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Effect of Feeding Probiotics and Milk Powder Supplemented Creep Ration on the Growth Performance and Efficiency of Feed Utilization in Pre-weaning Piglets

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ABSTRACT

The experiment was conducted to study the effect of creep feeding and its enrichment with probiotics and milk powder on the growth performance and efficiency of feed utilization in pre-weaning piglets. For the study, 28 piglets of uniform size and body weight were selected from four litters of Hampshire sows of similar parity and allocated to 4 different dietary groups: T_0 (fed conventional creep feed alone, control), T_1 (fed 5% milk powder supplemented creep feed), T_2 (fed probiotics supplemented creep feed added at 1g per kg creep feed) and T_3 (fed creep feed supplemented with 5% milk powder + probiotics at 1g per kg creep feed). The experimental protocol was followed upto weaning age. Body weights at 8th week of age was found to be significantly ($P<0.01$) higher in the treatment groups as compared to the control group. Piglets getting combined supplementation of milk powder and probiotics (T_3) had highest ($P<0.01$) feed consumption with better feed gain ratio followed by T_2, T_1 and T_0 groups. It was concluded that supplementation of probiotics and milk powder in the creep ration of suckling piglets resulted in a positive impact on their growth performance with an efficient feed utilization.

Key words: Feed conversion ratio, Growth performance, Hampshire piglets, Milk powder, Probiotics, Pre-weaning

INTRODUCTION

The strong positive relationship between weaning weight and growth of pigs post-weaning suggests that there are considerable economic advantages associated with increasing the weaning weight of pigs (Mahan and Lepine, 1991). Thus, efficient piglet rearing right from their birth undoubtedly is an important aspect of overall successful pig farming. Though sow milk consumption remains as the main source of nutrients for neonatal pigs, providing alternative food sources may offer numerous benefits (Sulabo, 2009). Another interesting fact is that the time that milk is available to the piglets is only approximately 10 to 20 seconds (Fraser, 1980), so the piglets should be able to start suckling as soon as milk is available, because a 5-second delay will cause a 25 to 50% loss of access to milk. As such, the importance of a quality creep feed holds more goods especially in case of prolific sows with larger litters and less functional mammary glands (Sarandan *et al.,* 2009). Thus, an appropriate creep feeding practice of the suckling piglets from an early age of 7 to 10 days or so in a standard management environment makes possible the farmers to obtain higher litter weight at weaning.

When the basal liquid milk diet is reduced and the stage where-in the piglets are offered with solid creep feed from the 10th day after birth, the digestive physiology changes wherein the intervention of different feed additives is needed to have the maximum nutrient utilization (Suiryanrayna *et al.,* 2015). Among various feed additives, probiotics is gaining importance as a potential alternative to antibiotics to improve production efûciency of animals, including pigs (Lee *et al.,* 2010). Probiotics may contain one or more strains of microorganisms and may be given either alone or in combination with other additives in feed or water (Thomke and Elwinger, 1998). Also, the effects of probiotics appear to be more consistent and positive in

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piglets rather than in growing finishing pigs (William, 2000). Pollmann *et al.* (1980) in his study found improved feed utilization in piglets with feeding probiotics (PROBIOS) alone or in conjugation with lactose, which is a milk sugar.

Therefore, the hypothesis of the present study is that the nutrient intake and efficiency of nutrient utilization is limited in suckling piglets and that higher pre-weaning growth rates can be achieved through supplemental nutrient sources by providing milk powder and probiotics incorporated creep feed to suckling piglets. Considering the above facts and views, the present research work of feeding milk powder and probiotics supplemented creep feed was undertaken to study their effect on growth performance and efficiency of feed utilization in pre-weaning piglets.

MATERIALS AND METHODS

The animal experimental protocol was approved by the Institutional Animal Ethics Committee (IAEC) of the Assam Agricultural University and carried out as per the guidelines of the Committee for the Purpose of Control and Supervision of Experiments in Animals (CPCSEA), Ministry of Environment, Forest and Climate Change, Government of India.

The experiment was conducted at the *30-Sow Teaching Unit* of the Department of Livestock Production and Management while laboratory analysis of feed samples was done in the Department of Animal Nutrition, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati, India. Four Hampshire litters from sows of similar parity were selected for the study. Seven healthy piglets of uniform size and body weight were selected from each of the litters constituting one group and thus four dietary groups were formed. So, a total of 28 numbers of experimental animals were finally selected for feeding trial and recording of experimental data. Each of the experimental piglets was randomly assigned to one of the four dietary groups *viz.*, T_0 (fed conventional creep feed alone, control), T_1 (fed creep feed supplemented with 5% milk powder of Sagar brand i.e 5 kg milk powder were added in addition to 100 kg of basal feed), T_2 (fed creep feed supplemented with probiotics of

Table 1. The formula of the basal conventional farm ration

Name of the ingredients	kg/100 kg
Maize crushed	50
Wheat bran	12
Ground nut cake (de-oiled)	27
Fish meal	8
Mineral mixture	2.5
Salt	0.5
Vitamins (A,D,E,K)	Added at 200 g/ 100 kg feed

Table 2. Composition of farm ration, milk powder (Sagar brand) and probiotics (Probios)

Farm ration (%)		Milk powder (per 100 g)		Probiotics (Viable lactic acid bacteria/ gm)	
DM (basal feed)	95	Energy (kcal)	366	*Enterococcus faecium, Lactobacillus acidophilus, Lactobacillus casei and Lactobacillus plantarum*	10 million CFU
DM (left over feed) on % DM basis	92	Total fat (g)	1.5		
Crude protein	22.1	Total carbohydrate (gm)	52		
Ether extract	5.06	Protein(g)	35		
Crude fibre	4.75	Sodium (mg)	549		
Total ash	7.75	Calcium (mg)	1200		
NFE	60.34				

Probios brand added at 1g per kg creep feed i.e 100 g probiotics were added in addition to 100 kg of basal feed) and T_3 (fed creep feed supplemented with 5% milk powder + probiotics at 1g per kg creep feed).

All the experimental piglets were raised entirely on their dams' milk from birth to 7 days of age. From day-8 onward, the piglets of T_0, T_1, T_2 and T_3 groups were offered respective experimental feed twice daily as per the feeding schedule up to weaning at 56 days of age. The piglets were separated from their sows daily in the morning and evening for a period of 1 to 2 h following suckling and offered feed in the outdoor run and fed to appetite. The piglets were provided clean water *ad libitum* round the clock. The formula of the basal conventional farm ration and also compositions of the farm ration, milk powder (Sagar brand) and probiotics (Probios) used for the piglets are shown in Tables 1 and 2, respectively. The proximate analysis of the feed samples was done as per methods described in AOAC (1990).

The body weight of the individual piglets was weighed using a hanging balance and recorded in kg in the morning before offering feed and water. The first (initial) body weights were recorded on 8th day morning and then subsequently at weekly interval up to weaning at 56 days of age. The body weight gain of the piglets in a particular week were worked out by subtracting the previous week's body weight from the present body weight and was recorded in kg.

The daily quantity of feed offered and leftover thereon in each group of piglets were measured by using a digital balance, and the consumption were calculated by subtracting the left-over amount from the quantity offered and was expressed in kg on D.M basis. The daily feed consumption of the seven days of a week was summed up to arrive at the weekly feed consumption. The weekly feed conversion ratio (FCR) was calculated as feed consumed in a week/ body weight gain during that week (Sapra and Shingari, 1991). Data obtained were subjected to ANOVA (two-way analysis) using software package of SAS (Guide4.3). Treatment means were separated by Duncan multiple range test and level of significance was set at $P<0.05$.

RESULTS AND DISCUSSION

The findings of this study indicated that both the overall and final body weights at 8 weeks of age (Table 3) of all the four groups differed significantly ($P<0.01$) among themselves, it was highest in probiotics cum milk powder group (T_3), followed by probiotics (T_2), milk powder (T_1) and was lowest in control group (T_0). The results showed that probiotics and milk powder supplementation had significant positive effect ($P<0.01$) on body weight of the piglets in all the subsequent weeks. The present findings are in agreement with the findings of King *et al.* (1998), who reported that litters given milk supplements grew faster than litters receiving no supplemental milk. Researchers like Novotni-Danko *et al.* (2015) and Azain *et al.* (1996) also reported significantly higher body weights of piglets at weaning in milk supplemented group than the control group. The findings of significant effect of probiotics in body weight is well supported by Venkatachalapathy *et al.* (2013) who found in their study that concentrate feed mixture supplemented with multi-species probiotics strains showed significantly higher litter weight at weaning than the control fed only concentrate mixture.

The result of average weekly body weight gains (Table 3) was found to be highest in T_3 followed by T_2, T_1 and T_0 group. The differences were significant ($P<0.01$) among all the four dietary groups. The piglets showed a trend of steady weekly gain from 2nd week onward in all the treatment groups. The better growth performance in T_3 group could be attributed to the probiotics action of stabilization of gut microbiota resulting in better digestion and utilization of nutrients in milk powder enriched ration. Researchers like Rava (1991) found that milk powder supplementation in diet resulted in significantly higher weight gain than the un-supplemented piglets. Ha *et al.* (2011) in an experiment found that creep feed with milk replacer from early lactation may be effective for increasing weight gain of light piglets. On the contrary, Douglas *et al.* (2014) observed no significant difference at any stage from birth to slaughter in the average daily gain (ADG) of piglets given access to supplementary milk or not ($P>0.05$). In respect of effect of probiotics

supplementation, Pollmann *et al.* (1980) found that addition of PROBIOS with lactose in feed tended to improve average daily gain in starter pigs. Abe *et al.* (1995) in a trial, obtained higher body weight gain in probiotics fed newborn piglets than the control group. On the contrary, Shim *et al.* (2005) and Lahteinen *et al.* (2015) found no significant effect of dietary supplementation of probiotics on body weight gain in piglets.

Feed consumption (Table 4) was significantly (P<0.01) different in treatment groups as compared to control groups, it was the highest in group T_3 getting combined supplementation of milk powder and probiotics, followed by T_2, T_1 and the lowest value was observed in group T_0. It is inferred that feed consumption pattern is positively influenced by the palatability of the ration due to addition of milk powder. Result of this experiment is in agreement with the findings of Kharpran (2014) and Toi (2017) who reported that piglets supplemented with probiotics had higher feed consumption than piglets with no supplementation of probiotics. Furthermore, Pustal *et al.* (2015) also reported significantly (P<0.01) more creep feed consumption in milk supplemented group of piglets than piglets of control group. However, the finding of Dlamini *et al.* (2017) is contradictory to the present result, which reported that the supplementation of probiotics had no effect on feed intake of the piglets. These differences to the present findings may be due to the different managemental practices followed and type of supplements or probiotics used.

The FCR values (Table 4) of T_2 and T_3 was significantly lower (P<0.01) than T_0 andT_1, also FCR value of T_1 was significantly lower (P<0.01) than T_0. The lower FCR in T_3 and T_2 than T_1 and T_0 is due to the higher body weight gain in relation to feed consumption

Table 3. Average weekly body weight (kg) and body weight gain (kg) of piglets of different treatment groups

Weeks	Parameters	Treatment groups*			
		T_0	T_1	T_2	T_3
1st	Body weight	2.28^{a}±0.01	2.31^{a}±0.02	2.32^{a}±0.01	2.30^{a}±0.01
2nd	Body weight	2.76^{b}±0.04	3.10^{a}±0.04	3.18^{a}±0.04	3.23^{a}±0.06
	Body weight gain	0.51^{c}±0.01	0.79^{b}±0.03	0.86^{ab}±0.03	0.93^{a}±0.02
3rd	Body weight	3.36^{d}±0.03	4.05^{c}±0.04	4.23^{b}±0.05	4.39^{a}±0.03
	Body weight gain	0.60^{c}±0.01	0.97^{b}±0.49	1.05^{b}±0.03	1.17^{a}±0.02
4th	Body weight	4.19^{c}±0.03	5.06^{b}±0.04	5.48^{a}±0.12	5.60^{a}±0.11
	Body weight gain	0.82^{d}±0.01	0.99^{c}±0.03	1.08^{b}±±0.03	1.21^{a}±0.03
5th	Body weight	5.22^{c}±0.05	6.17^{b}±0.11	6.75^{a}±0.08	6.90^{a}±0.04
	Body weight gain	1.03^{c}±0.02	1.10^{b}±0.03	1.25^{a}±0.03	1.30^{a}±0.01
6th	Body weight	6.35^{c}±0.01	7.37^{b}±0.11	8.47^{a}±0.05	8.44^{a}±0.06
	Body weight gain	1.16^{b}±0.075	1.21^{b}±0.03	1.27^{b}±0.03	1.54^{a}±0.03
7th	Body weight	7.50^{d}±0.03	8.61^{c}±0.10	9.43^{b}±0.09	10.29^{a}±0.08
	Body weight gain	1.15^{c}±0.04	1.24^{c}±0.01	1.72^{b}±0.05	1.85^{a}±0.03
8th	Body weight	8.78^{d}±0.07	9.94^{c}±0.10	11.23^{b}±0.09	12.40^{a}±0.05
	Body weight gain	1.28^{c}±0.03	1.33^{c}±0.05	1.81^{b}±0.05	2.11^{a}±0.05
Overall	Body weight	5.05^{d}±0.30	5.83^{c}±0.34	6.38^{b}±0.40	6.70^{a}±0.44
	Body weight gain	0.94^{d}±0.04	1.09^{c}±0.03	1.29^{b}±0.05	1.4^{a}±0.06

*(P<0.05); **a,b,c Means with different superscript differ significantly; *Piglets of the control group (T_0) were fed conventional creep feed alone, whereas, basal diet was supplemented with 5% milk powder (Sagar brand), probiotics (Probios brand) added at 1g per kg creep feed, and 5% milk powder + 1g probiotics per kg creep feed in groups T_1, T_2 and T_3, respectively.

Table 4. Average weekly feed consumption (kg/piglet) and feed conversion ratio (FCR) of piglets of different treatment groups

Weeks	Parameters	Treatment groups*			
		T_0	T_1	T_2	T_3
2nd	Feed Consumption	$0.42^{c}\pm0.01$	$0.55^{b}\pm0.01$	$0.57^{b}\pm0.01$	$0.62^{a}\pm0.01$
	FCR	$0.83^{a}\pm0.02$	$0.70^{b}\pm0.03$	$0.66^{b}\pm0.02$	$0.67^{b}\pm0.02$
3rd	Feed Consumption	$0.58^{d}\pm0.01$	$0.74^{c}\pm0.01$	$0.79^{b}\pm0.01$	$0.85^{a}\pm0.01$
	FCR	$0.97^{a}\pm0.02$	$0.77^{b}\pm0.04$	$0.76^{b}\pm0.03$	$0.73^{b}\pm0.01$
4th	Feed Consumption	$0.75^{d}\pm0.02$	$0.87^{c}\pm0.01$	$0.98^{b}\pm0.01$	$1.14^{a}\pm0.01$
	FCR	$0.92^{a}\pm0.02$	$0.88^{a}\pm0.02$	$0.92^{a}\pm0.02$	$0.95^{a}\pm0.02$
5th	Feed Consumption	$0.89^{d}\pm0.00$	$0.98^{c}\pm0.01$	$1.12^{b}\pm0.02$	$1.25^{a}\pm0.01$
	FCR	$0.86^{b}\pm0.01$	$0.89^{b}\pm0.02$	$0.90^{b}\pm0.03$	$0.96^{a}\pm0.01$
6th	Feed Consumption	$1.05^{c}\pm0.04$	$1.15^{b}\pm0.03$	$1.20^{b}\pm0.01$	$1.40^{a}\pm0.02$
	FCR	$0.93^{a}\pm0.06$	$0.95^{a}\pm0.04$	$0.95^{a}\pm0.015$	$0.91^{a}\pm0.01$
7th	Feed Consumption	$1.11^{c}\pm0.03$	$1.21^{b}\pm0.01$	$1.48^{a}\pm0.02$	$1.50^{a}\pm0.03$
	FCR	$0.97^{a}\pm0.04$	$0.97^{a}\pm0.01$	$0.87^{b}\pm0.03$	$0.81^{b}\pm0.02$
8th	Feed Consumption	$1.25^{c}\pm0.03$	$1.31^{c}\pm0.03$	$1.68^{b}\pm0.02$	$1.88^{a}\pm0.01$
	FCR	$0.98^{a}\pm0.04$	$0.99^{a}\pm0.04$	$0.94^{a}\pm0.04$	$0.90^{a}\pm0.02$
Overall	Feed Consumption	$0.86^{d}\pm0.04$	$0.97^{c}\pm0.04$	$1.12^{b}\pm0.05$	$1.23^{a}\pm0.02$
	FCR	$0.92^{a}\pm0.02$	$0.89^{b}\pm0.02$	$0.86^{c}\pm0.02$	$0.85^{c}\pm0.02$

*($P<0.05$); ^{**a,b,c} Means with different superscript differ significantly; *Piglets of the control group (T_0) were fed conventional creep feed alone, whereas, basal diet was supplemented with 5% milk powder (Sagar brand), probiotics (Probios brand) added at 1g per kg creep feed , and 5% milk powder + 1g probiotics per kg creep feed in groups T_1, T_2 and T_3, respectively.

rate in T_2 and T_3 groups as compared to T_0 and T_1 groups. Researcher like Pollmann *et al.* (1980) found that Probios, a probiotics alone or in conjugation with lactose, a milk sugar to improve feed utilization. Contrary to the present findings, Toi (2017) did not observe any significant difference of FCR in piglets fed with solid-state fermented feed (done by *Lacto-bacillus plantarum)* from the control piglets. These differences to the present findings may be due to the different managemental practices followed and type of supplements or probiotics used.

CONCLUSION

The results of the present study conclude that feeding of a suitable probiotic is always beneficial while simultaneous enrichment of the feed with a good supplement like milk powder is even better for the piglets to attain maximum weight at weaning and might affect their post weaning growth performance.

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