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DIARRHOEA SCORES AND WEIGHT CHANGES IN RESPONSE TO ARTIFICIAL MILK SUPPLEMENTATION OR USE OF SOLULYTE-NEOMYCIN SOLUTION IN PREWEANING PIGLETS

K.H. Chua, Y.M. Goh, Y.H. Lee and F.L. Elizabeth-Law

Faculty of Veterinary Medicine
Universiti Putra Malaysia
43400 UPM Serdang. Selangor. Malaysia

SUMMARY

The objective of this study was to determine the effects of supplemental milk replacer and solulyte-neomix solution in preweaning piglets. A total of 199 five-day-old piglets from 22 litters were available for this three-week study. 12 litters (110 piglets) were allocated into the milk replacer supplemented group (MILK), five litters (47 piglets) were allocated into the ELEC group which was given an antibiotic-fortified electrolyte solution for pigs, and five litters (45 piglets) remained as untreated control (CTRL). However, after matching for litter size and total litter weights among treatment groups, only 44 piglets (5 litters) in the MILK group, 47 piglets (5 litters) in the ELEC group and 45 piglets from 5 litters in the CTRL group were considered in this report. All sows were fed the same diet (18% protein, 3,952 kcal of ME/kg). Body weights of piglets were measured at days 5 and 25 of age. Fresh liquid commercial milk replacer and solulyte-neomix solution were prepared daily. The fluids were offered thrice daily at 100mL per litter for 5-day-old piglets. Supplementation was increased to 5 times daily at 200mL per litter when piglets were 9 days or older, till the end of the trial. Average litter weight gain was higher in the ELEC piglets given solulyte-neomix solution and creep feed ($P<0.05$). Milk replacer-supplemented group (MILK) generally had lower average litter weight gains at 3.72 kg. However, the diarrhea scores were affected by the types of supplementation fluids given. The overall diarrhoea scores were higher in the MILK and CTRL piglets compared to the ELEC piglets. In conclusion, milk replacer supplementation offered no obvious benefit in terms of weight gain, final weight, and overall diarrhoea scores in piglets compared to solulyte-neomix supplemented piglets.

Keywords: Preweaning piglets, milk replacer, diarrhoea score, weight gain

INTRODUCTION

The growth rate of suckling piglets becomes impaired two to three weeks post-farrowing because daily milk yield of sows becomes insufficient (Zijlstra *et al.*, 1996). In conjunction with the swine industry's move to earlier weaning ages, the need to increase weaning weight has become more critical. Previous work has demonstrated that weaning weight is predictive of overall pig performance and days-to-market weight (Mahan and Lepine, 1991), and it is generally accepted that differences in weaning weight at a given age are a function of milk production (Lewis *et al.*, 1978). Milk production is directly related to energy intake of the sow, which in turn is influenced by diet composition (O'Grady *et al.*, 1985; Tokach *et al.*, 1992; Pettigrew *et al.*, 1993; Coffey *et al.*, 1994) and the environment (Black *et al.*, 1993). Thus, in order to maintain piglet growth close to its genetic potential, alternative rearing strategies are needed. Supplemental milk replacer has been used to a limited extent to support growth of orphaned pigs or in situations in which the sow's milk is not able to meet the demands of the litter (USDA, 1992). Management schemes, such as Segregate Early Weaning have been developed to improve performance of early weaned piglets. However, these systems utilising liquid milk-replacer diets, were less successful under practical conditions (Zijlstra *et al.*, 1996). Therefore, the objective of this study was to (i) determine the effect of using supplemental milk replacer in preweaning piglets and (ii) whether milk is superior to the solulyte-neomix (which is routinely used as supplementation in the Malaysian commercial pig farm) in weight gain and diarrhoea score.

MATERIALS AND METHODS

Animal management and treatment allocation

The experiment was conducted in a 2000-sow farrow-to- nursery breeder farm using F2 (Yorksire x Landrace) x Duroc crossbreds. A total of 199 five-day-old piglets from 22 litters were available for this three-week study. 12 litters (110 piglets) were allocated into the milk replacer supplemented group (MILK), five litters (47 piglets) were allocated into the ELEC group which was given an antibiotic-fortified electrolyte solution for pigs, and five litters (45 piglets) remained as untreated control (CTRL). However, after matching for litter size and total litter weights among treatment groups, as well as taking into account farm restrictions on the sample number, only datasets derived from five litters from each of the treatment group were analysed and considered in this report. In total, there were 44 piglets (5 litters) in the MILK group, 47 piglets (5 litters) in the ELEC group and 45 piglets from 5 litters in the CTRL group.

All piglets had *ad libitum* access to the sow's milk. Piglets were weighed upon entry into the trial (5-day-old) and at the end of the trial (25-day-old). This was done to minimise any unnecessary stress to piglets and sows. During the experimental period, data on diarrhoea score and mortality were recorded daily. Score for diarrhoea was defined as: 0 = no diarrhoea in the litter, 1 = diarrhoea in less than four piglets within the litter, 2 = diarrhoea in the entire litter. Intakes of milk and electrolytes were measured daily. Creep feed (containing 0.1% ferrous sulphate) was provided at 400g per litter to all of the litters as dry feed supplement and to all of the piglets from 9-day-old until weaning. Piglets were kept with their sows within farrowing crates measuring 0.61 x 1.98 metres (width x length). The crates had raised flooring made from plastic-coated metal slots. The crates were equipped with a trough feeder and a nipple drinker for the sow and additional nipple drinkers for the piglets. Air temperature was maintained using manually controlled ventilation fan and windows were closed during raining days and night time to maintain an ambient temperature of between 27 to 30°C. Supplementary heat was provided to the piglets using heat lamps.

The antibiotic-fortified electrolyte solution used for the ELEC group had the following constituents: glucose, 32.80 mM, citrate 8.66 mM, sodium 15.78 mM, chloride 10.01 mM, bicarbonate 7.44 mM, potassium 25.20 mM and 147.50 mg/L Neomycin Sulphate. The nutrient composition of the milk replacer and creep feed used in this experiment are as shown in Table 1.

Treatment administration and management

Piglets in the CTRL group were left untreated while those in MILK and ELEC groups were supplemented with a liquid milk replacer and the antibiotic fortified electrolyte, respectively, as described in the following paragraph.

Table 1: Proximate analysis of milk replacer and creep feed (dry matter basis)

Constituents	Milk replacer (powder)	Creep feed (pellet)
Energy (Kcal/g)	5.36	3.30
Crude protein (%)	21.10	21.00
Crude fat (%)	6.67	7.50
Crude Fibre (%)	1.10	2.00
Moisture (%)	3.71	14.00

Briefly, on day 1 of the experiment, the five-day old piglets in the MILK and ELEC groups were offered liquids at 100 mL/litter once daily at 1500 h. Between days 2 to 5 of the experiment, liquids were given at 100mL/litter thrice daily at 0800 h, 1000 h and 1500 h. Between days 6 to 15 of the experiment, liquids were offered five times daily at 0800 h, 1000 h, 1300 h, 1500 h and 1700 h at 100 mL/litter. In the final week of the experiment, when the piglets were between 20 to 25 days old, liquids were offered at 200 mL/litter, five times daily at 0800 h, 1000 h, 1300 h, 1500 h and 1700 h. Feeding amounts and feeding frequencies had to be adjusted in order to match the growth requirements of the piglets. Liquids were always offered to the treatment groups simultaneously and at the exact same amounts. Liquid milk replacer was prepared by hand-mixing a milk replacer powder with warm water (43°C - 49°C) in a ratio of 1:10 (W/W). The milk feeder bowls were washed each time before a fresh solution of milk replacer or electrolyte was added. The volume of liquids supplied and refused in the bowl was measured and recorded during each feeding to determine total fluid consumption.

Data analysis

Datasets were analysed using the one way analysis of variance to determine the effects of treatments on entry and exit weights, as well as weight gains. Significantly different means were then elucidated using the Duncan's multiple range test. Weight gain percentages and overall diarrhoea scores were analysed using a non-parametric one way analysis of variance based on their median scores. All tests were conducted at 95% confidence level using SPSS software.

RESULTS

In general, piglets that were fed with milk replacer and untreated controls had a similar weight gain pattern and diarrhoea scores (Table 2). Those fed with solulyte-neomix solution (ELEC) demonstrated better weight gain at 25 days old, as well as minimal incidence of diarrhoea. This could be attributed to the presence of neomycin, an antibiotic incorporated into the electrolyte itself which had protein sparring effect in the gut and also served to control occurrence of piglet diarrhoea. This ultimately resulted in excellent weight gain of more than 200 % compared to their entry weight. There was no direct mortality as a result of the treatment allocations. Only two piglet mortalities were recorded throughout the experiment due to fatal crushing by a lying sow.

DISCUSSION

It was clear from the results that the ELEC piglets supplemented with solulyte-neomix solution had better weight gains. These piglets also recorded better diarrhoea scores compared to milk replacer supplemented piglets (MILK group) and control animals (CTRL). In earlier experiments and under practical conditions, artificial rearing of newborn pigs resulted in diarrhoea and subsequent poor survival, due to uncontrolled intake of milk replacer and need for a nearly sterile environment (Lecce, 1986). More recent research with artificial rearing or supplementation of milk replacer during suckling, suggested that the sow limits maximum pig weight gain as early as 7 days after farrowing (Harrell *et. al.*, 1993; Azain *et al.*, 1996). However in this study, we have shown that adequate creep feed supplementation in ELEC group had better growth performance and better diarrhoea scores compared to the MILK group given both creep feed and milk replacer. So, in terms of piglets management, it is better to use solulyte-neomix rather than a milk replacer under farm conditions, because solulyte -neomix is cheaper, easier to be provided to piglets (not temperature dependent) and does not attract flies which may serve as vectors for many diseases. The milk can also be a good medium for bacteria growth if not handed properly at the farm.

Based on the results, the CTRL and MILK groups experienced mild to moderate diarrhoea especially in the first two weeks post-treatment, but not the ELEC group. This is because intestinal macromolecule absorption is greatly influenced by the composition of the fluid in which they are dissolved (Carisson *et al.*, 1980; Westrom *et al.*, 1985). No diarrhoea was observed among the litters during the third week except occasionally among the CTRL animals. Piglets less than 7 days old suffer severe osmotic diarrhoea, weight loss and high mortality if fed diets containing fructose or sucrose (Aherne *et al.*, 1969). The major carbohydrate components of our milk replacer were sucrose (12.4g/100g) and lactoce (3.5g/100g). At 7 to 10 days of age, piglets could utilise the fructose and sucrose because the well developed intestinal systems started to have enzymes that could hydrolyse the fructose or sucrose (Aherne *et al.*, 1969). In general, the lower weight gain ($P > 0.05$) in the MILK group could be due largely in part to diarrhoea and its sequelae. The milk replacer used in this experiment was rejected human milk powder which was reprocessed by adding corn.

Use of individual feeders in each crate, as in the experiments described above, is labour intensive and would not be practical on a large scale. Other problems associated with milk replacer supplementation as outlined in this study included difficulties in maintaining suitable milk temperature (H" 40°C) to promote optimal intake and rapid spoilage of the milk under crate conditions. Spoiled milk also attracts flies and may disturb fluid intake behaviour among the MILK group. However, the practical application of supplemental milk replacer for general use in all litters often requires a cost intensive automated delivery system. The system provides a sterile environment and maintains the temperature of the milk replacer. However, cost and farm level constraints under the Malaysia pig farming system often prevents the usage of these technology intensive facilities, thereby making creep feed supplementation and use of solulyte-neomix solution a viable alternative to milk replacer supplementation under Malaysian farming conditions.

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Table 2 : Effects of milk replacer (MILK) and solulyte-neomix (ELEC) on weight parameters (Mean ± SD) and median diarrhoea scores in preweaning piglets

	MILK	ELEC	CTRL
Weight at entry (5 days old) (kg)^{ns}	2.12 ± 0.10	1.97 ± 0.09	2.06 ± 0.11
Weight at end of trial (25 days old) (kg)	5.84 ± 0.20^{a}	6.21 ± 0.28^{b}	5.92 ± 0.29^{ab}
Weight gain (kg)	3.72 ± 0.25^{a}	4.24 ± 0.22^{b}	3.86 ± 0.42^{a}
Weight change (Median %)	171.02^{a}	206.00^{b}	180.70^{a}
Overall median diarrhoea score (Days 5 to 25)	1.20^{a}	0.04^{b}	0.92^{a}

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