Development of liquid milk replacer for rearing early weaned piglets

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ABSTRACT

A 28 day feeding trial was conducted to assess the effect of liquid milk replacer on the growth performance of early weaned piglets. Forty piglets (average birth weight 1.18 ± 0.01 kg) of 14 days of age were selected and grouped into five treatments groups viz (control, unweaned), T_1, T_2, T_3 T_4 and T_5 and fed with liquid milk replacer type I, type II, type III and type IV, respectively. This study revealed that piglets supplemented with liquid milk replacer type I (T_2) had comparable body weight gain (5.95 ± 0.08 kg) compared to control (5.77 ± 0.28 kg) and T_3, T_4 and T_5 had significantly lower weight gain than T_2 and control piglets.

Key words: Average daily gain, Feeding trial, Milk replacer, Piglets,

INTRODUCTION

A newborn piglet lacks a fully developed immune system since they are born immature and they have never been exposed to antigens (Rooke and Bland, 2002). The rapid development of the neonate coincides with the rapid changes in composition of mammary secretions consumed by the suckling piglet. Sow milk production is the major factor limiting piglet growth prior to weaning. Weaning weight is quite variable from litter to litter and much of this variation is due to the quantity of milk produced by sows. Due to larger litter sizes and increased competition for sow milk, nutrient availability for newly born piglets is often limited (Kyriazakis *et al.,* 2006).

Milk replacer may also be offered to piglets while they are with the sow in the farrowing crate to increase weaning weights and reduce variation in weaning weight and mortality in early weaning programme (Hurley, 2016). Hence, an attempt was made in the present study to develop liquid milk replacer for rearing of early weaned piglets.

MATERIALS AND METHODS

The study was undertaken at the Pig Breeding Unit of Post Graduate Research Institute in Animal Sciences (PGRIAS), Kattupakkam, Kanchipuram district, Tamil Nadu. The research station is located in the longitude of 80.0395° E and latitude of 12.8259°N.

Liquid milk replacer preparation

Four types of liquid milk replacers were prepared by fortifying the cow milk with the deficit nutrients**.** Based on the analyzed chemical composition of sow milk and the cow milk as per AOAC (2016) the

deficit nutrients in cow milk is calculated as follows

% Difference in nutrients = % of Nutrients in Sow milk - % of Nutrients in Cow milk.

The deficit nutrients were supplied by using skim milk powder, whey protein, ghee and coconut oil (Table 1). The prepared liquid milk replacer was boiled and cooled at 35-37 ^{o}C then fed to piglets eight times in day viz 7 am, 9 am, 11 am, 1 pm, 3 pm, 5 pm, 6 pm and 8 pm. The liquid milk replacer intake was determined as per Thodberg *et.al*. (2006) and Skok *et. al*. (2007). Creep feed was offered *ad libitum* from 21 days of age to all the treatment groups.

Table 1 Ingredients Composition of liquid milk replacers (g/100g)

Types of milk replacers	Ingredients Composition of milk replacers				
	Cow milk, ml	Skim milk powder, g	Whey protein, g	Coconut oil, g	Ghee, g
Type I	100	4.8	-	-	1.75
Type II	100	4.8	-	1.75	-
Type III	100	-	2.1	-	1.75
Type IV	100	-	2.1	1.75	-

Animal feeding trial

The prepared liquid milk replacers were tested with the piglets from five crossbred sows (Tamil Nadu veterinary and Animal Science University Kattupakkam Gold) with a litter size of eight. Five treatments were formed in which treatment one (T_1) was kept control where the piglets were not separated from sow. The piglets from each of the other four sows were weaned by 14 days of age and assigned to one of the treatment two (T_2), three (T_3), four (T_4) and five (T_5) and fed with liquid milk replacer type I, type II, type III and type IV respectively. The weekly body weights were recorded and weekly body weight gain was calculated.

Statistical analysis

The data on weekly body weight and body weight gain were statistically analyzed using Analysis of Variance as per Snedecor and Cochran (1994). Means were compared by Duncan multiple range test using SPSS package of version 20 for windows.

RESULTS AND DISCUSSION

The data on proximate composition of cow milk and sow milk used for calculating the deficit nutrients were as follows. The present chemical composition of sow milk and cow milk for total solid, total ash, crude protein, fat, lactose and SNF was 20.81 ± 0.41 and 14.48 ± 0.37, 0.82 ± 0.04 and 0.71 ± 0.02, 5.01 ± 0.16 and 3.33 ± 0.12, 8.25 ± 0.34 and 4.74 ± 0.03, 6.25 ± 0.27 and 5.69 ± 0.29 and 12.64 ± 0.21 and 9.7 ± 0.35, respectively. The proximate composition results of cow milk and sow milk were in agreement with the findings of Scnurn (1968) and Hamad (2010).

The overall body weight of piglets at the start of the feeding trial in T_1, T_2, T_3, T_4 and T_5 were 3.68 ± 0.11, 3.40 ± 0.04, 2.89 ± 0.12, 4.08 ± 0.27and 4.07 ± 0.37 respectively. The average body weight of piglets at the end of the feeding trial in T_1, T_2, T_3, T_4 and T_5 were 9.45 ± 0.33, 9.36 ± 0.07, 8 ± 0.60, 8.29 ± 0.60 and 8.39 ± 0.52 respectively (Table 2). The body weight gain at the end of trial in T_1, T_2, T_3, T_4 and T_5 were 206.18 ± 9.83, 212.59 ± 2.71, 182.54 ± 9.9 150.36 ± 17.73 and 154.24 ± 9.12 respectively (Table 3).

Table 2 The effect of liquid milk replacer on the weekly body weight (kg) of piglets.

Days	T_1	T_2 (cow milk+ skim milk powder + ghee)	T_3 (cow milk+ skim milk powder + coconut oil)	T_4 (cow milk+ whey protein + ghee)	T_5 (cow milk+ whey protein + coconut oil)
Birth weight	1.20 ± 0.02	1.13 ± 0.01	1.16 ± 0.02	1.22 ± 0.04	1.23 ± 0.04
14	3.68 ± 0.11^{bc}	3.40 ± 0.04^{ab}	2.89 ± 0.12^{a}	4.08 ± 0.27^{c}	4.07 ± 0.37^{c}
21	4.90 ± 0.15^{ab}	4.57 ± 0.08^{ab}	4.16 ± 0.24^{a}	5.18 V 0.38^{b}	4.90 ± 0.33^{ab}
28^{NS}	6.39 ± 0.22	6.26 ± 0.11	5.64 ± 0.23	5.79 ± 0.38	5.69 ± 0.39
35	8.05 ± 0.24^{b}	7.88 ± 0.04^{b}	6.58 ± 0.18^{a}	6.83 ± 0.39^{a}	6.86 ± 0.40^{a}
42	9.45 ± 0.33^{b}	9.36 ± 0.07^{b}	8 ± 0.25^{a}	8.29 ± 0.60^{ab}	8.39 ± 0.52^{ab}

P≤0.05, Means with different superscripts in a row differ significantly

Table 3 The effect of liquid milk replacer on the cumulative body weight gain of piglets.

Weeks	T_1	T_2	T_3	T_4	T_5
1	1.22 ± 0.06^{ab}	1.17 ± 0.08^{ab}	1.27 ± 0.19^{b}	1.10 ± 0.15^{ab}	0.83 ± 0.13^{a}
2	2.71 ± 0.13^{b}	2.85 ± 0.12^{b}	2.75 ± 0.24^{b}	1.71 ± 0.21^{a}	1.62 ± 0.20^{a}
3	4.37 ± 0.17^{b}	4.47 ± 0.03^{b}	3.69 ± 0.22^{b}	2.75 ± 0.24^{a}	2.79 ± 0.22^{a}
4	5.77 ± 0.28^{b}	5.95 ± 0.08^{b}	5.11 ± 0.28^{ab}	4.21 ± 0.50^{a}	4.32 ± 0.26^{a}

P≤0.05, Means with different superscripts in a row differ significantly

The piglets fed with liquid milk replacer type I have gained 5.95 ± 0.08 g of body weight when compared with other treatments. There was no significant (P<0.05) difference in body weight and body weight gain between the treatments. This was in agreement with the findings of Ruurd *et.al*. (1996). However, Dunshea *et.al*. (1999) found that skim milk feeding before and after weaning could result in cumulative improvements in growth performance in the nursing piglets. André *et. al.* (2005) also observed that feeding whey protein as source of protein increased the weight gain by 20 percent when compared with the vegetable protein source. Richard *et. al.*(1990) concluded that there was no difference in the average daily weight gain between the semiautomatic feeding system group and conventionally fed group, but the diarrhea was commonly seen in conventional system of rearing. Azain *et.al.* (1996) fed commercial milk replacer on fresh basis (150g/L) *ad libitum* till

weaning (d 21) and observed that the average pig weight and total litter weight at weaning there was no significant difference in litters receiving supplemental milk replacer.

Based on the results obtained from the present study it is observed that there was a significant reduction in the weight gain in the treatments T_3, T_4 and $T_5$when compared to the T_1(control) and T_2. However there was no significant difference between the T_1 (control) and T_2 in body weight and body weight gain at 42nd day of weaning age. Piglets supplemented with liquid milk replacer type I has shown comparable body weight and body weight gain with that of piglets reared with sow's milk (control).

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