Haryana Vet. (December, 2021) **60(2),** 233-237 **Research Article**

EFFECT OF RESTRICTED SUCKLING ON GROWTH, BIOCHEMICAL AND HORMONAL PROFILE OF CROSSBRED (LANDRACE × DESI) PIGLETS

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ABSTRACT

A total of 244 piglets from 36 pregnant crossbred (Landrace×Desi) sows with 18 sows each during summer (April to June) and winter (December to February) season were used to evaluate the impact of restricted suckling on growth performance and various biochemical and hormonal parameters in crossbred piglets. Sows with their piglets were randomly distributed in 3 treatment groups, viz., T_0 (control), T_1 (restricted suckling with mother's visibility) and T_2 (restricted suckling without mother's visibility) for the study for 3 months period. Piglets were allowed for suckling only for 15 minutes in both the restricted suckling groups. However, in control group (T_0) piglets were with their mother throughout the study period. Post-weaning body weight gain was non-significantly different under different treatment groups during the summer and winter season. All the estimated values of haematology, serum biochemical and hormonal profiles in piglets were within the normal range. Cortisol level depicted significant difference (P<0.01) with higher value in T_1 group as compared to T_0 and T_2 group with non-significant difference between T_0 and T_2 group. It can be concluded that for early adaptation of weaning process, restricted suckling without mother's visibility may be recommended at farm level.

Keywords: Biochemical parameter, Hormonal parameter, Restricted suckling, Piglet

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Weaning is the most challenging part of piglet's life because during this period, they experience significant physiological, environmental, and social challenges. When piglets are separated from the sow, they can predispose to subsequent diseases and other production losses. At this stage, piglets are exposed to a number of stressors, like separation from the sow, handling stress, social hierarchy stress, new food source, different physical environment (room, building, farm, water supply, etc.), exposure to new pathogens and dietary or environmental antigens (Campbell *et al.*, 2013). The pre-weaning environments of piglets are also important factors in their ability to adapt to the post-weaning environment. Stress due to weaning may leads to energy deficit. Feed consumption is reduced after weaning in conventional weaning practices and piglet becomes undernourished which leads to reduced growth rate. The cortisol and corticotrophin hormones increased after weaning which indicated the stress level in piglets (Moeser *et al.*, 2007). The blood parameters are improved as the body weight of piglets increase after weaning (Bhattarai and Nielsen, 2015). Pigs are social animals and social interaction between them helps in general well-being. However, when they are debarred, it becomes a stressor which may affect the growth and blood parameters of piglets. Therefore, in order to improve piglet performance through acclimatization of stress tolerance by using restricted suckling before weaning, the present study has been planned with the objective to study the growth and blood biochemical and hormonal changes under restricted suckling regime.

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MATERIALS AND METHODS

The experiment was conducted at Swine Production Farm, Livestock Production and Management Section, IVRI, Izatnagar, Bareilly, Uttar Pradesh, India. 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 study. Total numbers 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 (control). Piglets of T_0 were allowed to move freely with its dam throughout the study period (Fig 1). For the piglets of T_1 and T_2 groups, restricted suckling regime were practiced. In T_1, piglets and sows visibility (after suckling) were maintained by putting litters in creep area made up of iron bars (Fig 2). However, in T_2 group, piglets after suckling, were shifted to the conventional creep enclosure made up of bricks and non-visibility of piglets and their dams were ensured during non-suckling period (Fig 3). A total of 15 minutes suckling time was allotted for piglets in T_1 and T_2 groups. Creep ration were provided to all the treatment groups everyday in the morning and left over feed were measured on the following day to calculate the feed intake by the piglets.

The frequency of suckling was gradually reduced in restricted suckling groups from 2nd weeks onwards such as 8 times, 3rd week 6 times, 4th week 4 times, 5th week 2 times and 6th week 1 time in a day. Thereafter weaning was done at 42 day. For the control group, conventional suckling and feeding practices were followed in which piglets are with their dams throughout the period and weaning was done at 42 days.

The body weights of piglets were recorded at fortnightly interval till 90 days to record the growth pattern of piglets with the help of digital weighing balance.

For biochemical and hormonal profile, blood samples were collected from anterior venacava on day 42nd from piglets in fluoride and gel tubes for glucose and serum separation. The experiment was conducted with the approval of IAEC. Samples were centrifuged at 3000 RPM for 10 minutes and serum was separated in Micro Centrifuge Tubes (MCT) and stored at -20 °C till it was further used for estimation of different parameters. Biochemical parameters such as glucose, total protein, SGOT, SGPT and LDH were estimated using Coral Clinical Systems, whereas, Beckman Coulter RIA Kit was used for estimation of cortisol, T_3 and T_4 hormones.

Statistical Analysis: The generated data of different experiments were subjected to statistical analysis using the following General Linear Model (GLM)

$Yijk = \mu + Ti + Sj + (TS)ij + eijk$

Yijk = observation of lth individual under ith treatment and jth season

μ = overall mean

Ti = Fixed effect of ith treatment where i= 0, 1, 2

Sj = Fixed effect of jth season where j= 1, 2

(TS)ij = Fixed effect of interaction between ith treatment and jth season

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

RESULTS AND DISCUSSION

Body weight of piglets during pre-weaning and post-weaning period is depicted in Table 1. Body weight of piglets during the pre-weaning period was non-significantly different between the treatment groups during summer season. However, during winter season, significant difference (P<0.01) was observed between the treatment groups, with highest value observed for T_0 and T_2 group as compared to T_1 group. The higher body weight in T_0 and T_2 group during the pre-weaning period may be because the piglets are not suffering from any kind of stress or less stress due to adaption in T_2 group with no visibility of dams. Body weights during post-weaning periods were found non-significantly different between the treatments groups both duringly different summer and winter seasons. Although negative effect of restricted suckling was observed when the restriction started. However, towards the end of study, there was non-significant difference observed between the treatment groups. This may be due to the fact that piglets might have acclimatized to the situation of suckling restriction. This is in agreement with Kuller *et al.* (2007) who reported improvement in post weaning performance of piglets during intermittent suckling in first week after weaning. Berkeveld *et al.* (2007) determined the effect of intermittent suckling (IS) combined with an extended lactation to reduce post-weaning body weight losses in pigs and found that body weights at the end of the experiment were similar among weaning regimens. They suggested that intermittent suckling with 12 hour separation might be preferable for a practical implementation of IS.

In between the seasons, the body weight was significantly higher (P<0.01) during winter than summer in control group both during pre-and-post weaning periods. Similarly, significantly (P<0.01) higher winter body weight of piglets was recorded in T_2 group as compared to summer. Seasonal variation of body weight gain showed higher gain during winter season as compared

Table 1

Body weight (Kg) of piglets during pre- and –post weaning periods

Periods	Season	T_0 (control)	T_1 (with mother's visibility)	T_2 (without mother's visibility)	Significance level
Pre-weaning (0-42 days)	summer	4.68 ± 0.24^{x}**	3.68 ± 0.16	3.74 ± 0.18	NS
	winter	6.06 ± 0.43^{Ay}**	3.93 ± 0.20^{B}	4.12 ± 0.25^{A}	P<0.01
Post-weaning (43-90 days)	summer	17.97 ± 0.53^{x}**	16.85 ± 0.51	16.82 ± 0.61^{x}**	NS
	winter	23.92 ± 0.68^{y}**	17.79 ± 0.62	21.06 ± 0.69^{y}**	NS

Means with different superscripts (A, B) 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)

Fig. 1.T_0 (Control)

Fig. 2.T_1 (Treatment 1)

Fig. 3.T_2 (Treatment 2)

to summer season. This may be because of higher feed intake and comfortable environment as compared to summer season where feed intake reduced in piglets. This is in agreement with Prunier *et al.* (1993) who reported higher live weights in late winter and concluded that temperature may have a greater influence on sow and litter performance than photoperiod.

Creep feed intake difference during the pre-weaning period was non-significant between treatment groups both for summer and winter season (Table 2). Grower feed intake differemce during the post-weaning period was found non-significant during the summer season, however, significant difference ($P < 0.01$) was observed for winter season with higher intake seen in T_2 group as compared to T_0 and T_1 groups. 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 may be because the litters are already adapted to separation from its sows and experiencing lesser stress due to restricted suckling. This increased feed intake is in agreement with Thompson *et al.* (1981), who reported that creep feed intake increased up to double during the intermittent suckling period in a 33 day lactation. Also, the positive effect of IS regime on intake of creep feed intake with subsequent changes in growth rate and body composition was also observed by Castellano *et al.* (2014).

The serum biochemical index revealed significant difference between all the treatment groups and also between different seasons (Table 3). Significant difference ($P<0.01$) was observed for glucose concentration between all the treatment groups during summer season with lower concentration observed in T_2 group where higher feed intake was observed. The present result is in contrast with Toscano *et al.* (2007) who reported decrease serum glucose during restricted feeding in gilts and grower pigs. Significant differences ($P<0.01$) were recorded between the season with lower glucose level during summer season which may be reduce feed intake as compared to winter season. However, the glucose values were within the normal range (Kaneko *et al.*, 2008). Total protein was significantly higher ($P<0.05$) in T_2 than T_0 with value of T_1 group in between T_0 and T_2 during summer season. During winter, total protein was significantly higher ($P<0.01$) in T_2 as compared to T_0 and T_1 groups. The values of total protein were within the normal range (Kaneko *et al.*, 2008). Significant differences were observed between the seasons with higher values recorded during summer season. The present finding is in agreement with Helal *et al.* (2010) who reported higher total protein level during hot season which may be due to vasoconstriction and reduced plasma volume during heat stress. SGOT values showed significant difference ($P<0.01$) with higher value observed in T_2 during summer and T_1 and T_2 during winter season as compared to other groups. Similarly, SGPT activity shows significant difference ($P<0.01$) with highest value observed in T_0 during summer and T_1 during winter season

Table 2

Feed consumption (kg) per piglets under different treatments due to restricted suckling

Periods	Season	T_0 (control)	T_1 (with mother's visibility)	T_2 (without mother's visibility)	Significance level
Creep feed (pre-weaning	summer	1.50 ± 0.41	2.15 ± 0.49	2.25 ± 0.50	NS
periods)	winter	1.74 ± 0.44	2.09 ± 0.48	3.38 ± 0.86	NS
Grower feed (post-weaning	summer	8.53 ± 0.57	8.64 ± 0.44	9.60 ± 0.38^{x}**	NS
periods)	winter	9.81 ± 0.50^{B}	9.20 ± 0.53^{B}	13.18 ± 0.97^{Ay}**	$P<0.01$

Means with different superscripts (A, B) in a row vary significantly between treatments
Means with different subscripts (x,y) in column vary significantly between season within treatment (** $P<0.01$)

Table 3

Biochemical profile of piglets under different treatments

Periods	Season	T_0 (control)	T_1 (with mother's visibility)	T_2 (without mother's visibility)	Significance level
Glucose (mg/dl)	summer	65.22 ± 2.17^{Bx}**	79.86 ± 2.64^{Ax}**	64.66 ± 1.51^{Bx}**	P<0.01
	winter	122.78 ± 3.16^{y}**	125.80 ± 3.48^{y}**	128.17 ± 4.96^{y}**	NS
Total protein(g/dl)	summer	11.42 ± 0.11^{Bx}**	11.82 ± 0.15^{ABx}**	11.92 ± 0.17^{Ax}**	P<0.05
	winter	5.71±0.15B^{y}**	5.57 ± 0.13^{By}**	7.98 ± 0.12^{Ay}**	P<0.01
SGOT (U/L)	summer	58.47 ± 3.82^{Bx}**	65.77 ± 3.79^{Bx}**	91.50 ± 4.78^{A}	P<0.01
	winter	44.50 ± 2.072^{By}**	97.34 ± 3.68^{Ay}**	90.76 ± 2.19^{A}	P<0.01
SGPT(U/L)	summer	55.93 ± 3.61^{A}	39.29 ± 4.08^{Bx}**	24.55 ± 2.86^{Cx}**	P<0.01
	winter	62.10 ± 2.15^{B}	69.23 ± 2.35^{Ay}**	56.40 ± 2.36^{By}**	P<0.01
LDH(U/L)	summer	224.85 ± 4.11^{x}**	232.72 ± 5.14^{x}**	213.47 ± 13.25^{x}**	NS
	winter	281.86 ± 7.73^{By}**	315.77 ± 8.29^{Ay}**	301.55 ± 12.36^{ABy}**	P<0.05

Means with different superscripts (A, B) 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

Hormonal profile of piglets under different treatments

Periods	Season	T_0 (control)	T_1 (with mother's visibility)	T_2 (without mother's visibility)	Significance level
Cortisol (nM/L)	summer	107.94 ± 5.77^{Bx}**	131.40 ± 5.73^{A}	101.14 ± 5.84^{Bx}**	P<0.01
	winter	131.73 ± 3.99^{y}**	117.73 ± 5.52	131.99 ± 4.31^{y}**	NS
T3 (nM/L)	summer	1.56 ± 0.07^{A}	1.23 ± 0.08^{B}	1.23 ± 0.05^{B}	P<0.01
	winter	1.54 ± 0.06^{A}	1.16 ± 0.04^{B}	1.21 ± 0.06^{B}	P<0.01
T4 (nM/L)	summer	36.30 ± 1.19^{abx}**	38.32 ± 1.28^{ax}**	33.93 ± 1.07^{bx}**	P<0.05
	winter	55.43 ± 2.01^{Ay}**	43.64 ± 0.97^{By}**	55.39 ± 1.32^{Ay}**	P<0.01

Means with different superscripts (A, B) 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)

as compared to other groups. Although SGOT and SGPT level in present study falls under normal range, however, high levels of SGOT and SGPT indicate that oxidative stress was a common mechanism that damaged hepatocellular function (Knudsen *et al.,* 2016). Environmental temperature also affects the SGOT and SGPT level with higher values observed during summer as compared to winter in cattle (Brijesh, 2012). Lower SGPT level during summer may be due to lower intake during summer which is accordance with the result of Kaushik and Bugalia (1999) in goats. Among the treatment groups, significant differences were observed for all the parameters however, the values falls under normal range. The normal respective range of Glucose (mg/dl), Total protein (g/dl), SGOT (U/L), SGPT (U/L) and Lactate dehydrogenase (U/L) were 85-150, 7.9-8.9, 32-84, 31-58 and 380-634 (Kaneko *et al.*, 2008).

Cortisol level between the different treatment groups was found significantly different during the summer season with highest value observed in T_1 group (Table 4). This may be because the piglet must have felt more stress due to hot season as well as suckling restriction in mother's visibility. The present study is in agreement with Klemcke and Pond (1991) and Kanitz *et al.* (2004) who reported that maternal separation results in elevated cortisol levels in piglets. However, Caroll *et al.* (1998) observed that neither weaning nor changing post-weaning diets resulted in an elevation of serum concentration of cortisol that was detectable 4 d later, indicating an adaptation to the stress of maternal separation and the lack of a chronic state of undernutrition. Moeser *et al.* (2007) evaluated stress hormones and reported increased serum corticotrophin-releasing factor (CRF) and cortisol in weaned pigs indicating that weaning induces activation of the stress pathways. T_3 hormone level showed significant difference (P<0.01) with highest value observed for T_0 group for both summer and winter seasons. During summer season, T_4 hormone level showed significant difference (P<0.05) with highest value observed for T_1 group. However, during winter season, significant difference (P<0.01) was observed with higher value observed for both T_0 and T_2 as compared to T_1 group. Between the seasons, comparison showed significant difference (P<0.01) for cortisol and T_4 hormone level with higher values observed during winter season among all the treatment groups except for cortisol in T_1 which was non-significant (Table 3). T_4 value was significantly lower during summer season. The lower T_4 value may be due to lower basal metabolic rate during summer season which is in agreement with Pourouchottamane *et al.* (2013). Dvorak and Neumannova (1986) also reported that increased serum concentration of T_4 among piglets in response of weaning induced stimulated adrenocortical activity and suggested that both specific stressor effects and circulating corticosteroids are responsible for the changes of T_3 and T_4 concentrations in blood sera of stressed animals.

The result of the study indicated that piglets on restricted suckling regime without mother's visibility has equivalent body weight as compared to conventional suckling practices during the post-weaning period which is indicative of acclimatization of stress by the piglets. Biochemical and hormonal parameters indicate that welfare of piglets will remain protected both under restricted and conventional suckling regimes. From the present study, restricted suckling without mother's visibility may be recommended at farm level for early adaptation of piglets after weaning.

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