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Workers Risk Levels of Noise in the Dairy Cow Milking Parlor

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Abstract: The study was carried out in the milking parlor of a dairy cattle farm consisting 500 animals from Holstein-Friesian breed in Bulgaria. The animals were housed in a freestall dairy barn and milked in double-8 milking parlor "herringbone" type. The level of noise was measured three times in every milking (at the beginning, in the middle and at the finishing of the milking) in the morning, midday and evening milking every month for one year. The noise level in the working environment was recorded by noise meter,, Lutron SL-4023SD. The highest noise levels were reported in summer and winter, with maximum values up to 78.3 dB. It was found that regardless of the season during the morning milking the lowest noise levels in the milking parlor were reported (from 70.37 to 70.46 dB). The average values for noise level for an 8-hour working day by seasons varied from 69.87 dB to 74.36 dB, with the highest reported value for the winter season.

Keywords: Milking Parlor, Noise level, Workers.

Introduction

Problems with noise are some of the most ignored: the farms do not evaluate the exorbitant noise levels, and do not equip their workers with adequate ear protectors. (Castelhano-Carlos & Baumans, 2009; Brouček, 2014). This approach is the consequence of two facts: first, the absence of information among farmers of the degree of harming that can be caused by intense exposure at high noise levels, followed by underestimation of the seriousness of protection, and secondly, the prevalent but wrong opinion that in milking parlors there are no devices that produce loud noise, leading to rejection of workers to use protection devices against noise (Castelhano-Carlos & Baumans, 2009). Humans are more sensitive to noise sense in the 500 Hz to 4 kHz range, which is the diapason of normal talking (in this range it is possible for quiet sounds to be heard) (Castelhano-Carlos & Baumans, 2009). Noises of doors opening and closing, washing, workers talking, setting feed into the manger, etc. due to common activities in the farm environment can also contribute to increasing noise level. Also, noise caused by mechanical ventilation, animal activity (climbing railings, chewing them, cow's own vocalization) (Žitňák *et al*., 2011; Mihina *et al*., 2012).

Although there are differences in the perception of noise levels, workplace noise

limits have been established for workers (EU Directive, 2003), and workers must be provided with adequate hearing protection and their impact should be monitored (McBride *et al*., 2003). Noise damage can lead to personal and social consequences for affected individuals and their families (Depczynski *et al*., 2005).

Severe hearing impairment and even hearing loss in farmers and their families was reported by a number of studies (Thelin *et al*., 1983; May *et al*., 1990; Crutchfield & Sparks, 1991; Plakke & Dare, 1992). Hearing loss is widespread among aged farmers, but it also can be found in younger farmers and teenagers at farms (Broste *et al*., 1989). It was reported that among 72% of workers engaged in farms in New York suffer from high-frequency range hearing damage (Beckett *et al*., 2000). There were factors related to hearing impairment such as: age, sex, hunting, and work with grain dryers. In Ohio, the noise sources pointed were tractors without cabin (almost all farmers), chainsaws (80%), combined saws (70%), off-farm work (33%), hunting (51%) and motorcycle use (21%) (Wilkins *et al*., 1998).

Noise in the milking parlor has a direct impact on the efficiency of work associated with improving cow behavior and human-animal interactions (Waynert *et al*., 1999). If the noise level in the milking parlor is too high, the animals thicken, become more restless and cannot be fully milked, leading to the development of udder infections (Nosal & Bilgery, 2002). Kauke (2007), point out that the noise intensity is usually unacceptable for both dairy cows and the operators (milkers). For that reason, to minimize stressful environmental noises for cows and for workers must be made an attentive planning before the building of animal premises (Brouček 2014). The goal of the study was to measure the level of noise in the milking parlor and to find whether there was a risk of hearing damage to the workers in the milking parlor.

Material & Methods

This study took place in the milking parlor of a dairy cattle farm in central southern Bulgaria in Sliven district. Milking parlor was a double-8 “herringbone” type. The installation has been in use for 10 years. The farm consists of 500 animals, including 200 Holstein-Friesian lactating cows. There were four employed milkers on a contract on the farm, milking two in shifts. They were men, at age between 40 to 55 years. The milking was three times a day, lasting 2.5 hours each. In the morning it started at 5:00 h, at midday at 12:00 h and evening at 18:00 h.

The noise was measured three times throughout every milking (beginning, middle and end), as this was repeated in the morning, midday and evening milking. The data recording was performed each month for one calendar year.

Fig. (1): Lutron“ SL-4023SD.

The noise level in the working environment was measured by Lutron SL-4023SD (Fig. 1). The daily noise exposure of workers for an eight-hour working day was determined using the following dependence (Psenka *et al*., 2016):

$$L_{AEX,8h} = L_{Aeq} + 10lg(T_e / T_o), dB$$

Where: $L_{AEX, 8h}$ was the noise level for an 8 hour exposure period; L_{Aeq} was the noise level for a period of one milking T_e; T_o is an exposure period of 8 hours.

The MS Excel package was used for basic statistical data processing, and the corresponding STSISTICA modules of StatSoft (Copyright 1990-1995 Microsoft Corp.) were used to obtain the mean values, errors and analysis of variance.

To evaluate the influence of the factors the following model was used:

$$Y_{ijkl} = \mu + S_i + M_j + P_k + e_{ijkl}$$

Where:

Y_{ijkl} was the dependent variable (noise level); μ was the mean for the model; S_i was the reporting season effect, M_j was the sequential milking effect, P_k was the sequential reporting effect and e_{ijkl} was the uncontrolled factors effect (error).

The means of least squares (LSM) were derived by classes of the fixed factors using analysis of variances (ANOVA) for the model.

Results & Discussion

On table (1) are presented averages and standard deviations of the noise level in the milking parlor by milking sequence and season of reporting. High average values of noise level were reported during the midday milking of all seasons except the spring and the highest value reached was 76.3 dB. This can be attributed to various technological processes carried out on the farm during midday milking. When compare by seasons, high noise levels were observed during the summer and winter. For the summer season, these high levels were associated with the operation of the animal cooling fans, which were in the immediate vicinity of the milking parlor and helped to increase the noise level.

In the winter season high level of noise was associated with the closure of windows and doors to prevent heat loss from the premise and at the occurrence of various noises of any nature, they were not able to dissipate in the space outside the building and this helped amplifying the noise inside. Due to the large capacity of the farm, the volume of activities carried out was large. All this was accompanied by the production of noise. Farms with higher capacity and more frequently applied servicing (triple milking, cleaning, more fans, etc.) also have a higher noise level (Dimov, 2017). Šistkova *et al*. (2016) in a one-year study found a noise level in a milking parlor of the same type (herringbone) of 69.2 dB and a maximum reached value of 82 dB.

When milking dairy cows, the noise level should not exceed 65-70 dB or, if it exceeds it, it should be for a short time, as this can lead to human and animal health disorders in the medium term (Nosal & Bilgery, 2002; Behrend, 2003). According to this recommendation, in our study in all seasons there was an exceeding of these recommended values, especially during the summer and winter seasons.

Table (1): Average values and standard deviation of the noise level in the milking parlor by milking sequence and season of reporting.

Milking	Number N	Noise , dB			
		X ± Se	SD	Min	Max
Summer					
Morning	9	71.7±1.45	4.35	63.3	77.0
Midday	9	74.5±0.89	2.66	70.5	78.3
Evening	9	72.8±0.65	1.95	69.0	75.0
Autumn					
Morning	6	69.2±1.40	3.43	65.0	73.0
Midday	6	71.7±1.60	3.93	64.5	76.4
Evening	6	70.3±1.19	2.91	66.8	73.9
Winter					
Morning	3	72.6±0.86	1.48	71.0	73.9
Midday	3	76.3±1.50	2.60	73.3	77.9
Evening	3	75.7±1.86	3.21	72.0	78.0
Spring					
Morning	9	69.3±1.69	5.08	63.0	78.5
Midday	12	69.7±1.11	3.86	64.6	76.5
Evening	12	72.7±2.03	7.03	63.7	84.4

According to the definition of Baumgarten (2005), the noise level in the milking parlor can be assessed as "moderate" at values from 71 to 75 dB. Referring the values reported by us to the given recommendation only for the winter season and only during midday milking there was an increase in the noise level slightly above that recommendation of 76.3 dB. A part from the technological equipment of the milking parlors and their age, the level of noise when cows are milked also depends on the total of animals milked at a given time, and therefore on the number of milking units of the installation. Exposure to noise directly depends on the way the milkers work, especially in terms of speed of operation (faster is noisier), the precision and accuracy of the placement of the milking cups (if done incorrectly, unpleasant noise may occur) , communication of milkers and moving the animals to the parlor or other activities (Psenka *et al*., 2016). Fig. (2) presents the variation of the noise level by sequential milking and sequential reporting during milking. It was found that regardless of the season during the morning milking the lowest values of noise on the farm were reported. The reason for this was that during the morning milking the various activities on the farm related to the normal daily work (passage of machines; veterinary activities, etc.) have not started yet. At the end of the midday and evening milking, higher noise levels were reported due to other activities on the farm. Regularly exposure to noise over 85 dB for more than 8 hours a day (or its equivalent sound energy) may cause constant hearing impairment (ISO, 1990).

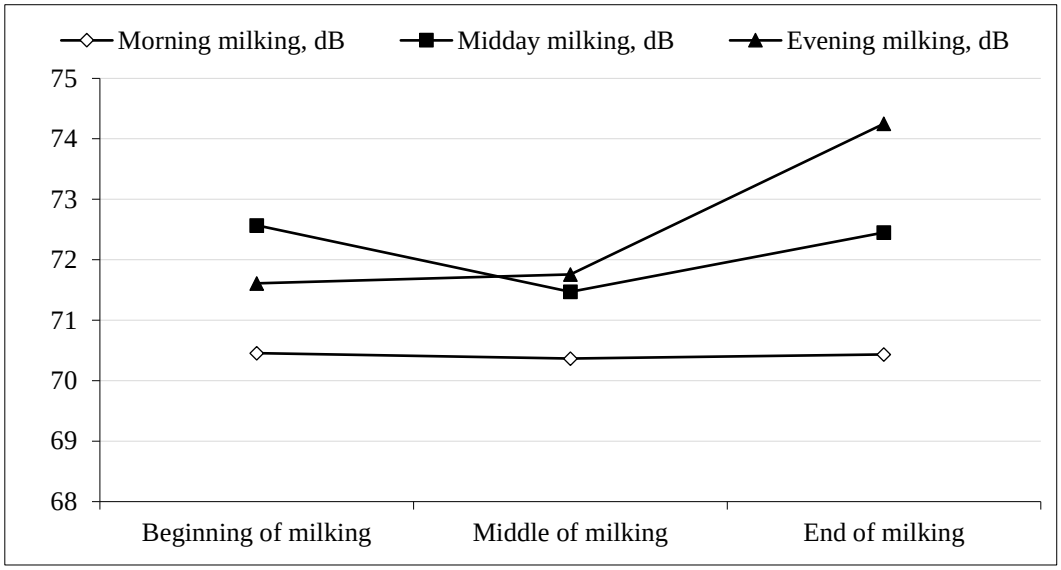

Fig. (2): LS-mean values for noise level by sequential milking and sequential reporting during milking.

Fig. (3) presents the average values for noise levels for 8 hours of working day by seasons. According to the legislation in force in our country concerning the noise level in a working premise for an eight-hour working day, a limit value of 87 dB is defined by regulation (Directive 2003/10/EO). In our study (Fig. 3) such a value was not reached, the highest reported value was 74.36 dB for the winter season. However, in terms of noise level, considered as good are farms reaching levels of up to 70 dB, and problematic ones with a noise level above 70 dB (Nosal & Bilgery, 2004). Noise levels above 70 dB also have a detrimental effect on the welfare of cows, and this is associated with a higher number of somatic cells in the milk. According to this recommendation, the summer and winter seasons were problematic in our study, where the given value was exceeded. Hearing impairment can be due to protracted and additive effects of noise for years, resulting in metabolic impairment of the cochlea. The impairment can also be the result of acoustic trauma associated with peak noise levels above 140 dB, which leads to immediate damage to auditory structures. At noise levels of 90 to 140 dB, metabolic impairment to the cochlea is observed rather than mechanical. It occurs in three stages, in the first stage there is damage to the sensory cells of the cochlea, which do not regenerate, in the second stage, which lasts from months to years, there is audiometric hearing loss, in the third stage the person begins to have difficulty hearing other people's speech and seeks medical help himself (Clark & Bohne, 1999). In our study no such high and dangerous noise levels were reached. Table (2) presents the degree of ear damage at different noise levels according to the World Health Organization. In our study, such threatening noise levele were not reached, and it was not examined whether there was hearing impairment of workers.

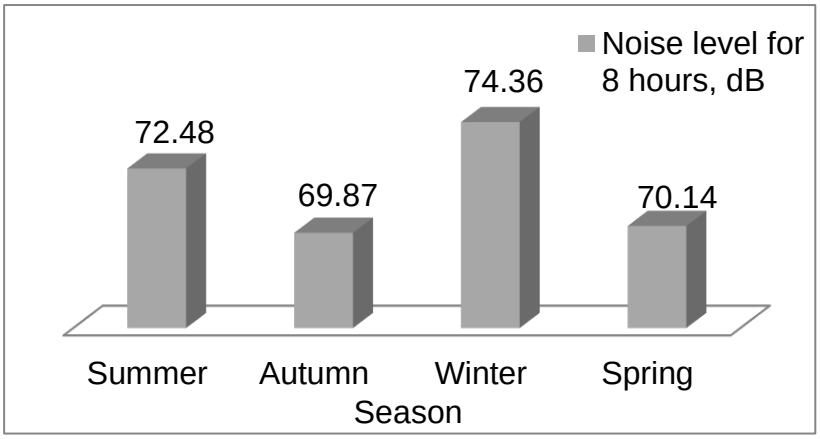

Fig. (3): Noise level for an eight-hour working day.

Table (2): Definition of hearing impairment[a]

Grade of hearing Impairment	Audiometric ISO value[b]	Performance
0 no impairment	<25 dB	No, or very slight, hearing problems. Able to hear whispers.
1 slight impairment	26−40 dB	Able to hear and repeat words spoken in normal voice at 1 m.
2 moderate impairment	41−60 dB	Able to hear and repeat words using raised voice at 1 m.
3 severe impairment	61−80 dB	Able to hear some words when shouted into better ear.
4 profound impairment, including deafness	>81 dB	Unable to hear and understand even a shouted voice.

a WHO (1991).

b International Organization for Standardisation, average of 500, 1000, 2000, 4000 Hz.

Conclusion

In the study, no threatening or dangerous noise levels were reached, both at the momently reported values and at the equated for the eight-hours working day, only momentary maximum values above the limit were reported. It is recommended to optimize the technological processes so as to minimize the noise level during milking, which is undoubtedly important for both operators (milkers) and animal comfort.

Contributions of authors

D.D.: Manuscript writing.

T. P. : Data collection.

I.M.: Statistical analysis and linguistic editing.

Conflict of interest

The authors have no possible conflict of interest.

Ethical approval

All ethical guidelines related to poultry breeding and care issued by national and international organizations were implemented in this report.

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تعرض العمال لمستويات الضوضاء في محلب الأبقار

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الملخص: أجريت الدراسة في صالة حلب بمزرعة أبقار حلوب تتكون من 500 حيوان من سلالة هولشتاين-فريزيان في بلغاريا. تم إيواء الحيوانات في حظيرة ألبان ذات طابق واحد وتم حلبها في صالة حلب مزدوجة ثمان من النوع" عظم السمكة**.** تم قياس مستوى الضجيج ثلاث مرات في كل حلب في البداية وفي منتصف الحلب وفي نهايته **(**في الصباح، منتصف النهار والمساء كل شهر لمدة عام واحد). تم تسجيل مستوى الضوضاء في بيئة العمل بواسطة مقياس الضوضاء "Lutron" SL. 4023SDتم الإبلاغ عن أعلى مستويات الضوضاء في الصيف والشتاء ، مع قيم قصوى تصل إلى 78.3 ديسيبل **.**وجد أنه بغض النظر عن الموسم أثناء الحلب الصباحي ، تم الإبلاغ عن أدنى مستويات الضوضاء في صالة الحلب (من 70.37 إلى 70.46 ديسيبل) . تفاوت متوسط قيم مستوى الضوضاء ليوم عمل مدته ثمان ساعات حسب الفصول من 69.87 ديسيبل إلى 74.36 ديسيبل ، مع أعلى قيمة تم الإبلاغ عنها لموسم الشتاء**.**

الكلمات المفتاحية : صالة الحلب، مستوى الضوضاء، العمال**.**