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Research Article

COMPARATIVE STUDY ON DIARRHOEAL INCIDENCE AND MORTALITY RATE OF YOUNG PIGS FED WITH DIET CONTAINING SKIMMED MILK AND MILK REPLACER DURING PRE AND POST WEANING PERIODS

CHANAM R., KALITA G., GOSWAMI R., DAS H.*, KALITA A., JAGAN MOHANRAO G. AND DAS B.K.
College of Veterinary Sciences and Animal Husbandry, Central Agricultural University, Selesih, 796014, Mizoram, India
*Corresponding Author: Email - hemenvet@rediffmail.com

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Abstract: Present study was conducted to compare the diarrhoeal incidence, faecal consistency score (FCS), general appearance score (GAS), mortality rate and causes of mortality of Large White Yorkshire young pigs (LWY) fed with diet containing skimmed milk and milk replacer during the pre and post weaning periods *i.e.*, from 0 to 56 days of age. All the young pigs under the experiment were weaned on day 28 of age. The experiment was conducted in Livestock Farm Complex, College of Veterinary Sciences and Animal Husbandry, Central Agricultural University, Selesih, Aizawl, Mizoram, India. One hundred and twenty-nine (129) numbers of Large White Yorkshire young pigs from 12 litters having at least 6 young pigs/litter were utilized and sub-divided into three homogeneous groups- Control (C), treatment 1 (T_1) and treatment 2 (T_2) groups. Young pigs under C, T_1 and T_2 groups were fed starter ration containing 30% SMP, 15% SMP + 15% MRP and 30% MRP during 3rd to 5th week of age respectively, grower-I ration containing 15% SMP, 7.5% SMP+ 7.5% MRP, 15% MRP respectively during 6th and 7th week of age and grower-II ration without milk-based ingredients were fed on 8th week. Statistical analysis of diarrhoeal incidence, FCS and GAS revealed non-significant ($P \geq 0.05$) differences between the three groups during pre-weaning, post-weaning and overall periods. Mortality rate (%) of LWY young pigs shows comparatively similar result. It may be concluded that skimmed milk powder (SMP) can be replaced by milk replacer powder (MRP) in the diet of weaned pigs without any clinical complications.

Keywords: *LWY pig, Diarrhoea, Mortality, Skimmed milk powder, Milk replacer powder*

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Introduction

Piglets are subjected to rapid and simultaneous stresses during weaning, which can result in low and variable feed consumption, sub-optimal weight gain, diarrhoea episodes and increased morbidity and mortality [1]. Weaning is frequently associated with gastrointestinal disorders and post-weaning pigs may experience gastrointestinal problems [2], especially in early weaned pigs. Young pigs who have not been exposed to creep feeding are challenged with novel nutrients (mostly of vegetable origin) that are difficult to digest with the available milk-oriented enzymes at the time of weaning.

Therefore, it is advisable to offer young pigs a post weaning diet based on milk-derived products like whey, skim milk and lactose. Depending on the usage of other animal protein sources like fish meal and synthetic amino acids in the diet and the stages of growth, the number of dairy-based products in the diets of piglets ranges from 20% to 40% [3]. Due to the higher price of skimmed milk powder, pig farmers are either not adding or adding at a lower quantity. Commercial milk replacer powder for feeding calf has accessible in Indian market at lower prices. Keeping in view of the above-mentioned facts, the present study was conducted to compare the growth performance of young pigs fed with diet containing skimmed milk and milk replacer during pre and post-weaning periods

Materials and methods

Location and period of the study

The experiment was conducted in the Livestock Farm Complex, College of Veterinary Sciences and Animal Husbandry, Central Agricultural University, Selesih, Aizawl, Mizoram, India. The present study was conducted for a period of four months *i.e.*, January, 2021 to April, 2021.

Experimental animals and design

For the present study, 129 numbers of Large White Yorkshire young pigs from 12 litters having at least 6 young pigs/litter were selected. All the young pigs were identified individually just after birth and their body weights were recorded. Considering the litter size and litter weight at birth, parity number and sire number, all the twelve litters were subdivided into three homogenous groups (Control-C, T^1- Treatment 1, and T_2- Treatment 2). Young pigs of all the experimental groups were weaned at 28 days of age. After weaning, young pigs from the litter (without mixing of different litters) were shifted to weaner pens and reared till the end of the experiment, *i.e.*, day 56 of age. A period of 42 days feeding trial was conducted.

Feeding

Young pigs under Control (C), treatment 1 (T_1) and treatment 2 (T_2) groups were fed starter ration containing 30% SMP, 15% SMP + 15% MRP and 30% MRP during 3rd to 5th week of age respectively, Grower-I ration containing 15% SMP, 7.5% SMP + 7.5% MRP, 15% MRP respectively during 6th and 7th week of age and Grower-II ration without milk-based ingredients were fed on 8th week. All the experimental animals were fed with standard rations prepared as per NRC (2012) specification using conventional feed ingredients [4].

Analysis of data

The data collected from the study was statistically analysed with appropriate design [5].

Parameters recorded

Occurrence rate (%) of diarrhoea and faecal consistency score

The rate of occurrence of diarrhoea for a specific period of time was determined

by applying the following formula:

Occurrence rate (%) = [Observed total no. of young pigs having diarrhoea / Total no. of young pigs] × 100

The data so gathered were presented week-wise, analyzed and interpreted accordingly. While observing general appearance, the number of animals suffering from diarrhoea (faecal soiling around the anal region) were noted and the week-wise occurrence rate (%) of diarrhoea were calculated. The severity of diarrhoea was assessed using the faecal consistency score card as described by McLamb *et al*. (2013) [6] [Table-1].

Table-1 *Faecal consistency score card for young pigs to access the condition of the diarrhoea*

Classification	Score
Dry, hard, well-formed faeces	0
Soft but formed faeces	1
Pasty faeces green or brown in colour	2
Viscous faeces in light colour, episodic	3
Fluid faeces in light colour	4
Watery faeces, continuous	5

General appearance of young pigs

All research animals were individually inspected daily in the morning hours (after feeding) and scores were given [Table-2] according to their general appearance as specified by Meeuwse *et al*. (2002) [7]. The data were presented week-wise, analysed and interpreted accordingly.

Table-2 *General appearance score card for young pigs*

Classification	Clinical observations	Score
Normal	Alert, active, eating and drinking well, coat normal, well hydrated	0
Mildly depressed	Eats and Drinks, but does not move as quickly as normal, coat may be rough	1
Moderately depressed	Able to stand but inactive, head down, gaunt but still drinking, may be dehydrated	2
Severely depressed	Reluctant to stand, not eating or drinking, gaunt, dehydrated	3
Moribund	Unable to stand, not eating or drinking	4

Mortality rate and causes of mortality in young pigs

The following formula was used to determine mortality rate:

Mortality rate (%) = [Number of death during the period / Total number of animals at the beginning of the period] × 100

During the experiment, animals that died were sent to the Department of Veterinary Pathology, C.V.Sc. & A.H., CAU, Selesih, Aizawl, Mizoram for post mortem examination and the causes of mortality were determined accordingly.

Results and discussion

Occurrence rate (%) of diarrhoea

Occurrence rate (%) of diarrhoea in LWY young pigs under control (C), treatment 1 (T_1) and treatment 2 (T_2) groups during week 1 to week 8 of age are presented in [Table-3]. Statistical analysis revealed non-significant ($P \geq 0.05$) differences in occurrence rate (%) of diarrhoea in young pigs between the three groups during different periods of rearing. Generally, up to 14 days of age, maternal immunity via colostrum protects the young pigs from infections and some of the bioactive peptides and IgA in milk also protect the piglets during the lactation period [8]. During the 1st week of life, the sow's milk consumption by the young pigs is normal and they do not consume any feed or water. From the second week onward, they started to lick, drink and eat small amounts of feed, which predisposes the young pigs to infections. The occurrence of diarrhoea in the present experiment during the week 2, 3 and 4 of age might be due to the above-mentioned factors. In the present study, higher occurrence rate of diarrhoeal was observed in young pigs of all the three groups during the 5th week of age (1st week following weaning), which is supported by Sugiharto *et al*. (2014). This might be attributed to the weaning stress and abrupt dietary changes from liquid to solid diets. Diarrhoea was observed from 2nd to 3rd day following weaning in most of the young pigs under all the three groups (C, T_1 and T_2). Dunshea *et al*. (2000) [9] also reported that early weaned pigs experienced diarrhoea as early as day 2 after weaning in some piglets.

Williams (2003) and Lalles *et al*. (2004) [10] reported that the period immediately after weaning was associated with a higher prevalence of digestive disorders with incidence of diarrhoea and depression in the growth performance of piglets. Multi-factorial stressors such as environmental, dietary, and psychological stressors all contribute to poor growth performance in pigs after weaning. Similar results in young pigs following weaning were also observed by Pajor *et al*. (1991) [11], Gerritsen *et al*. (2008) [12] and Thu *et al*. (2011). However, during the week 6, 7, and 8 of age, the occurrence rate of diarrhoea was much reduced in the young pigs of all the three groups.

From the present study's results of the occurrence rate (%) of diarrhoea in LWY young pigs, it can be concluded that there are no significant differences in the diarrhoea occurrence rate (%) in LWY young pigs given diets containing skimmed milk powder or milk replacer powder during the pre and post-weaning periods.

Faecal consistency score (FCS)

The mean ± SE faecal consistency score (0-6 scale) of LWY young pigs under control (C), treatment 1 (T_1) and treatment (T_2) groups during week 1 to week 8 of age are presented in the [Table-4]. The statistical analysis revealed non-significant ($P \geq 0.05$) differences in faecal consistency score of LWY young pigs under C, T_1 and T_2 groups during week 1 to week 8 of age, pre-weaning (week 1-4), post-weaning (week 5-8) and overall (week 1-8) periods.

Marquardt *et al*. (1999) [13] reported the faecal score (0-3 scale) of piglets as 1.0, 2.0 and 3.0 for control group and 1.6, 0.0 and 0.5 for treatment group after 24, 48 and 72 hours after weaning respectively (weaned at day 21 of age). Nyachoti *et al*. (2006) [14] reported the faecal consistency scoring (0-3 scale) of piglets weaned at 18±1 d of age as 0.36, 0.20, 0.18 and 0.29 for the groups fed diet containing 23, 21, 19 and 17 CP % respectively for the period of 3 weeks following weaning. Htoo *et al*. (2007) [15] reported the faecal score (0-3 scale) during day 0 to day 21 post-weaning period as 0.17 & 0.18 for pigs fed with 24% CP and 20% CP groups respectively which weaned at day 19 of age. The current findings of FCS of young pigs were within range as recorded by the above mentioned authors.

From the present findings, it can be inferred that there were not much differences in faecal consistency score when young pigs were fed a diet containing SMP or MRP during the pre and post-weaning periods.

General appearance score (GAS)

The mean ± SE general appearance score (0-5 scale) of LWY young pigs under control (C), treatment 1 (T_1) and treatment 2 (T_2) groups during week 1 to week 8 of age are presented in the [Table-5]. Nyachoti *et al*. (2006) reported the body condition score of piglets weaned at 18±1 d of age as 2.75, 2.79, 2.75 and 2.67 for the groups fed diet containing of 23, 21, 19 and 17 CP % respectively for the period of 3 weeks following weaning. Camerlink *et al*. (2021) [16] reported the body condition score (0–5 scale) of litters kept with their littermates, whereas litters grouped by mixing two to three piglets from four different litters as 2.91 ± 0.04 and 3.04 ± 0.04 respectively on 4th week of age and 2.91 ± 0.04 and 2.86 ± 0.04 respectively on 5th week of age. However, no such records of general condition score of young pigs are available using the scale (0 to 4) to compare the present data. From the present findings, it can be inferred that there were not much differences in general condition score when young pigs were fed a diet containing SMP or MRP during the pre and post-weaning periods.

Mortality rate and causes of mortality in young pigs

The mortality rate (%) and causes of mortality in LWY young pigs during the entire period of study *i.e*., day 0 (birth) till day 56 of age (end of the rearing period) has been presented in the [Table-6] and [Table-7]. Out of the total of 129 young pigs reared, 15 numbers of young pigs died during the period of study which resulted in total mortality rate of 11.63%. The overall (week 1 to 8) mortality rates for C, T_1, and T_2 groups were 9.09%, 14.28%, and 11.63% respectively. The pre-weaning (week 1 to 4) mortality rates were 4.54%, 9.52%, and 6.97% for C, T_1 and T_2 groups respectively.

Similar pre-weaning mortality rate were recorded by Roychoudhury (1990) [17] upto 56 days, Abraham (2001) [18] upto 56th day, Wolter *et al*. (2002) [19] upto 3rd week with both milk replacer and no supplementation group,

Table-3 *Occurrence rate (%) of diarrhoea in LWY young pigs under control and treatment groups*

Age (Week)	Control (C)	Treatment 1 (T_1)	Treatment 2 (T_2)	P-value
1	1.99	2.11	2.09	1.000^{NS}
2	9.52	7.33	9.76	0.921^{NS}
3	8.16	7.75	7.67	0.974^{NS}
4	6.46	10.15	6.71	0.419^{NS}
5	18.21	24.71	28.36	0.096^{NS}
6	5.3	6.18	5.93	0.982^{NS}
7	3.93	3.94	3.38	0.982^{NS}
8	0	0.76	1.50	0.430^{NS}
Pre-weaning (Week 1-4)	6.51	6.76	6.56	0.831^{NS}
Post-weaning (Week 5-8)	6.97	8.98	9.94	0.100^{NS}
Overall (Week 1-8)	6.73	7.83	8.19	0.126^{NS}

Table-4 *Mean (±SE) faecal consistency score of LWY young pigs under control and treatment groups*

Age (Week)	Control(C)	Treatment 1(T_1)	Treatment 2(T_2)	P-value
1	0.03±0.01	0.03±0.01	0.01±0.01	0.395^{NS}
2	0.15±0.03	0.11±0.02	0.18±0.04	0.476^{NS}
3	0.12±0.02	0.16±0.04	0.12±0.03	0.734^{NS}
4	0.10±0.02	0.17±0.04	0.17±0.04	0.143^{NS}
5	0.35±0.05	0.34±0.05	0.42±0.06	0.762^{NS}
6	0.11±0.03	0.13±0.03	0.14±0.03	0.722^{NS}
7	0.05±0.02	0.03±0.02	0.05±0.02	0.343^{NS}
8	0.00±0.00	0.02±0.01	0.03±0.01	0.138^{NS}
Pre-weaning (Week 1-4)	0.10±0.03	0.11±0.03	0.10±0.03	0.850^{NS}
Post-weaning (Week 5-8)	0.13±0.02	0.15±0.05	0.16±0.05	0.834^{NS}
Overall (Week 1-8)	0.11±0.02	0.13±0.02	0.14±0.01	0.551^{NS}

Table-5 *Mean (±SE) general appearance score of LWY young pigs under control and treatment groups*

Age (Week)	Control (C)	Treatment 1 (T_1)	Treatment 2 (T_2)	P-value
1	0.04±0.02	0.09±0.03	0.04±0.01	0.289^{NS}
2	0.06±0.02	0.09±0.02	0.08±0.02	0.372^{NS}
3	0.07±0.02	0.09±0.03	0.08±0.02	0.970^{NS}
4	0.02±0.01	0.07±0.02	0.07±0.02	0.078^{NS}
5	0.21±0.03	0.20±0.03	0.30±0.04	0.316^{NS}
6	0.07±0.02	0.08±0.02	0.07±0.02	0.741^{NS}
7	0.04±0.01	0.04±0.02	0.04±0.02	0.707^{NS}
8	0.00±0.00	0.01±0.01	0.00±0.00	0.057^{NS}
Pre-weaning (Week 1-4)	0.04±0.04	0.08±0.02	0.07±0.02	0.230^{NS}
Post-weaning (Week 5-8)	0.08±0.01	0.08±0.03	0.11±0.04	0.635^{NS}
Overall (Week 1-8)	0.05±0.02	0.09±0.02	0.09±0.014	0.292^{NS}

Table-6 *Mortality rate (%) of LWY young pigs under control and treatment groups*

Age(week)	Control (C)	Treatment 1 (T_1)	Treatment 2 (T_2)
1	4.54(2)	7.14(3)	4.65(2)
2	0(0)	0(0)	0(0)
3	0(0)	0(0)	0(0)
4	0(0)	2.38(1)	2.32(1)
5	0(0)	0(0)	4.65(2)
6	4.54(2)	0(0)	0(0)
7	0(0)	4.76(2)	0(0)
8	0(0)	0(0)	0(0)
Pre-weaning (Week 1-4)	4.54 (2)	9.52(3)	6.97(3)
Post-weaning (Week 5-8)	4.54 (2)	4.76(2)	4.65(2)
Overall (Week 1-8)	9.09(4)	14.28(6)	11.63(5)
Total mortality (%)	11.63(15)		

Table-7 *Causes of mortality in LWY young pigs under control and treatment groups*

Causes of Mortality	Control	Treatment 1	Treatment 2	Total
Crushing	0	1	0	1
Gastroenteritis	2	2	3	7
Pneumonia	0	1	1	2
Sudden death	1	0	1	2
Other causes	1	2	0	3

Kuller *et al*. (2004) [20] with intermittent sucking upto 27 days and Roy (2019) [21] weaned at day 28 of age.

The post-weaning (week 5 to 8) mortality rates were 4.54%, 4.76%, and 4.65% for C, T_1, and T_2 groups respectively. Similar post-weaning mortality rate were recorded by Jayashree *et al*. (2013) [22] from 28 to 120 days and Mondal *et al*. (2012) [23] from 46-240 days.

Regarding causes of mortality, 6.67 % died in crushing by mother, 46.67 % died in gastroenteritis, 13.33% died in pneumonia,13.33% died due to sudden death and remaining 20% due to other causes like iron toxicity, injuries. Present findings of causes of mortality were similar with the reports of Kalita *et al*. (2002) [24], Pathak *et al*. (2004) [25], Yedukondalu *et al*. (2004) [26], Hmar (2006) [27], Pachuau (2019) [28] and Roy (2019). Differences in pre-weaning and post-weaning mortality reported by different workers versus the current findings might be attributed to breed, weaning age, feed, rearing period, and other management systems.

According to the present study results, the mortality rate and causes of mortality of young pigs did not differ significantly when young pigs were fed diets containing SMP or MRP during the pre and post-weaning periods.

Conclusion

In the present study, the diarrhoeal incidence and mortality rate of LWY young pigs were comparable when diet containing skimmed milk powder and milk replacer powder were fed during pre and post-weaning periods. Therefore, milk replacer powder can be used as a substitute to skimmed milk powder for feeding of LWY young pigs to minimize the feed cost during pre and post weaning periods.

Application of research: The present study demonstrates that milk replacer powder is an effective to skimmed milk powder for feeding young pigs during pre and post weaning periods.

Research Category: Veterinary Sciences

Abbreviations: LWY- Large White Yorkshire
SMP- Skimmed Milk Powder
MRP- Milk Replacer Powder
FCS- Feacal Consistency Score
GAS- General Appearance Score

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****Principal Investigator or Chairperson of research: Rubyta Chanam**
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Author statement: All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

Study area / Sample Collection: Livestock Farm Complex

Cultivar / Variety / Breed name: Large White Yorkshire

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
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