RESEARCH ARTICLE Indian Journal of Animal Research, Volume 54 Issue 12: 1572-1577 (December 2020)

Effect of Restricted Suckling on Growth Performance and Behaviour of Crossbred Piglets

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10.18805/ijar.B-3913

ABSTRACT

Present study was planned to acclimatize the pre-weaned piglet for stress tolerance through restricted suckling with or without mother's visibility for improved piglet and through stress tolerance. For this, 244 piglets from 36 pregnant crossbred sows (Landrace × Desi), with 18 sows each, during summer season having 147 piglets and during winter season having 97 piglets were used. Eighteen sows along with their piglets were randomly distributed in 3 treatment groups *viz*. T_0 (No restriction), T_1 (restricted suckling with mother's visibility) and T_2 (restricted suckling without mother's visibility) for the above said study for 3 months. A total of 15 minutes time was allotted for suckling of piglets in T_1 and T_2 group. Different records pertaining to body weight, feed intake, behaviour and growth parameter of piglets were recorded up to 3 months of age. At the end of the study period, body weight of piglets showed non-significant difference between the treatment groups. Grower feed intake during post-weaning (after 42 days) period showed significant difference ($P<0.01$) during winter season with highest value observed in T_2 group. In rest of the period, non-significant difference was observed for all the treatment groups both during summer and winter season. Higher values for suckling behaviour was recorded for T_1 and T_2 groups than T_0. From the present study, restricted suckling without mother's visibility may be recommended at farm level for quick adaptation of piglets after weaning.

Key words: Behaviour, Body weight, Piglet, Restricted suckling.

INTRODUCTION

Weaning is one of the most stressful events in the pig's life. The piglets pre-weaning experiences are likely to be important factor in their ability to adapt to the post-weaning environment. The piglets experiences significant physiological, environmental and social challenges when it is weaned from the sow that can predispose piglets to subsequent diseases and other production losses. During this time, piglets are subjected to a number of stressors, such as separation from the sow, handling stress, a different food source, social hierarchy stress, co-mingling with pigs from other litters, a different physical environment (room, building, farm, water supply, *etc*.), increased exposure to pathogens and dietary or environmental antigens (Campbell *et al*. (2013). Ostindjer *et al.* (2014) also reported that weaning problems are multi factorial, but an early intake of solid food and reduced stress around weaning are major determinants of quick adaptation of piglets to the new post-weaning situation. It is generally accepted that the separation of sows and piglets during day time in the second half of lactation (intermittent suckling, IS) stimulates pre-weaning feed intake and enhances performance shortly after weaning (Berkeveld *et al.* (2007a) and Kuller *et al.* (2007).

Pigs are social animals and social interaction between them helps in general well-being and welfare. However, when they are debarred, it becomes a stressor, e.g. weaning stress in this condition. Therefore, acclimatization of animals for stress tolerance through restricted suckling with or without mother's interaction may maintain the growth rate and welfare and may be economic substitute for conventional weaning. Therefore, for improved piglet and sow performances through acclimatization of stress tolerance using restricted or intermittent suckling during pre-weaning period, the present study has been planned with the objectives to study the growth performance and behavioural response under restricted suckling regime.

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How to cite this article: Devi, L.S.,Chandrahas, Sahoo, S.P., Godara, A.S., Kumar, N., Gaur, G.K. and Singh, M. (2020). Effect of Restricted Suckling on Growth Performance and Behaviour of Crossbred Piglets. Indian Journal of Animal Research. 54(12): 1572-1577.

Submitted: 27-08-2019 **Accepted:** 15-01-2020 **Published:** 17-06-2020

MATERIALS AND METHODS

Animals and design of experiment

Present study was conducted at Swine Production Farm, Livestock Production and Management Section, IVRI,

Izatnagar, Bareilly, Uttar Pradesh, India. All the experimental piglets were marked with silver nitrate solution for easy identification. Piglets were housed along with their dams up to weaning and thereafter in grower pens in groups. Pens were well-ventilated with dimensions of 2.997 m length and 3.505 m width each for both the closed and open area and RCC (reinforced cement concrete) roof on cement concrete floor (Fig 1, 2 and 3). The size of creep area was 1.27 m length and 1.016m width. Pens were cleaned and washed with water twice daily and proper hygienic conditions including healthy surroundings were maintained. All the management practices except restricted suckling regime were same for all the piglets and their dams.

Farm born piglets of 36 pregnant crossbred (Landrace × Desi) sows with 18 sows each during summer (April to June) and winter (December to February) season were used for the said study. Total number of piglets used during summer season were 52, 51 and 44 and for winter season 29, 35 and 33 for T_0, T_1 and T_2 groups. Conventional suckling and feeding regime were adopted for the piglets of T_0 group and treated as control. Piglets of T_0 were allowed to move freely with its dam throughout the study period. For the piglets of T_1 and T_2 groups, restricted suckling regime were practiced as per schedule given in Table 1 except mother's visibility. In T_1, piglets and sows visibility (after suckling) were maintained by putting litters in creep area made up of iron bars. However, in T_2 group, piglets after suckling, were shifted to the conventional creep enclosure made up of brick and non-visibility of piglets and their dams will be ensured during non-suckling periods. A total of 15 minutes suckling time were allotted for piglets in T_1 and T_2 groups.

Parameters recorded

Piglet growth performances

The birth weight of individual piglet was recorded with the help of digital weighing balance. From 1st fortnight onwards piglets were weighed in the morning prior to feeding on a digital platform weighing bridge having 50 g least count and 200 kg capacity. Bodyweights of litters of each sow were weight at fortnight intervals up to 90 days. Recorded body weight of piglets and feed intake were used for calculation of growth indices feed conversion ratio. The daily feed intake record was maintained for each group of piglets up to 90 days. The feed was provided *ad-libitum* to the piglets.

Behavioural observation

Behavioural observations were recorded using installed closed-circuit television (CCTV) camera (Sparsh CCTV camera) above each pen. Recording for different behaviour was done for 15 minutes for each treatment groups. This footage was used for quantification of various behaviour, listed below in Table 2.

Statistical analysis

The collected data of different experiments was subjected to statistical analysis using the following General Linear Model (GLM):

Y_{ijkl} =

$\mu + Ti + Pj + Sk + (TP)ij + (TS)ik + (PS)jk + (TPS)ijk + eijkl$

Where,

Y_{ijkl} = observation of l^{th} individual under ith treatment, j^{th} period and k^{th} season

μ = overall mean

T_i = Fixed effect of i^{th} treatment

Where

i= 0, 1, 2

P_j = Fixed effect of the j^{th} period where j= 1, 2, 3, 4, 5, 6, 7

S_k = Fixed effect of k^{th} season where k= 1, 2

$(TP)_{ij}$ = Fixed effect of interaction between i^{th} treatment and j^{th} period

$(TS)_{ik}$ = Fixed effect of interaction between i^{th} treatment and k^{th} season

$(PS)_{jk}$ = Fixed effect of interaction between j^{th} period and k^{th} season

$(TPS)_{ijk}$ = Fixed effect of interaction between the i^{th} treatment, j^{th} period and k^{th} season

e_{ijkl} = Random error associated with observation normal in distribution (NID) with mean = 0 and variance σ^2.

With above Mathematical model the collected data was analysed using Software Package for Social Sciences (SPSS version 20.0).

RESULTS AND DISCUSSION

Body weight of piglets at fortnightly interval under different treatment groups

The body weight of piglets due to restricted suckling was almost same at the beginning of the study period. However, it affected significantly ($P<0.01$) during 2nd, 3rd, 4th and 5th fortnight (Table 3) and body weight was higher for the piglets of T_0 group as compared to T_1 and T_2 group both during summer and winter season which is the negative effect of restricted suckling on T_1 and T_2 group. Towards the end of the trial during winter season, however, significant difference

Fig 1: Creep for T_0.

Fig 2: Creep for T_1.

Fig 3: Creep for T_2.

Table 1: Suckling/feeding schedule of piglets during the study period.

Treatment	Suckling Plan and Frequency (Daily)						
	1st week	2nd week	3rd week	4th week	5th week	6th week	Weaning
T_0 (control)	Conventional suckling and feeding as practiced at SPF, LPM, IVRI						42 days
T_1 (piglets in mothers' visibility)	As T_0	8	6	4	2	1	42 days
T_2 (without mothers' visibility)	As T_0	8	6	4	2	1	42 days

Table 2: List of Behaviours recorded along with its definition.

Behaviour	Definition
Suckling	Teat in mouth
Eating	Head in feeding trough

(P<0.01) was observed between the treatment groups with higher body weight observed both in T_0 and T_2 as compared to T_1 group which support our hypothesis that restricted suckling may be adopted without mother's visibility to break the bond between mother and piglets for better acclimatization.

Throughout the study period, piglets weight of T_0 during winter season was significantly higher (P<0.01) than summer season. This trend was not observed in T_1 group. However, in T_2 group, significantly higher (P<0.01) winter body weight than summer season was recorded from 3rd fortnight onwards. Among the treatment groups, body weight was higher for restricted suckling without mother's visibility which may indicate that piglets were acclimatized to the situation. Other authors have reported reduced growth and BW of piglets at weaning (Kuller *et al.* 2004 and 2007; Berkeveld *et al.* (2009), suggesting that feed intake in the IS (Intermittent suckling) period might still be too small to compensate for the milk deficit caused by separation from the sows. Season wise comparison of body weight of piglet shows higher body weight during winter season during the study period which is in accordance with Raseel *et al.* (2016) who reported that piglet born during summer and winter season shows higher body weight than rainy season as the litter size was more during rainy season.

Body weight gain of piglets during pre-and-post weaning periods

Body weight gain of piglets during pre- and- post weaning period is depicted in Table 4. Body weight gain during pre-weaning period was non-significant for summer season. However, there was significant differences (P<0.01) observed during winter season with higher gain observed for T_0 and T_2 as compared to T_1. However, post-weaning body weight gain was either numerically higher or similar in both the treatment (T_1 and T_2) groups than T_0 group which may be due to acclimatization to restricted suckling regime. This is in agreement with Kuller *et al.* (2004) who conducted an experiment to study effects of intermittent suckling (IS) on weight gain of litters and reported that IS litters that consumed little or no feed during lactation had an ADG after lactation that was higher than in control litters with comparable creep feed intake during lactation: 204 g.d-1 vs 136 g.d-1.

Kuller *et al.* (2007) conducted an experiment to determine the improvement in post weaning performance of piglets during intermittent suckling. They concluded that

Table 3: Body weight (Kg) of piglets at fortnightly interval under different treatment groups.

Fortnight	Season	T_0	T_1	T_2	Significance level
0th	summer	$0.86\pm0.02_{x**}$	0.97 ± 0.03	0.93 ± 0.03	NS
	winter	$1.07\pm0.05_{y**}$	0.97 ± 0.03	0.97 ± 0.03	NS
1st	summer	$3.31\pm0.15_{x**}$	2.99 ± 0.10	3.04 ± 0.12	NS
	winter	$4.25\pm0.22^{A}_{y**}$	3.23 ± 0.14^{B}	3.13 ± 0.15^{B}	P<0.01
2nd	summer	$6.07\pm0.26^{A}_{x**}$	4.51 ± 0.24^{B}	4.71 ± 0.22^{B}	P<0.01
	winter	$8.22\pm0.38^{A}_{y**}$	4.89 ± 0.23^{B}	5.07 ± 0.22^{B}	P<0.01
3rd	summer	$8.76\pm0.33^{A}_{x**}$	6.25 ± 0.22^{B}	$6.59\pm0.26^{B}_{x**}$	P<0.01
	winter	$12.50\pm0.43^{A}_{y**}$	6.66 ± 0.29^{C}	$7.83\pm0.30^{B}_{y**}$	P<0.01
4th	summer	$11.66\pm0.42^{A}_{x**}$	9.77 ± 0.33^{B}	$9.72\pm0.40^{B}_{x**}$	P<0.01
	winter	$15.44\pm0.59^{A}_{y**}$	9.68 ± 0.41^{C}	$12.17\pm0.38^{B}_{y**}$	P<0.01
5th	summer	$16.15\pm0.57^{A}_{x**}$	14.46 ± 0.44^{B}	$14.26\pm0.61^{B}_{x**}$	P<0.01
	winter	$21.22\pm0.64^{A}_{y**}$	14.85 ± 0.55^{C}	$17.14\pm0.42^{B}_{y**}$	P<0.01
6th	summer	$21.57\pm0.81_{x**}$	20.06 ± 0.66	$21.03\pm0.87_{x**}$	NS
	winter	$27.30\pm0.80^{A}_{y**}$	20.79 ± 0.75^{B}	$25.03\pm0.70^{A}_{y**}$	P<0.01
7th	summer	$25.66\pm0.94_{x**}$	25.29 ± 0.70	$24.75\pm1.02_{x**}$	NS
	winter	$31.70\pm0.73^{A}_{y**}$	25.82 ± 0.88^{B}	$29.90\pm0.68^{A}_{y**}$	P<0.01

Means with different superscripts in a row vary significantly between treatments.

Means with different subscripts (x,y) in column vary significantly between season within treatment (*P<0.05; ** P<0.01).

Table 4: Body weight gain (kg) of piglets under different treatment groups.

Stages	Season	T_0 (control)	T_1 (with mother's visibility)	T_2 (without mother's visibility)	Significance level
Pre- weaning	summer	$2.78 \pm 0.17_{x**}$	2.17 ± 0.27	$2.17 \pm 0.23_{x**}$	NS
	winter	$3.89 \pm 0.16^{A}_{y**}$	2.22 ± 0.17^{B}	$3.28 \pm 0.30^{A}_{y**}$	P<0.01
Post-weaning	summer	4.39 ± 0.38	5.00 ± 0.30	$4.83 \pm 0.33_{x*}$	NS
	winter	5.33 ± 0.42	5.56 ± 0.33	6.11 ± 0.39y*	NS

Means with different superscripts in a row vary significantly between treatments.

Means with different subscripts (x,y) in column vary significantly between season within treatment (*P<0.05; ** P<0.01).

Table 5: Feed consumption per piglet (kg) under different treatments due to restricted suckling.

Age (Days)	Season	T_0 (control)	T_1 (with mother's visibility)	T_2 (without mother's visibility)	Significance level
28	Summer	0.06 ± 0.02	0.23 ± 0.07	0.15 ± 0.04	NS
	Winter	0.12 ± 0.02^{B}	0.22 ± 0.01^{A}	0.13 ± 0.02^{B}	P<0.01
42	summer	0.66 ± 0.13^{B}	1.46 ± 0.16^{A}	1.62 ± 0.19^{A}	P<0.05
	winter	1.01 ± 0.16^{b}	1.32 ± 0.18^{ab}	2.09 ± 0.37^{a}	P<0.05
56	summer	3.80 ± 0.28	4.78 ± 0.45	$4.97 \pm 0.33_{x*}$	NS
	winter	4.10 ± 0.47^{B}	4.74 ± 0.35^{B}	$7.91 \pm 0.95^{A}_{y*}$	P<0.01
70	summer	$7.57 \pm 0.81_{x*}$	7.39 ± 0.69	$8.95 \pm 0.38_{x*}$	NS
	winter	$9.59 \pm 0.32^{ab}_{y*}$	8.85 ± 0.65^{b}	$12.21 \pm 1.26^{a}_{y*}$	P<0.05
84	summer	10.19 ± 0.90	10.26 ± 0.68	$11.27 \pm 0.58_{x*}$	NS
	winter	12.24 ± 0.43^{b}	11.62 ± 0.45^{b}	$16.58 \pm 1.96^{a}_{y*}$	P<0.05
98	summer	7.83 ± 1.00	8.26 ± 0.42	$8.56 \pm 0.33_{x*}$	NS
	winter	7.60 ± 0.34^{B}	7.13 ± 0.47^{B}	$10.74 \pm 0.65^{A}_{y*}$	P<0.01

Means with different superscripts in a row vary significantly between treatments.

Means with different subscripts (x,y) in column vary significantly between season within treatment (*P<0.05)

IS improves ADG in the first week after weaning. Colson *et al.* (2006) conducted an experiment and reported that reduced weight gain in pigs post-weaning is likely due to a combination of factors including reduced feed intake and lower feed quality/quantity as compared to what the pigs were receiving from their mother's milk. Berkeveld *et al.* (2007a) also reported that post weaning weight loss can be prevented through IS and increasing the duration of IS from 1 to 2 week slightly improved growth shortly after weaning, but the contribution to post-weaning adaptation seemed to be relatively small compared with extending lactation (Berkeveld *et al.* 2009).

Feed consumption of piglets at fortnightly intervals

Feed consumption of piglets at fortnightly intervals is given in Table 5. Feed intake of piglets up to 28 days of age were found non-significant between different groups during summer season. However, significant difference (P<0.01) was observed for winter season with higher value recorded for T_1 group as compared to T_0 and T_2. Between the age group of 28 to 42 days, feed consumption was found significant (P<0.05) between the groups and higher values was observed for T_1 and T_2 than T_0 groups. After weaning from 56 days onwards, feed consumption vary non-significantly during summer season. However, significant difference was observed during winter season with higher values recorded in T2 than the T_0 and T_1 groups. Between seasons within treatments comparison indicated that higher feed consumption was observed during winter season. Furthermore, in T_2 group, significantly higher (P<0.05) feed intake was recorded during winter than summer season from 56th days onwards till the end of the study period. As a whole feed consumption was higher in T_2 than T_0 and T_1 groups during winter season. However, it was non-significant during summer season. This may be because of restricted suckling and mother's visibility in case of T_1 where piglets were more attracted towards mother than the feed and led to lower feed intake in that group. In case of T_0 group, as piglets are getting ample milk they might not have attraction towards feed. This increased intake is in agreement with results of an earlier study of Thompson *et al.* (1981), in which IS almost doubled creep feed intake in one experiment and tripled it in another during a 33 d lactation. Possibly, restricted suckling litters experienced weaning as a lesser stressful event, because they might had already adapted to separation from the sows. According to Kugonza and Mutetikka (2005) greater creep feed intake was observed in the intermittent suckling piglets as compared to conventionally weaned piglets although high variations was observed among animals. However, lack of feed intake stimulation was observed if sows and piglets were separated for shorter periods according to Berkeveld *et al.* (2009) and Millet *et al.* (2008). Castellano *et al.* (2014) also reported that IS regime had a positive effect on the intake of creep feed and subsequent changes in growth rate

Table 6: Time spent (seconds) for depiction of ingestive behaviour by piglets under different treatment groups.

Parameters	Season	T_0	T_1	T_2	Significance level
Suckling	summer	$172.51\pm14.29^{B}{}_{x**}$	$354.61\pm35.63^{A}{}_{x**}$	423.70 ± 41.57^{A}	P<0.01
	winter	$272.46\pm21.34^{C}{}_{y**}$	$523.64\pm20.37^{A}{}_{y**}$	363.20 ± 20.01^{B}	P<0.01
Eating	summer	$0.35\pm0.16_{x**}$	1.44 ± 0.81	0.90 ± 0.49	NS
	winter	$17.60\pm5.10^{A}{}_{y**}$	2.66 ± 0.24^{B}	0.97 ± 0.41^{B}	P<0.01

Means with different superscripts in a row vary significantly between treatments.

Means with different subscripts (x,y) in column vary significantly between season within treatment (*P<0.05; ** P<0.01)

and body composition at weaning, mainly related to a higher fat deposition in the carcass. Gomez-Carballar *et al.* (2009) reported variable food intake in intermittent suckling probably due to breed, management, duration of intermittent suckling and weaning age etc. Sulabo *et al.* (2010) concluded that within the same litter, the piglets which consume more solid food during lactation are usually the first ones to try to consume feed after weaning.

Piglet behavioural response

Ingestive behaviour of piglet

Ingestive behavioural pattern of piglets presented in Table 6 clearly indicated that suckling behaviour was significantly higher (P<0.01) in T_1 and T_2 group as compared to T_0 both during summer and winter seasons. Lower values observed in T_1 group may be due to restricted suckling with mother's visibility which allowed them to be more attracted towards mother than the feed. Lower values of T_0 group may be because piglets were full fed as they were always with their mothers.

Eating behaviour was non-significant during summer, but, during winter season significant differences (P<0.01) were observed between the treatment groups with higher value recorded for T_0 as compared to other two groups. Oostindjer *et al.* (2011) also demonstrated a process of vertical social learning in which piglets learned to eat solid food from the sow, showing shorter latencies to eat, greater consumption and preference for the feed containing the same added flavour as was consumed by the sow and piglets during lactation. Berkeveld *et al.* (2007b) concluded that intermittent suckling may contribute to adaptation to the post-weaning state by stimulating eating behaviour, without causing obvious behavioural distress. Decreased milk intake might have motivated the piglets to increase solid food intake as stated by others (Puppe and Tuchscherer, 2000). Oostindjer *et al.* (2014) observed that intermittent suckling without extended lactation leads to piglet showing frequent visits to the feeder, higher feed intake and pre- and post-weaning body weights.

CONCLUSION

It can be concluded that piglets on restricted suckling regime without mother's visibility has higher feed intake and numerically equivalent or higher body weight gain than conventional suckling practices during post-weaning period.

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