Fish
	Mean* \pm SEM			
Biological functioning is important for their welfare	4.81a \pm 0.02	4.77a,c \pm 0.03	4.71b,c \pm 0.03	4.64b \pm 0.04
Emotional states are important for their welfare	4.20a \pm 0.04	3.77b \pm 0.05	3.60c \pm 0.05	3.30d \pm 0.06
Natural living is important for their welfare	4.74a \pm 0.03	4.64b \pm 0.03	4.56b \pm 0.04	4.49b \pm 0.04
Capacity to think	3.90a \pm 0.04	3.35b \pm 0.04	2.89c \pm 0.04	2.42d \pm 0.04
Capacity to feel	3.89a \pm 0.04	3.24b \pm 0.05	2.92c \pm 0.05	2.48d \pm 0.05
Welfare compromise	3.85a \pm 0.04	3.71b \pm 0.04	3.64b \pm 0.04	3.63b \pm 0.05
It is acceptable to keep these species as pets	3.45a \pm 0.05	3.25b \pm 0.05	3.12b \pm 0.05	3.45a \pm 0.05
Owners are sufficiently informed before purchasing	3.28a \pm 0.05	3.17 \pm 0.06	3.07b \pm 0.06	3.07b \pm 0.06
Risk for other animal health and safety	2.47a \pm 0.05	2.70b \pm 0.05	2.45a \pm 0.05	2.12c \pm 0.05
Risk for public health and safety	2.42a \pm 0.05	2.63b \pm 0.05	2.29a \pm 0.05	1.96c \pm 0.04
Risk for environment	2.25a \pm 0.05	2.35a \pm 0.05	2.20a \pm 0.05	2.08b \pm 0.05
I have sufficient knowledge on their housing	3.00a \pm 0.04	2.53b \pm 0.05	2.23c \pm 0.04	2.72d \pm 0.05
I have sufficient knowledge on their feeding	3.05a \pm 0.05	2.49b \pm 0.05	2.20c \pm 0.04	2.78d \pm 0.05
I have sufficient knowledge on their health	2.80a \pm 0.04	2.36b \pm 0.04	2.13c \pm 0.04	2.42b \pm 0.05
I have sufficient knowledge on their behaviour	2.98a \pm 0.04	2.50b \pm 0.04	2.27c \pm 0.04	2.56b \pm 0.05

*1 - fully disagree, 5 - fully agree; values in the same row marked with different letters differ significantly ($P < 0.05$)

Discussion and Conclusions

Veterinarians should be the main actors ensuring and promoting the welfare of all animals. In this study of the Croatian veterinarians-to-be attitudes towards and knowledge about exotic non-mammal pet animals and their welfare, the majority of statements had neutral responses, in particular for the species other than birds. Siğirci et al., who identified self-evaluation of competency and knowledge of small pet practitioners about exotic pets in Turkey, have reported similar results. The results obtained point to the need of additional student education on exotic non-mammal pets and can serve for upgrading veterinary curriculum in the field.

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Public awareness on animal cruelty, influenced by personal attitudes to animals

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Introduction

Modern civilized societies recognize animals as sentient beings as experimental research provides scientific evidences on the ability of non-human animals to feel pain and distress. At international level, a comprehensive legislative framework clearly defines the requirements for proper treatment of animals throughout their life-span (breeding, transport, slaughter, entertainment, experiments, etc.), ensuring the core “five freedoms” are met. At national level, the legislation covers more diverse animal welfare issues, while determining the liability towards all acts perceived as animal cruelty. Although clearly stated, acts of cruelty towards animals are to some extent underestimated by the public due to various reasons as demographics, misunderstanding, lack of information, etc. Moreover, animal abuse is tightly connected with similar violent acts towards humans (interpersonal violence). This paper investigates how personal attitudes towards animals, their rights and feelings influence the public understanding of the nature of animal abuse and predispose the respondents` reaction to violent behaviour directed to non-human animals.

Materials and Methods

The study was carried out under the form of an anonymous written questionnaire among randomly chosen veterinary students at Trakia University – Stara Zagora and other respondents throughout Bulgaria (n=333). The questions covered the respondents` attitudes to the ability of animals to have feelings and rights, and the personal understanding and awareness on acts, presenting animal abuse. Data received were statistically processed (Statistica v. 7 software). The Kolmogorov-Smirnov test was used for verification of normality of data distribution. The study parameters were analyzed through descriptive statistics (frequency distribution tables), correlation analysis (Pearson correlation coefficient) and Student's t-test (t-test for independent samples).

Results

The results from the survey are presented in Figures 1 and 2. The majority of the respondents strongly agree that animals are able to experience emotions (94%) and have own rights (69.97%), with positive correlation between the two groups ($r=0.40$; $P<0.05$). The survey recorded a positive correlation, as well

as between the respondents who strongly agreed on animal rights and those who stated to be fully aware (86.19%) of the nature of animal cruelty acts ($r=0.39$; $P<0.05$).

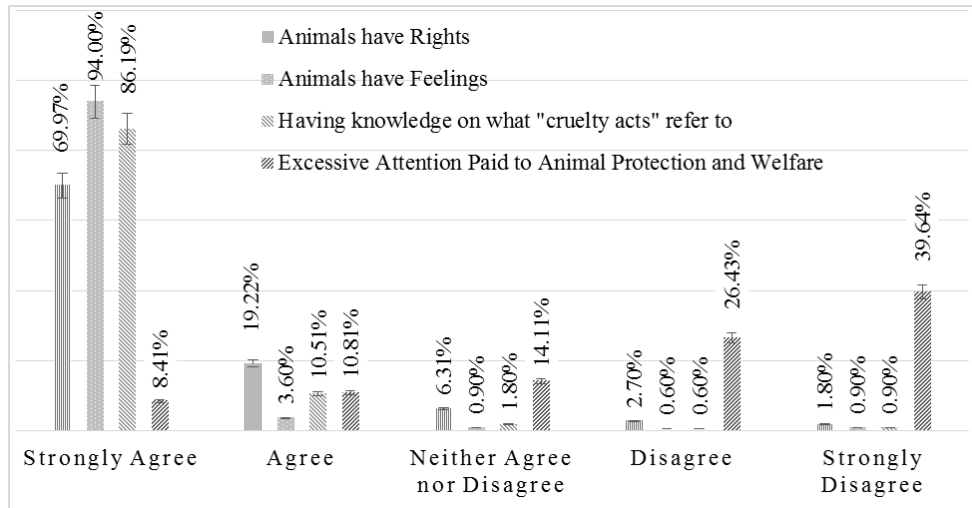


Figure 1. Respondents' attitudes towards animal rights, feelings, animal cruelty and welfare issues.

The rate of the participants in the survey who strongly disagree that excessive public attention is paid to animal protection and welfare (39.64%) increased with the decrease of the respondents who recognize the animal emotions and rights (1.80%, respectively 0.90%), with negative correlation established ($r= -0.31$, respectively $r= -0.26$; $P<0.05$). The Student's t-test found significant difference between the group of the respondents who had strongly agreed on their high awareness of animal abuse acts and those who had disagreed that too much attention had been put on the animal welfare and protection issues ($P<0.01$). The respondents' perceptions on the sentience of non-human animals (recognition of animal rights and feelings) appear to be among the factors determining their personal reactions in situations with expressed violence against animals, in favour of verbal approach towards the offender ($P<0.01$).

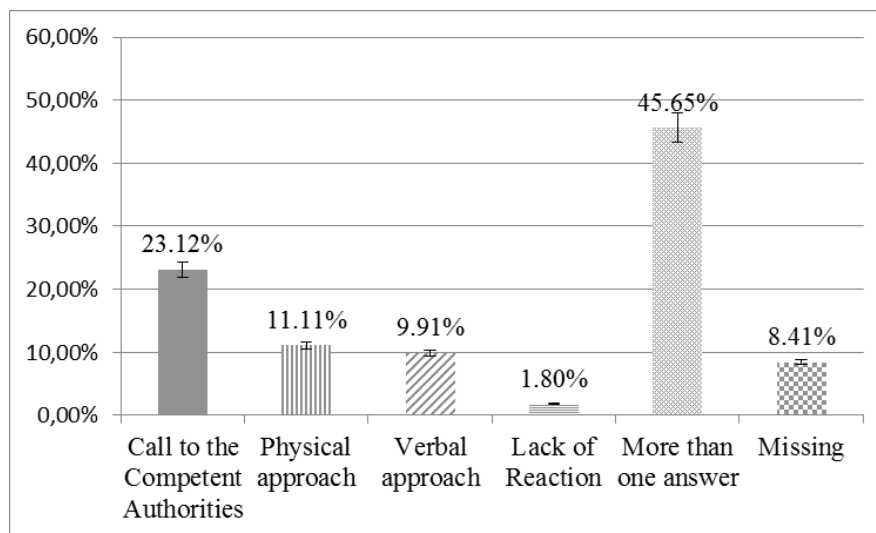


Figure 2. Type of personal reaction in animal cruelty situation, frequency distribution.

Discussion and Conclusions

Increasing public awareness on animal cruelty could lead to increase of the overall animal wellbeing through raising the sensitiveness of the society to acts that are not usually seen as violent. In addition, it is argued that people's attitudes to the way animals are treated vary significantly even among different groups of professionals (including veterinary students), some of which appear to be more likely to disregard certain acts of animal cruelty than others. It is thus important to establish the present level of public understanding of core issues as animal rights, feelings and ability to feel pain, together with the readiness to react in controversial abusive situations, with the aim to promote positive welfare in animals.

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Regional differences in the attitudes of veterinary students in Croatia towards welfare of farm and companion animals

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Introduction

Attitudes towards animals are important because they affect how humans validate animal life, how they behave towards animals, or how they treat them. In that sense, veterinarians are expected to have and promote highly positive attitudes towards animals and their welfare. However, attitudes towards animals may be influenced by many factors, including animal, personal and cultural characteristics. The aim of this study was to examine the attitudes of veterinary students in Croatia according to region where they spent most of their lives towards the level of cognitive abilities in farm and companion animals, and their welfare compromise.

Materials and Methods

The survey was carried out at the Faculty of Veterinary Medicine, University of Zagreb, Zagreb, Croatia, including 505 (91%) students of all (six) years of integrated undergraduate and graduate study programme. The distribution of students according to the region of the country where they come from was as follows: eastern Croatia (15%), northwest Croatia (12.9%), Zagreb and central Croatia (44.8%), Istria and Croatian littoral (8.7%), Lika and Gorski Kotar (2.6%), Dalmatia (13.5%), and another country (2.5%). Seventeen five-point Likert scale questions (1 - strongly disagree through 5 - strongly agree), focusing on cattle, pigs, poultry, dogs and cats, were used to examine their attitudes, with higher scores meaning more positive attitudes. Data were analysed by use of SPSS v. 21.0 statistical software. Univariate analysis was used to determine the frequencies of student answers. Regional differences in student answers were tested by Kruskal-Wallis test and Mann-Whitney *U*-test.

Results

Of 17 statements, regional differences were determined for eight statements. For most of these statements, i.e. the level of thought process in cattle, pigs, dogs and cats, and the level of welfare compromise in pigs, students from Zagreb and central Croatia expressed significantly higher attitudes ($P < 0.05$) as compared to students from eastern Croatia and Dalmatia. Students that spent most of their lives in other countries expressed the highest level of concern about the welfare of laying hens, and the lowest about the welfare of dogs and cats. Students from Lika and Gorski Kotar expressed significantly more concerned attitudes ($P < 0.05$) regarding the welfare of dogs and cats as compared to all other regions observed. There were no regional differences in student attitudes towards the level of emotions in any species observed.

Table 1. *Student attitudes towards the level of thought process in farm and companion animals*

Region	Cattle	Pigs	Poultry	Dogs	Cats
	Mean* \pm SEM				
Eastern Croatia	3.70a \pm 0.11	3.91a,b \pm 0.11	2.75 \pm 0.12	4.61a \pm 0.08	4.32a \pm 0.11
Northwest Croatia	3.97 \pm 0.11	4.29a \pm 0.10	3.05 \pm 0.14	4.77 \pm 0.07	4.62b \pm 0.08
Zagreb and central Croatia	4.08a,b \pm 0.06	4.32b,c \pm 0.05	2.98 \pm 0.08	4.85a,b,c \pm 0.03	4.67a,c,d \pm 0.05
Istria and Croatian littoral	3.81 \pm 0.16	4.05 \pm 0.16	2.68 \pm 0.17	4.66b \pm 0.10	4.46c \pm 0.12
Lika and Gorski Kotar	4.15 \pm 0.27	4.39 \pm 0.27	3.23 \pm 0.36	4.69 \pm 0.13	4.69 \pm 0.13
Dalmatia	3.69b \pm 0.12	3.93c \pm 0.13	2.88 \pm 0.15	4.75c \pm 0.06	4.32b,d \pm 0.11
Other country	4.08 \pm 0.29	4.39 \pm 0.24	3.46 \pm 0.35	4.62 \pm 0.24	4.54 \pm 0.18

*1 - strongly disagree, 5 - strongly agree; values in the same column marked with same letter differ significantly ($P < 0.05$)

Table 2. *Student attitudes towards the level of emotions in farm and companion animals*

Region	Cattle	Pigs	Poultry	Dogs	Cats
	Mean* \pm SEM				
Eastern Croatia	3.92 \pm 0.12	4.01 \pm 0.11	3.15 \pm 0.14	4.66 \pm 0.09	4.33 \pm 0.13
Northwest Croatia	4.26 \pm 0.12	4.43 \pm 0.10	3.57 \pm 0.16	4.80 \pm 0.07	4.65 \pm 0.09
Zagreb and central Croatia	4.27 \pm 0.06	4.26 \pm 0.06	3.44 \pm 0.08	4.88 \pm 0.03	4.62 \pm 0.05
Istria and Croatian littoral	4.14 \pm 0.14	4.39 \pm 0.13	3.23 \pm 0.19	4.81 \pm 0.08	4.50 \pm 0.11
Lika and Gorski Kotar	4.00 \pm 0.36	4.31 \pm 0.26	3.31 \pm 0.37	4.62 \pm 0.18	4.62 \pm 0.18
Dalmatia	4.02 \pm 0.11	4.10 \pm 0.11	3.13 \pm 0.15	4.75 \pm 0.07	4.40 \pm 0.11
Other country	4.08 \pm 0.33	3.92 \pm 0.37	3.54 \pm 0.43	4.77 \pm 0.17	4.31 \pm 0.33

*1 - strongly disagree, 5 - strongly agree

Table 3. Student attitudes towards the level of welfare compromise in farm and companion animals

Region	Dairy cows	Beef cattle	Pigs	Laying hens	Broilers	Dogs	Cats
	Mean* ± SEM						
Eastern Croatia	3.92 ± 0.11	3.95 ± 0.10	3.74a ± 0.11	4.08 ± 0.11	4.11 ± 0.11	3.17 a,b,c ± 0.14	2.86a ± 0.13
Northwest Croatia	3.68 ± 0.11	3.92 ± 0.12	3.75 ± 0.13	3.83a ± 0.13	3.97 ± 0.13	3.34d,e,f,g± 0.14	3.12b,c,d ± 0.12
Zagreb and central Croatia	3.89 ± 0.07	4.01 ± 0.06	3.98a,b ± 0.06	4.11b ± 0.07	4.10 ± 0.07	3.16h,i,j,k ± 0.08	2.93e ± 0.08
Istria and Croatian littoral	3.84 ± 0.16	4.11 ± 0.13	3.96c ± 0.15	4.16c ± 0.16	4.25 ± 0.15	2.66a,d,h,l ± 0.16	2.59b,f ± 0.16
Lika and Gorski Kotar	3.69 ± 0.43	3.85 ± 0.37	3.92 ± 0.35	3.69 ± 0.40	4.00 ± 0.34	4.08b,e,i,l,m,n ± 0.27	3.85a,c,e,f,g,h ± 0.25
Dalmatia	3.88 ± 0.13	3.78 ± 0.13	3.56b,c ± 0.13	3.78b,c,d ± 0.13	3.69 ± 0.15	2.81f,j,m ± 0.15	2.72d,g ± 0.14
Other country	4.39 ± 0.27	4.08 ± 0.31	4.15 ± 0.32	4.46a,d ± 0.31	4.23 ± 0.32	2.31c,g,k,n ± 0.35	2.46h ± 0.37

*1 - strongly disagree, 5 - strongly agree; values in the same column marked with same letter differ significantly ($P < 0.05$)

Discussion and Conclusions

Study results showed that regional differences existed in the attitudes of veterinary students in Croatia towards welfare of farm and companion animals. This is not surprising as Croatia is a multiregional and multicultural country. However, these differences may not only be the result of cultural differences, but veterinary students may also increasingly encounter welfare issues in certain regions, especially in case of companion animals.

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Section 3 – Animals and the environment



Photo by Lopez Garre, E.

KEYNOTE LECTURE

The relevance of the One Welfare Framework on animals and the environment

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The concept of One Welfare describes the interrelationships between animal welfare, human well-being and the physical and social environment. The one welfare framework helps capture and better understand the multifaceted aspects of One Welfare. When we talk about animal welfare most times we tend to focus on the direct interconnections between humans and animals, neglecting most times the key impacts that the environment may have. The concept of One Welfare helps to describe how animal welfare can have wider implications. One Welfare also serves as a tool to identify the added value that each individual area may bring to the others, setting into context how the environmental aspects of the five freedoms, provisions and domains can be applied at a holistic level. The One Welfare umbrella helps to highlight the multiple interconnections between animal welfare, human well-being and environmental aspects. The One Welfare Framework is made up of five sections which can help to identify how the physical and social environment interconnect with human and animal welfare at different levels.

Figure 1. *The One Welfare Umbrella.*

This talk will cover the five sections of the One Welfare framework with a focus on the environment aspects, providing examples on how the environment is relevant within One Welfare. Species-specific environmental needs and the requirement for environmental optimization are a key part of animal welfare, as well as the way we interact and manage animals in any captive or wild state.

Some examples of this are:

- Animal hoarding, which has an important component of interconnections with animal-human shared living spaces and the surrounding environment that may reach the level of environmental nuisances such as accumulation of litter, bad smells or noise;
- Farm animal production where both the social and physical environment play a key part on, for example, how animals are handled or how animals interact with their conspecifics and have opportunities to display normal behaviours;
- Captive wild animals in zoos, where the environment plays a key part on aspects of sociality, such as social structure and social learning, across many vertebrate taxa as well as the keeper-animal interaction and visitors' experience.
- The desert locust outbreak in the Horn of Africa which, according to the Food and Agriculture Organization of the United Nations (FAO) could provoke a humanitarian crisis as a result of the destruction of hundreds of thousands of acres of crops, depriving humans and kept/wild animals of food and feed.

Heat stress in dairy calves

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Introduction

Heat stress is one of the main challenges facing the dairy industry. Physiological and behavioural coping mechanisms of lactating dairy cows are well documented, however, the thermal status of calves kept outdoors from birth to weaning gets less attention from a scientific, and even more so from a management standpoint. Our aim was to collect recent knowledge about the effects of heat stress and the methods of heat alleviation in dairy calves, focusing mainly on Holstein Friesian breed in the preweaning period.

Indicators of heat stress in the prenatal period

There is growing evidence that the uterine environment of pregnant cows exposed to heat stress in the dry period can convey an indirect effect of environmental stress and evoke adaptive mechanisms in the calf fetus that have prolonged effects in the postnatal period.

Lower birth weight and shorter mature height. Fetal growth is compromised due to hyperthermia-induced placental insufficiency, involving reduced placenta size and impaired vascularization that limits maternal-fetal exchange of oxygen and nutrients. Moreover, even a few days reduction in gestation length, as it is often seen in times of heat stress, shortens the period of rapid fetal growth and thus reduces calf birth weight.

Metabolic shift. Besides insufficient uterine supply of nutrients, the heat exchange between the dam and the fetus is also impaired, which can result in fetal hyperthermia. The fetus might develop adaptive mechanisms like reduced protein accretion in favor of hepatic gluconeogenesis and impaired insulin action at the expense of growth. Calves born to heat stressed dams responded to similar diets with higher circulating insulin concentrations in the first 7 days of life, than calves born to cooled dams, suggesting a carryover effect of maternal heat stress. Dahl et al. concluded that calves heat stressed in utero are prone to develop smaller mature body size and greater fat deposition, compared with calves from cooled cows.

Impaired immune function. Lower serum IgG concentrations and apparent efficiency of IgG absorption was observed in calves from heat-stressed dams relative to calves from cooled dams. Heat stress in late gestation has no apparent effect on IgG content of colostrum, thus impaired IgG absorption is due to deficiency of passive transfer in calves heat stressed in utero. It was observed that peripheral blood

mononuclear cell proliferation rate was lower in calves born from heat stressed dams, as compared to the offspring of cooled dams.

Indicators of heat stress in the postnatal period

Severe heat load experienced after birth may also affect performance in the rearing period. However, the term heat stress is used quite loosely and defining it in the sense of the amount of strain that environmental conditions impose on dairy calves seems challenging. As opposed to dairy cows, no clearly defined thresholds of biological or environmental indicators that necessitate cooling interventions are determined for dairy calves. The animal-based indices of assessing thermal status proposed in the literature are discussed below.

Acute stress response parameters. Heart rate variability analysis of calves exposed to high solar radiation confirmed a higher sympathetic tone. Endocrine changes, such as elevated salivary and cortisol concentrations measured in preweaned calves also suggest increased level of stress. Plasma triiodothyronine and tetraiodothyronine concentrations were lower due to heat stress.

Behavioural responses. Behavioural thermoregulation is the first sign of thermal discomfort: calves seek shade, change posture, align their body away from the sun, reduce locomotion during the hottest hours of the day and bunch to seek shade from other animals, as reviewed by Roland et al.

Increased respiratory rates. Evaporative heat loss is promoted by increased respiratory frequency. Textbooks, publications and online guides describe rates of 20-70 breaths/min as normal. Studies on adaptive responses of calves in moderate/shaded vs. hot/noncooled thermal environments have reported a relative increase in respiration rate of approx. 50%, that was considered a sign of increased efforts of evaporative heat loss.

Elevated rectal temperature. The normal body temperature of calves in thermoneutral circumstances is between 38.5-39.1 (39.5) °C. Consistently, studies on calves exposed to high ambient temperatures report on maximal body temperatures of 39.7-40.4 °C.

Water consumption. Water requirement is elevated in the hot periods of the year, as calves may lose water via increased rate of respiration and sweating. It was shown by a field study that water intake increased almost 4-fold, beside the milk consumption, as the ambient temperature elevated from 0 to 35 °C.

Early mortality. Elevated ambient temperature, especially in calves housed outdoors proved to be a risk factor for early calf mortality in veal calves. Extreme heat waves can cause an excess death of different cattle subpopulations, including dairy calves, as it was analyzed by Morignat et al.

Weight gain. Only a very few number of studies are available on the effect of season on growth rate in preweaned calves, yet, they are all consistent in the finding of lower average daily weight gain in seasons with higher ambient temperature. The reduced growth rate is attributed mainly to reduced starter intake in the hottest periods of the year.

Techniques to decrease heat load in calves

Most calves are kept in individual hutches with a small outdoor area during the preweaning period, where they are exposed to solar radiation. Polyethylene hutches – even if placed under shade – provide a

slightly worse microclimate for the indwelling calf in summer than conventional plywood hutches. Rectal temperature and respiration rates were lower in calves housed in plywood hutches as compared to plastic ones, however, no differences in weight gain or general health status were observed when comparing the two housing systems. Practicality of durable and more hygienic plastic hutches won over, making them the most popular type of housing for outdoor reared calves worldwide. It is still necessary to reduce heat load and/or heat absorption of plastic hutches.

Increasing air flow. Increasing air speed could help heat dissipation of the calves, thus better ventilation may be useful. Elevation of the back side of the hutches is showed to increase airspeed, decrease CO₂ concentration within the hutch, and therefore decrease respiration rate of the calves (44 vs. 58 compared to the control).

Reflective covers. Friend et al. tested different reflective materials in their study. Reflective painting was almost ineffective, while aluminized plastic covers were successful in decreasing black globe temperature by 2-4 °C in empty hutches. Carter et al. found that rate of increase of interior hutch temperature relative to ambient temperature was lower in insulated hutches indicating they were warmer at low THI and cooler at high THI. Increase in respiration rate and ear canal temperature of the calves, relative to THI, were moderated in insulated hutches, however the advantages of reflective covers are not clear enough.

Shading structures. Shading seems to be more effective in decreasing exposure to solar radiation, since the results are more consistent in decreasing ambient temperature in the hutch or in the outdoor area under the shade. Respiratory rate of calves are usually found to be lower under the shade. A very positive side effect of shading is that workers mentioned that they were more comfortable working under the shade.

Acknowledgements

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Heat stress hazards in dairy cattle industry in the Prefecture of Central Macedonia, Greece

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Introduction

Global surface temperature is expected to rise exponentially in the following years, rendering livestock owners confronted with a hazardous situation. Recent research has indicated that climate change endangers the health and welfare status of farm animals, significantly, affecting productivity and profitability of dairy farms. As a direct result of the above, heat stress in dairy cattle receives the attention of researchers worldwide. Although Greek dairy farms are already facing the adverse effects of climate change, very limited data on its' impact on dairy cattle and milk quality are available. The aim of this study is twofold: (a) to identify, assess and map heat stress hazards in the Prefecture of Central Macedonia in Greece and (b) to estimate the impact of heat stress in cattle dairy industry of this region.

Materials and Methods

The study comprised of two parts. The first part of the study involved the identification, assessment, and mapping of the hazard generated by elevated temperatures and causing heat stress in dairy cattle. Dairy farms located within the Prefecture of Central Macedonia, where 61.8% of the all Greek dairy farms are based, served as case studies. Data regarding animal population (2015) were excerpted from the database of the Greek Ministry of Rural Development and Food and the respecting meteorological data were collected from the Hellenic National Meteorological Service. Spatial and statistical data were analyzed using a Geographic Information System (GIS Software). Hazard was evaluated for the 2021-2050 period by evaluating the variance of the mean number of hot days ($T_{max} > 30^{\circ}\text{C}$) per year.

The second part of the study was carried out based on recent data from the period of April to September 2014, collected from a commercial dairy farm sited in Central Macedonia. Eighty Holstein cows were milked daily and were housed in cubicles. Environmental temperature and relative humidity values were recorded in 5-minute intervals using digital relative humidity and temperature sensors. Thermal heat index (T.H.I.) was calculated using the methodology described by Burgos Zimbelman et al. and a threshold of T.H.I.=68 was considered aggravating for high-producing cows. Thus, observations were allocated into two groups (mean T.H.I.<68 and mean T.H.I.≥68). Average herd milk yield was calculated daily, while milk quality parameters (fat and protein percentage, freezing point, somatic cell count and total bacterial count),

dry matter intake and ration cost were calculated and adjusted on a weekly basis. Bulk milk composition was determined weekly. Mean differences were statistically analyzed with one-way ANOVA model at level of significance $\alpha=0.01$ for all main effects using the statistical software SPSS® v.21.

Results

Regarding the first part of the study, the mean minimum temperature during winter months in Central Macedonia will be higher by 1.5°C, by 2021 and the mean minimum during summer months will be higher by 2.5°C. Additionally, over 40 more extreme warm nights (nights when minimum temperature does not drop below 20°C) will be observed. In the second part, milk yield was significantly lower when cows were exposed to significant heat stress (T.H.I. \geq 68), ($P\leq 0.01$). Milk composition did not appear to be significantly affected by heat stress, apart from somatic cell count that was significantly higher under circumstances inducing heat stress (T.H.I. \geq 68), ($P\leq 0.01$). The significant reduction in dry matter intake is directly linked to heat stress and was evident when T.H.I. exceeded a value of 68 ($P\leq 0.01$). Means and standard error values of all parameters examined are summarized in Table 1.

Table 1: *Effects of heat stress on milk yield and milk composition*

Parameter	T.H.I.				P
	<68		\geq 68		
	Mean	\pm SE	Mean	\pm SE	
Temperature (°C)	17.05	0.321	25.19	0.186	0.001
Relative humidity (%)	74.4	1.187	68.17	0.872	0.002
Dry matter intake (kg/cow/day)	26.92	0.205	25.55	0.928	0.001
Milk yield (kg/cow/day)	32.98	0.207	30.40	0.105	0.001
Somatic cell count (x10 ³ cells/ml)	228.83	24.339	266.89	7.000	0.004
Ration cost (€/cow/day)	6.87	0.042	6.78	0.212	0.040
Milk fat (%)	3.73	0.030	3.82	0.025	0.06
Milk protein (%)	3.31	0.021	3.30	0.0170	0.63
Milk freezing point (°C)	0.525	0.001	0.524	0.00004	0.70
Total bacterial count (x10 ³ CFU/ml)	28.33	11.936	27.06	11.520	0.95

Discussion and Conclusions

The significant differences in milk yield dry matter intake and somatic cell count between T.H.I.<68 and T.H.I. \geq 68 groups throughout the examined time period are indicative of the impact of heat stress on productivity of dairy cattle in Greece, a fact that merits further investigation. As the areas where high density of dairy farms and large number of dairy cows was observed, are included within high hazard zones for elevated temperatures, additional care regarding management practices and attempts to minimize the effects of the phenomenon must be implemented.

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Religious slaughter: Evaluation of current practices in Greece

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Introduction

The term “ritual slaughter” refers to the slaughter of animals exclusively for meat consumption according to a specific ritual protocol, possibly imposed by certain religions such as Judaism and Islam. The term does not cover the slaughter of an animal as a “sacrifice” in a religious ritual. The aim of the present study is to present and discuss the legal framework and the practices currently existing in Greece for the religious slaughter of animals.

Legal framework in Greece

The Greek legal framework permits some religious slaughter but the new regulation requires post-cut stunning. In the Greek Presidential Decree 327/1996 the original English text of Directive 93/119/EC “in the case of ritual slaughter” is referred as “in the case of slaughter on religious grounds” leading to the exclusion of animal slaughter for other purposes except food. The Greek Joint Ministerial Decisions 951/44337/2017 and 292/46122/2018, in compliance with EU Council Regulation 1099/2009, require that religious slaughter may occur without prior stunning; such slaughter must occur in a slaughterhouse and animals must be properly restrained and individually monitored. The Greek legislation imposes conditions beyond the requirements of Regulation 1099/2009 by requiring a suitably sharpened knife of appropriate size and a readily available spare knife. The publication of the Joint Ministerial Decisions generated lots of feedback in social media, mainly due to the provision which states that “animals which are ritually slaughtered, need not be stunned before slaughter under the condition that the slaughter is carried out at a slaughterhouse and that the requirements of Article 15 (2) of the Regulation are complied with” (meaning of Council Regulation (EC) No 1099/2009). The exemption from the obligation to stun animals prior to ritual slaughter was not initially introduced by the Greek legal system by the above ministerial decision. Therefore, in response to negative feedback on social media, politicians have now called for the immediate withdrawal of the Joint Ministerial Decision (JMC) 951/44337/2017. They cite its insensitivity and animosity, apparently ignoring that the ritual slaughter of animals without prior stunning is legal in Greece since 1996.

Current practices in Greece

Although the majority of Greek citizens and consumers are not aware of the exact meaning of the term “halal”, the production and consumption of halal meat in Greece steadily rises. This may be explained by the impressive increase in the number of Muslims living in Greece -mainly due to migration- (according to relevant data released by PEW Research Center, there are approximately 500,000 Muslims currently living in Greece, representing 4.7% of the population) leading to the increased preparation of foods specially for the Islamic market since they are not allowed to consume meat that has not been certified as “halal.” This term describes the products produced and prepared based on traditions and rules of Islam. More specifically, halal refers to meat, excluding pork, slaughtered according to a specific ritual under the blessing of the Mufti. Only Muslims are allowed to slaughter the animal and the Mufti makes an invocation to Allah. The animal must be conscious during the whole process of ritual slaughter and be slaughtered with a very sharp knife on the neck and wait for full exsanguinations which takes place in inversion. Many complications result from slaughtering cattle and small ruminants without stunning, including pain and stress related to restrained movement, pain resulting from the incision and stimulation of nociceptors in the wound, delay in the time to loss of consciousness and related stress and blood aspiration into the respiratory tract during the inversion. In Greece there is already a halal meat certification organization, the European Centre of Halal Certification, also member of World Halal Council. It is based in the Xanthi area and is recognized by the Greek government and supervised by the Mufti office of Komotini. It has to be referred that many Greeks consume halal meats unknowingly.

In Greece there are some full equipped slaughterhouses of cattle, sheep, goats and poultry, according to European Kosher standards. The Regional Competent Veterinary Directorates, with a view to consumer protection control and, with regard to animal welfare regulations, simultaneously monitor the empowerment and the compliance of the Rabbis.

Discussion and Conclusions

Anthropologists have frequently noted the importance of food ways in segregate ethnic and other group identities. This fact implies deep changes in the meaning of ethnic cuisines and gives a clear explanation on the meaning of halal and kosher practice among Muslims and Jews in Greece, respectively. To this end, discussions were held with all the interested parties: representatives of religions, animal welfare associations and slaughterers' federations with the main objective to support this market.

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Section 4 – Animals in food production



Photo by Buri, R.

KEYNOTE LECTURE

The art and science of measuring behaviour in the assessment of animal welfare

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If you work with animals on the farm, in the laboratory, at the zoo, or if you are a pet owner or veterinarian, you invariably use behaviour as your first indicator of the animal's welfare. However, it is also a scientific discipline. One positive characteristic of animal behavior is that it is readily accessible. Anyone working with animals can be an anecdotal or amateur observer of behavior. However, this accessibility can also be problematic in that scientists with other specialties think it is simple to measure and may incorporate it into their research without the necessary professional knowledge to measure or analyze it appropriately. Animal behavior is no different from any other aspect of biology, in that the more you learn about it, the more complex it becomes. We can define behavior as the actions and reactions of whole organisms, and its interactions with its environment and with other animals of the same or other species. How we design our study will largely depend on the question we are asking, but that question is the essential starting point. It may be broad or it may be quite specific, but it will drive the behavioural component of our study, and establish a series of methodological questions that will ultimately help us fix our approach. For example, will our study be purely observational or will we be applying experimental treatments or asking more complex behavioral questions? What will be our level of analysis – are we interested in generalized behavior or more detailed components of specific behaviours? What are the behaviors of interest – are they long-duration behavioral states or short-duration behavioral events? Where will we carry out the study – in a large, complex environment or a small, simple pen? How many animals can we observe and do we need to identify individuals or will group averages be sufficient? When will we observe – do we want to know how behaviour changes over the whole day, or focus on specific times of the day, over weeks, or months? How will we observe – directly or will we record and analyze the video data later? What will be our sampling rule – will we use ad libitum, focal, scan or behavior sampling? What will be our recording rule – will we use continuous recording, instantaneous sampling or one-zero sampling? These aspects all need consideration if the behaviour component of a study is to produce valid and worthwhile data. All these questions will be covered. Done correctly, behaviour can add significant value and information to studies in other specialties of animal science.

Does keel bone damage, housing system, hybrid and phase of production cycle affect the plumage condition of laying hens?

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Introduction

The plumage condition of laying hens is regarded as an indicator of animal health and behavior. On the other hand, feather damage (FD) is a continuous welfare challenge in the housing of egg-laying hens. It is a multifactorial problem that has been associated with housing system, phase of production cycle and genetic factors but also with abnormal behavior such as feather pecking, nutrition, physical environment such as light intensity, social factors and sex differences. Feather loss increases the risk of abrasion and infection due to exposed areas of skin resulting in difficulty maintaining body temperature and balance, and can lead to mortality due to cannibalism of denuded areas. Thus, FD significantly reduces birds' welfare and increases financial losses for producers due to increased flock mortality and feed consumption and reduced egg production. Another highly frequent problem of commercially raised laying hens reported by many countries is Keel Bone Damage (KBD), a term that refers to both deformations and fractures of the keel bone. KBD is a painful condition negatively influencing the welfare of laying hens. It has been shown to reduce birds' mobility, increase time spent in the nest at egg laying and also prevent the expression of natural behavior such as perching. Furthermore, KBD has been found to be linked with bumble foot and poor feather cover, as well as with increased consumption of feed and water. In the present study the effect of KBD, housing system, hybrid and phase of production cycle on plumage scoring of laying hens was evaluated.

Materials and Methods

The study was conducted in five (3 Greek and 2 Serbian) farms of commercially raised laying hens using different housing systems: (a) enriched cage system (EC), (b) floor system (FL), (c) free range system (FR) and (d) aviary system (AV). EC system consisted of three tiers of cages that were fully equipped and met the requirements of EU Directive 1999/74/EC. The FL system consisted of one level of plastic grade floor. At the FR system, hens had access to a grass-covered run during day and remained inside a barn similar to that of FL system during night. The aviary system consisted of two rows (two tiers per row) that created a portal, which provided the layers with much room to scratch. The pen floor was covered with wood shavings that were replaced regularly. The studied hybrids were Isa Brown for the Greek farms, Hyline Brown, Hyline Silver and Lohman Brown for the Serbian Farms. According to their age birds were categorized as being in the beginning of production cycle (22–38 wk of age) or in the middle of production cycle (43–56 wk of age). A sample of 50 laying hens/ housing system and per phase of production cycle was randomly selected for the assessment of KBD according to Wilkins et al. palpation technique.

Palpation was performed by running fingers alongside and over the keel bone. It was only determined whether KBD was present (fracture, deformation) or not (completely straight and flat keel bone). Feather scoring was determined at the same sample of hens used for the KBD evaluation and the method of Tauson et al. was used on all birds with the neck, breast, tail, wings, back and cloaca/vent being scored. Feather scoring ranged from 1 (severe feather damage) to 4 (perfect feather coverage). Data were analyzed using the statistical program IBM SPSS® Statistics 25 (2017). Normality of data distribution was assessed with the Kolmogorov-Smirnov test and homogeneity of variances was evaluated with the Levene's test. Univariate ANOVA was applied to evaluate the effects of KBD, housing system, hybrid and phase of production cycle on plumage scoring. The main effects of the evaluated factors were tested and the confidence interval was adjusted with Bonferroni test. A value of $P \leq 0.05$ was considered significant in all comparisons.

Results

Based on the results of the present study (Table 1) neither the KBD nor the phase of production cycle had any significant effect ($P > 0.05$) on the plumage scoring of laying hens. On the other hand, plumage coverage was significantly affected by the type of housing system since hens reared in AV and FL systems presented significantly ($P < 0.05$) better feather coverage compared to the hens reared in the other two farming systems, while the worst feather coverage was found in hens housed in FR system. Moreover, from the hybrids used in this trial, Hyline Silver and Isa Brown had significantly ($P < 0.05$) worst feather coverage compared to Lohman Brown laying hens.

Table 1. *The effect of KBD, housing system, hybrid and phase of production cycle on plumage scoring of laying hens (Mean \pm SE).*

Plumage scoring	Keel bone damage			
	Deformation and fractures		No deformation or fractures	
	3.74 \pm 0.04a		3.79 \pm 0.02a	
	Housing system			
	Aviary	Enriched cages	Floor	Free range
	4.00 \pm 0.03a	3.77 \pm 0.03b	4.00 \pm 0.06a	3.25 \pm 0.05c
	Hybrid			
	Hyline Brown	Hyline Silver	Isa Brown	Lohman Brown
	3.80 \pm 0.08ab	3.62 \pm 0.04a	3.66 \pm 0.03a	3.97 \pm 0.03b
	Phase of production cycle			
	Beginning of production cycle (22-38 wk of age)		Middle of production cycle (43-56 wk of age)	
	3.75 \pm 0.03a		3.78 \pm 0.03a	

a,b,c Values within each row with different letter differ significantly ($P < 0.05$)

Discussion and Conclusions

The results of the present study confirm previous reports that housing system and genotype have significant impact on plumage condition of laying hens. Contrary to our findings other researchers observed that plumage condition deteriorates as birds' age increases and that KBD is associated with poor feather coverage. The differences observed in our investigation compared to the findings of other reports indicate that further research is necessary in order to determine specific risk factors of FD and its association with KBD in order to develop strategies for reducing the incidence and severity of this multifactorial welfare issue.

Acknowledgements

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Exposure of pullets to different sources of Vitamin D3 and its effect on keel bone damage and outdoor behaviour

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Introduction

Vitamin D is known to be necessary for the regulation of Ca in the body and it can be synthesized in the skin after exposure to UVB light, or it is absorbed from the diet. The commercial hen is one of the highest producing animal species and the Ca demands for egg production are very high. Lack of Ca can lead to increase in bone fragility and susceptibility to fractures. Due to the extremely high prevalence of keel bone damage, this has become one of the most challenging animal welfare problems in the modern chicken industry and could be linked to high calcium demands together with lack of vitamin D3 to regulate its absorption in the body. Aim of the present study was to determine the influence of different sources of Vitamin D3 on keel bone damage (KBD) and behaviour of pullets.

Materials and Methods

120 Lohmann Brown pullets reared in battery cages were used in this study. At the age of 15 weeks birds were moved to research facility where they were kept on floor and were tested until first egg was laid in the flock (18 wk). Pullets were randomly divided into 6 pens (3 pens per treatment, 20 birds per pen) with daily access to outdoor run. One group was fed only commercial diet (Treatment 1) and the other one was fed commercial diet + complementary feed (Treatment 2). Complementary feed was a herbal product made from the plant *Solanum glaucophyllum*, containing 1,25-dihydroxycholecalciferol-glycosides – the main metabolically active form of vitamin D. It was mixed into the commercial diet in concentration 100g/t of feed. At 15 and 18 weeks of age each bird was examined for KBD with palpation method performed by a qualified person. For each deformation also the location was determined – top, middle or tip of the keel bone. In the outdoor area three types of behaviour (comfort, drinking and head up) were observed directly 2 times per week for 2 hours.

Results

In this article only statistically significant results will be shown.

At the age of 15 weeks 25 % of pullets had no KBD (n=30), and there was no difference found in prevalence of KBD between treatments. At the age of 18 weeks only 3.33 % of pullets had no KBD (n=4). After three weeks of this study no differences were found between treatments in number of birds without injury, but number of fractures and deviations changed significantly according to the treatments. The number of deviations in Treatment 2 increased more than in Treatment 1 ($x_2 = 5.83$, $df = 1$, $P < 0.05$), but the number of fractures decreased in Treatment 2 more than in Treatment 1 ($x_2 = 4.00$, $df = 1$, $P < 0.05$). The number of birds with both deviation and fracture decreased in Treatment 2 and increased in Treatment 1 ($x_2 = 12.14$, $df = 1$, $P < 0.005$) (Figure 1).

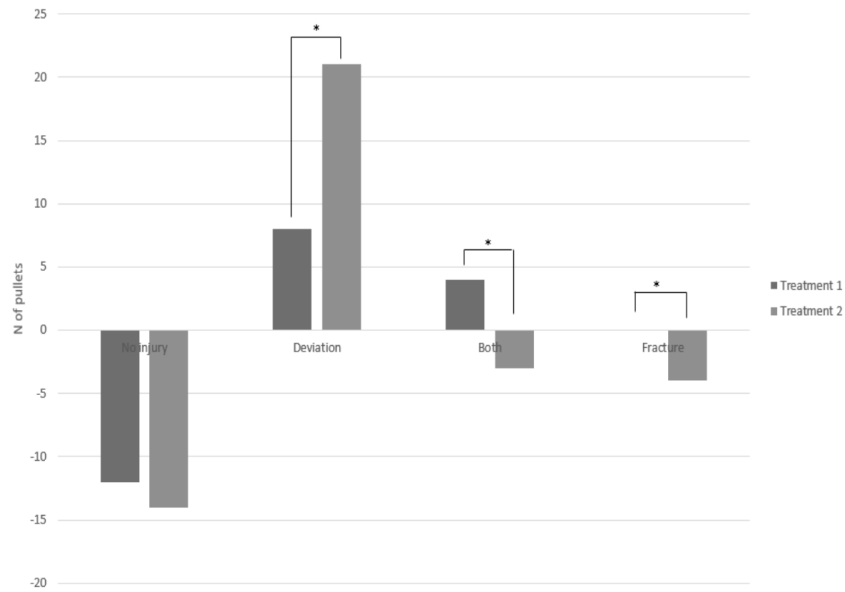


Figure 1. Changes in N of pullets without injury, with deviation/fracture or both, divided by treatment,

* $P < 0.05$.

There was a significant difference found between no KBD on top of the keel bone at 15 wk (Estimate \pm SE = 0.2892 ± 0.009499) and deformity on top of the keel bone at 15 wk (0.3423 ± 0.02338) in comfort behaviour (-0.05308 ± 0.02524 , $F = 14.97$, $df = 8515$, $P = 0.04$) and also between no KBD on the top of the keel bone at 15 wk (0.2478 ± 0.007390) and deformity on top of the keel bone at 15 wk (0.2886 ± 0.01825) in head up behaviour (-0.04082 ± 0.01971 , $F = 4.29$, $df = 8515$, $P = 0.04$). There was a significant difference found between no KBD in the middle of the keel bone at 18 wk (0.03222 ± 0.008857) and deformity in the middle of the keel bone at 18 wk (0.05413 ± 0.006241) in drinking behaviour (-0.02192 ± 0.009094 , $F = 3.14$, $df = 8515$, $P = 0.04$).

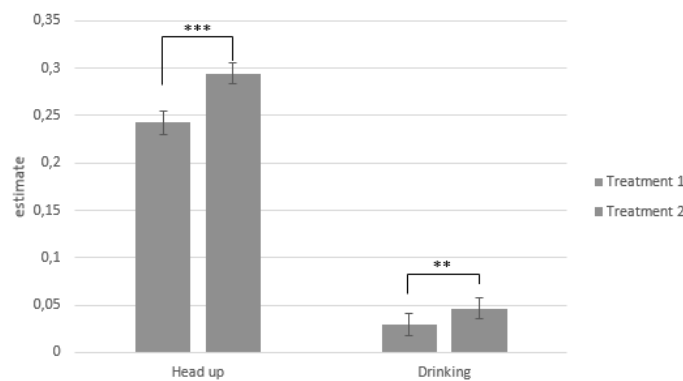


Figure 2. Effect of treatment on head up and drinking behaviour; ** $P < 0.001$, *** $P < 0.0001$.

In Figure 2 effect of treatment on behaviour is shown. Between Treatment 1 (0.2424 ± 0.01219) and Treatment 2 (0.2941 ± 0.01187) there was a significant difference in expression of head up behaviour (-

0.05171 ± 0.01386, $F = 13.92$, $df = 116$, $P=0.0003$). More head up was noticed in birds from Treatment 2. Significant differences were also found between Treatment 1 (0.02954 ± 0.01088) and Treatment 2 (0.04638 ± 0.01137) in drinking behaviour (-0.01683 ± 0.005549, $F = 9.20$, $df = 111$, $P=0.003$). Birds from Treatment 2 showed more drinking behaviour. No differences between treatments were found in expression of comfort behaviours.

Discussion and Conclusions

The aim of this study was to investigate the effect of exposure of pullets in pre-laying period to two different sources of vitamin D on KBD and behaviour. The prevalence of keel bone deformities and fractures was already high at 15 wk (75.00% of birds at 15 wk), and has increased over the three weeks of this study (96.67% of birds at 18 wk), although breeding conditions were improved and were changed from battery to floor housing and birds were exposed to additional sources of vitamin D. After three weeks of treatment with additional vitamin D in the diet, there was a difference in number of fractures between treatments, which was at 18 wk lower in pullets fed with complementary feed. Vitamin D has an important role in bone strength in laying hens and adding vitamin D into the diet could affect and reduce bone susceptibility to fractures in pre-laying hens. Birds with no KBD showed less comfort behaviour, which could be associated with an increased need for comfort in those with KBD. Birds with no KBD had also shown less head up position and less drinking behaviour, although sick, injured or animals in pain normally show less activity and drinking behaviour. Pullets fed with complementary feed were more active, they showed less foraging and more head up position, and they drank more. Drinking could be associated with increase in activity of birds. Further research should be made regarding feed intake, which could also reflect in increase in drinking behaviour and in decrease in foraging behaviour/searching for food reflecting in more head up behaviour. Our conclusions are that vitamin D supplementation could have a positive effect on bone strength in pre-laying hens, reducing the incidence of fractures of the keel bone already after short period of time using the additive. Birds with deformations and fractures show different behaviour patterns, which may be related to animal welfare and should not be neglected.

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Differences and similarities of animal welfare assurance schemes and its practical applications to support welfare risk management

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Introduction

Farm animal welfare remains an important societal issue, subject to national and international legislation to enforce minimum welfare standards within the various livestock industries and augmented by various voluntary retailer and producer-group schemes intended to raise welfare standards above the minimum.

Within the United States, animal welfare issues are becoming increasingly higher profile. Animal welfare has become important factor in many food companies. Number of companies that are considered to have farm animal welfare as an integral part of their business strategy has grown significantly. Companies that have started to introduce improved farm animal welfare mainly introduced it through their management practices and using animal welfare insurance schemes.

Farm animal welfare assurance schemes have important role in convince public in animal welfare standards. They provide information through robust auditing and assurance processes, and outcomes of this auditing systems provide relevant data to consumers and stakeholders about animal welfare.

The EU Animal Welfare Strategy 2015-2020 calls for the development of tools to strengthen Member States' compliance with animal welfare legislation, with a focus on animal-based indicators. Approaches that facilitate flexibility to accommodate the diversity of production systems, and encourage farmers to adopt good animal welfare practices are key considerations. Such efforts may in fact also facilitate the development of animal welfare standards beyond legislation, e.g. for purposes of product labelling and marketing, which may strengthen producer competitiveness and secure consumer trust. Efficient animal welfare policies require decision-makers to focus on critical parts of the production chain, and on high-risk animal operations. Thus, there is a need to develop methods to assess and monitor welfare risks on an international scale, and to manage these risks efficiently.

The objectives of this study were to provide overview of differences and similarities in content and scope between the farm animal assessment standards and identifying assurance scheme as data capture that have a potential use for animal welfare risk assessment analysis, practical applications to support welfare risk management.

Material and Methods

We have made evaluation of various assurance schemes in USA: Humane farm animal care, Global animal partnership, American humane certified, Animal welfare approved, National pork board standard and United egg producers certified.

Firstly, we create a questionnaire which was send in advance and then we made phone conference separately. Questionnaire had three major parts. First part consisted of questions to find out driving forces

within US regarding AW standards, second part was focused on understanding concepts of assessment protocols and third how these protocols were accepted by stakeholders and legislators.

Results and Discussion

Animal welfare is a complex combination of factors that include environment, housing, genetics, health, hygiene, and management. Evaluation of animal welfare is task of defining objective and quantifiable parameters of an animal's welfare status under given conditions. There is no consensus on how to measure the welfare status of an animal objectively or the welfare implications of any given management practice. Moreover, every definition of animal welfare is influenced by the moral or ethical standards of society.

Selection of assessment criteria that reflects quantitative comparisons is equally challenging. There is a number of assurance schemes in order to evaluate farm animal welfare standards. Furthermore, it is often difficult to compare this schemes because of differences in the requirements (e.g. in relation to the space requirements specified, the training requirements for those companies involved in animal handling, monitoring and corrective action processes, the welfare outcomes that are required) and differences in the schemes' auditing and assurance processes (e.g. the frequency of auditing, the qualifications of the auditors). For this reason we were following to major criteria relevant for evaluation of animal welfare standards.

All welfare assessment assurance scheme cover similar topics such as nutrition, housing, handling, and health. All assessment programs address guidelines or standards in the following areas: management, facilities and environment, handling, health care, management, nutrition, and transportation. In addition, some program address further development of guidelines for slaughter procedures. The technical guide provides information for management based on scientific principles or best management practices. The assessors for the on-farm audit are primarily veterinarians and animal scientists trained by developed specific minimum standards.

Differences, however, exist in the recommendations and standards among these programs on topics such as the practice of docking tails, transportation of non-ambulatory animals to slaughter, opportunity for exercise for all animals and training of employees on animal welfare issues. One major difference among programs is the application of the assessment results. For example, HFAC program provides the third-party assessor with a checklist of questions corresponding to each of their standards. Each standard is evaluated with a written response of compliance, noncompliance, or not applicable on the checklist by the assessor.

Differences in assessment scores among programs may be confusing to the consumer who is not familiar with the details of each program. Perhaps a standardized compliance scoring system or a set of specific minimum standards could be developed and applied across all assessment programs to provide the consumer with a basis of comparison.

Training programs for assessors by the individual programs may assist in "standardizing" the interpretive evaluations of the assessors. Because the questions in this survey included standards of all programs, relative difference among programs was likely to be identified by the questionnaire. Furthermore, the rank order based on compliance scores of each program was used to examine the similarity among programs, but no significant correlation was found among any of the programs for the rank order indicating different indices were measured by each program. Actual compliance scores would differ with implementation of each program due to the differences in their design, objectives, and standards.

The other important consideration is that this assurance standards are primarily concerned with quality and safety related issues rather than farm animal welfare. They provide many of the core process elements (e.g. on auditing, on traceability). These mostly focus on measuring the adequacy of input factors, such as the physical environment and resource availability ("resource-based indicators"), and management provision ("management-based indicators"). Recent progresses in the field of animal welfare science demonstrate that these indirect methods indicate the risk of welfare problems rather than providing an actual measure of welfare state. Therefore, in recent years, effort has been concentrating on the identification of direct measures of animal welfare, using "animal-based indicators".

Conclusions

The results of this survey indicate that selection of the available assessment programs for welfare of animals is important to determine outcomes-based measures. The programs covered similar topics, but the outcomes reflected each program's design, purpose for assessment, certifying criteria, and differences in specific standards. Comparison of scoring values and ranking order among these programs is likely to indicate differences in the standards, not necessarily the welfare differences per se. Use of the assessment results from any of the programs may be beneficial as a guide to improve or define notable deficiencies. Basically, a risk-based animal welfare surveillance scheme will have the capacity to continuously or repeatedly classify farm animal operations (i.e. farms, transport units, and processing plants) with respect to the risk of poor animal welfare.

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Effect of extensive systems on behavior of autochthonous sheep breed Vlašićka zackel

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Introduction

In Balkan region, the welfare of sheep is little known. The general perception of sheep in extensive systems living “natural lives” with few welfare compromises, along with the practical challenges of adequately assessing their welfare, has caused them to be largely ignored in comparison to other species. In Bosnia and Hercegovina, the most common autochthonous sheep breed is a Vlašićka zackel. Its name comes from Mountain Vlašić near the town of Travnik where the breed was developed. Travnik zackel sheep (*pramenka*) is very enduring sheep breed that is easily adapted to severe weather conditions and lower quality feed being more resistant to local parasites and diseases.

The relationship between animals and farmer is complex. Although in extensive environments the role of the human is more remote than in intensive production systems, the relationship between a stockperson and its flock can have considerable consequences on animal welfare. Fear associated with humans is likely to be one of the most detrimental issues to an animal welfare as it can lead to acute or chronic stress. Behavioral observation can give information on animal's preference, requirements, and internal states. The aim of this study was to assess the behavior of Vlašićka zackel using welfare principle of appropriate behavior and to identify the behavior problems that affect these animals.

Materials and Methods

The study was conducted in December 2018, in a farm of 230 autochthonous sheep breed Vlašićka zackel reared in extensive systems. The farm is representative of the western hill and mountain regions of Bosnia and Herzegovina. The hills range from 600 m up to 1,300 m above sea level, with natural pasture. Ewes graze all year round on the hill and water is provided from natural spring waters. Shelter from varying climatic extremes is provided by trees, shrubs and other vegetation. During the winter, only ewes and newly-born lambs stay in sheep pen in a maximum of three weeks. The flock had generally good levels of health management and surveillance, being managed within a flock health plan, including measures to prevent infectious diseases from the off-wintering procedure. No infectious diseases were contracted, no known problems occurred in mineral deficiencies and there were no extreme cases of parasitism. The advice of farm consultants and veterinarians was also considered.

The assessment of the ewes was conducted using the AWIN welfare assessment protocol for sheep, welfare principle of appropriate behavior, respectively. QBA assessment took place immediately after entering the farms and letting the animals adapt to the observer's presence. Assessor had never entered the farm before and was unaware of the different backgrounds of the farm, so as not to be biased by any pre-existing prejudices regarding these backgrounds. The observer then spent 5 min at the observation point, visually scanning the designated observation area to assess the entire sample group of sheep. When observations were completed, the groups' predominant behavioral expressions were scored on each of the QBA terms along a visual analogue scale (VAS) of 125 mm length, labeled from 'min' to 'maximum'.

Results

All animals showed no signs of social isolation, stereotypies and excessive itching. On the other side, all sheep showed negative relationship with humans (Table 1).

Table 1. Results of “appropriate behaviour”

Welfare indicator		Sheep (n=65)	
		N	%
Expression of social behaviour	Social isolation	/	/
Expression of other behaviours	Stereotypy	/	/
	Excessive itching	/	/
Human-animal relationship	Positive	/	/
	Negative	65	100

Regarding to qualitative behavioural assessment (Figure 1), the most negative emotions such as agitated, aggressive, subdued, physically uncomfortable, frustrated, apathetic and tense were not or were minimally manifested. The most negative manifested emotion was fearful and wary. Positive emotion such as active, content, sociable, vigorous, calm, bright, assertive and inquisitive were the most expressed. The most animals were alert and no relaxed.

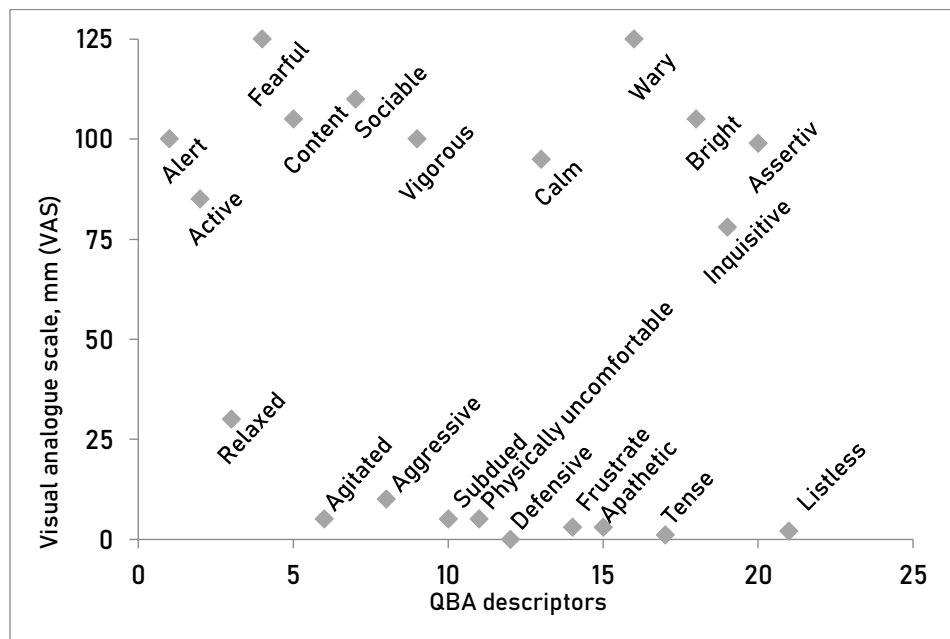


Figure 1. Qualitative behavioural assessment.

Discussion and Conclusions

Findings of no signs of social isolation, stereotypies and excessive itching indicate that “freedom to express normal behavior” was provided by appropriate environment, space and company of the animals of own kind. Regarding to human-animal relationship, all animals were fearfulness. Result of qualitative behavior analysis confirms that fearful and wary were the most expressed emotions, and other negative emotions were not or were minimally manifested. These findings indicate an absence of habituation to human contact, or a learned negative association. In extensive management systems, sheep receive only

neutral or aversive contact with people, e.g. restraint, shearing or medication administration. Fear is a strongly aversive emotion and may also result in difficulties in handling, thus causing delays in detection of other welfare problems and an increased risk of injuries to both animals and farmer. Quality of human-animal interaction is very important for good animal welfare so improving the human-animal relationship with positive interactions is crucial. A stable human-animal relationship does not fully develop after one or two interactions but is built up from a series of interactions over weeks or months.

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Can life experience reduce the stress of early weaning in cows?

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Introduction

Early weaning is one of the prominent problems of animal welfare in the dairy industry, whereby calves are separated from their mothers immediately or in the first hours after calving for the purpose of greater milk production. Stress caused by early weaning can result in decreased immunity and increased risk of diseases, as well as behavioural disorders that can be manifested throughout the animal life.

The response to stress in general involves three stages - alarm reaction, adaptation, and exhaustion stage. Since cortisol is the end-product of the hypothalamus-pituitary-adrenal gland, or the result of an acute stress response, it is quite understandable that increased cortisol levels have been found in cattle after early weaning. Weaning in cattle, unlike pigs or rats, is specific because the calf is physically separated from the mother, but continues to receive milk (or milk replacer). This is the reason why stress due to separation from the mother can be investigated separately from the stress due to the transition from liquid to solid food. Relatively little is known about how maternal alert signals develop in farm animals and how they are affected by changes in breeding conditions.

The aim of the study was to determine whether there are differences in stress response caused by early weaning in cows of different age groups.

Materials and Methods

The study was conducted under commercial conditions on the dairy farm with a total capacity of 900 lactating cows, out of which 48 cows, all Holstein breed were included in the study. The cows were divided into two age groups (group I: first calving, n = 23; group II: last calving before culling; n = 25). Calves were weaned after the first sucking of the colostrum. Level of stress at early weaning was evaluated based on the concentration of cortisol in colostrum, in the periods 9 – 10 hours and 50 – 51 hours after calving, respectively. Colostrum samples were collected and frozen directly on the farm. After defrosting in the laboratory, samples were analysed on the chemical analyser ChemWell 2910 (Awareness Technology, Inc., USA) with Bovine Cortisol ELISA Kit (NOVATEINBIO, Novatein Biosciences, USA). Statistical analysis was performed by SYSTAT v. 13.2 (Systat Software Incorporated, USA). All of the investigated parameters were processed by conventional methods of descriptive statistics, and the normality of data distribution was verified by the Shapiro-Wilk test. Differences between levels of cortisol in different age groups of cows were tested by Kruskal-Wallis test and the Conover-Inman test.

Results and Discussion

According to the study results, the response to stress at early weaning was significantly more pronounced ($P<0.05$) in the primiparous group of cows as compared to multiparous cows (Figure 1).

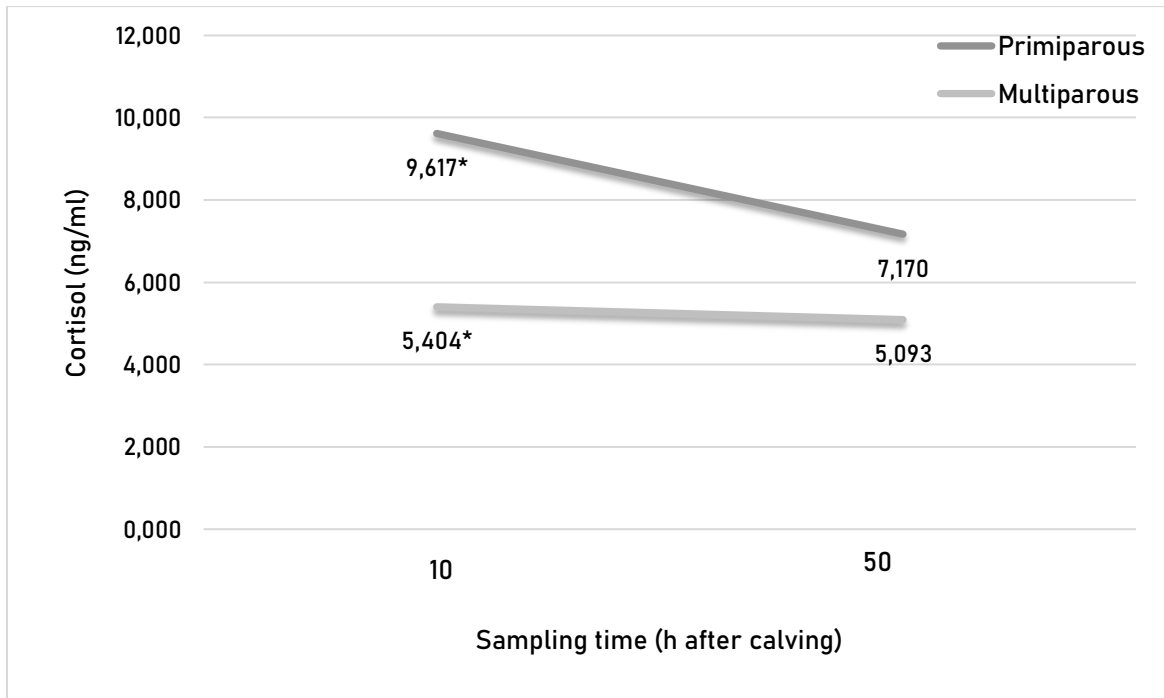


Figure 1. Mean cortisol concentration in colostrum through sampling period. - * ($P<0.05$)

Conclusion

It can be concluded that early weaning is more stressful to primiparous than older cows. Study results also suggest that colostrum cortisol is a good indicator of stress at early weaning. Therefore, farmers should take into account the stress caused by early weaning and carry out the process of separating calf from a cow in a less stressful way for animals, especially in primiparous cows.

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Animal welfare assessment and short-term impact of improvement strategy in dairy cattle in Kosovo

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Introduction

The livestock sector was suffering from several diseases with high prevalence such as lameness and mastitis, which often exceeded expert intervention thresholds and were faced with criticism of animal welfare standards. The health and welfare improvement strategy is a way of starting a process to detect and solve problems, although degree of implementation with effectiveness will be measured in a continuous process after long monitoring periods. Nowadays, research is conducted on new methods to solve problems through dissemination of knowledge and collaboration with farmers and advisors as main actors. This created an improved strategy to contribute to health promotion and disease prevention in livestock production. According to some authors the concept of health and improvement strategies basically rely on three key elements: (1) assessment of health and welfare state (current situation), (2) feedback report and advice on issues (related health and welfare) and (3) constant review and adaption (re-assessment of the farm). In recent years, concerns about dairy cattle welfare have been raised in the Western Balkan region, but on-farm welfare assessment and/or improvement studies are rare. The present study covers the first study on dairy cattle welfare in Kosovo, where dairy cattle husbandry mostly takes place in comparatively smallholdings with low productivity and tie stalls as the most prevalent housing system.

Materials and Methods

This study was conducted on 30 commercial dairy cattle farms with tie-stalls. This is fairly representative of Kosovo dairy farming as the majority of farms in Kosovo have tie-stall housing, as cubicle housing is in the initial stage of introduction and very low in numbers. The study approach was based on three main stages: (1) Visit I implementation of the Welfare Quality® protocol (not covered in this study), (2) Visit II reassessment of the farms focusing only on clinical scoring, giving the feedback report (taken results from the Visit I) and implementing the potential improvement strategy and (3) Visit III final re-assessment of the farms for possible changes. The improvement strategy consisted of two visits (V2 and V3) each of all 30 farms included in the previous welfare assessment. Each farm risk factors were identified based on the initial data analysis derived from Visit I. The majority of identified risk factors derived from poor housing conditions and management of farms. By reason of these risk factors the farm visits were focused on clinical scoring only. The visits II (V2) were carried out in December 2014, 9 months after the initial implementation of the Welfare Quality® protocol (V1). The aims of the improvement strategy were: re-assessment of the farms (clinical scoring only), in-situ calculation of the results and comparison with previous results of the report, reporting to farmers the obtained results (Feedback report presented by the Benchmarking method) and discussing results and possible agreements to implement changes. The final farm visit (V3) to collect data was carried out in April 2015, four months after agreement with the

farmers to implement the chosen measures. The aim of the visit was to assess the animal welfare situation on farms for possible improvements.

Results

In 30 dairy farms, in total 5 different focus areas were discussed (Table 1). These areas were comfort around resting/injuries, cleanliness, provision of water, claw health and feeding. In 6 out of the 30 dairy farms, no addressed welfare issue was achieved for any of these areas, whereas 24 farms agreed for addressing different AHW (animal health and welfare) issues, cleanliness (21 farms) and comfort around resting/injuries (18 farms) being the most prevalent ones. In total 56 measures addressed the 5 focus areas. The median number of measures per focus area addressed was mostly 1.

Table 1. Number of farms addressing different focus areas, total number as well as median and range of measures per farm agreed upon and total number as well as median and range of implemented measures in the animal health and welfare plans per farm

Focus areas as regards improvement	No. of farms addressing focus area	Total number of measures agreed upon	Median and range of number of measures agreed upon	Total number of implemented measures	Median and range of number of implemented measures
Comfort around resting /injuries	18	18	1 (-)	5	1 (-)
Cleanliness	21	24	1 (1-2)	14	2 (1-2)
Provision of water	2	3	1.5 (1-2)	0	0
Claw health	5	8	1 (1-3)	1	1 (0-1)
Feeding	1	3	3	0	0
Total	24	56	1 (1-3)	20	1(1-2)

When considering control, non-implementation and implementation groups (Table 2, Model A), both group and time had a significant effect on the percentage of animals with dirty lower hindleg, hindquarter and udder, respectively. The percentage of dirty animals decreased with time and implementation farms had a lower percentage of dirty animals. The decrease in dirty animals tended to be higher in implementation farms than in the two other groups. This effect became more pronounced when only taking implementation and non-implementation farms into account (Model B). Across all farms, no significant changes were observed for the parameter of mild integument alterations during the study period. In terms of severe integument alterations, in both control and non-implementation groups prevalence increased during the study period (December to April) while it decreased in the farms which had actually implemented measures.

Table 2. Health and welfare parameters for control, non-implementation and implementation groups (LS mean \pm SE) before (visit V3, December 2014) and after initiating the improvement process (visit V4, April 2015). Model effects are provided for the comparison of control, non-implementation and implementation groups (A) and the comparison of non-implementation and implementation groups only (B).

Parameter	Time	Control	Non implementation	Implementation	Model effects A			Model effects B		
					Group	Time	Group x Time	Group	Time	Group x Time
% of animals with dirty lower hindleg		(n=9)	(n=12)	(n=9)						
	V2	81.2 \pm 5.4	93.6 \pm 4.6	69.3 \pm 5.4	0.001	0.001	0.093	0.001	0.001	0.023
	V3	67.1 \pm 5.6	88.5 \pm 4.9	43.9 \pm 5.6						
% of animals with dirty hindquarter		(n=9)	(n=12)	(n=9)						
	V2	82.9 \pm 6.1	95.7 \pm 5.3	79.3 \pm 6.1	0.001	0.001	0.272	0.001	0.006	0.090
	V3	68.4 \pm 6.2	87.1 \pm 5.4	51.9 \pm 6.2						
% of animals with dirty udder		(n=9)	(n=12)	(n=9)						
	V2	80.8 \pm 4.3	95.1 \pm 3.7	80.8 \pm 4.3	0.001	0.004	0.063	0.001	0.001	0.027
	V3	77.9 \pm 5.4	87.8 \pm 4.7	56.5 \pm 5.4						
% of animals with mild integument alterations		(n=12)	(n=13)	(n=5)						
	V2	69.0 \pm 4.5	72.6 \pm 4.4	61.9 \pm 7.0	0.763	0.420	0.116	0.925	0.235	0.045
	V3	66.1 \pm 3.9	67.9 \pm 3.8	79.7 \pm 6.1						
% of animals with severe integument alterations		(n=12)	(n=13)	(n=5)						
	V2	22.4 \pm 5.2	23.9 \pm 5.0	34.9 \pm 8.1	0.920	0.741	0.044	0.680	0.422	0.046
	V3	33.6 \pm 3.9	31.3 \pm 3.8	20.2 \pm 6.1						
% of lame animals		(n=25)	(n=4)	(n=1)*						
	V2	23.5 \pm 2.4	38.8 \pm 4.6	31.5	0.001	0.708	0.559	-	-	-
	V3	19.1 \pm 2.3	39.8 \pm 4.5	16.0						

Discussion and Conclusions

The implementation rate was 35.7%, i.e. 19 out of the total 56 measures addressing housing and management that had been agreed upon were put in place. Improvement in cleanliness over time was evident in all groups (Control, Non-implementation, Implementation) but it was more pronounced in the Implementation group. This can be attributed to the raised awareness of participants even when they are not directly involved in implementing changes in a given area. Similarly, a reduction of prevalence of dirty udders was found in other research. This improvement may have occurred due to changes of the daily management routines such as intensifying cleaning routines and improving. The prevalence of mild integument alterations (hairless) remained largely unchanged but prevalence of severe integument alterations (lesions and swellings) decreased in the Implementation group. In conclusion, considering the relatively short duration of the implementation study, improvement measures were put into practice almost exclusively in the focus area of hygienic measures, but implementation exerted measurable effects in some of the health and welfare indicators. To assure improvement to a larger degree, further studies

with longer observation periods and in cooperation with veterinary and/or agricultural advisory services are recommended.

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Evaluation of health disorders incidence in Romanian Black Spotted dairy calves

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Introduction

Health disorders in calves have a major impact on the economic viability of dairy cattle farms, on one hand because of the costs of calf mortality and veterinary treatments and on the other hand because of the long-term effects of calves health on the performance efficiency as adult animals (e.g. impaired growth and development). Morbidity and mortality represent reasons of concern in all cattle breeds, however, this is a particular problem in Holstein-Friesian dairy derived breeds which have a lower organic resistance, due to selection for high yields. The most common causes of the dairy calves diseases are parasitological, bacteriological or viral neonatal calf diarrhea (NCD) and bovine respiratory disease (BRD) that can have a negative impact on welfare and growth rates. Assessment and control are the main measures that can be taken in order to provide optimal health management in cattle farming with a positive influence on the overall herd health and production efficiency. The aim of the current pilot study was to evaluate incidence of the main health disorders affecting dairy calves up to one year of age under European temperate conditions.

Materials and Methods

The study was carried out at the Research and Development Institute for Bovine Balotesti (44°36'46"N 26°4'43"E), Romania, where health data was collected for two consecutive years, between November 2017 and October 2019, from a number of 177 purebred Romanian Black and White (Holstein Friesian group) calves, managed under identical conditions. Incidence of the following health disorders were recorded during the pilot study: coccidiosis, ricketts, enteritis, respiratory diseases, colibacillosis, hemorrhagic enteritis incidences and mortality rate. Calves were fed a milk replacement diet up to the age of 80-90 days, and were housed in individual calf hutches up to weaning, after that calves were group-housed based on their sex in groups of 10-15 heads and fed with alfalfa hay, corn silage and concentrates. The animals were divided into age groups, as follows: un-weaned calves (0-3 months), 3 to 6 months and 6 to 12 months of age, calves included in the study being both males and females. In order to assess the effect of the age group on the above-mentioned health traits, the MiniTab®18 software was used, with the statistical significance level set at values of $P \leq 0.05$. The research activities were performed in accordance with the European Union's Directive for animal experimentation (Directive 2010/63/EU).

Results

The study results are shown in Table 1. Colibacillosis and hemorrhagic enteritis were found only in un-weaned calves, between the age of 0 to 3 months, with an incidence of 8.52±2.11% and 1.13±0.80%, respectively. Coccidiosis incidence was on average of 39.20±0.36% in un-weaned calves, 1.44±1.01% in the

3-6 months group and of 5.04±2.01% in the 6-12 months group. Incidence of coccidiosis was significantly higher ($P\leq 0.001$) in the 0-3 months age group, compared to the 3-6 and 6-12 groups. The rickets incidence in un-weaned calves (0-3 months) was on average 6.25±1.83%, compared with 1.44±1.01% and 4.20±1.85% in 3-6 and 6-12 months groups, respectively. Significant statistical differences were registered between 0-3 and 3-6 months groups ($P\leq 0.05$). Enteritis had the highest incidence in un-weaned calves, of 29.55±0.34%, significantly higher ($P\leq 0.001$) compared to 3-6 and 6-12 age groups. Respiratory diseases affected on average 3.98±1.48% of calves before weaning, 0.71±0.71% in 3-6 months age group and 5.04±2.01% in the 6-12 months calves. Although, the highest incidences for BRD were observed in the 0-3 and 6-12 age groups, significant statistical differences were registered only between 3-6 and 6-12 months groups ($P\leq 0.05$). The differences among 0-3 and 3-6 age groups were not statistically significant ($P> 0.05$), however there was a tendency towards significance ($P=0.068$). Mortality rates were not considered for the current study because during the two years of data collection, only one stillbirth was registered in the experimental herd.

Table 1. Means (\pm SEM) for disease incidence in Romanian Black Spotted calves

Calves age group	n	Coccidiosis (%)	Rickets (%)	Enteritis (%)	Respiratory diseases (%)
0-3 months	176	39.20±0.36	6.25±1.83	29.55±0.34	3.98±1.48
3-6 months	139	1.44±1.01	1.44±1.01	2.16±1.24	0.71±0.71
6-12 months	119	5.04±2.01	4.20±1.85	5.88±2.17	5.04±2.01
Statistical differences (P value)					
0-3 vs. 3-6		*** ($P=0.0000$)	* ($P=0.0335$)	*** ($P=0.0000$)	NS ($P=0.0688$)
0-3 vs. 6-12		*** ($P=0.0000$)	NS ($P=0.4479$)	*** ($P=0.0000$)	NS ($P=0.6640$)
3-6 vs. 6-12		NS ($P=0.0972$)	NS ($P=0.1751$)	NS ($P=0.1237$)	* ($P=0.0337$)

NS; $P>0.05$; * $P\leq 0.05$; ** $P\leq 0.005$; *** $P\leq 0.001$.

Discussion and Conclusions

Calves diseases have a detrimental effect on the overall animal welfare and also to the direct farm returns, due to mortality rates, costs associated with veterinary treatments and prevention, and indirectly due to decreased growth performances and feed efficiency, an increase in the number of days on feed and lower market values of the calves. Previous reports on morbidity attributed to BRD accounted for roughly 75% of the total health problems in calves and associated costs of BRD in cattle are estimated to range between \$50 to \$250. In our study the incidence of BRD was significantly lower than previous published results.

Current results have showed that calves are significantly more susceptible to diseases prior to weaning, compared to 3-6 and 6-12 months of age groups. Our data are in accordance with previously published results. Thus, good veterinary and health practices should be put in place at farm level in order to mitigate the effects of diseases on productivity and animal welfare. The highest number of health disorders in our study were attributed to coccidiosis and enteritis, altogether affecting over two thirds of the calves.

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Associations between the attributes and social interactions using social network analysis in lactating dairy cows

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Introduction

Dairy cows as herd animals have an established social structure. The agonistic and affiliative behaviours of each cow define its social bonds and lead to well established social hierarchy and privileges to perform preferable activities and behaviours. Social network analysis (SNA) is measuring and analysing the structural properties of networks of interdependent dyadic relationship. This allows analysing the dyadic social interactions between animals, including cows. The social network is consisted of “nodes” representing the individual animals, i.e. cows, and “edges” which indicate the specific social interactions between nodes. Individual attributes, such as age, body condition scores, productivity level or medical history of an animal can affect and change their behaviour and social interactions. Additionally, some medical conditions can appear as a cause of their social status in the herd, emphasizing the importance of SNA in medical, behaviour and animal welfare science. SNA in cows is used by several studies regarding the agonistic and affiliative interactions, but associations with the individual’s attributes and detailed analysis of node and network structure based measures is the current imperative. The objective of this study was to identify the potential associations between the attributes and the SNA of agonistic, affiliative behaviour and overall social interactions in dairy cows.

Materials and Methods

This study was carried out on a commercial dairy farm with a free stall confined area. In total, 91 cows were observed by 4 video cameras for duration of 28 hours in two sessions of 14 hours (from 7am – 9pm) for two consecutive days. The following interactions were observed: headbutts, displacements, chasing, chasing up, mutual interactions and grooming. The observation of the video recordings was done in Behavioral Observation Research Interactive Software (BORIS) and the behaviours determined in the ethogram were automatically recorded. The individual attributes included in the study were collected from the farm management software (InterHerd) and they include information about: the age, body condition scoring, pregnancy, milk production, somatic cell counts, mastitis, lameness, sickness, treatments, reproduction disorders and other disorders. Based on the social interactions, three different types of social networks were developed: network with all social interactions (ALN), network with agonistic (AGN) and network with affiliative/grooming (AFN) behaviours. The network and node based measures such as density, degree centrality, betweenness and clustering coefficients were calculated. Additionally, the equation for the displacement index in order to identify the dominance hierarchy was used. Homophily models, autocorrelations, tested associations between these measures and attributes and descriptive, spearman rank order correlations and Mann-Whitney U -test of network measures considering the animal’s attributes. Network substructures (cliques) and relations between them in association with the attributes were also analysed. On network level, the correlations between different social networks were performed by using Pearson Correlation and Quadratic Assignment Procedure (QAP).

Results

The total social interactions within the observed herd were 3.231, where the number of agonistic behaviours i.e. interactions related to dominance was 1608 and the least present were the affiliative interactions with 298. Proportionally, the density network (ρ) was higher in ALN, then in AGN and AFN, i.e. 0.40, 0.20 and 0.04, respectively. The distance between nodes is lowest in the ALN of 1.89, then in AGN of 2.16 and the nodes have the highest distance in the AFN of 4.20. Considering the centralisation measures, the average degree is varying from 35.51 in total interactions, 17.67 in agonistic behaviour and 3.28 in affiliative networks. The homophily measures and autocorrelation values between the social networks and the individual's attributes reveal high values considering the age of the animals in all three networks ($r_{ALN}=0.34$; $r_{AGN}=0.21$; $r_{AFN}=0.74$). Moreover, pregnancy and high somatic cell counts were found to have high autocorrelation in the AFN, $r_{AFN}=0.50$ and 0.51 , respectively, and higher homophily in the same network regarding the body condition score, $E-I_{AFN}=0.30$. Correlation between some of the attributes and the nodes' measures are presented in Table 1. There was positive correlation between the AGN and AFN of $r=0.46$, $P<0.001$ in the comparisons between these social networks.

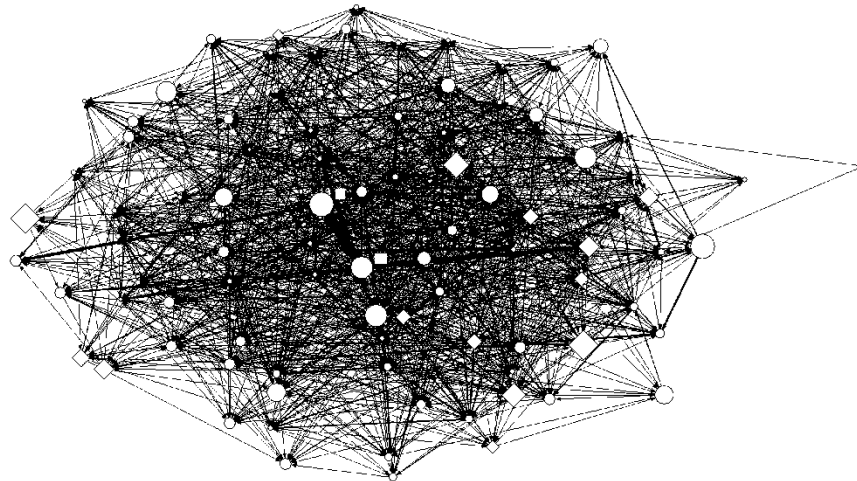


Figure 1. *Social network of all interactions between 91 cows observed within 28 hours (2 x 14h/day). The size of the node is reflecting the age of the cow and the shape is relevant to the lameness (circle – not lame and square – lame cows).*

Discussion and Conclusions

The SNA reveals higher density in the agonistic social behaviour in comparison to the affiliative behaviours indicating higher frequency of agonistic social interactions, also confirmed with previous studies. Proportionally, the distance between nodes is higher in the affiliative network, indicating lower interaction and smaller number of individuals included in the interactions. In regards to the attributes, the highest association in establishing herd's hierarchy based on dominance rank was with the age of the cows. Furthermore, animals with similar age had higher affiliative interactions, which were also noticed with the pregnancy stage and the incidences of high somatic cell counts in the life of the animal. The agonistic networks showed that the higher milk production in the last lactation had negative association with the number of received agonistic behaviours from other animals, while the animals with higher body condition score are receiving more grooming from other mates. The presence of mastitis, lameness, reproduction disorders and medical treatments are more related with the animals with higher agonistic behaviours as actors. Although this might be related with the age i.e. the older had higher number of medical conditions. However, there was a positive correlation between agonistic and affiliative social

network, meaning that the established social structure is partly maintained through grooming which is directed down the dominance hierarchy. This supports the so called Grooming for Stability hypothesis, which was also found in beef cattle. The associations between the individual's attributes and SNA found in this study confirm that SNA could be used as a tool for early detection or as welfare indicator tools in the livestock management. However, this study only opens the doors for further research by developing hypotheses that should be tested in the future.

Table 1. *Correlation coefficients of different individual's attributes and node measures in social networks*

Attribute	Social network	Out Degree	In Degree	Degree	In Closeness	Out Closeness	Betweenness	Clus. Coef.
Age	ALN	0.20	-0.23*	-0.01	-0.32*	0.20	0.04	0.11
	AGN	0.21*	-0.29*	-0.01	-0.44*	0.28*	0.04	-0.09
	AFN	0.18	0.21*	0.17	0.04	0.19	0.24*	0.10
Body condition score	ALN	0.21*	0.16	0.24*	0.14	0.20	0.24*	0.02
	AGN	0.13	0.12	0.19	0.08	0.16	0.17	0.08
	AFN	0.08	0.22*	0.25*	0.25*	-0.02	0.11	0.19
Pregnancy	ALN	0.01	0.04	0.06	0.08	0.06	0.09	0.03
	AGN	0.06	0.07	0.13	0.09	0.08	0.10	0.26*
	AFN	-0.10	0.03	-0.02	-0.08	-0.08	-0.04	-0.03
Milk production	ALN	0.05	-0.16	-0.06	-0.23*	0.09	-0.03	0.02
	AGN	0.08	-0.11	0.00	-0.17	0.12	0.00	0.01
	AFN	0.05	-0.04	-0.03	-0.04	0.06	0.05	-0.02
Milk production in last lactation	ALN	0.17	-0.11	0.03	-0.23*	0.17	0.06	0.09
	AGN	0.15	-0.11	0.07	-0.25*	0.21	0.06	0.12
	AFN	0.11	0.08	0.05	-0.02	0.12	0.17	0.11
Dominance rank	AGN	0.86*	-0.19	0.54*	-0.43*	0.85*	0.48*	-0.32*
	AFN	0.39*	0.24*	0.35*	-0.05	0.27*	0.44*	0.19

* $P < 0.05$

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Animal welfare challenges in the modern dairy sector

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Introduction

The modern dairy sector is under pressure from different points of view and the lack of species-specific regulation on the protection of dairy cattle rises additional concerns on the steps forward to implement scientifically sound changes to the production system. Along with some longstanding concerns that have not been totally overcome, there are new concerns related to antibiotic resistance, increasing numbers of cows per farm and thus decreasing stock personnel per animal, environmental impact and ethical attributes given to milk and dairy products. From the ethical point of view, the rising consumers' awareness on the early cow-calf separation is opening new research questions and debate and several recent scientific publications are indeed questioning the possibility of keeping calves with the cows for a prolonged time on dairy farms. The aim of the current contribution is to raise a number of animal welfare challenges that the modern dairy sector is facing through the investigation of the opinion of stakeholders involved in the sector.

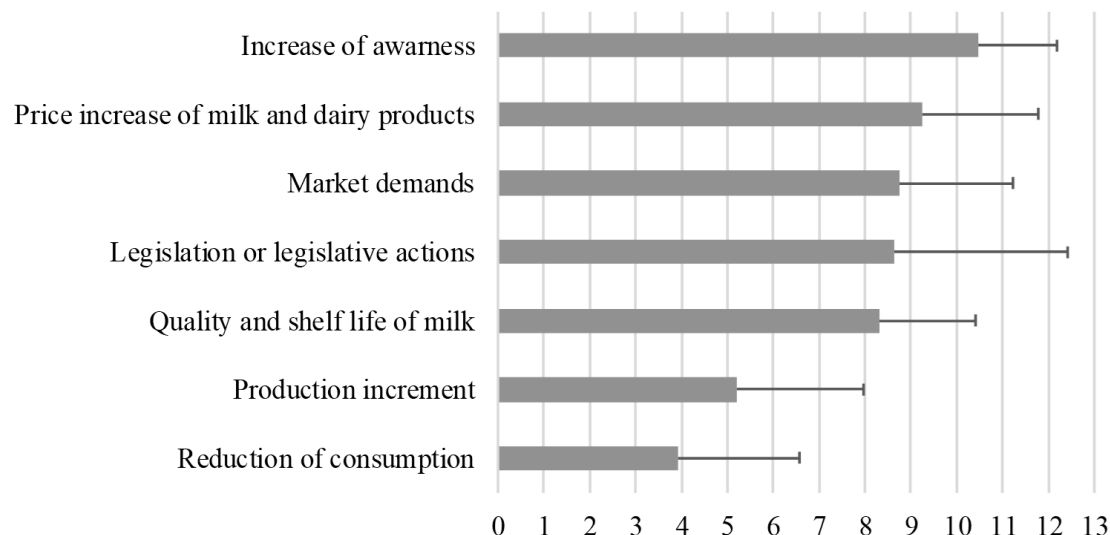
Materials and Methods

The study was carried out using a very short specific questionnaire that takes 3-7 minutes to be filled in which was distributed through different channels to farmers, veterinarians, technicians (agricultural and nutritionists) and other stakeholders in Northern Italy. The questionnaire contained a first part on the characterization of the responder and his/her involvement with the sector. The other parts of the questionnaire included the ranking of the top triggering issues around modern dairy production and numerous questions investigating the perspective and opinion on the pulling factors for change. The preliminary results were submitted to descriptive statistics.

Results

The results of the study showed a low number of respondents involved in the sector ($n = 10$) with different backgrounds that were recruited on an international dairy fair. Respondents were mid age and prevalently male, all involved in the sector as farmer (3), veterinarian (2), veterinary student (1), technician (2), professor in animal sciences (1) and journalist (1). Respondents gave different weights to different challenges in the dairy sector and all respondents except one ticked changes as feasible. In particular, the alternatives to the early cow-calf separation were marked as an opportunity. The potential factors determining major driving or pulling forces towards higher levels of ethics in dairy production were higher prices, consumers' awareness and market demand (Figure 1).

Figure 1. *Score attributed to the major pulling factors for higher levels of ethics in the modern dairy production according to respondents involved in the sector. Score 0 was attributed to minimum to score 12 attributed to maximum. Values are expressed as Mean \pm SD.*



Discussion and Conclusions

People involved in the modern dairy sector are interested in increasing the level of ethics in the production system, see changes as an opportunity and are aware of the changes necessary to improve animal and farmer welfare on dairy farms. Although preliminary and with the main shortcoming of the very low sample size that does not allow to do any statistical inference, the results of this study point out the opinion of stakeholders towards major pulling factors as increase of consumer awareness on the production system, increase of prices and marked demands along with the need for species-specific legislation. This supports the needs for changes put forward by Brombin et al. raising the question whether the dairy sector is ready to implement changes.

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KEYNOTE LECTURE

The role of Precision Livestock Farming (PLF) technologies in animal welfare monitoring

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Precision livestock farming (PLF) is the use of technology to help farmers monitor and manage their animals and their farm. The word 'help' is important here, as PLF is not meant to replace humans, but to function as a tool to improve monitoring and make sure that time is spent on the most useful and important tasks. It is also worth noting that PLF technologies can be used to improve not only animal welfare and health, but also production; however, these aspects are frequently linked.

What type of automated measures could reflect the welfare of the animal? These can be related to the behaviour of the animal, but also physiological changes are relevant. It is rarely feasible, nor desirable to take frequent blood samples for the purpose of monitoring, but for example automatic measures of milk quantity obtained twice a day may be used to identify sudden changes in production, which in turn may indicate a welfare problem.

We need to ensure that the automatic measures we record reflect the type of behavioural or physiological changes we are interested in. In terms of behavioural measures, this can be done by observing the animal concurrently with the automatic data recording to check that the two methods correspond to a certain degree. It should be kept in mind that the PLF method is unlikely to provide the same accuracy as continuous observation of behaviour. However, as long as the PLF data can detect the changes, within or between individuals, sufficiently to indicate a potential welfare issue, this is not a problem. One way to ensure this is to reverse the method of gadget development: meticulous study of behaviour at key moments, such as during tail biting, can provide information on what to measure and when. Other aspects to consider are space and time, in terms of variable environmental conditions and animal-related changes that occur gradually.

Different types of equipment can be used for measuring behaviour automatically, and these can roughly be divided into three categories, depending on their proximity to the animal: Attached to (e.g. accelerometers); Interacting with (e.g. feed troughs on weigh scales, sensors detecting presence), and

Remote from (e.g. video and sound recording) the animal. A combination of these is often the most efficient, but also more complex to manage. It would be optimal if different gadgets were able to talk to each other, and there are also species differences as to what is feasible (though many techniques are adaptable). Small farms are unlikely to be able to afford the type of equipment used by big enterprises, and we need to put more effort into finding PLF technologies that can work for the small-holder. One solution is the use of sentinels, where only a fraction of the herd or high risk individuals are fitted with a given piece of equipment, such as accelerometers.

The use of PLF technologies for efficient animal welfare monitoring in practice requires affordable, reliable, and easy-to-use equipment providing data that reflect – adequately and in real-time – different aspects of the welfare state of animals within the herd.

On-farm assessment of the health and welfare of pregnant sows on pig farms in Kosovo and Albania

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Introduction

The pig production industry has been improving increasingly with the creation of small family farms and large commercial farms. These changes have also brought the refinement by farmers of the system of management, keeping and care of pigs in the stables. Different bar filing systems are applied for keeping sows; as free systems, in metal or mixed cages but not all meet animal welfare standards.

In Kosovo and Albania to date there are no genuine studies of animal welfare, specifically for pig welfare and farmers are still in the early stages of recognizing this term. The aim of this first study in both countries was to assess and record the data about health and welfare status on pregnant sows.

Materials and Methods

This study was carried out from January 2019 to April 2019 in Kosovo and Albania. During this time, 30 farms were visited in total (15 farms per each country) both family and commercial pig farms. Each farm surveyed fulfilled the lower thresholds of having minimum 5 sows per farm. Assessment of the health and welfare of the sows was carried out in accordance with the Welfare Quality® Assessment protocol for pigs. Parameters such as body condition score, soiling body, body lesions, shoulder lesions, conjunctivitis, lameness, swelling in limbs, vulva lesions, vulva deformation, protruding claws, respiratory problems, were evaluated in this study. Statistical analysis was performed by use of SPSS 22 software. Mean, SD, min and max values and the differences were tested by Wilcoxon test for *P* values.

Results

During the study we have evaluated in total 349 sows from 1770 pregnant sows presented or about 20% in all 30 farms; from them 182 pregnant sows in Kosovo and 167 in Albania. The results after the assessment of the health status of the sows on 30 farms are presented in Table 1.

As shown, the health status of sows in both countries does not differ significantly in majority of parameters such as: thin sows, fat sows, shoulder and body lesions, vulva lesions and deformed. The prevalence of these parameters was relatively in lower occurrence: 4.5, 6.6, 2.8 and 5.2, 3.1 and 2.4 respectively for Kosovo farms and, 5.6, 6.1, 1.2 and 1.5, 4.9 and 4.8, respectively for Albanian farms. The

differences between countries were found for the swelling legs, claws too long, conjunctivitis and lameness ($P < 0.05$).

Table 1. *Health status of the evaluated sows in Kosovo and Albania*

Clinical manifestation	Kosovo n=15				Albania n=15				P-value
	Mean	SD	Min	Max	Mean	SD	Min	Max	
Body soiling	10.5	17.9	0.0	66.7	21.6	22.6	0.0	60.0	0.158
Thin sows	4.5	6.0	0.0	15.0	5.6	7.2	0.0	22.7	0.760
Fat sows	6.6	9.4	0.0	28.6	6.1	8.4	0.0	30.0	0.878
Mild body lesions	5.2	10.7	0.0	40.0	1.2	4.7	0.0	18.2	0.225
Shoulder lesion	2.8	7.5	0.0	28.6	1.5	3.3	0.0	10.0	0.917
Vulva lesion	3.1	5.0	0.0	15.0	4.9	5.9	0.0	16.7	0.444
Vulva deformed	2.4	5.0	0.0	15.0	4.8	5.9	0.0	16.7	0.260
Swelling legs	4.0	7.1	0.0	20.0	11.5	12.7	0.0	50.0	0.041
Claws too long	0.3	1.0	0.0	4.0	17.6	16.9	0.0	57.1	0.003
Conjunctivitis	0.0	0.0	0.0	0.0	4.3	7.2	0.0	20.0	0.042
Lameness	3.5	7.1	0.0	24.0	15.9	10.6	0.0	40.0	0.011
Needing hospitalisation	3.5	7.2	0.0	25.0	0.3	1.2	0.0	4.5	0.080

Discussion and Conclusions

To our knowledge, this study represents the first scientific study approach of evaluating and assessing the welfare of pig farms in both countries Kosovo and Albania. The results showed that body conditions of sows were at the satisfied level and only about 4-6% of them were too thin especially in large farms, whereas too fat sows often linked to small and family farms.

The overpopulation and lack of space seem to be crucial factors for health and welfare status. In Kosovo farms that represent mostly small farms the welfare situation especially the hygiene was at the higher level compared to Albania. This difference may be attributed to the small and family farms where the care for pregnant sows is much greater than in the larger farms in Albania e.g. the body soiling, which is an indicator of their welfare, is about 2 time less in Kosovo compared to Albania. The leg problems like lameness and claws too long were more prominent in Albanian farms compared to Kosovo farms. In most Albanian farms (9 of them) the pregnant sows were in metallic crates, 2 farms had mixed system and 3 farms free system, whereas in most farms in Kosovo (13 farms) the pregnant sows were kept in mixed and free system.

Considering that this was the first study in both countries, these results will serve as a starting point for further research on this field. More detail evaluation of the impact of housing system under conditions in Kosovo and Albania is needed in the future.

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Survey on the health and welfare conditions of the weaners and fatteners in commercial pig farms in Kosovo and Albania

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Introduction

The pig breeding industry is an important source of the Albanian livestock economy with about 185,000 pigs while in Kosovo around 43,000 pigs. However, the pig sector is still at the initial stage and faced with a major gap on reliable data of farm structure, husbandry systems and health and welfare state of pigs. In many areas of central and southern Albania, pigs are bred in intensive systems, while in most of northern Albania and Kosovo, pigs are traditionally bred in extensive holding. The main objective of this study was to assess, collect data and create a database of results on certain clinical manifestations and behavioral parameters of weaners and fatteners as a prerequisite of successful rearing condition, and at the same time to gain information about the current state of pig welfare in Kosovo and Albania.

Materials and Methods

This study was carried out from January 2019 to April 2019 in Kosovo and Albania. During this time, we have visited 15 family and commercial pig farms per each country. Assessment of the health and welfare of the weaners and fatteners was carried out in accordance with the Welfare Quality® Assessment protocol for pigs. Parameters, such as, positive and negative manipulations, body soiling, runt pigs, lameness, ear and tail lesions, red eyes, respiratory problems and diarrhea were evaluated. Statistical analysis was performed by use of SPSS 22 software. Mean, SD, min and max values and the differences between countries were tested by Wilcoxon test for *P* values.

Results

During the study we have evaluated 87 pens with 1,557 weaners and 97 pens with around 2,000 fattening pigs from about 4,300 and 5,400 pigs' categories respectively in both countries. The results on health and welfare status of weaners and fatteners are shown in Tables 1 and 2.

Table 1. Behavioral and health parameters of weaners in Kosovo and Albania (%)

Parameters/pen level	Kosovo n=14				Albania n=15				P-value
	Mean	SD	Min	Max	Mean	SD	Min	Max	
Positive behaviour	18.14	24.13	0.00	83.30	24.14	23.10	0.00	80.00	0.173
Negative behaviour	1.02	3.82	0.00	14.30	15.73	7.98	0.00	29.00	0.001
Lameness	1.52	4.53	0.00	16.70	4.64	5.50	0.00	20.00	0.019
Runt pigs	4.79	5.06	0.00	16.70	2.79	3.49	0.00	13.20	0.308
Body soiling	0.00	0.00	0.00	0.00	4.44	13.31	0.00	50.00	0.18
Pens with red eyes	3.57	13.36	0.00	50.00	2.22	8.61	0.00	33.30	0.655
Diarrhoea	9.52	27.51	0.00	100.00	0.00	0.00	0.00	0.00	0.18
Pens with ear lesions	13.10	29.37	0.00	100.00	2.78	7.50	0.00	25.00	0.225
Pens with body lesions	27.38	42.17	0.00	100.00	1.67	6.46	0.00	25.00	0.044
Pens with tail lesions	9.52	27.51	0.00	100.00	2.17	5.89	0.00	20.00	0.465

Table 2. Behavioral and health parameters of fatteners in Kosovo and Albania (%)

Parameters/pen level	Kosovo n=9				Albania n=15				P-value
	Mean	SD	Min	Max	Mean	SD	Min	Max	
Positive manipulation	6.8	16.6	0.0	50.0	35.6	23.0	14.8	100.0	0.015
Negative manipulation	2.5	7.4	0.0	22.2	22.9	15.2	0.0	65.3	0.012
Lameness	1.9	2.5	0.0	6.1	4.0	3.1	0.0	9.4	0.260
Runt pigs	0.6	1.9	0.0	5.6	0.3	0.5	0.0	1.3	0.715
Body soiling	13.9	33.3	0.0	100.0	22.6	36.3	0.0	100.0	0.352
Pens with red eyes	0.0	0.0	0.0	0.0	8.6	18.4	0.0	55.6	0.180
Pens with ear lesions	0.0	0.0	0.0	0.0	10.1	26.0	0.0	100.0	0.180
Pens with body lesions	5.6	16.7	0.0	50.0	1.7	6.5	0.0	25.0	0.655
Pens with tail lesions	5.6	16.7	0.0	50.0	0.8	3.2	0.0	12.5	0.655

In general, the majority of parameters that indicate the health status of pigs in both categories (weaners and fatteners) did not differ significantly. The parameters such as body lesions and diarrhoea in weaners in Kosovo farms and prevalence of body soiling in fatteners in Albanian farms were considered at the high prevalence.

Discussion and Conclusions

Health status of weaners in Albanian farms seems to be better compared to Kosovo farms especially in parameters such as: diarrhea, runt pigs, body lesions, ear lesions and tail lesions. However, the situation of negative manipulations, body soiling and lameness was better in Kosovo farms. In fatteners the health status seems to be better in Kosovo farms compared to Albanian farms in parameters of negative manipulations, lameness, body soiling, red eyes, ear lesions and body lesions. These differences between countries can be attributed to the rearing system. In Albania the farms are much bigger and the focus at the individual level of animals tend to be more lower compared to the small or family farms such as in Kosovo. Significant differences were found in behavior parameters. The situation of drinkers, feeders, ventilation and heating was in very well level in both countries: about one nipple per 9.43 weaners and 10.38 fatteners which is in full accordance with normal parameters of pig protocol. As a conclusion from this first study the obtained data tend to elect the risk factors that potentially can reduce the welfare of

weaners and fatteners. This study shows the importance of further investigation in this field and raising the awareness to the farmers about importance of health and welfare indicators in both weaners and fatteners.

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A practice-led approach for starting with intact pigs in Slovenia

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Introduction

The lack of behavioural complexity in pigs expressed in the intensive systems often leads to psychological problems for the animals, resulting in excessive tail or ear biting or are psychological problems and other health problems those who result in biting of body parts. Biting pigs' tails is a phenomenon that causes animals' pain, social disturbances, health problems and consequently increased consumption of medicines/antibiotics, high losses on the slaughter line, and poor meat quality. The bitten pig grows slower and needs to be fed longer to the desired weight. The cost of feed is further increased and space is lost for new animals in the turn. In fact, tail biting is a problem in pigs with docked and intact tails and in systems with and without the possibility of outdoor run. Despite the known facts, breeders have difficulty understanding the economic costs of the tail-bite outbreak. Therefore, the breeders play a major role in its prevention. The problem, however, arises due in part to the fact that breeders are only interested in issues that concern them only, and because integration into science is difficult because it breaks into the breeder's daily work. As a result, in Slovenia, the ambition in the pig breeding practice was to test the innovative idea that using a social toy would reduce the frequency of biting of pigs' tails, thereby enabling animal-friendly breeding conditions and providing safer food for the consumer.

Material and Methods

The farms included in the experiment ($n = 9$) were, on average, large farms (30 to 50 breeding sows and 200 fatteners) providing their pigs with a 10% larger floor area than prescribed. In the spring-summer 2019 we monitored two groups of pigs per farm. Each groups had 10-15 animals. Data were collected from farrowing to weaning, at the time of rearing to 30 kg and at the time of fattening at 20 or 100 days of fattening. We weighed 362 pigs in total. One group of pigs on the farm was short-tailed group, the other intact group. We did not change the technology of rearing nor feeding regime in the study. We further monitored the occurrence of behavioural abnormalities by looking at damage to the ears and tails. In addition to the classic enrichment regularly used by breeders - straw, chains and wood - in the observation pens, pigs were offered an alternative toy. In the rearing and fattening stables we made a special toy made of natural materials. Data were statistically processed in program 9.2. SAS and used the proc MIXED to check the difference in daily weight gain between treatment groups. We used a farm as a random effect. The proc CORR was used to look for a correlation between the number of tail injuries and daily weight gain. The use of a non-parametric Hi-square test made it possible to find differences between groups in the number of tail injuries.

Results

During the suckling period, there were no differences in daily weight gain between pigs with intact tails (254.66 ± 14.09 g / day) and those with shortened tails (260.01 ± 14.09 g / day; F -value = 0.11; P = 0.76), while a tendency in favor of the intact group (515.84 ± 67.32 g / day) was shown during the rearing period (476.20 ± 67.32 g / day); F -value = 5.94; P = 0.07). In the 20 days after the start of fattening, there was a statistically significant higher (F -value = 7.41; P = 0.03) daily weight gain increase in pigs from intact groups (688.51 ± 42.45 g / day) compared to pigs from short-tail groups (639.59 ± 42.45 g / day). The way pigs were housed on an individual farm affected daily weight gain significantly and explained about 95% of variability (P = 0.04). The individual farm conditions had the same effect in the last observation period, i.e., between 20 and 100 days of fattening (P = 0.04), but the differences between the pig groups were no longer statistically significantly different (F -value = 2.75; P = 0.14), only numerically a larger daily weight gain was detected in pigs from intact groups (823.44 ± 44.25 g / day) compared to short-tail groups (800.56 ± 44.25 g / day). The farm, which diverged from average in daily weight gain, was a small-scale farm, up to 150 fatteners per turn, and focused exclusively on fattening. The number of tail injuries was not associated with daily weight gain (rearing: r = 0.17, P = 0.46; fattening up to 20 days; r = -0.34, P = 0.18, and fattening between 20 and 100 days: r = 0.04, P = 0.88). Pigs with intact tails tended to bite their tails more often than pigs with short-tailed pigs during the fattening period (Hi-square = 3.27; P = 0.07) rather than during rearing (Hi-square = 1.6; P = 0.21).

Discussion and Conclusions

In pig production, new housing systems limiting tail biting in group housed pigs need to be developed. Following this, on nine farms pigs were given a social toy as an enrichment object, which has never been tested in the practice before. By this approach we gained comprehensive ethological knowledge under commercial conditions. We included 8 farmers with 9 farms in Slovenia in the development of technological innovations enabling animal friendlier rearing conditions and safer food for consumers. We followed two groups of pigs per farm, one with short tails and the other one with intact tails. In the intact pig groups, we found a tendency with a larger number of damaged tails during the fattening period, but these pigs grew statistically significantly faster during the period from moving into the fattening facility and 20 days of fattening. Groups with intact tails did not have a statistically significant smaller daily weight gain, which indicates that pigs with whole tails can be raised in rearing conditions practiced in Slovenia without making changes in rearing management. The research, which is currently done in only one turn, also points to this and follows the conclusions recently published in a review article that current housing conditions are crucial for the occurrence of tail biting, but we must also be aware of the fact that the success during fattening is also influenced by conditions before weaning. Namely, the farm, which deviated by daily weight gain from the average positively, is a small-scale fattening house that has full floors in the inner part of the pens, allows the animals to be released on the grid floor and buys weaners only from one breeder where the suckling piglets have access to fully straw bedded floors and runners to partly slatted floors. Our survey is one of the few commercially conducted in the world where we wanted to encourage positive acceptance of the environment, which is one of the current trends in the livestock industry.

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Inter-observer reliability for Quality Behavioural Assessment in growing pigs

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Introduction

More recently, growing consumer demand both for quality food products and more ethical food production has meant that farm animal welfare is emerging as an area of potential added value for producers, retailers and other food chain actors. Under the influence of economics and increased yield per animal, pig welfare and behaviour were neglected. Pig farming became more intensive and controlled which resulted in rearing animals under confinement. All these demands dramatically increase the efforts to develop methods for assessing animal welfare and behaviour at farm level. As result, Welfare Quality® (WQ) protocols were developed by the researchers, culminating in the protocols developed by the European Welfare Quality program. For pigs, protocols exist for growing pigs and for sows in all production stages, including suckling piglets. One method which may be suitable as a screening tool for identifying farms with compromised welfare before applying the full WQ protocol is Qualitative Behavior Assessment (QBA) which relies on a human observer's ability to integrate perceived details of an animal's demeanor and its context, using 'whole animal' descriptors such as active, fearful, calm, playful, content, indifferent or happy, etc. Based on these premises, many authors have argued that QBA could potentially function as an integrative welfare assessment tool, complementing existing tools that focus on specific aspects of behavior and welfare. The main objective of this research was the inter-observer reliability for practical assessment of QBA protocol.

Materials and Methods

The QBA protocol was assessed on growing pigs kept under intensive conditions in two farms. The both commercial pig farms have integrated indoor production system. The growing pigs were reared in pens with concrete floor on straw and have enrichment materials in the pens. The number of animals per pen was differing related to pig's weight, ranging from 7 to 30 or 40 pigs. The pigs were fed ad libitum via a dry or wet-feed hopper. Every pen has two or more drinking nipples. The QBA protocol was carried out for a total of 20 min, during which time there was allowed to freely move around on the feeding table and choose as many observation points as felt for necessary, as long as reached both ends of the feeding table and as long as the observation time and points were equally distributed across the feeding table. The assessment and scan samples were taken regarding the WQ protocol for growing and finishing pigs. Between 4 and 6 observation points covering different areas of the farm were selected. After the animals were returned to undisturbed behaviour the expressive quality of their activity at group level was observed. It is likely that the animals will initially be disturbed, but their response to this can be included in the assessment. Total observation time was around 20 minutes and approximately 3 to 5 minutes per point of observation. After the observation finish, the scoring of the 20 descriptors was done using

continuous visual analogue scale (VAS) defined by its left 'minimum' and right 'maximum' point. Scoring each term was done by drawing a line across the 125 mm VAS scale at the appropriate point. The classification was done on farm level and only one integrative assessment was made per farm. Calculation of the index for positive emotional state assessment was done according the instructions given in the protocol for welfare assessment of pigs. The inter-observer variability between farms during assessment of QBA in growing pigs was calculated using Spearman's rang correlation.

Results

The on farm assessment of QBA for growing pig's resulting in data that comparatively are shown in Table 1. This data represent the inter-observer practical assessment of QBA protocol.

Table 1. *Comparative data from on-farm Qualitative Behavior Assessment for growing pigs and score calculation*

Measurements	Farm 1		Farm 2	
	Observation 1	Observation 2	Observation 1	Observation 2
Active	0.39296	0.71224	0.46664	0.09824
Relaxed	0.97830	0.90221	0.57611	0.96743
Fearful	0.00950	0.00950	0.03325	0.00000
Agitated	-0.01422	-0.49059	-0.10665	0.00000
Calm	1.02102	0.95370	0.94248	0.74052
Content	0.99456	0.66304	0.72224	0.31968
Tense	-0.00971	-0.07768	-0.13594	0.00000
Enjoying	0.96820	0.85490	0.24720	0.14420
Frustrated	0.01496	0.08976	0.07480	0.00000
Sociable	-0.15990	-0.33210	-0.33210	-0.67650
Bored	0.03704	0.29632	0.15742	0.03704
Playful	0.90668	0.65615	0.50106	0.27439
Positively occupied	-0.11584	-0.28960	-0.05792	-0.52128
Listless	0.11022	0.87174	0.23046	0.08016
Lively	-0.10458	-0.19422	-0.61254	-0.55278
Indifferent	-0.13245	-0.08830	-0.12362	-0.02649
Irritable	-0.22667	-0.46527	-0.42948	-0.82317
Aimless	0.70387	1.10949	0.40562	0.13123
Happy	-0.00700	-0.00700	-0.06825	-0.00525
Distressed	0.37536	0.52224	0.38080	0.21216
Index	1.20470	1.15893	-1.66602	-4.13802
Score	63.24859	62.77471	13.19067	19.97619

Estimated scores for QBA showed higher values in Farm 1 than in Farm 2. The inter-observer reliability was high and there was high positive statistical significant correlation between observer 1 and observer 2 during assessment of QBA in growing pigs (Table 2).

Table 2. Spearman's coefficient of correlation for inter-observer reliability for Qualitative Behavior Assessment on farm

Spearman's	Farm 1 x Observation 2	Farm 2 x Observation 1	Farm 2 x Observation 2
Farm 1 x Observation 1	0.930**	0.723**	0.737**
Farm 1 x Observation 2	1	0.665**	0.655**
Farm 2 x Observation 1		1	0.957**

** $P < 0.01$

Discussion and Conclusions

The QBA appears to be useful to distinguish between farms in which animals appeared to be in a more positive mood from farms in which animals showed a negative mood. The QBA by itself does not bear direct relevance to welfare, but it contributes to a meaningful transition between descriptive terms of positive and negative mood, demonstrating that the QBA appears to be a useful methodology to distinguish farms on the basis of expression of natural behaviour. Using QBA is not very time consuming and inter-observer reliability showed high positive correlation.

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Section 5 – Poster presentations



Photo by Lachmann-Anke, P. & M.

POSTER PRESENTATIONS LIST

No.	First Author	TITLE
1.	Ališah, A.	The ethological aspects of the Bosnia and Herzegovina bull fight
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3.	Ilieva, Y.	Would herbal preparation AyuFertin affect the milk components of the treated buffaloes?
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15.	Đukić-Stojčić, M.	The welfare of laying hens kept in enriched cages and aviary systems
16.	Sabur, A.	Opportunities and challenges of animal welfare in a Bathan in Bangladesh

1. Ethological aspects of the Bosnia and Herzegovina bull fight

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Introduction

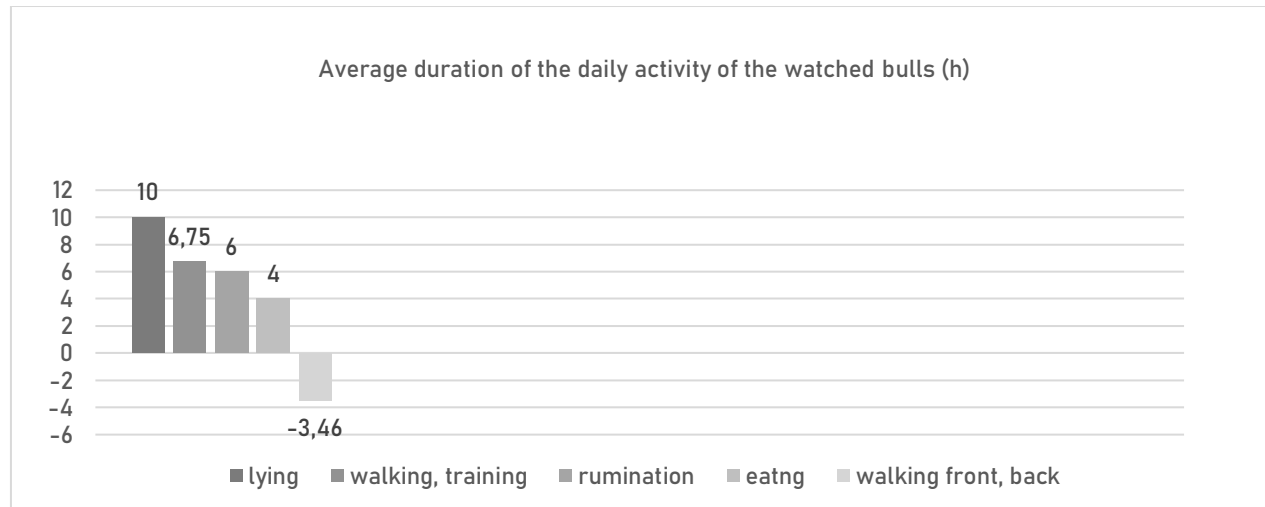
The term *corrida* is in everyday use when talking about traditional Bosnian and Herzegovinian bullfighting, modeled on the world-famous festival in Spain. This is a rather incorrect reference given that the Spanish *corrida* is conceptually completely different from the Bosnian bull fight. The ultimate difference between the two is defined by the position of rivals in the battle and position of the bulls, when it comes to ultimate fighting outcome. In Spanish *corridas*, the rivals are a large crowd of people on one and a bull, as an individual, on the other side. The viewers expect that this unequal battle lasts for as long as possible and be full of blood from the non-fatal wounds on the bull's body and ending in the death of such the tormented animal. The main players of the Bosnian and Herzegovinian bull fights are the bulls, who, independently and without any interference from people, in a man-to-man type of fight, show who is the alpha male. The fight ends, also to the great pleasure of a large number of viewers, with one bull turning its back to the rival, or with the escape of one of the players from the "battle field". Just the way it happens in nature. The bulls are destined to fight, as a form of their territorial and reproductive behavior. Observed through the ethological prism, it should be emphasized that the bull's position for the *corrida* and Bosnian bull fight in the preparation period of their lives, until the beginning of fight activity, is very similar. From birth to reaching sexual maturity, between the third and fourth year of life, when both the Spanish and Bosnian bulls are starting to get engaged into fighting activities, it can be claimed with certainty that they enjoy in the exercise of their natural rights and that they are in good shape. Unlike Spanish, male calves in Bosnia and Herzegovina are typically originating from the commercial herds and remain in them under the watchful supervision of the owners. In such circumstances, the behavior and position of alpha males is clearly a good base for the owner to recognize the potential fighting bull and give it the attention it deserves.

Material and Methods

As biological material we used four bulls, two aged five and two aged eight years, with a weight range 670-950 kg, fighting in medium and heavyweight category.

Results

Ethogram



Discussions and conclusions

Observing animal behavior and creating ethogram is being treated as a precise scientifically acceptable method to determine the level of their well-being. From our results, it is perfectly clear that the bulls, in this regard, had sufficient time to rest and used it in a proper way, meaning that their rest time is appropriate for free-range bulls that are considered to have the highest level of well-being. All other registered common patterns of behavior in the stables also clearly suggest the high level of their well-being. The best evidence for this is the amount of napping and sleeping time. During the observation period, the bulls spent in average nearly 7.5 hours sleeping and napping, or more precisely they had 2.6 hours of nap time, and almost five hours of sleep time.

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2. Hygienic status of water and water supply system as a factor of well-being of commercial egg laying hens

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Introduction

The Lohmann Brown commercial hybrid was formed in Germany by selective breeding of New Hampshire hens with other brown laying hens. It is one of the most famous and widespread light hybrid for the production of brown shell eggs. The emergence of this high productive performance hybrid was followed as a result of increased need for poultry products, more specifically eggs. It is well known that the well-being of commercial laying hens plays a very important role in egg production. Considering that it is essential for the well-being of animals to fulfill all five freedoms, in this paper we paid particular attention to the first freedom, freedom from hunger and thirst, but without neglecting the other four freedoms. The imperative for the normal course of physiological processes in the organism require adequate nutrition and a sufficient amount of microbiologically clean water. Focus of this research was to determine whether it is enough to offer a balanced diet without the preventive addition of antibiotics, vitamins, minerals and continuously available microbiologically clean water to accomplish a good production performance of flocks.

Materials and Methods

The study was conducted at the farm of laying hens "Bingo-Tuzla". Housing conditions, breeding conditions, nutrition of laying hens, egg production and liveability were observed. The data on production in facilities (F_1, F_2, and F_3) were collected over a period of 425 days. In production facilities F_1, F_2 and F_3 30,000, 30,000 and 31,000 laying hens were housed, respectively. The laying hens were housed in Big Dutchman's enriched cage systems for housing commercial laying hens. Micro-ambient parameters such as temperature, humidity, ventilation were automated in all production facilities. Laying hens were fed with food from a verified supplier and food was dosed according to nutritional norms for laying hens. Microbiologically clean water was provided by use of Dioxy Activ Supra, a stable liquid chlorine dioxide. Ad libitum water supply was provided by use of nipples. Permanent addition of Dioxy Activ Supra was made throughout the production period. Therefore, a residual amount of Dioxy Activ Supra was present in water all the time. With the same medium, but in adequate concentrations, before the start of production,

disinfection of all objects, surfaces, water supply system was carried out. The concept of production in this farm does not imply the use of antibiotics, vitamin preparations, any acidifying agents or other unnecessary chemical substances, which can disturb the balance in the organism.

Results

The results of the study presented in Table 1 show the number of laying hens (LH) per facilities, average egg production, liveability, average food and water consumption and ratio of food and water per facility during 425 days of production.

Table 1. *Production and technological parameters of the observed flocks*

	F_1	F_2	F_3	Technological norms
Number of LH	30.000	30.000	31.000	
Age of LH (day)	425	425	425	425
Number of eggs per LH	369	370	367	360
Liveability (%)	93.5	95.1	96.1	92 - 94 %
Food (kg)	1388.5	1412.9	1376.3	
Water (m ³)	2777.04	2684.47	2615.04	
Food (g/LH)	108.9	110.8	104.5	
Water (ml/LH)	217.8	210.5	198.5	
Ratio f:w	1:2	1:1.9	1:1.9	

Discussion and Conclusions

According to the literature, it is clearly evident that laying hens in classic cages with nipple water supply are in thirsty condition. The present water additives used for routine treatment of flocks reduce the amount of available water. Moreover, reduction in amount of available water is very often due to clogged nipples. The laying hens of our study in the circumstances of supplying microbiologically clean water with no additives have established a physiologically optimal ratio of food and water consumption of 1 : 2, maintained high vitality and egg production above technological standards. The presented parameters indicatively suggest a high degree of well-being of the observed flocks, potentiating the benefits of enriched cages over conventional ones.

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3. Would herbal preparation AyuFertin affect the milk components of the treated buffaloes?

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Introduction

Monitoring of dairy products for food safety hazards in the dairy supply chain is very important for consumers' health. Most chemical hazards enter the dairy chain at primary production, either through the ingestion of contaminated feed, via the uptake of chemical compounds as a result of grazing or via the administration of veterinary medicines. Different plant specific compounds or toxins may be transferred into the milk as well. Some of them pose a human health risk due to the genotoxic and carcinogenic properties of the compounds. For the sake of animal welfare and organic production, many herbal protocols instead of hormones or in combination with them have been used in buffalo breeding for the overcome of the postpartum anestrus. Therefore, a lack of data concerning the effect of these herbal preparations on the milk quality of buffaloes in the scientific literature is a crucial issue. AyuFertin, a non-hormonal and completely herbal preparation, is used for the treatment of the postpartum and postpubertal anestrus conditions in livestock animals. The present investigation aimed to analyze the milk composition of postpartum buffaloes treated with herbal preparation AyuFertin for ovaries activation and to track the changes occurred.

Material and Methods

The experiment with AyuFertin treatment was organized for the postpartum animals at the farm of Agricultural institute - Shumen, Bulgaria. In accordance with producer's instruction feed supplement AyuFertin (Indian Herbs, Ltd.) was administered orally for 3 consecutive days in dose of 3g/100kg live weight. The state of ovaries was analyzed by ultrasound investigation. In animals that did not manifest estrus, the same dose was repeated after 10 days. The both groups of animals received standard daily diet for dairy animals: 25 kg of green forage (vetch, oat, sorghum), 4.5 kg of concentrated forage and wheat straw ad libitum. The milk samples for the analyses of the fatty acids composition were collected before treatment and after first and second treatments from the experimental group. The investigated milk

samples were freeze-dried before analyzing. The extraction of the fatty acids was carried out by means of diethyl ether in a Soxhlet apparatus following AOAC Method 920.39 (2012). The fatty acids methyl esters (FAMES) were prepared in accordance with ISO 12966-2:2017 (2017). The identification of the individual FAMES was made by comparison of their mass spectra with NIST standard reference database. Quantification of the identified fatty acids was made by the area normalization method (represented as % of the area of total fatty acids in the sample). The statistical development of the results was done by StatSoft v.10 software (StatSoft Inc., Tulsa, USA). Results were considered significant at $P < 0.05$.

Results

The treatment of animals with AyuFertin was done during the May. The milk parameters at the milk control day in May and June are presented in Table 1. In June the significant difference in the content of fat and protein compared to the same parameters in May was defined in the experimental group.

Table 1. *Milk parameters of the investigated buffaloes at milk control day. Data are presented as Mean \pm SEM.*

Parameters/groups	Milk yield, kg/day	Milk fat, %	Milk protein, %
Control (n=6), May	7.52 \pm 0.65	7.77 \pm 0.31	5.01 \pm 0.05
Control (n=6), June	7.70 \pm 0.41	8.23 \pm 0.35	4.86 \pm 0.07
Experimental (n=7), May	8.87 \pm 0.85	7.57 \pm 0.13	5.12 \pm 0.04
Experimental (n=7), June	9.16 \pm 0.61	8.26 \pm 0.27*	4.93 \pm 0.03**

* and ** significant differences at $P < 0.05$ and $P < 0.01$, respectively, compared to May

No differences between total lipid content and fatty acids composition in pre- and post-treatment milk samples were defined (Table 2). The content of stearic acid in the samples of treated animals was only increased. The main active components of AyuFertin are special trienoic fatty acids that the body uses as precursors for the biosynthesis of prostaglandin. According to our results trienoic acids were not detected in the milk samples of the experimental animals in post-treatment period.

Table 2. *Total lipid content and fatty acids composition of milk samples from the experimental buffaloes in pre- and post- treatment period. Data are presented as Mean \pm SEM.*

Fatty acids, %	Capric acid	Lauric acid	Myristic acid	Penta-decanoic acid	11-hexa-decanoic acid	Palmitic acid	Elaidic acid	Stearic acid	Total lipid content, %
Pre-treatment period	1.95 \pm 0.56	3.40 \pm 1.02	14.06 \pm 3.52	1.20 \pm 0.91	0.68 \pm 0.09	41.54 \pm 3.18	22.87 \pm 4.37	14.45 \pm 0.77	34.61 \pm 4.11
Post-treatment period	1.02 \pm 0.18	1.77 \pm 0.15	11.56 \pm 1.35	0.58 \pm 0.05	0.83 \pm 0.06	38.61 \pm 2.11	26.23 \pm 2.73	18.22 \pm 1.01*	33.25 \pm 0.60

* $P < 0.05$

Conclusions

The treatment of the postpartum buffaloes with herbal preparation AyuFertin did not influence negatively the milk quality of the investigated animals. The main parameters of the milk control day as a milk yield, milk fat and milk protein are similar in the control and experimental groups in the post-treatment period. Slightly increase in the fat content and decrease in the milk protein are observed in the experimental group after treatment. No effect of AyuFertin on fatty acid composition in milk of treated animals is established. The samples differ only in amount of stearic acid. The containing trienoic acids in AyuFertin are not transferred into the milk of treated animals.

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4. Consumer attitudes towards farm animal welfare in Croatia: A review

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Introduction

In the past decades, farm animal production systems have rapidly changed, led by market demands for higher product quality and safety, better animal welfare, environmental protection and sustainability. Due to outbreaks of many food-borne diseases, food fraud and genetically modified food, greater attention is being paid to food quality and safety on the market, and consumers are ever more interested in the manner and procedures of food production. They want to know about the origin of food they buy and whether the animals were raised and treated in accordance with welfare standards. While poor animal welfare directly reduces product quality, consumer perception of animal welfare affects it indirectly by equating good animal welfare standards with good food quality standards. To date, only few studies examined the attitudes of Croatian consumers towards the issues related to animal welfare. The objective of this literature review was to provide and discuss the results of surveys conducted so far on consumers in Croatia about their perception of farm animal welfare and its importance for food production.

Results

The first study in Croatia on consumer attitudes towards farm animal welfare was conducted by Cerjak et al. The survey included 102 meat consumers from Zagreb. Study results revealed that a very high share of respondents (90%) believed that animal welfare was an important issue. However, only 40% of respondents stated they were thinking about animal welfare when purchasing meat or meat products. Almost all respondents (93%) stated to be willing to pay an extra price for animal welfare-friendly meat products. About one-fourth would pay up to 50% more for such products, and three-fourths of respondents would pay up to 20% additional price. Socio-demographic characteristics of the respondents did not influence their attitudes towards animal welfare and their willingness to pay an extra price for animal welfare-friendly products either. About one-third of respondents (31%) believed that farm animal welfare conditions in Croatia had improved over the past decade, 44% of them considered these conditions had even worsened, while others thought that animal welfare conditions remained unchanged in the last decade. Mijatović et al. conducted a survey on 187 consumers. Similarly to the results of the study by Cerjak

et al., the majority of respondents expressed high concern for farm animal welfare. However, most of them did not think about animal welfare when buying meat and meat products. Women paid more attention to farm animal welfare as compared to men. More than half of the respondents (55%) thought that meat produced in accordance with animal welfare standards had better quality as compared to classically produced meat. Consumers considered that they should be better informed on animal welfare issues and that society has moral obligation to maintain high farm animal welfare standards. They also believed that everyone should think about animal suffering and that animals should be able to express their natural behaviour. Accordingly, 24% of respondents were willing to pay 20% higher price for animal welfare-friendly meat products, and 37% were ready to pay 5%-20% higher price for these products. The authors concluded about the need of Croatian consumer education in order to raise their awareness towards farm animal welfare protection and its influence on meat quality. Knežević investigated student attitudes towards animal welfare and how they affected meat consumption. A study including 286 students showed that they had good understanding of the animal welfare concept but most of them did not consider animal welfare when buying meat and meat products. Students that expressed negative or neutral attitude consumed meat every day and considered themselves as great meat lovers, while those with positive and highly positive attitudes consumed meat less frequently. Students with more positive attitudes towards animal welfare were willing to pay more for animal welfare-friendly meat products. The study by Mikuš et al. included attitudes of 187 meat consumers surveyed on specific locations such as butcheries and farmer markets. The survey was conducted at the end of 2012 and beginning of 2013. According to study results, more than half of the respondents (63%) were familiar with the concept of animal welfare at the time of slaughter; 42% of these respondents stated to buy animal welfare-friendly products, mainly fresh meat and meat products. A high number of respondents (71%) were willing to pay higher price for animal welfare-friendly meat products. Household income had no impact on consumer willingness to pay more for animal welfare-friendly products.

Discussion and Conclusions

All identified studies used quantitative method for identification of consumer attitudes. Overall, the results showed that Croatian consumers were familiar with the animal welfare concept, considering farm animal welfare to be very important for food quality. The consumers had positive attitudes towards animal welfare-friendly products and were willing to pay an extra price for such products. However, most of consumers did not think about animal welfare when purchasing meat and meat products. All these studies were conducted before Croatia joining the European Union and focusing only on the consumer attitudes towards meat producing animal welfare. Therefore, more studies, including larger samples of respondents from different Croatian regions and other farm animal products (milk, eggs) are needed to examine more precisely the attitudes of our consumers towards farm animal welfare.

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5. Dynamics of Animal Welfare Officer Training in Croatia from 2015 to 2019

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Introduction

Experience from around the world shows that for the humane treatment of animals in slaughterhouses, next to the corresponding legislature, the education of personnel is indispensable. Beside on farm procedures, the most critical points for securing the animal welfare in the meat production, are handling during the loading and unloading, and all procedures regarding stunning and bleeding of the animals. European Commission (EC) recognized the problem and in 2009 published Reg. (EU) 1099/2009 on the protection of animals at the time of killing (Reg. 1099), which gave measurable parameters and introduced some substantial innovations in this field of animal protection. Reg. 1099 introduced novelty such as animal welfare officer, the certificate of eligibility, the compulsory assessment of stunning and the standard operating procedures (SOP) of the stunning phase. The goal of this paper was to present development and dynamics of Animal Welfare Officer Training in Croatia during last five years (2015 – 2019).

Materials and Methods

Croatia has started with training of slaughterhouse staff in early 2015, based on the training proposition presented as early as 2012. Training is organised as a two-day course with one day theoretical and second day of practical assessment based on video materials and discussions. All participants need to pass theoretical exam to obtain the certificate of eligibility, which is issued by Croatian Veterinary Chamber. During October 2019, data from the archives of Croatian Veterinary Chamber have been searched, collated and analysed to determine the total number of courses held and trained personnel in the period from 2015–2019. Data was grouped by several major parameters as follows: trainees – age, gender and country of origin; training itself – dynamics of training per year, total number of courses and average group size; and data regarding Food Business Operators (FBOs) location and size.

Results

A total of 169 slaughter man was trained in accordance with Reg. 1099. Large majority of the trainees were in the age groups 20-35 (31%) and 36-50 (48%) in comparison with two other age groups (<20=2% and 50+=19%). Only 8% of all trainees were females, and majority of trainees were native to Croatia (93%). During last five years in Croatia 21 course was held, and average group size of trainees per one course was 8. Dynamics of trainees trained per each year is presented in Figure 1.

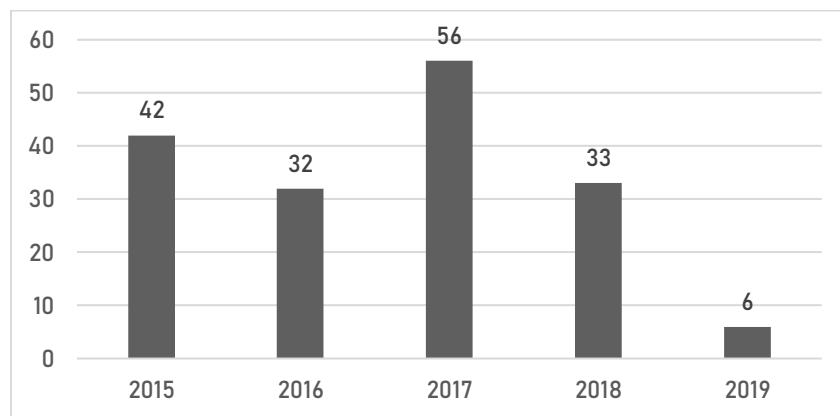


Figure 1. *Number of trained abattoir personnel in Croatia from 2015-2019.*

Two Croatian regions have been almost equally represented regarding FBOs distribution – central (41%) and south (40%), while eastern Croatia had only 17% share in total number. The rest of 2% referred to FBOs from other Member States (MS) which sent Croatian citizens to obtain the certificate of eligibility in their own native language. Out of total number, 31% of trainees came from industry wise slaughterhouses, while 69% were employed in small scale FBOs.

Discussion and Conclusions

In the period of 2013-2015 Food and Veterinary Office (FVO) of the EC published Overview report regarding Animal Welfare at slaughter in 13 different Member States (MS). In comparison with 13 MS evaluated in the report, as showed in this abstract, Croatia also has available training. Unlike practical forms of examination such to those conducted in four MS (Italy, UK, Germany and The Netherlands) which have been recognized as best practice for operator assessment, Croatian training only focuses on evaluation of theoretical knowledge of trainees similar to other evaluated MS. Developers of the Croatian training are upgrading the course at the moment, and it can be expected that the practical exam will be included in near future in the testing as a recommended method. Besides training of slaughterhouse staff, knowledge materials and training opportunities are also addressed to other key stakeholders (veterinarians and official veterinarians), which is in line with recommendation by contemporary literature on animal welfare training at slaughter. To conclude, during last five years majority of Croatian FBOs sent their employees to obtain certificate of eligibility regarding the Reg. 1099. In addition, Croatian training is in line with most trainings conducted in the EU, but trainers are upgrading the course as they recognized disadvantages in the current training.

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6. Public perception of stray dog population in six towns of Montenegro

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Introduction

Before developing stray dog population management interventions it is essential that the dynamics of the population are understood and measured objectively. Since the Authority for Food Safety, Veterinary and Phytosanitary Affairs (AFSVPA) planned to develop a National strategy for stray dog control that will define measures for stray dog population management for implementation at the local level by local authorities it was important to perform the initial survey to determine the main sources of stray dogs. In May 2018, the Ministry of Agriculture and Rural Development announced a public call for NGOs with the main aim of collecting data on the number of stray dogs in six selected municipalities in Montenegro, in central region: capital Podgorica, Cetinje and Nikšić; Kolašin in the north region and Kotor and Tivat in the south. Five NGOs have been awarded to conduct surveys: Ruka Šapi, Feniks, Nikšićko udruženje za zaštitu životinja, K9 Montenegro Svjetska zaštita životinja and Prijatelji pasa. Beside the survey looking at dog density and composition, the assessment also included a demographic survey with specific emphasis on ownership trends, owner attitudes and behavior, as well as interaction with stray dogs. The purpose of the survey was to gather baseline data that will be used for designing, planning and monitoring of local dog control interventions. This information will be utilized to set-up clear intervention objectives and indicators to monitoring and evaluate intervention progress. This part of the survey would also need to measure changes in human behaviour relating to dogs. The survey needs to be performed at regular intervals to monitor interventions and whether the measures are achieving desired results.

Materials and Methods

The technical input (specification) was prepared by the officials from the AFSVPA (competent authority for animal welfare), training has been organized by the experts of IPA project 2014 – Support to the veterinary services in Montenegro with the aim to transfer methodology for designing and conducting dog population management programs, developed by the International Coalition for Animal Companion Management (ICAM). The demographic survey participants were familiarized with the ICAM tool for monitoring and evaluation and were trained to conduct a public survey by using the questionnaire methodology. Questionnaire surveys were used to measure several indicators of improving dog welfare

such as public perception including attitudes and behaviour towards dogs. Questions were developed as part of the group activity and deployed in the free online tool KoBo Collect, developed by the Harvard Humanitarian Initiative, an open source suite of tools for data collection and analysis. The survey consisted of 30 questions, divided into three parts. The first group of questions requested information on respondent and household, the second group was related to dogs in the household and the third to abandoned dogs. The method was a face-to-face interview at the doorstep, the approximate length of the questionnaire was ten minutes. The specificities of different locations were taken into account and incorporated into the survey design. The activities were performed in March and April 2019.

Results and Discussion

Main results/outcomes from demographic survey with community views of the street dog populations are summarized below for all 6 municipalities. A total of 2,159 interviews were carried. When interpreting the results, it should be considered that the respondents were not required to answer each question, and that the values expressed as a percentage refer to the total number of surveys not to the number of answers on particular question. Over three quarters of respondents (79.57%) reported noticing abandoned dogs in their municipality, and 47% of the total percentage thinks that the number of stray dogs increased in the past year. Majority (52.43%) of respondents reported that they would not know whom to contact if they have a problem with stray dogs, but there is a good will to adopt dogs from the shelter, as indicated by 56% of citizens. Significant majority of 64% of citizens have a positive attitude towards stray dogs, which corresponds to the number of those who have not had problems with dogs and who would tolerate a dog treated in a shelter and released in their neighborhood (62.7%). Vast majority of participants stated that neither they nor someone from their household have experienced problems with stray dogs (63.8%). To the minority that has encountered problems with stray dogs (36.2%) a multiple answer option was given to identify problems which they encountered. They highlighted as follows – barking (67%), fear (40.5%), mess (23.8%), aggression (18.7%) and bites (14.6%). It is interesting to note that although they had encountered some problems with stray dogs, only 44.6% consider abandoned dogs themselves as the problem. Most respondents think that a shelter (36.2%) is the solution for strays, and they are also aware of the importance of responsible ownership (27.6%), while only 3.3% of respondents recognize euthanasia as the solution.

Conclusions

As observed throughout the survey results, Montenegrins are sensible and aware of the stray dogs' problems. With the baseline data presented in this paper, Republic of Montenegro will be able to set down a strategy and an action plan on how to deal with stray dogs on the streets of their cities. Furthermore, it is important to point out that citizens do understand that dogs themselves are not the problem, however the competent authorities will need to work more to raise awareness and educate citizens as they still do not know whom to contact when they encounter stray dogs.

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7. Welfare assessment of shelter dogs in Slovenia

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Introduction

Dog has been a reliable companion from the time human first started to domesticate animals. During a last half of a decade, care for animal welfare has improved and evolved. To unify and standardize the indicators of good animal husbandry, Welfare Quality and AWIN projects were launched. Based on those two projects, in year 2014 the IZSAM Teramo debuted a Shelter Quality protocol for shelter dogs, making data collected in different nation shelters comparable and repeatable. General public and modern society require for abandoned and stray dogs to be captured and detained in shelters in most European countries. Although Slovenia has a high adoption rate, dogs can be confined in shelters for a long time due to no-kill policy many shelters carry out. There was little research done in Slovenia, regarding welfare in dog shelters. In 2015 Cvetič analyzed and compared two Slovenian shelters just by their compliance with the state law. According to that pilot study, Shelter quality protocol proved to be not only easy to implement but also provided systematic data which could identify welfare weak points in certain shelter.

Materials and Methods

Shelter Quality Protocol was implemented on 8 Slovenian shelters, which presented 61.5% of the shelters in Slovenia. Locations of the shelters were equally distributed (Fig. 1), covering all country regions. The assessments were done in 5 days from 13th to 17th May 2019. Sample size varied from 4 to 25 assessed dogs per shelter in accordance to shelter size and number of housed dogs. The duration of individual shelter assessment ranged from 30 to 60 minutes. To provide unbiased scoring, the shelters were assessed by the same person, and the dogs were randomly chosen.



Figure 1. *Distribution of assessed Slovenian shelters.*

Results

Out of 13 Slovenian dog shelters, two of them were empty at the time of assessment, three of them were unwilling to cooperate although the anonymity was guaranteed. Out of 8 complying shelters, 2 of them were public and 6 of them were privately owned. There were 99 dogs assessed totally (mean 12.38 dogs per shelter, min 4, max 25), the largest share were young (40%) and 25% of them were geriatric dogs. The percentage of dogs lighter than 20 kg was 48%, which means there was almost an equal percentage of small and big dogs. Body condition was scored and the results show that most of the dogs had adequate body condition, 6% were too thin and 10% were overweight which indicates, that feeding habits and exercise levels of Slovenian shelters seem appropriate. Only 25% of shelters had exclusively indoor pen area, but provided daily exercise in outdoor fenced area. Assessed dogs showed almost no deviation from normal behavior, the recorded repetitive behavior was 4% and only 1% showed other compulsive anomalies. There was no observation of lameness and coughing, and the percentage of dirty animals was 4%. The majority of shelters had personnel specialized for behavioral problems resulting in 0.87% euthanasia's on yearly basis due to behavioral anomalies. Additionally, we observed and recorded emotional state of a dog (Table 1). Results show that half ($50\pm 0.21\%$) of shelter dogs in Slovenia were friendly. Data also show that $25\pm 0.15\%$ of housed dogs were nervous and $14\pm 0.12\%$ were recognized as anxious. The assessor did an aggression test, resulting in the majority of dogs (83%) showing no signs of fear or aggression (12% showed only fear while only 4% was scored as aggressive).

Discussion and Conclusions

We did the first objective assessment using a complex and repetitive protocol in Slovenia, which can now be served as a database for a unified comparison with other countries. Overall the data analysis showed no behavioral abnormalities in connection to poor management or available facilities. All shelters were aware of importance of physical exercise, providing regular walks or gated outdoor area. Feeding regime was also proven to be adequate, due to low rate of obese and slim dogs, all shelters providing special diet for puppies, geriatric and hospitalized dogs. By researching the husbandry of dogs in Slovenian shelters, it became evident, that dogs are in good mental and physical condition, possibly resulting in high

adoption rate. There were no signs of severe deviation from regulations. The protocol provided data that highlight the potential area of improvement such as more group housing for better socialization.

Table 1. *Emotional state scoring*

Emotional state	Emotional state index Mean \pm SD
Playful	0.28 \pm 0.20
Happy	0.37 \pm 0.27
Friendly	0.50 \pm 0.21
Confident	0.36 \pm 0.15
Nervous	0.25 \pm 0.15
Unsure	0.38 \pm 0.16
Anxious	0.14 \pm 0.12
Boisterous	0.31 \pm 0.22
Attention seeking	0.29 \pm 0.07
Alert	0.36 \pm 0.10
Quiet	0.20 \pm 0.13
Relaxed	0.31 \pm 0.19
Barking level	0.31 \pm 0.82

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8. Animal Welfare at Slaughter in Turkey

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Introduction

Protecting animal welfare at slaughter is about minimizing the pain, distress or suffering of the animals at the time of killing. Turkey has a large livestock sector with considerable numbers of slaughter animals. The slaughtering process in the country has been done according to the Islamic rules. Quality assurance systems based on HACCP are applied at many slaughter facilities. Present study analyses the current practices with regard to welfare issues both in poultry and ruminant slaughter facilities.

Materials and Methods

The current legislation, slaughterhouse licensing system, implementations, as well as Islamic viewpoint related to slaughter are reviewed and discussed in the study.

Results

In Turkey, poultry has successfully been stunned for many years, before slaughter. However, one of the most important welfare topics needing implementation in Turkey would appear to be the preslaughter stunning of ruminants. Although the slaughter facilities throughout the country have developed and modernized in terms of food hygiene, public and environmental health, one of the desirable practices for the welfare of slaughter animals is stunning.

Discussion and Conclusions

Despite the proclamation of the Religious Presidency of the Turkish Republic that stunning did not contravene Islamic rules, Turkish people are yet to openly back this directive. Religious authorities and animal scientists need to collaborate, informing people of the religion's true stance on stunning of the ruminants.

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9. The relationship between body temperature and egg production determined by a thermal camera in laying hens

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Introduction

High feed costs oblige culling to be practiced on a regular basis in layer hen flocks. If not culled, non-productive animals, which do not lay eggs but consume feed, reduce the profit of the commercial operation. The culling of low-producing hens not only reduces egg production costs, but also decreases disease incidence. Current methods used to cull non-productive chickens generally involve a subjective assessment. Non-productive animals are culled based on the individual inspection of their head (comb, wattles, eyes, eye rings, beak), abdomen, pubic bones and vent. Thermal imaging cameras are used in various areas, including among others, industry, construction, policing, rescue operations, border patrol, and human and veterinary medicine. Literature review has shown that, to date, culling practices aimed at increasing the egg yield of layer hens have been performed mostly using subjective methods. Generally, high-producing layer hens have high body temperatures due to their high metabolic rate. On the other hand, low-producing birds and broody hens have relatively lower body temperatures. In view of this information, the present study was designed to develop a more objective method for the culling of low-producing hens in egg farms with the use of thermal cameras.

Materials and Methods

This study was conducted at the layer hen premises of the Food and Livestock Research and Application Centre of Atatürk University. The animal material comprised sixteen 60-week-old hybrid layers of the Lohmann White and Lohmann Brown strains. The trial was continued for a period of 16 weeks. Eight hybrid layers of the Lohmann White (LW) genotype and eight hybrid layers of the Lohmann Brown (LB) genotype were housed individually in separate cages. The head and foot temperatures of the animals were determined using a thermal camera (Testo 855-2®). Measurements were performed on a weekly basis, at 9.30 am and 3.30 pm, on a selected day of the week, throughout the trial period. To avoid exposing the animals to stress, thermal images were taken at an approximate distance of 1 meter to the cages. The data obtained in this study was analyzed using the General Linear Model (GLM) procedure in the Statistical Package for Social Sciences (SPSS) software v. 19. Differences between the groups were determined with Duncan's Multiple Comparison Test. Cut-off values for egg yield and body temperature were determined by receiver operating characteristic (ROC) analysis. Results produced a 95% confidence interval for the area under the ROC curve (AUC).

Results

In order to determine whether or not a meaningful correlation existed between morning head temperature and egg yield in the LB and LW hybrids, a ROC analysis was performed. Accordingly, it was ascertained that hybrid layers with a morning head temperature of 38.3°C and above had a relatively higher egg yield, and this difference was found to be statistically significant (Figure 1). ROC analysis demonstrated that the correlation between morning foot, midday head and midday foot temperatures and egg yield was statistically insignificant ($P > 0.05$). Descriptive statistical data are presented in Table 1.

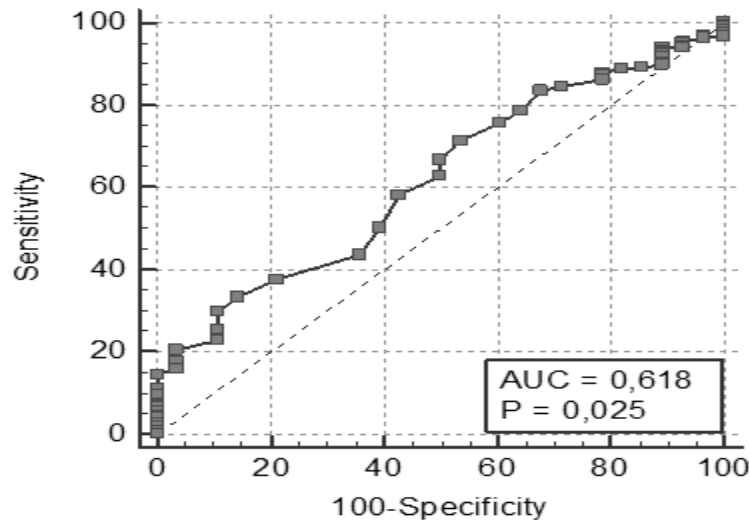


Figure 1. Cutting point corresponding to highest sensitivity and specificity values (morning head temperature-egg yield).

Table 1. Descriptive statistics of Roc analysis

Descriptive statistics	MHT	MFT	AHT	AFT
Area under the curve	0.618*	0.544	0.579	0.511
Standard error	0.053	0.06	0.05	0.05
Confidence limit %95	0.55-0.68	0.48-0.60	0.51-0.64	0.44-0.57
Z value	2.247	0.752	1.477	0.270

*P(Area=0.5)

MHT= Morning Head Temperature, MFT= Morning Foot Temperature, AHT= Afternoon Head Temperature, AFT= Afternoon Foot Temperature.

Discussion and Conclusions

It is considered that morning head temperatures would be more useful in determining the correlation between body temperature and egg yield. The greater standard deviation of foot temperatures reduces the precision in determining a correlation between body temperature and egg yield using foot temperature values. Furthermore, it is known that, in hens, conductive heat loss occurs at a higher level in the feet. Moreover, poultry house temperature, and thereby, cage temperature having effect on foot temperature may result in the correlation between foot temperature and egg yield being misleading. In conclusion, it is considered that the morning hours are the best time of the day for the measurement of body temperatures intended to be used in establishing a correlation with the production yields of animals.

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10. The incidence of tail biting in the Greek pig industry: Scientific evidence vs. farmers' attitudes

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Introduction

Tail biting is an abnormal behavior of pigs that consists a major welfare and economic issue for pig farming. Although it has been years since the European Commission banned tail docking on a routine basis, a significant percentage of pig farmers apply it as the only practice to minimize the risk of tail-biting. The aim of this study was twofold: (a) to identify the incidence of tail biting behavior in the Greek pig industry, and (b) to obtain a better understanding of Greek pig farmers' attitudes with regard to tail biting.

Materials and Methods

With the aim to get better insight into the incidence of tail biting in Greek pig industries, a retrograde study was done at a medium capacity slaughterhouse in Pieria region. Pigs (about 1.000,00 animals) were scored regarding the intensity of tail lesions (score 0 – no tail lesion, scores 4 tail lesion). The assessment was done on the slaughtering line, after exsanguination of the pigs and before the skin removal. Farmers' attitudes were collected using a structured questionnaire sent through the local veterinary services in hard copy and also by farmers' national association via an online form.

Results

The results showed that tail biting is an actual issue in pig production in Greece. Tail biting was found in almost 50% of the tested pigs. The most often tail damage detected were minor and mild skin lesions (scores 1 and 2), while moderate and severe (scores 3 and 4) were rarely detected. As for farmers, preliminary results (28 farmers) report very low figures of tail biting to their farms while claiming themselves to be capable of tackling the problem successfully if to be presented to their farm. An interesting finding is that enrichment material is still not recognized as an important factor in preventing tail biting (56% of respondents). High incidence of tail biting was anticipated when trying to keep undocked pigs based mostly on previous attempts. This may explain why pig farmers are so reluctant to raise pigs with intact tails. The vast majority of Greek pig farmers (80.8%) identified the length of the tail as a main risk factor for tail biting while 69.2% of them believe pigs do not feel pain when they are docked, a result that should be taken into account when information campaign strategies are developed.

Conclusions

Attitudes of Greek farmers toward tail biting and tail docking are controversy to scientific findings. As European Commission considers monitoring of tail biting in abattoirs an essential part of national action plans and under the threat of infringement procedures, it is important to set up a practical monitoring scheme in abattoirs in order to understand by data the real incidence of tail biting. Moreover, the data derived by such scheme could be used as a feedback to Greek pig farmers in order to help them identify the problem and later tackle with it.

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11. HERMES: An Erasmus+ project aiming to harmonization and recognition of Laboratory Animal Science education and training in EU member States

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Introduction

Laboratory Animal Science Education & Training (LAS E&T) among EU member states creates a challenge, well described by the Directive 2010/63/EU, to develop and recognize common principles, requirements and quality standards for LAS E&T.

HERMES Consortium-Duration-Aims

The HERMES project, entitled 'HARMONISATION & RECOGNITION OF LAS EDUCATION AND TRAINING IN MEMBER STATES', is the first cooperation at the EU level among stakeholders involved in the LAS E&T that aims to develop and test methodologies and tools to achieve harmonization and mutual recognition of E&T programmes in EU Member States. The project referred above has a duration of 36 months. It started on 01/09/2017 and ends on 31/08/2020. Members of the HERMES consortium are the Istituto Zooprofilattico Sperimentale dell'Abruzzo and Molise G. Caporale (IZSAM; leading partner), the University of Murcia (Spain), the University of Uppsala (Sweden), the Veterinary Research Institute of the Hellenic Agricultural Organization (HAO, Greece) and the Veterinary Continuous Education in Europe (VETCEE, an independent European accreditation organization, Brussels). HERMES main priority is to promote transparency and recognition of skills and qualifications of all non-regulated professionals, involved in the use and care of animals that serve scientific purposes, throughout the EU. In this context, HERMES has undertaken the obligation to design, test and validate a common certification, capable of promoting the free movement of competent personnel in EU member states, based on the development of an innovative multilingual 'digital certificate' for the recognition and validation of learning outcomes.

HERMES Methods

In order to achieve these goals, HERMES intends to propose a new model to plan and manage LAS E&T in EU, through:

- the definition of European quality standards for vocational eLAS E&T
- the assessment of LAS E&T providing organisations and the training they offer
- the harmonisation of the LAS E&T programmes in the EU
- the adoption of a common knowledge, skills and abilities certification scheme for the promotion of free movement of competent personnel within the EU territory.

Moreover, the HERMES project has undertaken the obligation to develop and test, through a blended approach, a web-learning course as an appropriate tool that could help balance practical and theoretical knowledge, as well as to take advantage on the use of ICT.

HERMES Expected results

The results of the HERMES project will respond to the training needs emerging from the Directive 2010/63/EU. Member States could take advantage, through HERMES results, in their effort to ensure, through authorization or by other means, that staff is adequately educated and trained. At national level, HERMES could be used to ensure satisfaction of conditions set by the Directive on the protection of animals used for scientific purposes.

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12. Fur farming in Greece: Animal welfare and economic implications

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Introduction

In Greece, fur farming is currently an outward-looking sector attracting the interest of a growing number of investors, notwithstanding the economic crisis. The aim of this paper is to discuss the status of animal welfare of fur animals in Greek farms together with the impact of this activity on the economy.

Animal welfare implications

The welfare of animals kept for fur production, like other subjects considered by the committee, raises ethical issues. With respect to the welfare of mink, the report of the EC Scientific Committee on Animal Health and Animal Welfare concluded that there is an average kit mortality of about 20%, and a yearly adult mortality of 2-5%. Stereotypies are widespread on mink farms and concluded by the largest study conducted, the number of affected females varied between 31 and 85% on different farms. Furthermore, minks in farm cages may show sucking or biting of their tail fur, and biting of other parts of their pelt. Self-mutilation of tail or limb tissue occurs, but its prevalence is unknown. In experimental conditions, farm minks show strong preferences for the opportunity to swim. The report concludes that the typical mink cage impairs mink welfare because it does not provide for important needs.

In Greece, fur farms are subjected to annual inspections by the competent authorities, based on Directive 98/58/EC concerning the protection of animals kept for farming purposes and on the Recommendation of the Council of Europe concerning fur animals adopted by the Standing Committee on 22 June 1999. Greek fur farmers comply with European statutory certification and animal welfare requirements. They also participate in Welfur programme designed to assess animal welfare, train breeders and to ensure transparency for consumers, the aim being to ensure that animals are properly treated on European farms. On the other hand, the debate on whether fur animal production should be allowed is opened with regular intervals. The included arguments is related to both ethics and animal welfare, and in some European countries, the production of fur animals is banned or in the process of being phased out.

Economic implications

Fur farming involves the production of mink (*Mustela vison*) fur and mainly takes place in the region of Western Macedonia, particularly in the prefectures of Kastoria, Kozani and Grevena. According to figures for 2015 from the Ministry of Agricultural Development and Food, there are 123 fur farms in Greece in total and this with exports exceeding EUR 280 million in value, providing over 7.000,00 jobs. This is of critical importance for Greek economy at the Epirus-Western Macedonia in which the highest unemployment rates have been recorded in 2019 (19.7%). The main export countries for fur products besides Greece are Russia and the United Arab Emirates. Fur production in Greece has been increasing over the past ten years. However, due to the severe political issues in Ukraine, the fur sector in Greece is facing a hard time.

Conclusions

Documenting and improving animal welfare on fur farms is important for the Greek fur industry and the sustainability of the sector.

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13. Farm animal welfare as an important element of the Circular Economy concept: The GLYC2BIOD perspective

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Introduction

Circular Economy concept refers to a new economic development model that benefits businesses, society and the environment, aiming to decouple growth from the consumption of finite resources. Circular Economy initiative was adopted in 2015 by the European Commission initially focusing on an ambitious program of actions and goals that would lead to the reduction of waste and the promotion of recycling/reuse. It soon became evident that Circular Economy encompasses three basic principles: phasing out waste production and pollution, keeping products and materials in repeated use, and regenerating natural systems. At first look, animal welfare seems to constitute a potential problem for the concept of Circular Economy, more specifically as related to the economic profitability of agricultural systems; maintaining current animal welfare standards necessitates higher production cost or/and reduced productivity. For example, it is estimated that the extra environmental and welfare cost for pig-meat production in European Union (due to EU legislation) is approximately 4.0 - 10.0 EUR per 100 kg of abattoir weight compared to Brazil and USA. Along the same line, the environmental and the economic sustainability of employing the best available practices during transport of living animals, which e.g. recommends the use of highways and motorways instead of country roads despite longer travel routes, does not become easily apparent. The aim of this paper is to note the importance of farm animal welfare as one of the main elements of the Circular Economy concept and present GLYC2BIOD project as an example of this approach.

The Circular Economy - Animal Welfare nexus

A closer look on the interconnections between the concepts of Circular Economy and animal welfare reveals that in the case of animal husbandry, adoption of Circular Economy concepts disregarding animal welfare issues may be problematic or even dangerous. The Bovine Spongiform Encephalopathy (BSE), believed to have been spread from feeding young calves meat-and-bone meal, is an excellent paradigm of how a Circular Economy practice may end-up as a disaster, significantly compromising apart from animal health and welfare, human health and environmental quality. Surprisingly, there are not many studies that consider the whole Circular Economy - Animal Welfare nexus, possibly due to the need for collaboration of different researchers from distant scientific areas. At the same time, adoption of best animal welfare practices should be also regarded from the standpoint of environmental and economic sustainability. Less intensive farming, promoting mixed agriculture and animal welfare practices (e.g. free-range, organic production systems etc.), contribute to the overall sustainability of primary production, through closed-loop nutrient recycling, soil regeneration, reduced water contamination etc. Lybaek and Kjaer studied the Circular Economy - animal welfare nexus in the case of substituting sand bedding in dairy cow stables and its effect on the performance of the subsequent manure treatment in an anaerobic digester, as well as on the animal bedding. The results suggest that manure fibers are beneficial for animal

welfare, and enhance biogas production results in a more sustainable farming system. However, enhancement of ventilation process should be carefully considered to reduce the ammonia level resulting from the use of manure fibers. Zarantoniello et al. studied the use of *Hermetia illucens* insects (black soldier fly) reared on organic by-products in aquafeeds production in various inclusion rates (e.g. 0, 25, 50, 75 and 100%) in the fish meal. Results showed that the 50% inclusion rate presented the best case concerning both aquafeed sustainability and fish growth and welfare. Higher inclusion rates were correlated with severe health effects (e.g. hepatic steatosis) and higher stress and immune response markers.

The GLYC2BIOD project perspective

GLYC2BIOD is a three-year, interdisciplinary project that aims to develop a technically and economically viable process to valorize crude glycerol, resulting as a by-product of biodiesel production, through novel biotechnological methods, to produce biolipids and a protein-rich fodder supplement. The biotechnological process comprises the use of oleaginous microorganisms (e.g. *Yarrowia lipolytica*) that produce and accumulate significant quantities of biolipids within their cells, using crude glycerol as substrate for their growth. The efficiency of biolipids production is enhanced through manipulating their metabolic profiles with advanced genetic engineering methods, and cultivation under specific conditions in novel membrane bioreactors, integrating microorganism cultivation and separation in one process stage. Biolipids will be recovered and used as raw material for 2nd generation biodiesel production. Furthermore, the yeast cells, after biolipids recovery, will be assessed as a protein-rich fodder supplement, that can substitute part of the current protein sources (imported soymeal) of broiler feeds.

Yarrowia lipolytica can be produced locally using agro-industrial by-product streams and has significant potential as a more sustainable protein source, significantly reducing the environmental impacts of animal feeds, which are currently based on imported soybean meal from South America, cultivated in vast monocultures on land obtained via deforestation. *Yarrowia lipolytica* and its fermentation products are Generally Recognized as Safe (GRAS) by the American Food and Drug Administration (FDA) and various studies have shown that inclusion of *Yarrowia lipolytica* in the diet of productive animals has a positive effect on their health and performance. In the context of GLYC2BIOD project, feeding trials are planned to be performed in broilers at different inclusion rates. The health and welfare of broilers, and their growth performance will be closely monitored, whereas the quality of the produced meat will be assessed based on both quantitative indices (e.g. meat color, fat content and lipids profile etc.) and qualitative (sensory) trials.

In conclusion, the GLYC2BIOD project takes into consideration the Circular Economy - Animal Welfare nexus and aims to capitalise on Circular Economy practices, improving sustainability of both the biodiesel industry and animal production, taking at the same time into consideration ethical issues related to animal health and welfare.

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14. The impact of heat stress and the resulting seasonal differences in the animal welfare assessment findings in small scale dairy tie-stall farms

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Introduction

Small-scale, family-run dairy farms with tie-stall systems are still predominantly used in the Balkan region. The rise of animal welfare (AW) concerns regarding the housing and management conditions in these farms opens the need for its assessment. The well-known Welfare Quality Assessment Protocol uses mostly animal-based measures and is suitable to be carried out in small-scale dairy farms. Thermal stress in dairy cows is considered as a major health, production and welfare issue especially in the Balkan region i.e. in continental and subtropical climates. Thus, hot summer season might have major role in heat stress of dairy cows kept in small-scale tie-stall farms. The negative effects of heat stress on the health and biological functioning such as reducing milk production and reproductive performance, as well as compromising the affective state in dairy cows, instigate the detection of seasonal impact on cattle's welfare. Furthermore, the air quality including the high concentrations of noxious gasses may vary seasonally and potentially can harm the general welfare of farm animals. Therefore, the objective of this study was to identify seasonal differences (winter versus summer) in animal welfare in tie-stall small-scale farms and to detect potential welfare indicators for heat stress in dairy cows.

Material and Methods

In total 16 dairy farms from Kosovo and Macedonia with tie-stall system and with up to 34 cows were involved in this study. All farms were assessed twice, once in the winter and once in the summer season. The Welfare Quality Assessment Protocol for Dairy Cattle was performed in both seasons in the farms. The inside and outside ambient temperature was measured three days before conducting the welfare assessment protocol in order to determine the climatic and ambient conditions. This was achieved by mounting one temperature logger outside and three loggers inside the farm (at both ends, as well as in the middle of the building), and recording the temperature in all loggers at 10-minute intervals. For determining the standing and lying behaviour in different seasons, accelerometers were attached on up to eight cows per farm on their right hind leg for up to 72 hours. Additionally, the relative humidity and concentrations of NH₃ and CO₂ in the ambient air were measured using suitable instruments, RAE[®] and TESTO[®].

For standing/lying behaviour, the Kolmogorov-Smirnov Test for comparing the data between seasons was carried out and for the paired data (data from animals which had been sampled in both seasons) the Wilcoxon Matched Pairs Test was used. For comparing the differences of measures in the farms between winter and summer season the Sign test was used. The associations between the outside air temperature and the measurements inside the farm were assessed using Spearman Rank Order Correlation.

Results

During the study, the outdoor air temperature exceeded 20°C ($T > 20^{\circ}\text{C}$) was measured 13.8 ± 16.4 times in winter versus 272.6 ± 106.5 times in summer. Similar differences were found for the inside air temperature where $T > 20^{\circ}\text{C}$ was detected 30.5 ± 115.4 times in winter versus 729.0 ± 442.2 times in summer. The average lying time of the dairy cows in winter was 12.2 ± 2.7 h, while it was shorter in summer with 11.7 ± 2.8 h ($P < 0.05$). Moreover, the number of lying bouts was lower in winter than in summer (pairwise comparison; Figure 1). The mean relative humidity was $70.2 \pm 11.6\%$ in winter and $55.2 \pm 9.1\%$ in summer ($P < 0.05$). The mean concentrations of CO_2 were 1390 ± 866 ppm in winter and 895 ± 276 ppm in summer ($P < 0.05$). There was no such difference for ammonia, for which the concentrations were similar in winter (2.9 ± 4.1 ppm) and summer (3.0 ± 4.2 ppm). Considering the AW measures from the Assessment Protocol, the only seasonal differences were found in: i) the frequency of coughing which was 2.6 times higher in winter than in summer; and ii) the percentage of animals with vulvar discharge with $7.7 \pm 8.1\%$ in winter compared to $5.0 \pm 5.5\%$ in summer.

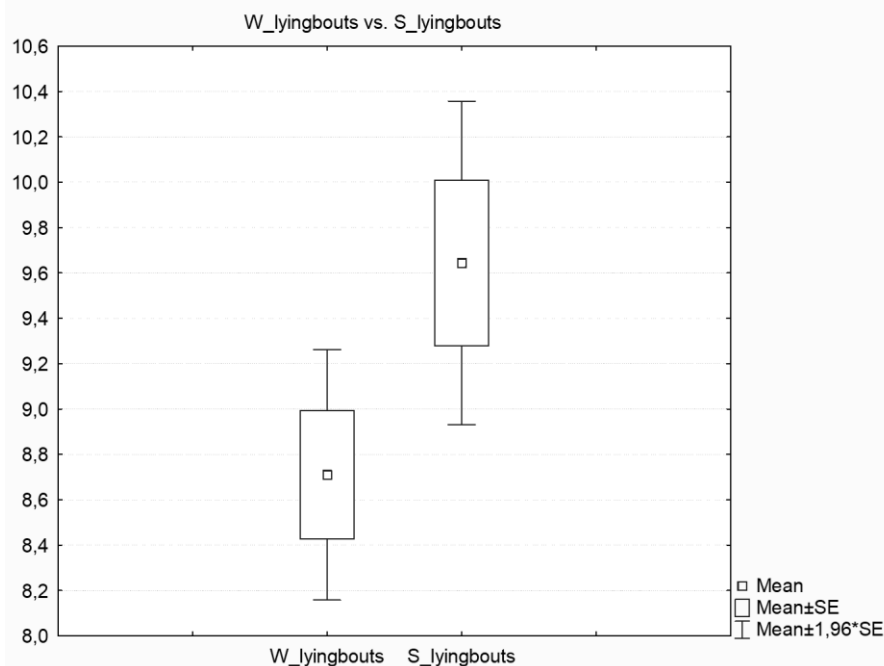


Figure 1. Pairwise comparison of number of lying bouts/24 hours in winter (W) and summer (S) seasons in dairy cows.

Discussion and Conclusion

The results concerning air temperature and relative humidity suggest that dairy cows housed in small scale tie-stall systems/managements are exposed to mild to severe heat stress during the summer season. The increased CO_2 concentrations during the winter period indicate a low ventilation rate of the buildings, contributing to poor indoor air quality during the winter period. However, the NH_3 concentration in the indoor air was similar in both seasons, suggesting that these concentrations are mostly related to the manure management system or other factors rather than season. The absence of seasonal differences in the measures from the AW assessment protocol, confirms its high consistency and eligibility to be carried out in different seasons. The higher coughing frequency in winter could be considered as an indicator of poor air quality. A higher incidence of vulvar discharge in winter might be related to the period of heat detection and conception time (mostly in winter and spring, instead of summer) with consequently higher incidence of vulvar discharge after calving. However, it can be questioned, whether the present AW

Assessment Protocol is sensitive enough to detect heat stress and the resulting welfare implications in dairy cows.

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15. The welfare of laying hens kept in enriched cages and aviary systems

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Introduction

The housing system has a big influence on animal welfare. The aim of this paper was to show how housing systems (enriched cage and aviary system) impact some of welfare parameters for laying hens. Plumage condition, skin lesion, footpad lesions, comb pecking wounds, bumble foot and claw length were measured on layers kept in enriched cages and aviary system.

Materials and Methods

The research was carried out on beak-trimmed Lohmann brown hens in the middle of the production cycle in two different production systems, enriched cage and aviary system. Each flock was visited around 40 weeks of age. During visit 100 hens were randomly selected from each housing system and were examined for plumage condition, skin lesion, footpad lesions, comb pecking wounds, bumble foot and claw length. The plumage condition was scored out of a 6 points, which was a sum of the scores for the neck, breast, wings, tail, back and cloaca/vent. The scoring criterion for each part was ranged from 1 (severe feather damage) to 4 (perfect feather coverage), and bumble foot were scored according to Tauson et al. The footpad lesions were recorded according to Ekstrand et al. Methodologies for other welfare parameters were adapted from some of the procedures presented in the Welfare Quality® Assessment Protocol for Poultry.

Results

The results of the investigation are presented in Table 1. Production system had a significant effect on plumage condition. There was no significant effect of production system on skin lesion, footpad lesions, comb pecking wounds, bumble foot and claw length. The layers kept in aviary system had significantly less plumage damage on wings than bird from enriched caged, in the middle of the production cycle.

Discussion and Conclusions

Overall, the hens in enriched cages had slightly poorer welfare conditions than in the aviary system. However, there is a need for further research to investigate the welfare of layers on the end of laying period.

Table 1. Average value with standard deviation for the plumage scoring of the different body region and skin lesion, footpad lesions, comb pecking wounds, bumble foot and claw length (%).

	Housing system			
	Enriched cage		Aviary system	
Plumage condition	Mean	SD	Mean	SD
Neck	4.00	0.00	4.00	0.00
Breast	4.00	0.00	4.00	0.00
Wings	3.10*	0.42	3.90*	0.56
Back	4.00	0.00	4.00	0.00
Cloaca	4.00	0.00	4.00	0.00
Tail	3.80	0.99	4.00	1.00
Skin lesion	0.00	0.00	0.00	0.00
Footpad lesions	0.30	0.92	0.20	0.88
Comb pecking wounds	0.20	0.92	0.10	0.93
Bumble foot	0.00	0.00	0.00	0.00
Claw length	0.00	0.00	0.00	0.00

* $P < 0.05$

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16. Opportunities and challenges of animal welfare in a Bathan in Bangladesh

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About 20,000 cattle are reared in a Bathan in Bangladesh for milk purpose. A Bathan can be said as a 'Ranch.' The Bathan has been founded on about 1,500 acres of pasture beside river Goala. River Goala is popularly known as 'River for Cattle' because cattle drink, bath and swim in Goala, moreover, the river is used for transporting milk, cattle feed and farmers, cowherds, veterinary doctors to Bathan. Traditional cattle husbandry is practiced here and 100% natural resources are used for rearing cattle. Basically cattle live on foraging in pasture and that covers about 80% feed needed by cattle, about 10% dry straw is used as dry matters and 10% cereal serves to ensure balance diet. Cattle drink optimally in river Goala. Cattle live under open sky, thus ventilation is open with fresh air. Everyday cattle have to walk 3 to 4 km for foraging and this gives good exercise to cattle, for that cattle have good digestion and good absorption and utilization of nutrients and cattle have good health. Calf caring is unique here; up to 30 days newborn calves suck mother's tits, then up to 60 days they are served by soft cereals, then they are taken to pasture to learn foraging. Traditional farming ensures excellent health and welfare to cattle in Bathan, but two major factors stand as potential threats to cattle health; these are diseases and climate.

Bathan is epidemic with FMD as a common cattle disease in the world, about 25-30% vaccinated cattle become infected with FMD, the disease in vaccinated cattle seems to be caused for huge cattle movement inside country and cattle influx through neighboring borders, that might bring new virus strain. BQ, Anthrax and HS are not so much reported here. About 10-15% mastitis occurs here. About 15-20% early lactating cattle suffer from milk fever and 3-4% of them die of it. Major climatic factors are flood and cold waves. Yearly occurrence of monsoon flood for about 2-3 months pose animals to suffer from feed and shelter. As welfare advocacy, farmers are advised to replace cattle to dry and high land and to supply sufficient maize and wheat crash as these are reasonably found available. They are advised to supply straw with molasses and trace amount of urea along as substitute of fodder, this feeding alternative keeps cattle healthier and productive during flood. Severe cold wave during winter is another climatic suffering to cattle, this time cattle suffer from seasonal flu, that impact on health and production and the problem can be minimized only by medical aid. This Bathan produces 64 million liters of milk per year and this is a place, where thousands of cattle are living in nature since centuries. Despite huge welfare opportunities, cattle suffer from disease and climatic events and these are the challenges for welfare activists.

