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EFFECTS OF DIFFERENT CLUSTER TYPES ON TEAT CONDITION AND MILK RELEASE PARAMETERS

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ABSTRACT In a joint project a standard cluster and a new innovative cluster were compared. The new cluster (AktivPuls, System Happel) is characterized by an innovative liner design. The vacuum shut off in the massage phase leads to a vacuum reduction at the teat under all milking conditions even with zero milk flow. In a 2 x 7 herringbone parlour the standard and the control group (137 animals in total) could be investigated for 127 days. Teat condition was assessed at five different occasions with the following parameters: teat skin condition, teat colour, ring formation, hardening and hyperceratosis. The assessment of the teat condition was based on an international standard. For the calculation a total of 2181 teat assessments could be used. One-way and two-way analyses of variance were carried out with the actuating variable "day in milk" and "lactation". There was a significant improvement with respect to ring formation and hyperceratosis. For the analysis of milk removal data two LactoCorder recordings were carried out. The investigations were carried out at the beginning and at the end of the project to gain information about total milk yield, rise, plateau and stripping-phase. Data from 75 animals could be used for one-way and two-way analysis. The first results show a highly significant effect of day in milk and lactation on some of the milk removal parameter. In addition two different models were used for optimized calculation of the data. The new cluster has a positive effect on the teat condition and causes a complete milk removal.

Keywords: soft massage milking, teat end condition, milk release

INTRODUCTION The invention of the two-chamber teat cup and pulsator around 1900 enabled gentle milking by machine. The working principle of the teat cup has hardly changed since then. But the parameters around the cow have changed. For instance, amount of milk produced, peak milk flow, quarter distribution, etc. These factors represent new challenges for milking equipment in ensuring rapid, gentle and complete milking-out [1]. A central function is played here by the pulsating milking vacuum. On the one hand, vacuum is necessary for milk withdrawal. On the other, it stresses the tissue [2]. Too high vacuum results in increased hyperkeratosis and tissue damage on the teats (e.g. reddening, hardening and ring marks). This damage is not without effect on milk letdown parameters [3]. A solution for the problem is offered by clusters that give optimum milking conditions, with at the same time, low stress on the teat. In a comparative milking trial this effect was tested for with the AktivPuls cluster and a conventional cluster.

MATERIAL AND METHODS The milking trial took place in a 120-cubicle barn at Köllitsch training and research farm in Saxony with a 2 × 7 herringbone parlour on one side of which were fitted for testing AktivPuls clusters (System Happel) featuring an innovatively designed liner and claw. During the massage phase, absence of vacuum in the lower area of the liner leads to less vacuum stress on the teat under all milking conditions, especially where there's no milk flow.

On the other side of the parlour the control clusters were left in place. At trial start the clusters on both sides of the parlour were fitted with new liners. The milking equipment set-up in the parlour remained otherwise unaltered. Before trial begin, settings were tested to conform with DIN ISO 6690. The equipment used is illustrated in **fig. 1**. The clusters were integrated with the existing milking equipment. The milking functions and disinfection between each milking was continued throughout the trial.

Figure 1: The technological design (source: Sagkob)

The trial animals were Holstein-Friesian "Schwartzbunt". In the trial year the herd averaged 9338 kg milk with 4.03 % fat and 3.47 % protein. Following a familiarisation period of 21 days with free choice of milking point, the herd was divided into a trial and control group and monitored over 106 days (August – December) with twice daily milking and each group driven to its respective side of the parlour. Taking arrivals and departures into account, 137 animals were assessed altogether.

Teat Club International udder scorecards were used as basis for the teat condition with parameters teat skin, teat colouring, ring formation, hardening and hyperkeratosis [4]. The cards were modified to offer comparability with earlier long-term studies. Teat skin, teat colouring, ring formation and hardening were marked on a three-level scale and hyperkeratosis on a five-level one, the highest scores being awarded to the worst and least desirable teat condition.

Five teat condition inspections were undertaken near milk recording dates during the trial. In total, data from 2181 inspected teats were assessed and analysed.

Two LactoCorder tests, respectively at begin and end of trial, were carried out to analyse milk flow. Hereby, total yield, flow increase, flow plateau and milking-out phases were measured with all milking cows. Because of the higher production at morning milking the tests were carried out then. In the evaluation, 75 cows had complete records and these cows were distributed as evenly as possible between trial and control groups. Recorded details were assessed and transferred into descriptive statistics. Information on teat condition and technical milk flow parameters was processed and subject to bifactorial variance analysis and covariance analysis. Factored in as model effect was lactation number and lactation day. Additionally, two evaluation variants were selected so that all collected data could be optimally evaluated. In the first variant 'A' were included animals that had taken part in the trial for at least three weeks, with arrival and departure dates taken account of. The second variant 'B' included only the animals in the trial during the entire period from August to December. This group therefore produced complete data.

RESULTS The 'A' variant was selected for presenting results on teat condition because development was comparable. Here, all observations were entered: for animals with incomplete data as well as those with complete data.

The descriptive statistic (**table 1**) gives an overview of herd teat condition. Average values (AW) and standard variations (SD) for teat scoring are presented for the characteristics recorded in the trial group (assay) and the control group (control)

Table 1: Results of teat condition (n-assay = 67 cows, n-control = 70 cows)

Parameters		AW assay (n= 67 cows)	AW control (n= 70 cows)	SD assay	SD control
teat skin	(note)	1,32	1,31	0,38	0,36
teat color	(note)	1,23	1,25	0,32	0,33
hardening	(note)	1,08	1,11	0,23	0,25
ring formation	(note)	1,26	1,66	0,37	0,41
hyperceratosis	(note)	1,71	1,91	0,65	0,79

Average values for teat skin and colour are comparable with both groups and lay around 1.3 with an average standard variation of 0.35. Hardening average for both groups was 1.1 which was a little better than the value of teat skin and colour.

Variance and covariance analyses gave no significant difference between both variants with parameters teat skin, teat colour and hardening. With ring forming, differences were indicated in averages with the trial group at 1.26 and the control group at 1.66. The standard variations of both groups were similar at 0.37 and 0.41. The ring forming is demonstrated in **fig.2**

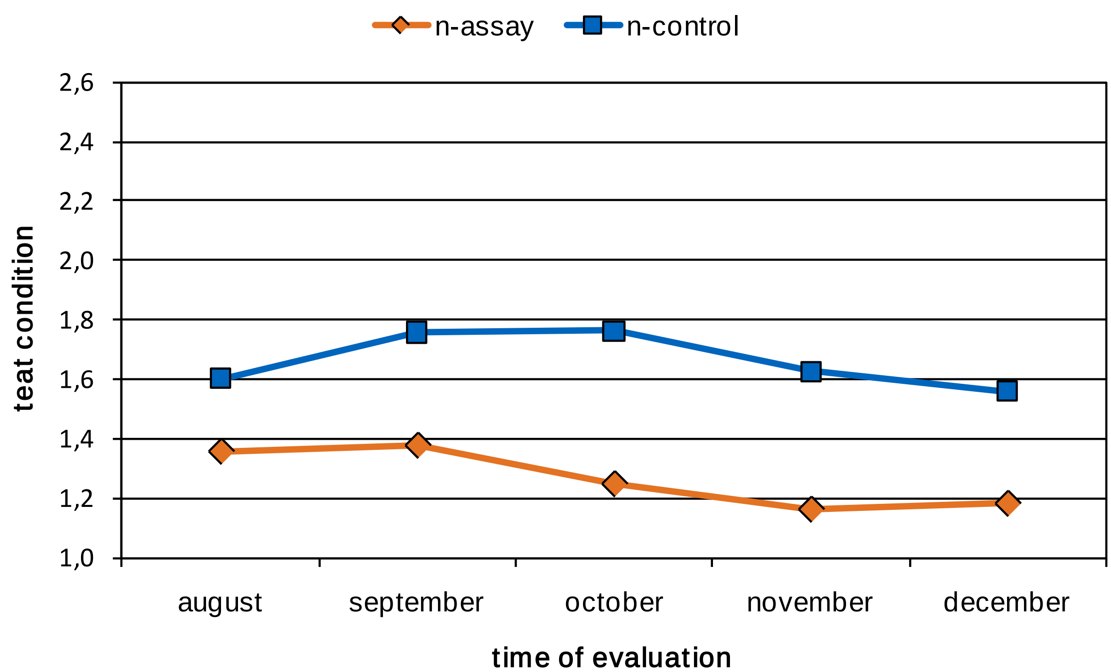

Figure 2: The development of the ring forming

A significant difference in ring formation between the variants ($p \leq 0.05$) was evident. Ring formation was less marked with the trial group.

Milking method or type of milking equipment were the biggest influences on hyperkeratosis development. This was shown most markedly by the analysis of the hyperkeratosis averages in the trial group with 1.71 and control 1.91. Despite taking into account the variables milk day and lactation number, a highly significant difference in favour of the trial group was evident ($p \leq 0{,}01$) as demonstrated in **fig. 3**.

Teat condition, above all the appearance of hyperkeratosis, was subject to seasonal variation. In winter months there was increased appearance of hyperkeratosis in general, which also explains the rise of both curves in December.

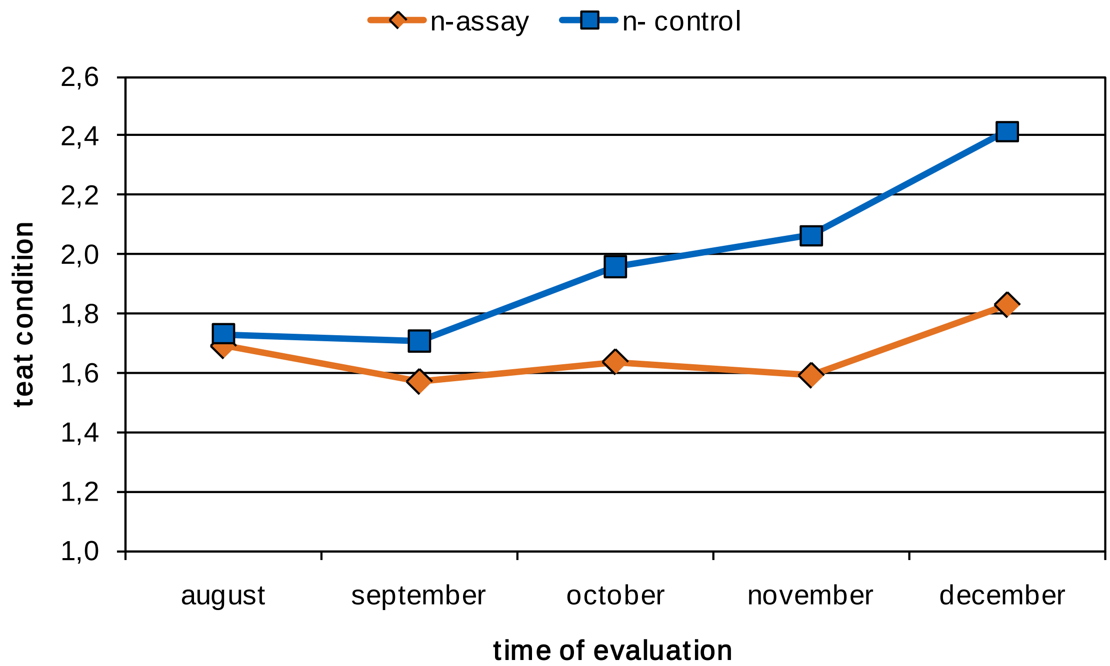

Figure 3: Development of hyperceratosis

The difference between both cluster types as far as hyperkeratosis development is concerned was shown clearly in the increasing divergence of both curves. This divergence is emphasised by the vertical lines between data points in each month for both groups. From this it can be deduced that the vacuum reduction counteracts hyperkeratosis.

Variant 'B' (animals with full data records) is presented in **table 2** for demonstrating LactoCorder results.

Table 2: Results of the LactoCorder-Analysis (n-assay = 44 cows, n-control = 31 cows)

Parameters	september		december	
	AW assay (n = 44 cows)	AW control (n = 31 cows)	AW assay (n = 44 cows)	AW control (n = 31 cows)
MGG / total quantity of morning-milk (l)	17,5	17,7	15,3	15,5
tS500 / first milking parameter (min)	0,5	0,33	0,34	0,56
tAN / beginning phase of milking (min)	0,94	0,78	0,95	0,83

Parameters	SD	
	SD assay	SD control
MGG / total quantity of morning-milk (l)	3,30	4,40
tS500 / first milking parameter (min)	0,14	0,13
tAN / beginning phase of milking (min)	0,29	0,31

The milk flow curves were compared between the same animals. The first analysis of milk flow parameters for animals present through the entire trial period timed, under total milk yield (MGG), milking period up to 0.5 kg/min milk (tS 500) and up to plateau phase (tAN) with averages presented in table 2.

Total milk in the morning milking for both groups averaged at trial begin 17.6 litres and at trial end 15.4 l per cow. Standard variation with the trial group was 3.3 and with the control group 4.4 l. One can successfully identify the two separate groups because their respective milk yields are almost identical.

The phase from recording start to reaching the 0.5 kg/min threshold (tS 500) is the first parameter of a milk flow curve with the tS 500 phase and the increasing flow phase (tAN) presented in minutes.

The tS 500 average for the trial group was 0.5 min at trial begin and 0.34 at trial end. Respective averages for the control group were 0.33 and 0.56. The standard variations of both groups were comparable at 0.14. The trial variant reached the tS 500 threshold at trial end faster than the control although this difference could not be statistically secured.

The increase phase follows the tS 500 phase and begins with the first milk flow $\geq$ 0.5 kg/min. The change to the plateau phase is determined when flow drops below 0.8 kg/min^2. **Fig.4** graphically presents the increase flow phase.

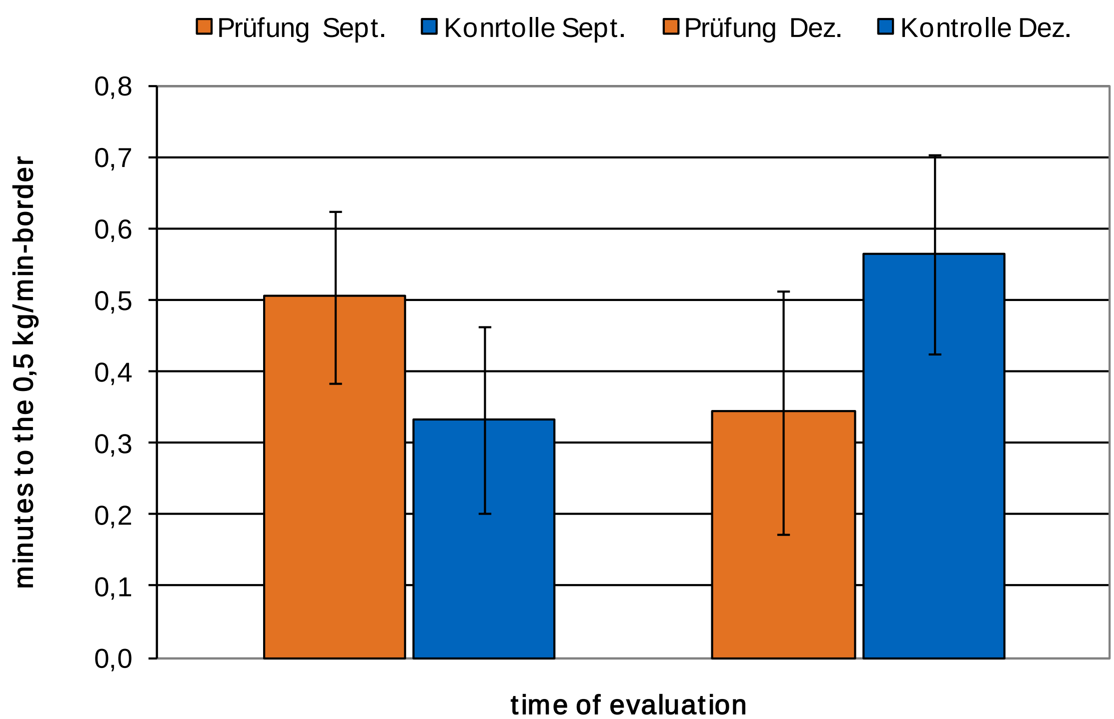

Figure 4: The beginning phase of milking

The trial group recorded 0.94 min at trial begin and 0.78 min at trial end with average standard variation of 0.29. The respective figures for the control group were 0.95, 0.83 and 0.31. The trial group thus showed a longer increase flow phase. There was a significant difference ($p \leq 0.05$) between both groups. The variables milking day and lactation are highly significant regarding parameters milk amount and flow increase phase ($p \leq 0.01$). No clear difference in milk flow curves resulted between the milking equipment in this trial.

CONCLUSION

- Vacuum reduction with the AktivPuls clusters led to improved teat condition.

- First evaluation of milk flow curves showed the milk letdown parameter as being more strongly influenced by the variables milk day and lactation than from the milking equipment used.

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