CHEMICAL ENGINEERING TRANSACTIONS
VOL. 58, 2017
A publication of AIDIC
The Italian Association of Chemical Engineering
Online at www.aidic.it/cet
Guest Editors: Remigio Berruto, Pietro Catania, Mariangela Vallone

ISBN 978-88-95608-52-5; **ISSN** 2283-9216
DOI: 10.3303/CET1758008

Working Time Requirements, Workload and Physical Strain of Daily Stable Work on Small Farms Specialized in Suckler Cows in Upper Carinthia

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Dairy cattle farming is the predominant production system in cattle farming in Austria. However, in Carinthia, particularly in the mountain areas, suckler cows are the predominant production system. Farms with suckler cows in the mountain areas rely mainly on the calf or baby beef fattening, mainly on pasture. The fattening of the calves is mostly outsourced, since concentrated feed can only rarely be grown and additional purchases are not economically viable. The current low milk prices could give a new impetus to suckler cows. Compared with dairy cattle farming, the milking process is no longer required, which means that the daily stable working time is shorter. Other activities, such as removing dung and providing litter, feeding and feed preparation, cleaning and daily outflow, can be considered as similar in both systems. All of these activities are the routine activities in suckler farming. A number of studies quantify the working time requirements of dairy cattle farming, but there are only a few recent studies dealing with suckler cows, in particular with the working time requirements for routine activities in suckler cow farming. Furthermore, there are no current studies dealing with the physical strain involved in suckler cow farming. Various physical and psycho-mental stress situations can cause occupational diseases. If the performance capabilities of farmers are overburdened, this can lead to different kinds of strains and health impairments (Kroll et al., 2011). However, it is not known to what kind of strains suckler cow farmers are really exposed to.
The main objective of this study was to collect information on the working time requirements, the workload and the physical strain involved in daily stable work on small suckler farms (with up to a maximum of 20 mother cows) in the area of Spittal an der Drau. Furthermore, the influence of different working methods on the working time requirements and the physical strain during feeding, manure removal, littering, cleaning and daily outflow were investigated. In addition, activities which are perceived by farmers as particularly physically demanding and which can lead to an increased strain or workload have been identified. In the process, special activities were also identified.
The results showed that manure removals with littering and feeding including food preparation are the most labor intensive activities. More mechanization reduces the working time requirements as well as the physical stress.

Working time requirements and physical strain concerning suckler cows

In order to be able to assess the data obtained from this study, several papers on the working time requirements referring to suckler cows, and the physical strain in dairy farming were investigated.
In 2006 a model for the calculation of the working time requirements of Austrian farms was developed. For the calculation of standard working time requirements of different branches, data from agricultural statistics about farm characteristics were used for categorization. An average of standard working time requirements of 28 MPh per cow was allocated for suckler cows. In comparison, for cattle the working time requirements were 120 MPh. There were regional fluctuations, which were related to the stocks of the main production areas (Handler et al., 2006).

Please cite this article as: Pichorner A., Schaffernicht S., Schick M., Moder K., Quendler E., 2017, Working time requirements, workload and physical strain of daily stable work on small farms specialized in suckler cows in upper carinthia, Chemical Engineering Transactions, 58, 43-48 DOI: 10.3303/CET1758008

RIEGEL & SCHICK (2006) determined working time requirements for cattle farming by time studies and measurements on farms. In addition to the total working time requirements, the working time requirements for activities such as feeding, manure removal, littering, special work, pasture management and management as such were calculated separately. For a livestock of 10 suckler cows the working time requirements were 61 MPh per suckler cow and year, a figure that decreased to 16 MPh per suckler cow and year for a stock of 400 animals. Feeding, littering and manure removal were performed in a mechanized method at the experimental farms (Riegel and Schick, 2006).
Despite increasing technology and automation, in the dairy industry, health impairing activities can occur, which can cause complaints. Employees of dairy farmers often suffer from diseases of the musculoskeletal system. One of the causes for these diseases is the milking activity. About a third of the milkers stated that the complaints did not occur during a particular activity. In addition to milking, activities performed with forks and shovels are perceived as activities inducing problems in the region of the lower extremities (Kauke et al., 2010).
With the standard Nordic questionnaire, POLD (2014) investigated the workload of milkers on cattle farms in Lower Austria. The results showed which body regions were aching within the past seven days, or whether the work could not be performed during the past 12 months due to the pain (Pold, 2014). In addition, PINZKE (2003) investigated the changing working conditions and health status of workers on dairy farms in Southern Sweden (Pinzke, 2003).

Materials and Methods

The survey covered 10 farms specialized in suckler farming with a population size of up to 20 suckler cows (on average 12 suckler cows). Data were collected in April and May 2016. Only farms were selected where suckler cow farming was the main production system. Only in one farm, the working couple carried out the work together, in the other cases only one person handled the daily stable work. All ten test farms were located in Upper Carinthia, in the district of Spittal an der Drau. Nine of the ten farms were in a disadvantaged area and belong to the category of mountain farmers. Only one farm had converted its stable into a free stall barn, the remaining 9 farms worked with tie-stalls. However, in these 9 farms the cows were on the alpine pastures during the summer.
Regarding the characteristics of the farmers, it can be said that more men than women worked on the farms and that the average age was 51 years. The health status of the surveyed farmers was assessed as being good to very good. 18% of the persons assessed considered their current state of health as satisfactory, 9% had permanent knee and back pain and 9% felt that their state of health was unsatisfactory.
Regarding the technical support, it can be said that a total of 40% of the farms cleaned their stables by hand and with a wheelbarrow. 40% of the farmers had a "manure channel", and 20% had a scraper or a dung channel cleaner. 70% of the farmers cleaned the calf boxes and the lying areas twice a day, 10% cleaned them only once a month, 10% only once every two weeks and 10% only every three days. 60 % of the farms were working with litter, whereas 40% of the farms had rubber mats in their stables. All farms littered by hand using a shovel. In addition to that, 30% of the farms had to prepare the litter by hand.
In addition to hay and silage, the suckling cows were given concentrated feed. The calves received besides milk (twice a day) also hay. The technical tools were only one silo cutter during the feeding and one farm loader and two hay cranes during the feed processing. On the other farms the work was carried out manually. In addition to that, some farmers cleaned the stall or the feed table daily with a broom. On some farms, the animals could be outdoors daily even during the indoor housing periods.
In addition to the daily work with suckler cows, special activities had to be carried out. The operational managers mentioned the following special activities: rutting checks, insemination, pregnancy checks, calving assistance, drying off of the cows, caring for the calf after birth, claw care, ear tagging, veterinary treatments, cleaning of the stables, scaling of the stable buildings and windows as well as cleaning of the working tools. Pasture work included fence maintenance, water supply, animal check, including feeding of concentrated feed, moving of cattle to the summer pastures, driving times, and keeping pastures open by cutting back shrubs and trees.
The data were collected with on-site recording or by means of questionnaires. During the direct observation, the working times of the work elements (such as taking up the handset, …) for routine activities were measured with a Pocket PC. The recorded times of the individual work elements in Ortim b3 (IST time) were transferred directly to a laptop using a USB cable and synchronization software. Later, they were reworked with the Ortim time software. Performance levels and reference quantities could also be included and entered. Subsequently, a statistical analysis and the calculation of the total working time requirements were carried out.

The main reason for the choice of the causal measurement method was that the most accurate results are to be expected, as only an estimate is given in an interview or a workbook. A disadvantage of this measurement, however, is the high labor time required for measuring (Martetschläger, 2007).
This method was successfully applied for the determination of the working time requirements in suckler farming by RIEGEL ET AL. (2007).
A one-time survey was chosen to record the working time requirements for special activities and work related to grazing as well as the state of health and the physical strain (workload).
The farmers who did the stable work were asked to complete a questionnaire. The questionnaire consisted of 40 questions. The first part of the questionnaire included questions related to the farm, operation managers and special activities. The second part covered the state of health, the physical strain as well as the risk assessment. Question No. 34 referred to problems in the muscular and skeletal system. These questions were extracted from the standardized Nordic questionnaire. This questionnaire was chosen in order to obtain information on the kind of complaints arising from the daily stable work on suckler cow farms. In addition, farmers were supposed to indicate during which activities complaints were arising (Kuorinka, et al. 1987). Questions regarding the farmers' current state of health and the technical equipment of the farms were only collateral issues.
In addition, the interviewees had to assess the presence of threats and, at the same time, indicate during which activities the threats occurred. The risk assessment was carried out according to the checklist "Orientated assessment of the hazard" (HARTMANN et al., 2013). The aim was to find out whether there were any hazards and in the case of certain activities which workloads existed.
The descriptive and analytical statistical analysis of the questionnaire was carried out in combination with the working time requirements. The statistics program SAS Enterprise Guide 7.1 was used for the descriptive and analytical evaluation of the parameters. The analytical methods applied were the correlation and GLM (Generalised Linear Model) to show significant relationships of the different features.

Results – Working time requirements and workload

The results indicated that manure removal and littering as well as feeding and feed preparations are the most time-consuming routine activities in suckler farming and that technical tools have an influence on the amount of working time requirements. Farms with low mechanization required 20.4 MPh per suckler cow per year for the manure removal (including littering), whereas farms with medium mechanization only needed 6.8 MPh. For feeding (including feed preparation), the difference between low and medium mechanization is very small (12.7 MPh and 12.4 MPh per suckler cow and year). As there were no technical tools for daily cleaning and daily grazing, the same working time was assumed for both degrees of mechanization (2.4 MPh and 2.3 MPh per suckler cow and year). In addition, significant effects were found for all different activities, which are shown in Table 1.
The lion's share of the working time requirements for routine work with a low degree of mechanization, more than 50 %, was taken up by manual manure removal and littering. The feeding process (including its preparation) share was more than one third, the daily cleaning and the daily outlet shares were less than one tenth. In the case of medium mechanization, the main part of the working time requirements for routine tasks was for feeding including preparation (52%). The manure removal and littering, each made more than a quarter and the daily outlet and the daily cleaning only caused 10% of the time requirements of routine work.
Thus, it can be said that mechanization has reduced the importance of manure removal and littering, and that the activity of feeding and its preparation has become the most time-intensive working task.
If all routine work is combined with special and pastoral as well as preparatory work, it can be observed that the special work occupied a very high share of the total working time, both in the case of low and medium mechanization. Among the preparatory tasks are the putting on and taking off of work clothing and shoes, going to the stable without load and coming back, switching on lights and turning them off as well as opening and closing the yard doors.
Figure 1 shows the annual working hours of routine tasks as well as special, pasture and preparatory work per degree of mechanization.
With a low degree of mechanization, 43% were accounted for special and routine work, 13% for pastoral work and just 2% for preparatory work. With a medium degree of mechanization, 50% corresponded to special work, 32% to routine work, 15% to pasture work, and slightly more than 2% to preparatory work.

Table 1: Different activities and parameters with significant influence (n=10).

Activity	Parameters	p-value
manure removal cows	sex	< 0.0053
	age	< 0.0001
	health status	< 0.0013
	interaction between number of cows and mechanization	< 0.0036
	interaction between age and health status	< 0.007
manure removal calf	frequency	< 0.0001
littering	lying area for cows or calves	< 0.0001
hay feeding	number of cows	< 0.0001
	feed quantity	< 0.0001
	interaction between feed quantity and feeding system (feeding system: fodder varieties per farm)	< 0.0001
silage feeding	feeding system	< 0.0001
	interaction between feed quantity and feeding system	< 0.0001
feeding with concen-trated feed	number of cows	< 0.0001
	interaction between feed quantity and number of cows	< 0.0001
hay feeding calf	number of calves	< 0.0006
	interaction between age and health status	< 0.0348
	feed quantity	< 0.0039
hay preparation	number of cows	< 0.0117
	feed quantity	< 0.0001
silage preparation	feed quantity	< 0.0001
concentrated feed preparation	number of cows	< 0.0001
	feed quantity	< 0.0001
litter preparation	litter quantity	< 0.0164
cleaning of feeding table	feeding table surface	< 0.0001
cleaning of stable alley	stable alley surface	< 0.0001
daily outflow	number of cows	< 0.0354
	stable system (tethering or loose housing)	< 0.0001

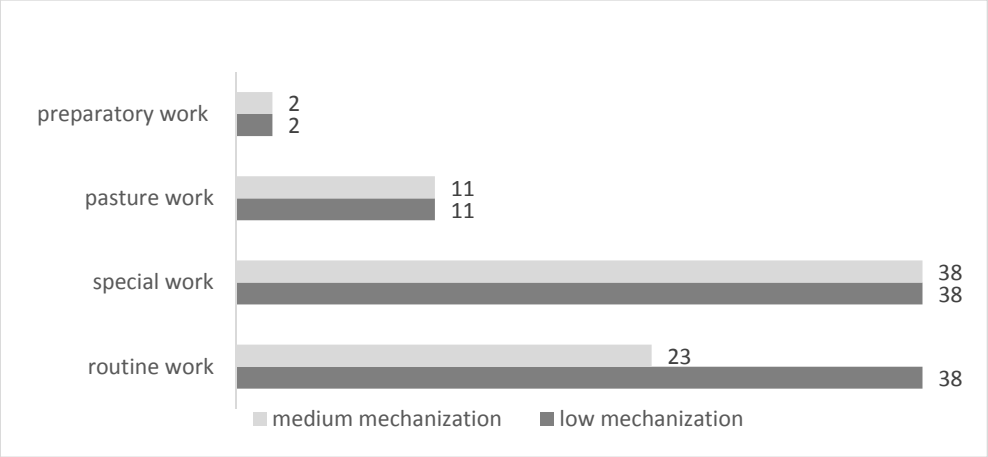

Figure 1: Working hours of routine as well as special and pasture work [MPh] per cow with calf and year by degree of mechanization.

Overall, the annual total working time requirements were 88.3 MPh per cow with calf and year for low mechanization and 74.5 MPh for medium mechanization. From the data collected by RIEGEL & SCHICK (2006), it appeared that the total working time requirements for 10 animals were 60.6 MPh per cow and year. However, in that study the feeding, the manure removal and the littering were performed with technical tools (Riegel and Schick, 2006). This could be one of the reasons for the shorter working time requirements per suckler cow, namely about 28 MPh.

Results – Physical strain and strenuous activities

In total, 6 out of the 11 people interviewed (55%) indicated that they experienced pain in the muscular and skeletal system during stable work (rate of complaint). In addition to ankle pain, they also mentioned neck pain, pain in the shoulder region, hand (joint) pain, back pain (both in the area of the thoracic spine, the dorsal vertebrae and the lower back), pain in the hips and thighs, as well as knee pain. 67% (4/6) of the persons questioned indicated that they had experienced pain during the last 7 days before the survey. Because of that, 83% (5/6) of the persons concerned were unable to do their stable work during the last 12 months nor could they pursue their leisure activities. In comparison, there are several studies which showed the muscular and skeletal strains in dairy farming. KOLSTRUP (2012) found in her study that 80% of Swedish farmers and 88% of female farmers suffered from musculoskeletal disorders (Kolstrup, 2012). In the present study, 75% of women (3/4) and 43% of men (3/7) were affected. POLD (2014) came to the conclusion that 100% of female milkers and "only" 44% of male milkers experienced problems in the muscular and skeletal areas within the last year before the survey (Pold, 2014). These three studies point out that in dairy farming as well as in suckler farming, women are more likely to have muscular and skeletal problems than men. According to POLD (2014), women were more likely to indicate problems in the muscular and skeletal systems (Pold, 2014).
The most strenuous activities in suckler farming included manual removal of manure, feeding, silage preparation, accustoming calves to the chain, leading bigger calves to the cows with a holder, attaching cows to the tethering and manual cleaning of the calf boxes. The percentages of these strenuous activities are shown in Table 2.

Table 2: Strenuous activities mentioned in suckler farming in percent (n=11)

Activity	Percent
Manual removal of manure - cows	21%
Accustoming calves to the chain	21%
Manual removal of manure - calves	16%
Manual feeding	16%
Manual silage preparation	16%
Tethering: fixation of animals	5%
Leading calves to cows with holder	5%

In addition, stable work also involved an exceeding of thresholds regarding the manual handling of loads, especially with regards to pulling, pushing as well as excessive bending of the torso. One person indicated that with pulling and pushing the daily standard measure was exceeded. Six out of 11 people even stated that they could not meet the daily standard regarding the bending of the torso. Especially during the activities of manure removal (also boxes) and feeding, increased strains could be detected. The exceeding of the limits in bending of the torso had a significant effect on the occurrence of increased strains.

Conclusions

Manure removal and littering, feeding and feed preparation, daily cleaning as well as daily grazing were among the main tasks during the stable period in suckler farming. The first two here before mentioned occupied the main part of the total routine working time requirements. By means of mechanical tools, such as dung channel cleaners, court loaders or hay cranes, the working time requirements can be significantly reduced. The installation of elastic floor coverings could also lead to time savings. However, every mechanized optimization and the conversion to a playpen involves costs. The question whether these are affordable for small scale suckler farms has to be clarified in each individual case.
A conversion to a running stable as well as the installation of technical tools for the removal of manure would also have a positive effect on the physical strain. 83% of the respondents who reported having pain could not carry out their work during the previous 12 months because of their ailments.
In addition to routine work, special and pastoral work also played an important role. The keeping of the fences and the transfer of the animals to the pastures as well as the animal check were mainly responsible for the high working time requirements.
The calculation of the working time requirements was carried out under the assumption that the animals were kept in the stable only during the winter and were kept on mountain pastures or on grazing land during summer. Some aspects, such as the loading of the calves after the sale or sales negotiations were not included in the calculations because of lack of data. This study can, therefore, only be regarded as a benchmark for daily stable work.

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