# METHOD OF UNITARY ASSESSMENT OF THE WELFARE OF ANIMALS IN SHELTERS

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**Abstract**

*The aim of the paper is to propose a method of unitary assessment of the welfare of food domestic animals exploited in shelters, an assessment that we consider mandatory to be made according to clear and non-subjective criteria, for all farmers in the European Union, who can benefit from welfare subsidies animal. The key to the example is based on the hygienic microclimate norms in shelters known in Romania and involves current determinations, using various methods, for the considered aerogenic environmental factors. Applying this method is achieved: a ranking of factors according to their ability to influence the welfare of organisms, by the maximum score given in the assessment and respectively the decrease scores given in case of deviations from their standard or recommended conditions and is highlighted synthetically and obviously the minimum insured factor (s) and the size of the deviation it records. This creates the conditions for a timely management and correction of these factors, with a speed and economic efficiency that meets the current requirements of economic competitiveness while maintaining a permanent high level of animal welfare.*

**Key words**: animal welfare, pet food, hygiene rules and recommendations, aerogenic environmental factors

## INTRODUCTION

The World Organization for Animal Health (OIE) defines animal welfare as "the way an animal copes with the conditions in which it lives". He goes on to explain: “an animal is in a good state of well-being if (as scientific evidence indicates) it is healthy, comfortable, well-fed, safe, able to express innate behavior and does not suffer from unpleasant conditions, such as be pain, fear, and suffering.” Thus, given the OIE definition, achieving a high level of animal welfare requires conditions that protect animal safety, health, behavioral needs and emotional states. Animal welfare has become a critical issue of global public interest, especially in Europe and North America [1].

The proposed paper is based on the 10 "General Principles for Animal Welfare in Animal Production Systems" adopted in 2012 by the 178 member nations of the World Organization for Animal Health to guide the development of standards for different animal species and focuses on controlling air pollution in animal shelters.

Air pollution in animal shelters is unanimously recognized as a major threat to safety and health or as a stressor, which could undermine other aspects of animal welfare. In addition to affecting animals, air pollution also affects the health of farm workers [2] and can affect workers' job satisfaction, which in turn is a determining factor in animal welfare [3].

## MATERIAL AND METHOD

The proposed method of unitary assessment of the welfare of domestic food animals exploited in shelters involves the use of a 100-point assessment key. The unitary assessment, for all species and categories of animals, raised in different housing systems, is based on the norms and hygienic microclimate recommendations from shelters known and already entered in the current zootechnical practice in Romania.

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The application of the method involves current determinations, with the use of various classical methods, or an automated monitoring for the aerogenic factors in the shelters considered.

## RESULTS AND DISCUSSIONS

The assessment must be performed simultaneously for all environmental factors considered. The method is based on the law of the minimum factor (J. Liebig's law or the factor limiting rule) according to which if at least one of the environmental factors approaches or exceeds the limits of critical values, then, despite the optimal combination of other conditions, it is not ensured the requirement of welfare, comfort, necessary to preserve the health of the organisms for the efficient obtaining of the animal productions pursued in their exploitation.

The key to the unitary appreciation of the welfare of food domestic animals exploited in shelters (*table 1*) achieves first of all a hierarchy of the microclimate aerogenic factors, through the assigned score. The ranking is made primarily taking into account the magnitude of the influence of aerogenic factors considered observed in the practice of animal husbandry and demonstrated by scientific research. To the ranking is added the penalty point assigned in case of deviations of the individual aerogenic factors considered from the hygienic norms and recommendations of microclimate (*table 2, table 3*). In addition, the combined, synergistic or antagonistic influence of microclimate airborne factors is taken into account (example: air temperature and relative humidity).

Monitoring of physical and chemical airborne factors will necessarily follow their diurnal evolution. The process can be automated with the use of sensors or can be performed using specific methods and classical instruments. Regardless of the type of monitoring, the determinations will be made in the place in the air of the shelter where the aerogenic characters significantly influence the organisms (where they inhale the air).

In order to know the biological factors (microorganisms and dusts in the air) it is recommended to use the quantitative methods consecrated in the practice of air quality control, with the harvesting of microorganisms and dusts by sedimentation.

To calculate the intensity of ventilation, the volume of air required to be ventilated will be calculated with the calculation formula according to the air humidity in all cases.

The relation is used:

$$\boldsymbol{V_{nec}} = \frac{U \text{ x number of animals}}{U_i - U_e} \ (m^3/h/shelter)$$

In which:

$\boldsymbol{V_{nec}}$ – the minimum volume of air required to be ventilated per shelter, in $m^3/h/shelter$

$U$ – the amount of water vapor excreted by an animal by respiration, increased by 10% for technological evaporation, in g/h

$U_i$ – the absolute humidity of the shelter air, in $g/m^3$, at the optimum temperature for the species, the category of accommodation and the season in which the calculation is made and the maximum relative humidity allowed for the species, the category of accommodation, regardless of the season.

$U_e$ – absolute humidity of the atmospheric air, in $g/m^3$, for the calculation outdoor temperature and the relative humidity of the measured air (variable values, between 55…70% in summer and 90…100% in winter).

The air flow ventilated by a ventilation installation is calculated, at the time of designing the shelters, the installations being dimensioned for the maximum volumes of air necessary to be ventilated in the hot season.

For the ventilation installations in operation, it is necessary to check the actual flow achieved. This assessment of actual efficiency is made using the relation:

$$\boldsymbol{V} = S \text{ x } v$$

In which:

$\boldsymbol{V}$ – air flow, in the $m^3/h$;

$S$ – section area of air intake/outlet pipes, in $m^2$;

$v$ – air circulation speed at the level of the air intake/exhaust pipes/mouths, in m/h.

The area of each section is obtained by measurements and the area of that section is calculated.

Table 1: Overall assessment of animal welfare in shelters

| The airborne factor considered | Score assigned | Welfare requirements and conditions for reducing the score awarded |
|---|---|---|
| Temperature | **20** | Keeping within the optimal limits of the rules - *table 2*, (diurnal variations, small (maximum 10 °C) are accepted for growing animals) |
| | Score decreases:<br>- with *5 points* when the deviation is wide (above 10 °C), occurs suddenly and is accompanied by relative humidity above the maximum allowed limit (*table 2*)<br>- with *3 points* when the deviation is wide (above 10 °C) and occurs suddenly<br>- by *1 point* for each deviation by 1°C from the optimum range in shelters in which very small, growing animal organisms with a high genetic productive potential are housed<br>- by *0,5 points* for each deviation by 1°C from the optimum range in shelters in which fattening animals are housed | |
| Relative humidity | **10** | Keeping within the optimal limits of the rules - *table 2* |
| | Score decreases:<br>- by *1 point* for deviations from the optimal limits of the norms by 1% | |
| The movement of the air (speed) | **6** | Keeping within the optimal limits of the rules - *table 2* |
| | Score decreases:<br>- by *2 points* when the deviation is above the maximum permissible limit by 0,1 m/s and is accompanied by lower air temperatures than the minimum permissible temperature | |
| Lighting intensity | **3** | Corresponding to the optimal conditions - *table 3* |
| | Score decreases:<br>- by *3 points* for any deviation from the optimal requirements | |
| Light uniformity | **3** | Uniform lighting over the entire accommodation area |
| | The score decreases by *3 points* in non-uniform lighting on the entire accommodation area | |
| Lighting duration | **3** | Corresponding to the requirements of species and categories of animals |
| | The score decreases by *3 points* at a time that does not meet the requirements of the species and categories of animals | |
| Intensity of noise pollution | **5** | Maximum noise intensity of 60 dB |
| | Score decreases:<br>- by *3 points* at a noise intensity between 60 and 80 dB<br>- by *5 points* at a noise intensity higher than 80 dB | |
| Concentration $CO_2$ | **5** | Concentration less than 3000 ppm in cattle, pigs, sheep and horses; 2500 ppm in adult birds and 1500 ppm in young birds. |
| | Score decreases:<br>- *1 point* for each deviation by 200 ppm above the permissible norm | |
| Concentration $NH_3$ | **10** | Concentration less than 26 ppm |
| | Score decreases:<br>- by *1 point* for each deviation by 1 ppm above the permissible norm | |
| Concentration $H_2S$ | **5** | Concentration less than 10 ppm |
| | Score decreases:<br>- by *1 point* for each deviation by 1 ppm above the permissible norm | |
| Number of germs (NTG/$m^3$) | **10** | Maximum 250000 germs / $m^3$ air |
| | Score decreases:<br>- by *1 point* at an increase of 10,000 germs/$m^3$ above the recommended value | |
| The amount of dust | **5** | Maximum 15 mg/$m^3$ air for suspended powders and / or maximum 20 g/$m^2$/30 days for sedimented powders. |
| | The score decreases by *1 point* when exceeding by 1 mg/$m^3$ air for suspended powders and / or by 1 g/$m^2$/30 days for sedimented powders | |
| Intensity of ventilation | **10** | Corresponding to the requirements of animal species and categories (zero ventilation deficit) |
| | The score decreases by *5 points* for every 5% ventilation deficit | |
| Uniformity of ventilation | **5** | Homogeneously distributed air throughout the shelter |
| | The score decreases by *5 points* when there are dead, stagnant areas. | |

Table 2: Hygienic standards for temperature, humidity and air movement in shelters

| Species and category of animals | Temperature (ºC) | | | Relative humidity (%) | | Air speed (m/s) | |
|---|---|---|---|---|---|---|---|
| | Min. | Max. | Best | Min. | Max. | Min. | Max. |
| Lactating cows | 6 | 24 | 10..14 | 60 | 75 | 0,2..0,3 | 1,0 |
| Maternity | 12 | 24 | 20 | 55 | 70 | 0,1..0,2 | 0,1..0,2 |
| Calves 0...14 days | 12 | 24 | 15..18 | 60 | 70 | 0,1..0,2 | 0,5 |
| Calves 15…21 days | 10 | 24 | 12..15 | 60 | 70 | 0,1..0,2 | 0,5 |
| Calves 22...90 days | 8 | 24 | 10..15 | 60 | 70 | 0,2..0,3 | 0,5 |
| Calves 90…180 days | 8 | 24 | 10..12 | 60 | 70 | 0,2..0,3 | 0,8 |
| Bullfighting youth 6...12 months | 6 | 24 | 8..10 | 60 | 75 | 0,2..0,3 | 1,0 |
| June 18…28 months | 6 | 24 | 8..10 | 60 | 75 | 0,2..0,3 | 1,0 |
| Bullfighting fattened him | 6 | 24 | 10..15 | 60 | 75 | 0,2..0,3 | 1,0 |
| Adults fattened him | 6 | 24 | 10..15 | 60 | 75 | 0,2..0,3 | 1,0 |
| Baby beef I | 18 | 24 | 18..20 | 60 | 75 | 0,2..0,3 | 1,0 |
| Baby beef II | 12 | 24 | 12..14 | 60 | 75 | 0,2..0,3 | 1,0 |
| Mares with mares | - | - | 12...15 | 60 | 75 | 0,3 | 1,5 |
| Stallions and horses in training | - | - | 10...12 | 60 | 75 | 0,3 | 1,5 |
| Boars | 10 | 24 | 15 | 60 | 70 | 0,2..0,3 | 1,0 |
| Pregnant sow | 10 | 24 | 15..18 | 60 | 70 | 0,2..0,3 | 1,0 |
| Breastfeeding sows | 15 | 24 | 18..22 | 60 | 70 | 0,2..0,3 | 0,5 |
| Piglets 0..7 days | - | - | 32..30 | 60 | 70 | 0,2..0,3 | 0,5 |
| Piglets 8..14 days | - | - | 30..28 | 60 | 70 | 0,2..0,3 | 0,5 |
| Piglets 15..21 days | - | - | 28..24 | 60 | 70 | 0,2..0,3 | 0,5 |
| Piglets 22..28 days | - | - | 24..22 | 60 | 70 | 0,2..0,3 | 0,5 |
| Piglets 29..36 days | - | - | 22..20 | 60 | 70 | 0,2..0,3 | 0,5 |
| Pig youth | 18 | 24 | 18..22 | 55 | 70 | 0,2..0,3 | 1,0 |
| Pigs for fattening (35-60 kg) | 15 | 24 | 18..20 | 55 | 70 | 0,2..0,3 | 1,0 |
| Pigs for fattening (60-105 kg) | 15 | 24 | 18..20 | 55 | 70 | 0,2..0,3 | 1,0 |
| Childbirth compartments | 8 | - | 12..15 | 60 | 75 | 0,3 | 0,3 |
| Youth compartments | 5 | - | 8..12 | 60 | 75 | 0,3 | 0,3 |
| Production hens (hybrid) | 12 | 24 | 13..18 | 60 | 70 | 0,3..0,5 | 1,5 |
| Breeding chickens: - parents | 14 | 24 | 16..18 | 60 | 70 | 0,3..0,5 | 1,5 |
| - grandparent | 16 | 24 | 18..20 | 60 | 70 | 0,3..0,5 | 1,5 |
| Youth production (hybrids): - week I | - | - | 33,5..33 | 50 | 70 | 0,15..0,3 | 0,5 |
| - week II | - | - | 32..30 | 50 | 70 | 0,15..0,3 | 0,5 |
| - week III | - | - | 29..26 | 50 | 70 | 0,15..0,3 | 0,5 |
| - week IV | - | - | 25..21 | 50 | 70 | 0,15..0,3 | 0,5 |
| Reproductive youth (parents, grandparents): - week V | - | - | 20..18 | 50 | 70 | 0,15..0,3 | 0,5 |
| - weekly VI..VII | - | - | 17 | 50 | 70 | 0,15..0,3 | 0,5 |
| - weekly VIII..IX | - | - | 16 | 50 | 70 | 0,15..0,3 | 0,5 |
| - weekly X..XI | - | - | 15 | 50 | 70 | 0,15..0,3 | 0,5 |
| - weekly XII..XIII | - | - | 14 | 50 | 70 | 0,15..0,3 | 0,5 |
| - weekly XIV..XV | - | - | 13 | 50 | 70 | 0,15..0,3 | 0,5 |
| - weekly XVI.XVIII | - | - | 12 | 50 | 70 | 0,15..0,3 | 0,5 |
| Meat chicken: - week I | - | - | 36..33 | 50 | 70 | 0,15..0,3 | 0,5 |
| - week II | - | - | 31 | 50 | 70 | 0,15..0,3 | 0,5 |
| - week III | - | - | 29 | 50 | 70 | 0,15..0,3 | 0,5 |
| - week IV | - | - | 27 | 50 | 70 | 0,15..0,3 | 0,5 |
| - week V | - | - | 25 | 50 | 70 | 0,15..0,3 | 0,5 |
| - week VI | - | - | 23 | 50 | 70 | 0,15..0,3 | 0,5 |
| - week VII | - | - | 21 | 50 | 70 | 0,15..0,3 | 0,5 |
| - weekly VIII..IX | - | - | 18 | 50 | 70 | 0,15..0,3 | 0,5 |
| Turkeys | 5 | 24 | 13..18 | 60 | 70 | 0,3 | 0,75 |
| Ducks and geese | 2 | 24 | 13..18 | 60 | 70 | 0,3 | 1,5 |

Table 3: Rules for shelter lighting

| The destination of the shelter | Natural lighting (*l*) | Artificial lighting (w/m$^2$) | Lighting intensity (lx) |
|---|---|---|---|
| Dairy cows | 1/20 | 2,5 | 50…60 |
| Maternity cows | 1/20 | 4,5 | 50...60 |
| Breeding cattle | 1/16 | 3,5 | 60…70 |
| Cattle youth fattened him period I | 1/10..1/14 | 3,5 | 60…70 |
| Cattle youth fattened him period II | 1/15..1/25 | 2,5 | 50…60 |
| Adult cattle fattened him | 1/25 | 2,5 | 50…60 |
| Mares with foals, stallions (in boxes) | 1/18 | 3,5 | _ |
| Pregnant sows and boars | 1/18..1/20 | 3,5 | 50…60 |
| Maternity sows | 1/18 | 5,0 | 50…60 |
| Breeding pig youth | 1/18 | 5,0 | 50…60 |
| Pigs fattened him | 1/25 | 2,0 | 30 |
| Saivane (calving compartment) | 1/20 | 1,2 | 20 |
| Hales rabbit breeding intensive adult breeding | _ | 3,0 | 30…40 |
| Hales rabbit breeding intensive youth | _ | 1,0..1,5 | 0,5…1 |
| Laying hens | _ | 3,5 | 20 |
| Reproductive poultry youth | _ | 3,0..3,5 | 5…20 |
| Chicken (by age) | _ | 2,5..1,0 | 20…5 |
| Ducks and geese | 1/14 | 1,2 | 2 |

The air circulation speed is obtained, in m / s, by direct measurement, with a dynamic anemometer or ultrasound, which is located in the center of the air stream. For transformation into m / h, the measured value is multiplied by 3600.

By summing the actual air flow achieved by all inlet / outlet pipes / outlets in a shelter, the volume of actual ventilated air is obtained.

If the ventilation system does not exchange the air to cover the ventilation needs, the ventilation deficit occurs, a situation that is unacceptable in terms of the hygienic criteria for the welfare of the animal organisms and must be corrected as soon as possible.

The correction is made starting from the calculation of the existing ventilation deficit, with percentage expression or in m$^3$/h/shelter, using the relation:

$$\textit{Ventilation deficit (\%)} = \frac{V_{nec.} - V_{real}}{V_{nec.}} \text{x}100$$

The overall assessment of animal welfare in shelters is as follows:

- Total score 90…100 - good welfare conditions;
- Total score 70…90 - mediocre welfare conditions;
- Total score below 70 - inadequate welfare conditions.

## CONCLUSIONS

Applying this method in the case of the global assessment of the welfare of sheltered domestic animals is achieved:

- a ranking of the factors according to their capacity to influence the well-being of the organisms, by the maximum score given in the assessment and respectively the decrease scores granted in case of deviations of their level from the normed or recommended conditions;
- the minimum insured factor / factors and the size of the deviation it registers are highlighted synthetically and obviously.

This creates the conditions for a timely management and correction of these factors, with a speed and economic efficiency that meets the current requirements of economic competitiveness while maintaining a high level of animal welfare.

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