

DETERMINATION OF NEW WELFARE AND STRESS INDICATORS OF THE ANIMALS ON CATTLE AND PIG FARMS BASED ON DIFFERENT PUBLICATIONS

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Abstract: In recent years, numerous plans and programs, instructions, recommendations, scientific opinions, analyses, reports, best practices, regulations, codes of practices and assurance schemes have been published in publications which were not published in journals and symposiums proceedings that consider indicators of welfare and stress of the animals on cattle and pig farms intending to improve their health and productivity. These indicators were created mainly as results of research in numerous national and international projects. Mentioned projects consider key indicators and prescribe on-farm assessments of animal welfare and stress in cattle and pig farms. In the assessments of the welfare and stress of the animals in different systems of keeping and accommodation, the need to determine new welfare and stress indicators on cattle and pig farms was observed. The publications about plans and programs, instructions, recommendations, scientific opinions, analysis, reports, best practices, regulations, code of practices and assurance schemes related to animal welfare and stress contain numerous indicators. The analysis of these publications aims to determine the main characteristics of the existing and to generate ideas to define new welfare and stress indicators of the animals on cattle and pig farms.

Key words: cattle, pig, welfare indicators, stress indicators, publications

Introduction

Numerous scientific projects and publications such as monographs, textbooks and doctoral dissertations have considered the welfare and stress of cattle

and pigs in different production systems. Based on the tangible results of those projects and detail descriptions in publications in recent years, numerous plans and programs, instructions, recommendations, scientific opinions, analyses, reports, best practices, regulations, codes of practices and assurance schemes for farmers, veterinary and animal science experts, as well as for policymakers were defined. Also, numerous regulations and guides have been published describing the abovementioned aspects of cattle and pig welfare and stress.

Mentioned projects and related publications consider key indicators and prescribe on-farm assessments of animal welfare and stress in cattle and pig farms. Although numerous indicators were identified in the assessments of the welfare and stress of the animals in different systems of rearing and accommodation, the need to determine new welfare and stress indicators on cattle and pig farms was observed. The paper analyses the most important publications, which were not published in journals and symposium proceedings, in which the main characteristics of the existing and generate ideas to define new welfare and stress indicators of the animals on cattle and pig farms are determined.

Cattle and pig welfare law regulations

In the publication by *Hild and Schweitzer (2019)* as editors of *Animal Welfare: From Science to Law*, detailed information on animal welfare and stress as taken into account by law around the world (acts, directives, regulations, etc.), recommendations, scientific opinions, plans and programs and other aspects of animal welfare and stress are presented in various topics. In the same publication, the European Union legislation on animal welfare by *Simonin and Gavinelli (2019)* is presented. An overview of laws and regulations on animal welfare in our country can be found in the publication "Ten Years of the Law on Animal Welfare of the Republic of Serbia" by *Stojanović (2019)*. A prominent place in these publications in this regard is the mentioned aspects related to the welfare of cattle and the welfare of pigs. They contain the principles and concepts for defining regulations, as well as the provisions of welfare regulations that serve as a basis for defining reliable indicators.

In Council directives (1. Council Directive 98/58/EC of 20 July 1998 concerning the protection of animals kept for farming purposes were adopted for the welfare of pigs and cattle; 2. Council Directive 2008/119/EC of 18 December 2008 laying down minimum standards for the protection of calves; 3. Council Directive 2008/120/EC of 18 December 2008 laying down minimum standards for the protection of pigs) and Council regulations (1. Council Regulation (EC) No 1/2005 of 22 December 2004 on the protection of animals during transport and related operations and amending Directives 64/432/EEC and 93/119/EC, 2. Regulation (EC)

No 1255/976 and 3. Council Regulation (EC) No 1099/2009 of 24 September 2009 on the protection of animals at the time of killing) contain direct or indirect indicators of the welfare of different categories of cattle and pigs.

Projects related to the welfare and stress of cattle and pigs

In our country, two significant projects were realized in connection with the generation of ideas, principles and concepts for defining the new welfare indicators of cattle and pigs which the project managers were the authors of this paper. In the first project (*Projekt 26/13*), in 2007 and 2008, the aspects of reviewing and implementing minimum standards of growing conditions and welfare on ruminant farms were considered in this regard. In the second project (*Projekt TR 20110*), from 2008 to 2011), aspects of the development and implementation of welfare and biosecurity standards to improve the technology of cattle and pig production were discussed. In addition, as members of the MC, the authors of this paper participated in two COST actions. In the first *COST Action CA15134*, from 2016 to 2020, the relevant aspects of synergy for preventing damaging behaviour in group-housed pigs and chickens were considered, and in the second *COST Action CA21124*, which is ongoing (from 2022 to 2026), the aspects lifting farm animal lives – laying the foundations for positive animal welfare. At the international level, the Welfare Quality® project (*Canali and Keeling, 2009*) is of great importance for the consideration of welfare indicators. The numerous categories of indicators listed in these projects can mainly be divided into animal-based, resource-based and management-based.

Textbooks and monographs related to the welfare and stress of cattle and pigs

In the monograph on the stress of domestic animals (*Hristov and Bešlin, 1991*), indicators of welfare and stress related to the health of animals, productivity, physiological changes in organisms and biochemical changes in the blood of animals, normal and abnormal behaviour, the relationship between the intensity of rearing and behaviour, experimental causing stress in animals, opportunities to choose the environment and behaviour of the animals in a specific environment are described. The genetics of stress syndrome is described in the monograph by *Stanković et al. (1992)*.

The chapters of the monographs listed as references in this paper describe the growing conditions, welfare and health care of animals in organic livestock production (*Hristov and Relić, 2005*), microclimatic and hygienic conditions for raising cattle (*Hristov et al., 2006*) and the welfare of dairy cattle on farms (*Hristov*

and Stanković, 2016). The textbooks listed as references in this paper describe farming conditions, stress and welfare of farm animals (Hristov, 2002), health care of domestic and farmed animals (Hristov and Stanković, 2021) and behaviour, welfare and protection of animals (Vučinić, 2006). The textbooks by Webster (2005), Vučinić (2006) and Broom and Fraser (2015) are particularly important, which discuss domestic animal behaviour, stress and welfare along with numerous aspects of determining welfare and stress indicators in different categories of cattle and pigs.

Doctoral dissertations related to the welfare and stress of cattle and pigs

The realized doctoral dissertations of the authors of the paper as candidates or mentors to doctoral students in our country represent a special contribution to deepening the understanding of indicators of welfare in cattle and pigs. In this sense, important are the doctoral dissertations on the influence of the way of keeping and some physiological conditions on the blood parameters of heifers and cows (Hristov, 1992), the assessment of the quality of welfare on dairy cow farms (Ostojić - Andrić, 2013), the influence of lameness on the milk yield of Simmental cows (Zlatanović, 2015) and the influence of rearing conditions and the season of birth on the welfare of calves in the first month of life (Samolovac, 2016). When it comes to the welfare of pigs, in the doctoral dissertation by Živković (2023), the influence of body weight, tryptophan levels and certain environmental factors on the behaviour and production results of piglets during the confinement period was considered.

Indicators of welfare and stress of cattle and pigs in scientific opinions and code of recommendations

It is considered that the abovementioned Council directives and regulations are out of date in certain aspects, and that is why the scientific opinion of the experts of the EFSA Panel on Animal Health and Welfare (AHAW) is needed. That is why methodological guidance for the development of animal welfare mandates in the context of the Farm to Fork Strategy was defined by the *EFSA AHAW Panel (2022)*. In this methodology, the importance of animal-based measures (ABMs) is particularly emphasized.

In scientific opinion (EFSA, 2022) experts EFSA Panel on Animal Health and Welfare (AHAW) focused on the welfare of all categories of pigs on farms based on numerous literature data and expert opinions. The most relevant husbandry systems used in Europe were taken into account. For each system, highly relevant welfare consequences were identified, as well as related ABMs,

and hazards leading to the welfare and stress consequences. In addition to ABMs, resource-based and management-based indicators were considered in terms of mutual conditionality.

The overall effects of farming systems on dairy cow welfare and disease, in which the indicators used for assessment of welfare and disease are listed by the experts of the AHAW panel (*EFSA, 2009a*) were described. In the same year (*EFSA, 2009b*) the scientific opinion on the risk assessment of the impact of housing, nutrition and feeding, management and genetic selection on behaviour, fear and pain problems in dairy cows was discussed in detail with relevant indicators. This was followed by a scientific opinion (*EFSA, 2009c, 2009d*) on the risk assessment of the impact of housing, nutrition and feeding, management and genetic selection on metabolic and reproductive problems in dairy cows and the risk assessment of the impact of housing, nutrition and feeding, management and genetic selection on leg and locomotion problems in dairy cows with associated indicators. When it comes to indicators, the scientific opinion on the use of animal-based measures to assess the welfare of dairy cows (*EFSA, 2012*) is of particular importance.

In considering the welfare of calves, fifteen highly relevant welfare consequences were identified by the AHAW panel of *EFSA (2023)*, the most significant of which are respiratory disorders, inability to perform exploratory or foraging behaviour, gastro-enteric disorders and group stress. In this regard, adequate indicators for assessing the welfare and stress of calves are proposed. Also, recommendations are given to improve the welfare of calves, which include increasing space allowance, keeping calves in stable groups from an early age, ensuring good colostrum management and increasing the amount of milk fed to dairy calves.

The publication Code of Recommendations for the Welfare of Livestock: Cattle (*DEFRA, 2003*) lists numerous welfare and stress indicators concerning stockmanship, health, feed, water and other substances, accommodation, equipment, management, fire and other emergency precautions, pregnancy and calving, calf rearing, breeding animals and dairy cows, which are applied in England. Recommendations and indicators to the breeders of these animals are described in detail, which relate to procedures with animals, preservation of health, provision of water, food and other substances, housing and keeping, equipment, organization and production technology. In a similar principle, the indicators and recommendations for pigs are defined in the Code of Practice for the Welfare of Pigs (*DEFRA, 2020*), which is applied in England, in two sections (section 1 – Recommendations applying to all pigs and Section 2 – Additional specific recommendations).

Welfare and stress monitoring systems

Different welfare monitoring systems have been developed in some European countries such as the animal welfare index TGI35L in Austria (*Bartussek, 2000*), TGI200 in Germany (*Sundrum, 1994*) for organic farms or specific tools for dairy cows, in France for assessing welfare in loose housed dairy cows (*Capdeville and Veissier, 2001*) and for assessing welfare quality in cattle, pigs and chickens (*Keeling and Veissier, 2005*).

In the guides concerning the welfare standards of cattle on farms (*Hristov et al., 2011a*) and the welfare standards of pigs on farms (*Hristov et al., 2011b*) in our country, questionnaires, as monitoring systems, containing indicators and criteria for their assessment were created. In essence, a total of 15 indicators were created with parameters and criteria for evaluation: 1. assessment of planning, organization and implementation of welfare protection, 2. assessment of employees concerning welfare protection, 3. competencies of employees concerning welfare protection, 4. the attitude of breeders according to the needs of animals, 5. assessment of monitoring and inspection of animals and equipment, 6. treatment of animals, 7. nutrition and feeding, 8. housing conditions, 9. microclimatic conditions, 10. hygienic conditions in the barn, 11. hygiene and body care of animals, 12. reproduction, 13. productivity, 14. behaviour and 15. health condition.

Analysis of the animal welfare and stress indicators in publications

In the mentioned publications in the paper, there are numerous physiological, behavioural and production indicators. When it comes to physiological indicators, it should be borne in mind that a change in the animal's welfare status causes physiological and psychological changes in the animal's organism, as well as changes in behaviour. That is why indicators of changes in the physiological status of the organism are taken into account as one of the groups of welfare and stress indicators. It is a well-known fact that when the animal's welfare status changes, its behaviour indicators also change. Behavioural indicators are indicators of the mental and emotional status of the animal. When the welfare status of the animal changes, there are also changes in its production characteristics. Therefore, changes in production characteristics can serve as an indicator of animal welfare and stress (*Hristov and Bešlin, 1991; Webster, 2005; Vučinić, 2006; Broom and Fraser, 2015*).

All the analysed animal welfare and stress indicators in this paper can be classified into two groups according to their impact on the animal welfare status, namely: 1. indicators originating from the external environment or the animal itself

and 2. indicators of the animal organism that reflect the action of external and internal environmental factors.

The first group of indicators indicate the influence of the living environment on the welfare and stress of animals and includes the way the animal is housed, the degree of freedom of movement, the degree of contact with animals of the same species, the use of bedding materials, microclimatic and macroclimatic factors that affect the animal, the method and quality of nutrition and feeding, etc. In addition, the attitude of the breeder towards the animals is also included, as well as factors originating from the animals themselves. The breeder's attitude towards animals implies the expertise of the breeder for a certain type of animal exploitation or a certain type of livestock production, the breeder's feelings towards animals, the breeder's ability to recognize the welfare and change in the animal's welfare status, understanding and valuing the life of animals, etc. Factors originating from the animal itself include the genetic predisposition of the animal for a certain type of exploitation or production, the use of an appropriate breed of animal for a certain type of production or another way of exploitation, the use of animals of the appropriate age, etc (*Hristov and Bešlin, 1991; Hristov, 2002; Webster, 2005; Vučinić, 2006; Broom and Fraser, 2015; Hristov and Stanković, 2016*).

The second group of welfare and stress indicators is viewed through physiological, behavioural and production indicators. Physiological indicators include the physiological status of the organism, the presence or absence of clinically manifest diseases, the presence or absence of wounds and injuries, nutritional status, physical condition, etc. Behavioural indicators include physiological forms of behaviour (intake of food and water, body hygiene, exploratory behaviour, territorial behaviour, social interactions, reproductive behaviour, rest and sleep, etc.), changes in behaviour, behavioural disorders and pathological forms of behaviour. Production indicators mean the physiological level of production that corresponds to the species and breed standard or age and production category, as well as changes in the animal's productivity level (*Hristov and Bešlin, 1991; Hristov, 2002; Webster, 2005; Vučinić, 2006; Broom and Fraser, 2015; Hristov and Stanković, 2016*).

Conclusion

Based on the data presented in the paper on the determination of new welfare and stress indicators of the animals on cattle and pig farms contained in different publications, which were not published in journals and symposium proceedings, it can be concluded:

- In the mentioned publications, there are numerous new physiological, behavioural and production indicators related to stress and welfare of cattle and pigs.
- Analysis of publications, that were not published in journals and symposium proceedings, indicates that they contain numerous new direct and indirect welfare and stress indicators of cattle and pigs.
- All the analyzed new animal welfare and stress indicators of cattle and pigs can be classified into two groups according to their impact on the animal welfare and stress status: 1. indicators originating from the external environment or the animal itself and 2. indicators of the animal organism that reflects the action of external and internal environmental factors.
- In the mentioned publications in the paper, there are numerous new physiological, behavioural and production indicators which can be used to assess cattle and pigs welfare and stress.

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