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Investigations into automatic feeding of suckling piglets with supplemental milk replacer

Biological progress in piglet production increasingly means litter sizes of more than 14 piglets with often associated lower birth weights. Furthermore, sow teat numbers and milk production are not always enough to ensure suitable nutrition for the entire litter. As well as balancing litter numbers or applying a mechanical foster sow system – which implies separation from the mother sow – an option is the supplementary feeding of milk replacer in the farrowing pen. This study investigates the drinking behaviour of piglets at an automatic supplementary milk feeder and records performance of sow and piglets in a case-control experiment. The supplemental milk feeding showed a positive effect on piglet growth. Video observation gave insight into the activity pattern and usage of the milk feeder.

Keywords
milk feeding, milk replacer, piglet, behaviour

Abstract
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Piglet losses increase as litters grow larger. With a litter size of 15 to 17 piglets the average weight per piglet sinks: the proportion under 750 g liveweight doubles and losses increase up to 24 % [1]. With milk production per sow averaging 8–10 kg per day and a maximum daily consumption per piglet of 1–1.3 kg [2] the amount of milk and often the number of teats are no long sufficient for supplying all litter members with milk at the same time. Several possibilities exist of aiding survival for all piglets. As careful balancing with an average 12 to 14 liveborn piglets per litter is often no longer possible, many pig units rear surplus piglets with milk replacer. For this approach there are different strategies. With a mechanical foster sow system and the rescue deck surplus piglets are reared without the mother sow, fed only with milk replacer during the first days of life. An alternative is manual or automatic supplementary milk feeding [3].

Within the framework of research for a Master thesis, a system for automatic feeding of supplementary milk was investigated on the basis of sow and piglet performance parameters and piglet drinking behaviour.

Animals, material and methods

Automatic supplementary milk feeding

The investigations were carried out in cooperation with the Education and Knowledge Centre for Pig Rearing and Pig Breeding Boxberg, Baden-Württemberg (LSZ) and the company Förster Technik GmbH from Engen. Förster Technik GmbH developed a prototype system for automatic feeding of supplementary milk according to the principle of "Baby-Milk-Mix-Feeders" (**Figure 1**). Two farrowing pen compartments of conventional design, each with eight pens, were connected via valve-controlled pipelines with the milk preparation and distribution station which was situated outside the compartment. In every farrowing pen a specially constructed tip-trough was attached to the respective pen wall (**Figure 2**). Each could be filled with fresh mixed and heated milk replacer when a sensor indicated the respective troughs were empty.

Animals

The investigation over four breeding cycles involving a total of 79 sows and 957 piglets. Every cycle featured a trial group and a control group with sows randomly penned in the farrowing compartments. The trial group comprised 46 sows and 574 piglets of which 286 piglets (from 23 sows) were observed for behaviour. The control group comprised 33 sows and 383 piglets. The piglets in the trial group received milk replacer via the automatic supplementary milk feeding system from day two postpartum. Control group piglets were offered water in the tip-

Fig. 1

Milk feeder mixing and distribution point

Fig. 2

Tiltable trough for additional milk feeding

troughs. Prestarter 1 was mixed with the milk replacer powder in gradually increasing amounts for the automatic supplementary milk feeding system. From day 10 postpartum all piglets (trial and control) were manually fed prestarter 2 comprising the unit's own feed mix. Sows were fed three times daily at 7.15 am, 12 noon and 3.30 pm.

Parameters

Recorded were number of weaned piglets, losses during suckling, liveweight of piglets on days 1, 6, 21 and 28 as well as sow condition (liveweight at penning and at weaning, backfat measurement and teat numbers). Via video, drinking behaviour of the piglets on supplementary milk feeding was observed (number of the respective animal individual drinking phases, phase beginning and end and therefore length). Video observation of piglets took place between days 2 and 6, on days 15 and 16 and on days 21 and 22, in each case over a period of 24 hours. Evaluation of video observations was via the Interact program from Mangold and linear mixed models were applied for evaluating the statistical data. Results

Physical development of nursing sows and piglets

Weight loss of sows during suckling averaged 33.89 kg in the control group and thus less than that for trial group sows where the respective average was 37.58 kg. Loss in backfat thickness was 5.22 mm in the trial group and thus 0.28 mm less than the figure for the control sows (5.50 mm backfat thickness reduction). All sows were judged "good" for teat and udder quality. Hardly any teat injuries were noted. On average the sows in the control and trial groups had 14.2 and 14.5 function-capable teats respectively and, at entering the farrowing pens, 11.5 and 11.6 milk-producing teats. No influence of the automatic supplementary milk feeding on the condition of the sows and their respective teats and udders was identified. In the trial group during the trial period 0.22 more piglets per litter were weaned compared with the control group whereby average number of born alive piglets during all the cycles, at around 12, was the same for both groups. However, piglet losses per litter were 1.8 % less in the trial group.

Table 1 shows daily liveweight gain of the piglets in association with automatic supplementary milk feeding. At 410 g up to day 6 postpartum this was significantly higher than the control group piglet average of 382g. Up to day 21 the respective results were 306 g and 294 g with almost identical performance for both groups from then to weaning. In three from four farrowing cycles daily liveweight gain and litter weaning weight was a little higher and more uniform for the trial group piglets and the trial group piglets were on average slightly younger (0.7 days) at weaning. The daily liveweight gain of the piglets post weaning did not differ significantly between the two groups; the piglets without supplementary milk feeding weighed slightly more at the end of the growing period than the trial piglets. Disadvantages from the suckling phase were to a large extent compensated for over the growing phase.

Drinking behaviour during feeding of supplementary milk

Behaviour observation showed that supplementary milk feeding system was well accepted by the piglets. Only seldom was a single piglet within a litter seen to ignore the supplementary milk. A typical biphasic activity rhythm was rapidly established (**Figure 3**) and this also corresponded to the nursing rhythm of the respective sows. The supplementary milk was drunk by the piglets mainly during morning and afternoon. The main resting phase for the animals lay between 9 pm and 7 am.

Allocating the piglets to different weight classes (light, medium, heavy) showed that there was hardly any difference in drinking behaviour between these classes. It was also shown utilisation by piglets of the supplementary milk did not de-

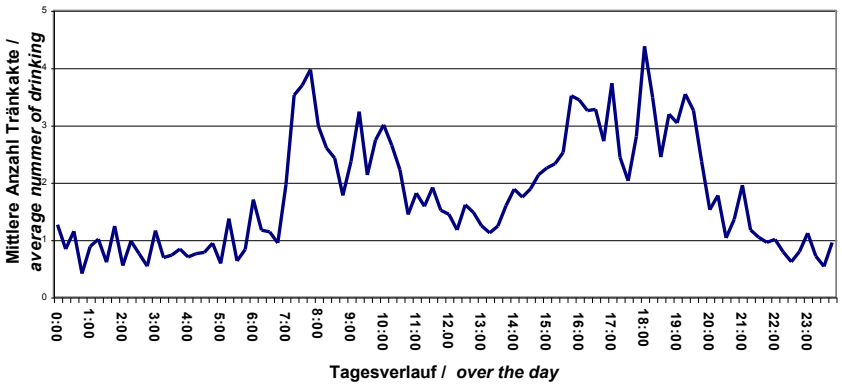
Table 1

Daily weight gain of piglets in dependence of additional automatic milk feeding

Datensätze ***Records***	**885**	**851**	**846**	**745**
Parameter ***Parameter***	**Tägliche Zunahmen 6. Lebenstag [g]** ***Daily weight gain day 6***	**Tägliche Zunahmen 21. Lebenstag [g]** ***Daily weight gain day 21***	**Tägliche Zunahmen Absetzen [g]** ***Daily weight gain weaning***	**Tägliche Zunahmen Aufzucht [g]** ***Daily weight gain growing***
Milchbeifütterung/*Additional milk feeding*				
Kontrolle/*Control*	382	294	281	421
Versuch/*Case*	410	306	294	417
p-Wert[1)]/*p-value*				
Milchbeifütterung *Additional milk feeding*	0,020	0,196	0,123	0,677

[1)] Die Daten wurden mit dem gemischten linearen Modell ausgewertet. Fester Faktor ist die Milchbeifütterung. Als Zufallseffekte werden die Wurfnummer und der Durchgang und die Sau miteinbezogen. Die Kovariable ist die Anzahl der lebend geborenen Ferkel (Mittelwert = 12,83). Für die Haupteffekte der festen Faktoren wurden die geschätzten Randmittel (LS-Means) angegeben/*data analysis with a mixed linear model. Fixed factor is the additional milk feeding. Random effects are the litter number, the period and the sow. Covariable is the number of piglets born alive (Mean = 12,83). For the main effects of the fixed factors the LS-Means are denoted.*

Fig. 3



Circadian rhythm of piglets fed with additional automatic milk feeding

Table 2

Daily weight gain of piglets in dependence of drinking frequency at additional milk feeder

Datensätze ***Records***	**267**	**255**	**252**	**229**
Parameter ***Parameter***	**Tägliche Zunahmen 6. Lebenstag [g]** ***Daily weight gain day 6***	**Tägliche Zunahmen 21. Lebenstag [g]** ***Daily weight gain day 21***	**Tägliche Zunahmen Absetzen [g]** ***Daily weight gain weaning***	**Tägliche Zunahmen Aufzucht [g]** ***Daily weight gain growing***
Tränkegruppe Tränkhäufigkeit/*Drinking group drinking frequency*				
Gelegentlich/*Sometimes*	399	302	288	425
Häufig/*Often*	364	295	283	459
Sehr häufig/*Very often*	351	270	253	469
p-Wert[1)]/p-value				
Tränkegruppe/*Drinking group*	0,059	0,286	0,194	0,025

[1)] Die Daten wurden mit dem gemischten linearen Modell ausgewertet. Fester Faktor ist die Tränkegruppe. Als Zufallseffekte werden die Wurfnummer und der Durchgang und die Sau miteinbezogen. Die Kovariable ist die Anzahl der in ihrem Verhalten beobachteten Ferkel (Mittelwert = 12,48). Für die Haupteffekte der festen Faktoren wurden die geschätzten Randmittel (LS-Means) angegeben/*data analysis with a mixed linear model. Fixed factor is the additional milk feeding. Random effects are the litter number, the period and the sow. Covariable is the number of piglets born alive (Mean = 12,48). For the main effects of the fixed factors the LS-Means are denoted.*

pend on litter size. In the main, it was the piglets that failed to establish a permanent drinking place at the mother sow's udder that sought out the supplementary milk and this occurred after a few unsuccessful attempts at natural suckling. When sows indicated the beginning of suckling with their typical grunts, litter members without an established teat place stayed apart and drank out of the milk troughs. Piglets without established teat places tended to gain weight more slowly and for this reason daily liveweight gain of piglets was also looked at in relationship to the number of times they drank from the supplementary milk trough (**Table 2**). For this approach the piglets were divided into groups according to the number of times they drank. A piglet in drinking group 1 drank between 0 and 80 times over the trial period and, with that, came under the category "occasional". Piglets in drinking group 2 drank from 81 to 160 times and were classed as "often" drinkers. Group 3 comprised piglets that drank more than 160 times at the supplementary milk feeding trough. These were classed as "very often" drinkers. The results show that piglets in the category "occasional" had a much higher daily liveweight gain during the suckling period. Conversely, the drinkers classed under "very often" had a low daily weight gain throughout the suckling period. During the growing phase the piglets that were observed very often at the supplementary milk feeding had significantly higher daily liveweight gain than the piglets from drink group 1.

Conclusions

Automatic supplementary milk feeding offers the possibility of ensuring nutrition for all the piglets in the farrowing pen. Compared to other systems (rescue deck, mechanical foster sow system, balancing litter size through fostering) the piglets stay with the mother sow and thus the mother-piglet relationship is maintained and the piglets are able to perform their natural behavioural traits. This proved to have positive effects on their development. There is room for technical optimisation of automatic supplementary milk feeding. The periods of supplementary milk supply, e. g., could be linked to piglet activity or sow suckling phases so that unconsumed milk left lying in the trough could be avoided and thus feed waste. Over and above this, the amount of feed and its composition could be more precisely adjusted to meet the nutritional-physiological requirements of the young animals.

Literature

[1] Feller, B. (2010): Bau- und Haltungstechnik zur mutterlosen Aufzucht (Landwirtschaftskammer Nordrhein-Westfalen). http://www.landwirtschaftskammer.com/duesse/lehrschau/pdf/2010/2010-01-07-wuerfe-03.pdf, Zugriff am 07.11.2011

[2] Kirchgeßner, M.; Roth, R. X.; Schwarz, F. J.; Stangl, G. I. (2008): Tierernährung. Frankfurt am Main, DLG Verlag GmbH, 12. Aufl.

[3] Knoop, S. (2009): Einsatz von Ferkelammen. Bildungs- und Wissenszentrum Boxberg, Newsletter, Juni 2009

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