Noise and vibration as stress factors in milking: causes, effects and possible solutions

D. Nosal[1] & L. Gygax[2]

[1]*Agroscope FAT Tänikon, Swiss Federal Research Station for Agricultural Economics and Engineering,*
CH-8356 Ettenhausen, Switzerland
E-mail: dusan.nosal@fat.admin.ch

[2]*Swiss Federal Veterinary Office, Centre for proper housing of ruminants and pigs,*
CH-8356 Ettenhausen, Switzerland
E-mail: lorenz.gygax@fat.admin.ch

Summary

As our research shows, design and installation faults occur in practice that not only completely wipe out the advantages of the new developments but also adversely affect udder health and the welfare and performance of both cow and milker.

Anyone wishing to install a milking parlour and his or her architect should contact the milking machine manufacturer as early as the planning phase. This will allow many assembly and installation errors to be avoided and will save on assembly and annual maintenance costs. The desired values of < 0,3 m/s^2 for vibration and < 70 dB (A) for noise are achievable and the farmer should ensure that they are stipulated in the purchase contract. The manufacturers of AMS should also take steps to ensure that their equipment achieves these values.

Key words: *Milking, stress, milking machine, air-borne noise, structure-borne noise, vacuum stability*

Introduction

A cow can realise its full performance potential only in an environment in which it feels comfortable. The milking parlour is part of this environment. Having purchased a new milking parlour, farmers often become aware that the advantages are accompanied by signs of unfavourable conditions:

- The cows do not enter the milking parlour of their own accord.
- They defecate before entering the milking parlour or during milking.
- They are restless during milking and pull the milking units (MU) off.

- There is a dramatic change in milking behaviour (decline in milk yield, longer milking time, the cows do not allow their udders to be stripped).
- The milker feels uncomfortable and under stress both during and after milking.

Measurements and studies show that a phenomenon to which little attention has been paid to date, that of airborne noise ("noise") and structure-borne noise ("vibration"), may be the cause of this change in behaviour.

Such phenomena can be a source of discomfort for both people and animals and can have a negative impact on the vacuum stability of the milking machine and the performance and general well-being of the animals.

Measurements taken at 38 farms classified as good, at 12 problem farms and at 9 farms equipped with AMS make it clear that the design, installation and quality of assembly significantly affect noise and vibration levels. At good farms noise of up to 70 dB (A) and vibration of between 0.1 and 0.2 m/s^2 were measured. Problem farms have noise levels of over 70 dB (A) and vibration in excess of 0.3 m/s^2. Statistical analyses show that the majority of farms with fewer than 200,000 cells/ml have vibration levels of up to 0.3 ms^2 and noise levels of up to 72 dB (A).

Material and methods

In choosing the farms to be investigated, we tried to take account of all the makes available on the Swiss market and the various types of milking parlour (side by side, herringbone, tandem). We also measured noise and vibration in nine farms equipped with AMS.

Using specially adapted sound meters (real time analysis), the individual values were recorded at various frequencies, generally between 1 Hz and 20 kHz, in the airborne noise and structure-borne noise range.

As we are particularly interested in the comfort of the milker and the animals in our study, our measurements and evaluations therefore focus on the values at the points of impact. Airborne noise was measured in the milking pit and milking stalls 1.2 m above the floor, while structure-borne noise was measured at the level of the manure splash guards and on the structure of the milking parlour.

We were interested in the levels of vibration and noise in these AMS farms. For our measurements we selected three farms for each make of AMS. Fig. 5 shows the points at which vibration and noise were measured. Vibration was measured at the places where the cows came into contact with the structure of the milking robot (point 1: fixing point, point 2: robot arm, point 3: concentrated feed distribution point). Noise was measured in the holding area directly in front of the entrance to the

milking stall (No. 1), near the robot arm (No. 2) and at head height in the feed distribution point (No. 3). At each of these three measurement points for vibration and noise, measurements were taken during various work processes: entrance of the animal, premilking (to clean the teats), attaching the milking unit, milking and removal of the milking cup.

In order to understand the effects of noise on the vacuum conditions of the milking machine, we measured the vacuum stability and frequencies in the air pipe, the milk pipe and the end unit using a measuring technique specially developed for this purpose.

As well as measuring airborne noise and structure-borne noise, we also noted the cell count, milking problems and any installation errors.

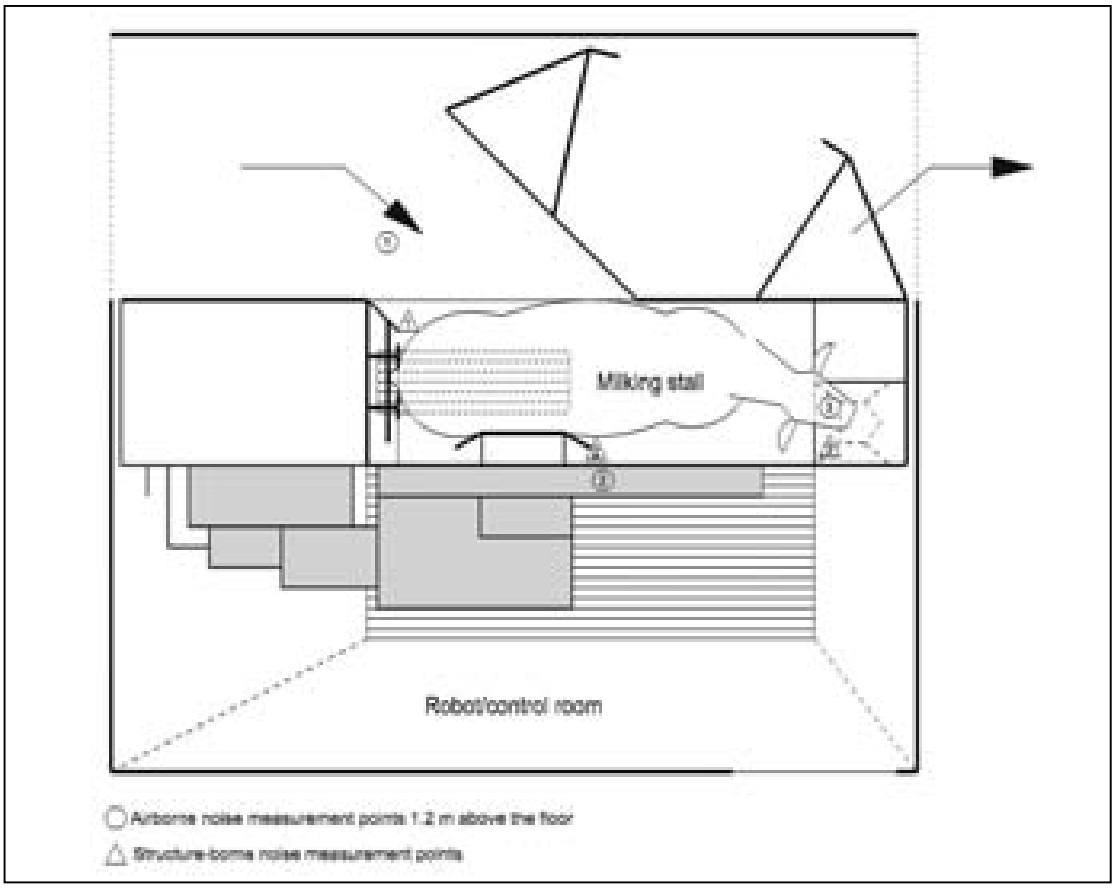

Figure 5. Measurements of vibration and noise in AMS farms taken during various operations.

Results

The statistical evaluation of all the farms shows that vibration has twelve times more impact on the cell count than noise. This is also clearly illustrated by a comparison of the trendlines for vibration (Fig. 1) and noise (Fig. 2). These two figures also show that the majority of farms with a cell count of fewer than 200,000 cells/ml experience vibration levels of up to 0.3 m/s^2 and noise levels of up to 72 dB (A).

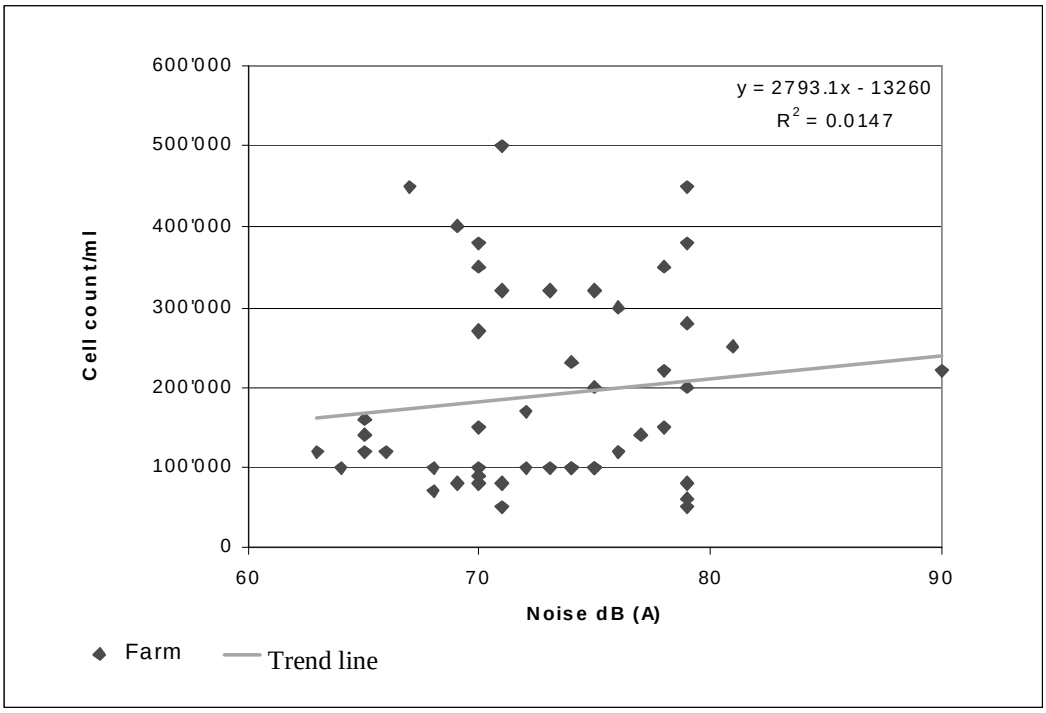

Figure 1. Relationship between vibration and cell count in the farms investigated.

In collaboration with the farmers and milking machine companies we were able to introduce changes in the installations of twelve farms and modify the milking machine.

The modifications significantly reduced the noise and vibration levels. The impact of these reductions in noise and vibration levels on the cell count (udder health) is shown in Figures 3 and 4 respectively. Statistical evaluations show that the reduction of vibration is three times more effective than the reduction of noise in decreasing the cell count per ml. There is a positive correlation between the reduction of vibration and reduction of the cell count.

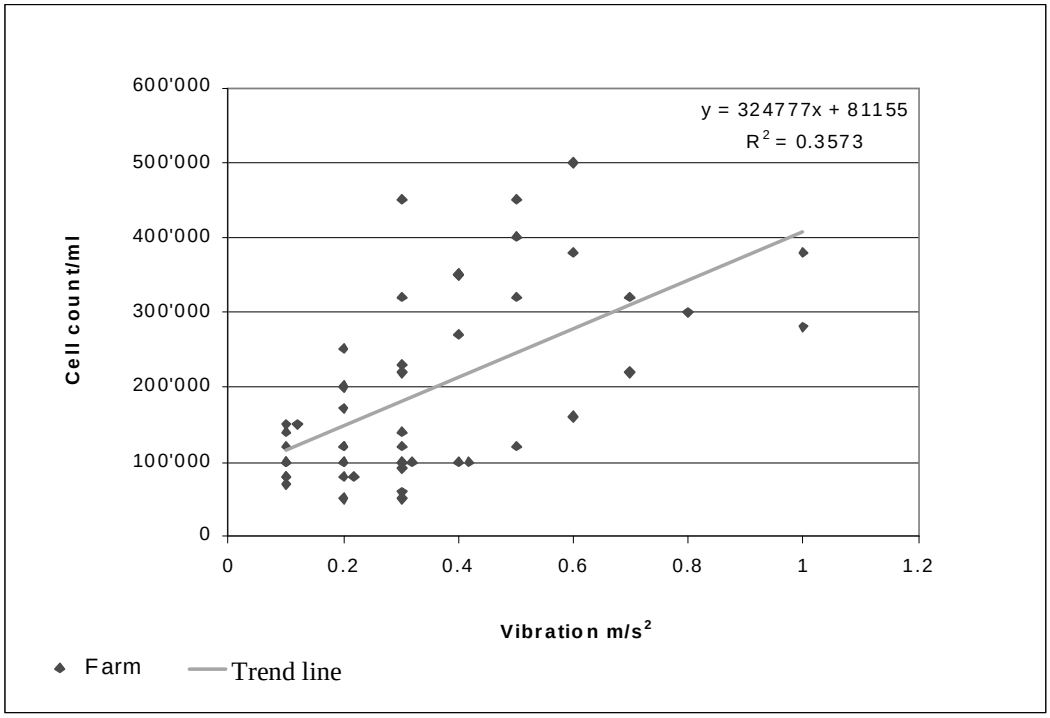

Figure 2. Relationship between noise and cell count in the farms investigated.

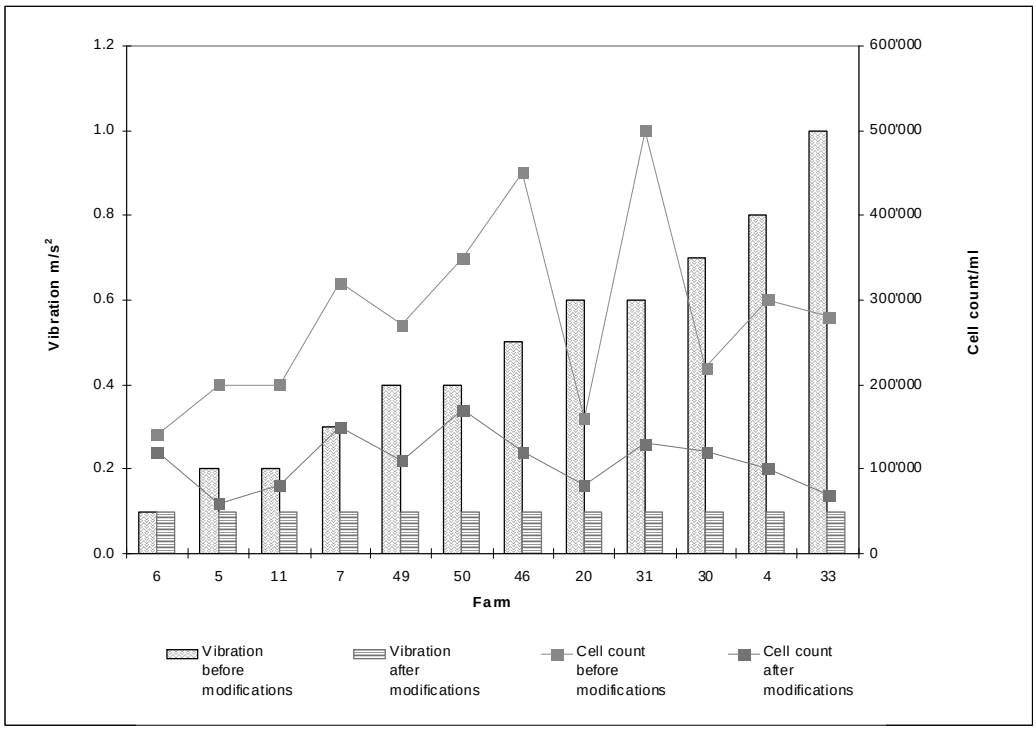

Figure 3. Relationship between vibration and cell count in the individual farms before and after the modifications.

For example, in farm No. 31 the vibration decreased from 0.6 to 0.1 m/s^2 and the cell count fell from 500,000 to 130,000 (Fig. 3). Noise reduction also produced striking results in terms of reduced cell count in certain farms. In farm No. 46 noise fell from 79 to 55 dB (A) and the cell count decreased from 450,000 to 120,000 (Fig. 4). The reduction of cell numbers also had a positive effect on the cows' performance (a healthy udder produces more milk). With the same feed and same farm management, the yield per cow per lactation rose from 7400 to 8100 litres.

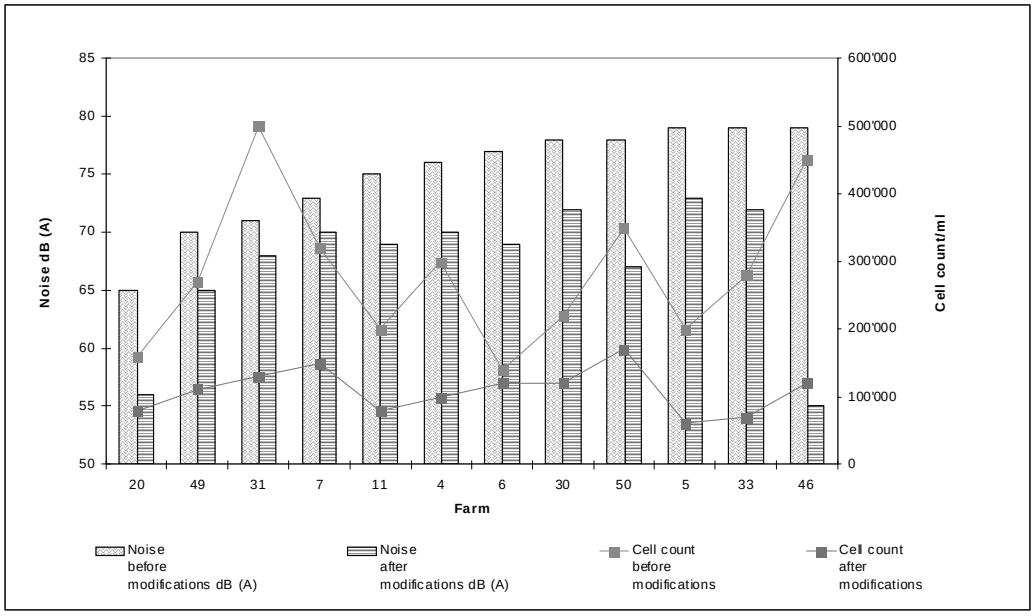

Figure 4. Relationship between noise and cell count in the individual farms before and after the modifications.

Today, around 30 farms in Switzerland are equipped with milking robots (AMS – automatic milking systems) made by DeLaval, Lely and Prolion. The results revealed no direct link between the level of vibration and noise and the measurement point, the work process or the make of AMS. The results for vibration and noise during the milking process (entrance of the animal, premilking, attaching the milking unit, milking and removal of the milking cup) show values that are too high for the individual work processes. In the case of vibration, the average value lies between 0.22 and 0.62 m/s^2, depending on the work process concerned. Maximum values of up to 1.50 m/s^2 were also reached in certain cases. In the case of noise, the average lies between 70.3 and 78.3 dB, (A) with maximum values of up to 88 dB (A).

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