Working Environment in Milking Parlours in Terms of Noise Exposure

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***Abstract**: The working environment is one of the most important factors according to which the employee decides when choosing a job, or when considering staying in it. Generally, it means all tangible and intangible factors that act directly on the employee and his work. Employees working in conditions of farms are exposed to different unnatural influences. Such an impact is also noise, which always arises with a certain energy conversion. In cattle farms, the sources of noise are represented by various mechanical equipment and machines that are used for enabling the operations of the farm. The aim of this article was to analyze the noise levels in the work space of various kinds of parlours. In terms of adverse effect of noise, tandem milking parlour, fishbone milking parlour and rotary milking parlour was evaluated. Values were processed in graphs and compared with values under the Directive of the European Parliament and the Council Nr. 2003/10/EC, which gives the exposure limit values $L_{AEX,\ 8h}$ (noise exposure with weighting filter "A" and upper and lower action value of exposure $L_{AEX,\ 8h}$.*

***Keywords**: working environment, noise, milking parlour*

INTRODUCTION

Cattle bred in farm buildings are exposed to noise, which can come either from outside or from inside of the building. Several published studies demonstrate different sounds that can occur inside the building for animal husbandry (Castelhano-Carlos, Baumans 2009). Not only farmed animals are exposed to noise on farms. Short-lived but intense noise can have a detrimental impact not only on farmed animals, but also on operators (Venglovský et al., 2007).

Humans are more sensitive to perception of noise in the range from 500 Hz to 4 kHz, which is the range of normal ordinary human speech (within this range, we can hear quiet sounds) (Castelhano-Carlos, Baumans 2009).

Noise sources on farms can be, in addition to ordinary activities (opening and closing doors, washing, speech of employees, dispensing feed, etc.), also machinery, basal levels of noise caused by mechanical ventilation, animal activity (climbing to barriers, chewing on barriers) and their own vocalization (Žitňák et al. 2011; Mihina et al. 2012). Work activities, which are carried out routinely in animal husbandry, are causing the loudest sounds, especially if a various metal tools are used, or if the work is done haste (Burn, 2008). Besides noise from technical and mechanized equipment, in animal production there are also noise emissions caused by biological noise of animals. This noise is by dairy cows in the range of 73.7 dB to 83.8 dB (Šístková et al., 2010).

If the sound pressure level exceeds a certain limit, and in long-term effects, it will have stressful noise reflect, followed by eventual damage to the health of workers (Havránek 1990, Decree of the Czech Ministry of Health 2000), and also animals. (Hauptman 1972). A great deal of research has been done on the effects of noise on performance (Kjellberg, Landström 1994) and (Smith, Jones,1992) and some recent field studies give evidence that noise may add to the development of fatigue (Kjellberg et al., 1998).

Braniš (1990) states that, like in humans, occurs also in animals directly to changes in the auditory organ, and if there is noise on adaptation threshold, it may be only so called auditory tiredness (reversible changes). It is a defense mechanism, in which the threshold of hearing temporarily increases, thereby depletion of metabolic and energy reserves in sensory cells and neurons of auditory lanes is limited. But when the intensity of the excitation exceeds adaptive possibilities of auditory organ, it leads to pathological changes.

Algers et al.(1978) detected noise levels in the milking parlours and states values from 75 to 90 dB. According to Kauke (2007) is the noise intensity in most cases ucacceptable for dairy cows and also for operator (milker).

Although the majority of the literature suggests that farming animals and wildlife species exhibit adaptation after repeated exposure to noise, careful planning should be made before construction of the animal building, in order to avoid stressful environmental sounds both for the animal and personnel (Brouček, 2014).

MATERIALS AND METHODS

Research place

The experiment was conducted on three farms for cattle in the Czech Republic.

Measurements were performed on a farm with 128 production dairy cows, with tandem milking parlour BAUER TECHNICS 2x4 (year of manufacture 2012), with automatic system ATA 25, placed outside next to barn. At number of 8 parlour places the milking lasted 275 minutes. Dairy cows are milked 2 times per day. Cows are moved to parlor at groups about 40 heads. Another group of cows is coming to the collection room after the last cow from the first group finish milking. Parlour is served by two workers (milkers).

Second measurements were performed in the farm with 536 production dairy cows, with fishbone milking parlour Fullwood 2x12 Rapid Exit (year of manufacture 2009). Dairy cows are milked 2 times per day. Cows are moved to parlor at groups. At number of 24 parlour places the milking lasted 475 minutes. Parlour is also served by two workers (milkers).

Third measurements were performed in the farm with 840 production dairy cows, with rotary milking parlour ROTO 36 Fullwood (year of manufacture 2007) with 36 parlour places. Dairy cows are milked 2 times per day and they are moved to parlor individually. At number of 36 parlour places the milking lasted 425 minutes. This parlour is served by three workers (milkers).

Measuring device

Brüel&Kjær type 2270, 611672-1:2002 Class1, IEC 61260:1995 w.Am.1, 1/1 a 1/3 Oct. Band Class 0, IEC 60804:2000 type 1, IEC 60651:1979 w. Am. 1 and 2 type1 was used for measuring of noise. It allows to measure sound levels in a standard way and carrying out evaluation of living and working environment. It consist of microphone, preamplifier, processor and reading unit. The software allows to measure parameters in time and to evaluate data statistically.

For calibration before the measurement was used Acoustic Calibrator AC – 300, IEC 60942: 2003 / EN 60942/2003 Electroacoustic Sound Calibrators / Class 1.

Conditions during measurement were recorded by digital meteorogical station WS – 1600 with an accuracy of +/- 1°C; +/- 5% and the height of the microphone on a tripod was measured by digital distance meter Bosch DLE 50 with accuracy class 2.

Data acquisition

Noise measurements were carried out directly in parlour space, i.e. in the space where the operator moves during milking. Measurements were performed during the milking process, i.e. when there was a milking parlour running. Measuring device was placed in areas, where the operator (milker) moves during implementation of operations necessary to ensure the process of milking in the area of parlour (working place).

It was made 15 repeated measurements in each parlour, the duration of the time interval of individual measurements was chosen to 180 seconds (to record any significant changes in the noise levels in the workplace). The microphone was placed at a distance of 1.5 meters above the floor (the point at which is located the head of the operator) and set in the viewing

direction of the operator (toward the noise source. Before each series of measurements, it was carried out calibration and control of the measuring with sound calibrator and measured the background noise level (when the parlour was off).

With sound level meter was recorded equivalent sound pressure level LAFekv, which reflects the equivalent value of sonic energy for a given measured period, weighted with filter "A". Another measured parameter, the maximum time-weighted sound level LAFmax.

Data analysis

One of the most important evaluation descriptors of working environment, according to ISO 9612:2009, is the equivalent sound pressure level A LA eq, T [dB]. It is calculated steady sound pressure level A. It applies always to a particular time interval T. Directive of the European Parliament and the Council Nr. 2003/10/EC indicates the exposure limit values LAEX, 8h (noise exposure during weighting filter "A" for 8 hour shift) and upper and lower exposure action value LAEX, 8h.

Determining the daily noise exposure at working place with a shorter or longer time of duration Te to the nominal duration of the working day 8 hours T0 can be with normalizing of equivalent sound pressure level A at nominal time of working day according to relationship [1].

$$L_{AEX,8h} = L_{Aeq,Te} + 10lg\frac{T_e}{T_o}\,dB \; L_{AEX,8h} = L_{Aeq,Te} + 10\lg\frac{T_e}{T_o}\,\mathrm{dB}, \qquad [1]$$

Where is:

$L_{Aeq,Te}$ - equivalent sound pressure level durint the period of T_e

T_0 - nominal duration of working day – 8 hours

RESULTS AND DISCUSSION

The measurements were conducted under the climatic conditions specified in the table 1.

Table 1 Climatic conditions during measurement

Location of measurement	Air temperature, [°C]	Relative humidity of air, [%]	Atmospheric pressure, [hPa]
Tandem milking parlor	16.7	35	949
Fishbone milking parlor	20.1	54	991
Rotary milking parlor	19.1	64	943

Measured values of noise LAFeq [dB] and LAFmax [dB] in parlours were processed in a graph (Fig. 1). From these values, arithmetic averages were calculated and processed in the bar graph (Fig. 2), where it´s possible to see differences in the exposure to noise, depending on the type of milking parlours.

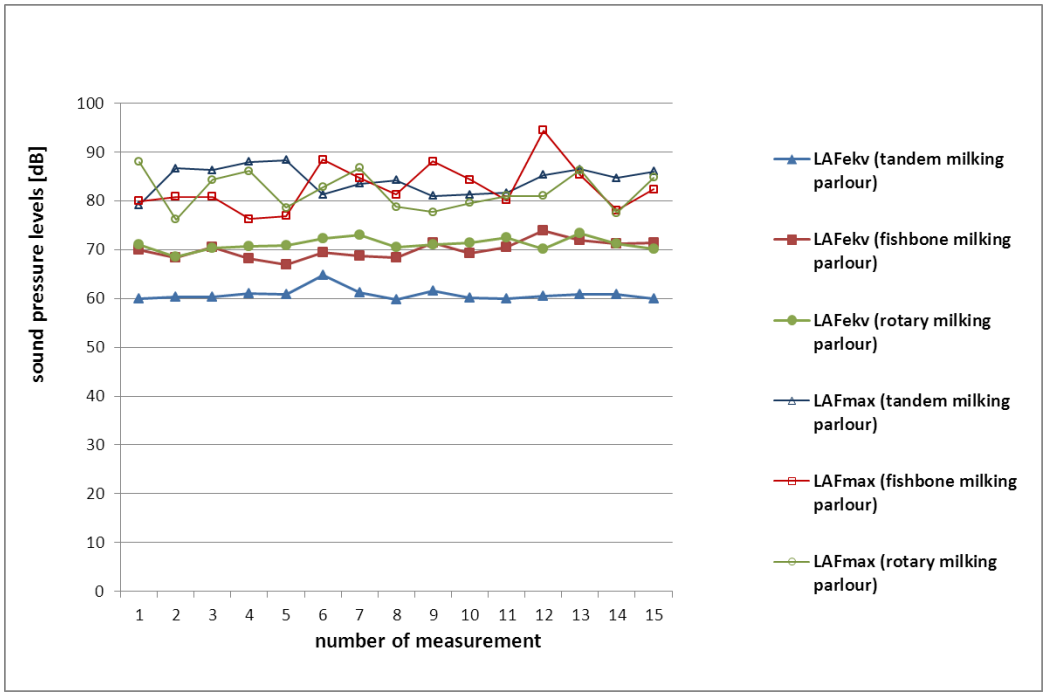

Fig. 1 Equivalent and maximum sound pressure levels measured in workplaces of operators during milking in different types of milking parlours

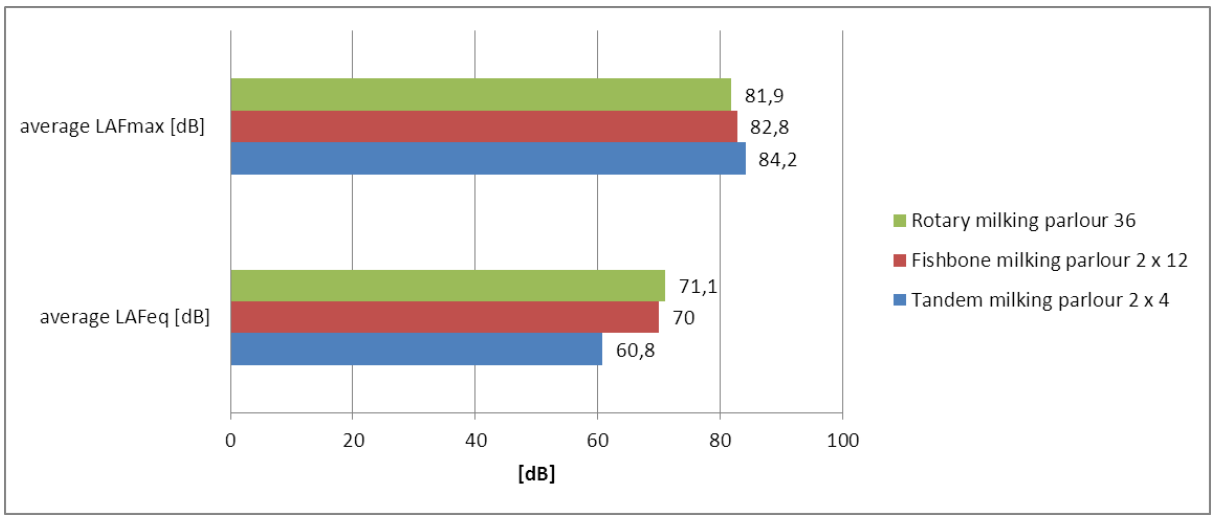

Fig. 2 Average values of noise in milking parlours when the milking parlour was on

As can be seen in the graph (Fig. 2), the average maximum sound pressure levels are about the same. This was due to the fact, that during milking are occurring different noises, caused by hitting metal parts to each other. For example metal barriers, namely chains, locking mechanisms of barriers and so on. In reality, these values were in the range of 76 dB to 94 dB.

Equivalent levels were in rotary milking parlour in range of 68.59 dB to 73.42 dB, in fishbone milking parlour in range of 66.87 dB to 73.83 dB, and in tandem milking parlour in range of 59.68 dB to 64.86 dB. Measured values, as well as their arithmetic averagesin graph (Fig. 2) indicate, that while in rotary milking parlour and in fishbone milking parlour the values were almost the same and about 70 dB, in tandem milking parlour the levels were around 60 dB.

Table 2 Calculated noise exposure with weighting filter "A" for an 8-hour shift

Parlor type	Average LAFeq, [dB]	Total milking time, [min]	$LA_{ex.8hours}$, (dB)
Tandem milking parlor 2x4	60,8	275	58,38
Fishbone milking parlor 2x12	70	475	69,95
Rotary milking parlor 36	71,1	425	70,57

In the table (Tab. 2) are shown calculated noise exposure values of operators Lex.8hod (dB).

According to Directive of the European Parliament and the Council Nr. 2003/10/EC, exposure limit value $L_{AEX, 8h}$ has a value L = 87 dB and with this value, the worker can´t be exposed under any circumstances, therefore after use of methods for reducing noise. The upper exposure action value $L_{AEX, 8h}$ has a value a = 85 dB, and the lower exposure action value $L_{AEX, 8h}$ has a value a = 80 dB. These action values are noise values in working place, beyond which is the employer obliged to carry out actions (shares) to reduce noise.

As can be seen from the values Lex.8hod (dB) in the table (Tab. 2), in any of parlours the noise level didn´t exceed even the value of the lower exposure action value of 80 dB.

CONCLUSION

Noise generated during the milking process depends not only on technological equipment of parlours, allocation of resources of required pressure (vacuum pump, compressor etc.) and their age. An important factors are also the number of animals milked at the same time, and thus the number of parlour places, and system of individual or quick exit after milking.

Furthermore, the noise directly depends on the way of working of operators, especially on the speed of work (more noise in haste), precision of teat cups application (if improper application, unpleasant noise can occur), the volume of mutual communication of operators and by chasing the dairy cows into the parlour, and used technique for excrement removing from parlour places and its intensity (flushing water during milking).

Noise exposure levels didn´t exceed the values given in The Directive of the European Parliament and the Council Nr. 2003/10/EC. In terms of noise, most favorable working environment was in case of tandem milking parlour.

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