Bhutan Journal of Animal Science (BJAS), Volume 7, Issue 1, Page 100-107, March 2023

COMPARATIVE PERFORMANCE OF PIGS FED WITH CASSAVA BASED DIETS AND COMMERCIAL FEEDS

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ABSTRACT: This study was conducted to explore the possibility of replacing maize component in pig feed with cassava chips. Sixteen sows were allotted into two groups – experiment and control group equally. The animals in the experimental and control group were fed diet containing 50 % cassava chips and usual commercial sow ration, respectively, for a duration of one production cycle from April to November 2022. Animals in both groups were raised under similar management practices. Parameters such as body condition score and back fat thickness, and breeding parameters namely conception rate, dry period, litter size, average birth weight, average weaning size, average weaning weights, post-weaning weights of piglets were compared between two groups. Independent Sample t test, Pearson correlation and descriptive statistics were used to analyse the variables. The findings revealed no significant differences in non-reproductive and reproductive parameters except for the post weaning weight gain ($p < 0.001$) of the piglets. The piglets born from the experimental group attained higher post weaning weights than the control group. The study recorded average dry period and conception rate of about 5 days and 11.63 days; and 50 % and 75 % for the experiment and control groups, respectively. The average post-weaning weights of piglets recorded was 9.24 and 6.94 kg for the experiment and the control group, respectively. The study concludes and suggests that the cassava chips can be used as an alternative basal ingredient and can replace 50% of maize in pig diet thereby reducing the cost of feed. Further in-depth study may be required with breeding animals and the fattening pigs including cost- benefit analysis in order to provide strategic recommendations for pig producers in the country.

Keywords: basal; body condition score; breeding parameters; cassava; gestation

1. INTRODUCTION

Cassava (*Manihot esculenta Crantz*.) is a woody perennial shrub that grows up to five metres in height and has large, spirally arranged, lobed leaves of variable forms (Kouakou et al. 2016). This hardy crop that grows well on poor soil condition and in areas with low or unpredictable rainfall (Howeler nd). It is found to yield higher in irrigated soil (DoAFF 2010) and can be cultivated as a sole crop or intercropped with other crops (Howeler nd). Cassava is a popular crop among poor farmers requiring low inputs to produce reasonable yield (Howeler nd). It is the third largest source of carbohydrates for humans and animals in tropics (FAO and IAEA 2018). For instance, it is a major food crop for Africa (FAO and IAEA 2018), and an important economic crop for Thailand cultivated in about one million hectares annually (Kanto and Juttupornpong 2005).

In Bhutan, two varieties of cassava (red and white) are cultivated in the southern foothills mainly for human consumption. Information on production and use of casava for animal feed is limited in Bhutan, although a wide use of cassava root chips in animal feed as energy component is recorded globally. The dry root chips and leaf silage of cassava is considered excellent feed for animals (FAO and IAEA 2018). Bhutan imports a huge quantity of pig feed ingredients particularly maize a major component of pig feeds from India, and as a result the price of a pig feed is high and fluctuate often. This has huge bearing on the production cost for the piggery farmers. Thus, exploring for an alternative option to reduce import of maize as raw materials and on overall pig feed cost is imperative. Beside reduction in feed and production costs, it will also diversify income sources for rural farmers from growing cassava. As cassava is rich in energy it is considered an excellent feed for animals; therefore, this study was conducted to explore the possibility of substituting maize component in pig diets with cassava.

2. MATERIALS AND METHODS

2.1 Location of study

The study was conducted at the National Piggery Research and Development Centre (NPiRDC) Gelephu, Sarpang for a duration of one production cycle from April to November 2022. The area falls under wet sub-tropical agro-ecological zone with average annual temperature of 26.63°C and humidity of 62.27 %.

2.2. Cassava chips production

The cassava chips were produced by the trained Cassava growers of Dechenling, Nganglam, Pema Gatshel following the methodology adopted by Kanto and Juttupornpong (2005) illustrated in Figure 1. The cassava chip production is quite popular and considered as an important activity in these pockets.

2.3 Feed formulation and composition

The sun-dried cassava chips were procured from farmers of Dechenling, Pemagatshel and transported to BMG feed plant at Chokhorling, Sarpang for milling and feed formulation. The pig feed (sow ration) was formulated with the technical guidance from the National Research and Development Centre for Animal Nutrition (NRDCAN), Bumthang.

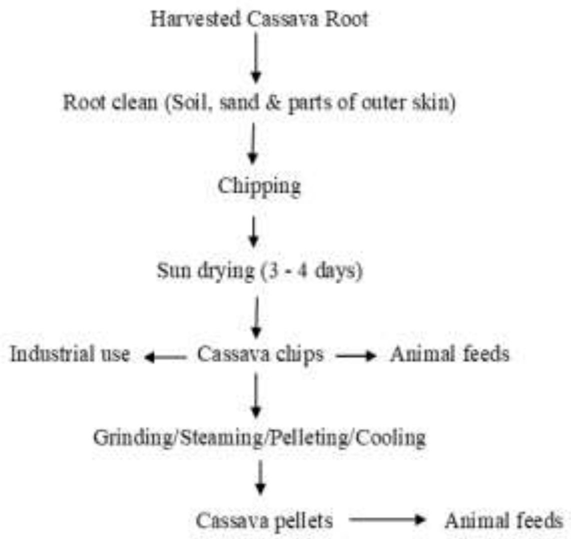

Figure 1: Flow chart of cassava chip production

About 50% of feed ingredients used consisted of Cassava chips (530Kg) for every 1000 kg feed. Formulated pig feed was analysed for the nutritional content at the Nutrition laboratory of NRDCAN and College of Natural Resources (CNR). As per the laboratory result the formulated pig feed (sow ration) had 92.20% dry matter (DM), 13.0% ash, 86.98% organic dry matter, 21.04% crude protein (CP), 2.39% crude fat, 2.36 crude fibre (CF) and 53.40 % carbohydrate. The composition of normal commercial sow ration was 88.21% dry matter (DM), 9.30% ash, 15.14% crude protein, 2.5% crude fat (CF) and 6% crude fiber (CF).

2.4 Experiment design

A total of 16 dry sows of 5th parity were selected and were allotted into two groups (Experiment and Control) of eight sows each randomly. Animals in experiment and control groups were fed formulated feed with 50% cassava and normal commercial feed, respectively. Animals in both groups were fed based on the existing feeding practices of the farm. All other routine farm management activities like iron injection, vaccination and clinical case treatment were carried out as usual.

2.5 Data collection

All animals were evaluated for the whole production cycle (weaning-weaning). Data on breeding parameters (conception rate, dry period, litter size, average birth weight, average weaning size, average weaning weight, post-weaning weight of piglets) and body condition score and back fat thickness of sows were collected. Initial birth weight of piglets was measured and recorded. Then the weight gain of piglets was recorded every seven days until 35 days of weaning age. After weaning, piglets were weighed individually once in every 5 days until piglets attained age of 60 days. All records were maintained using different formats.

The weaners were also evaluated for their average daily gain (ADG) for next 25 days. Body condition score and back fat thickness were recorded for the animals at three different stages – at weaning, at the time of breeding service and farrowing using Ultrasound machine *Duo-Scan: Go*. The piglets were weaned at 35 days.

2.6 Data analysis

Data collected for all parameters were recorded in excel sheet, cleaned and exported to Statistical Package for Social Sciences (SPSS) version 23.0 for the analysis. The data were analysed using Independent Sample t test, Pearson correlation and descriptive statistics and accordingly interpreted.

3. RESULTS AND DISCUSSION

3.1 Dry period

The time from weaning to first service interval (WSI) is a key performance indicator that drives farrowing rate and litter size in pigs. The present study recorded mean dry period of 4.88 ± 1.64 days & 11.63±9.93 days for the experimental and control groups, respectively (Table 1). The study findings were in line with Mabry et al. (1996), who recorded seven days or less dry period. Similarly, Wilson and Dewey (1993) and Karvelience et al. (2008) have recorded 7-10 days dry period and 9.34±1.12 days in sows. Tantasuparuk et al. (2001) found that sows with longer dry period (30+ days) had lower lifetime production than those sows returning to oestrus at shorter dry period (below 18 days) of weaning. This indicated that Cassava based feed had no adverse

Table 1: Performance parameter of sows fed with Cassava-based feed and commercial feeds

Parameters	Cassava-based feed		Commercial feed		*p*-value
	N	Mean ± SD	N	Mean ± SD	
BCS at weaning	8	2.75±0.71	8	2.69±0.80	0.871
BCS at mating	8	2.81±0.65	8	2.56±0.62	0.446
BCS at farrow	8	3.63±0.44	8	2.88±0.44	0.004
BF depth at weaning	8	15.58±5.05	8	14.52±6.95	0.732
BF at mating	8	16.26±3.93	8	14.83±4.20	0.507
BF at farrow	8	19.25±3.40	8	18.36±4.02	0.641
WSI (dry period)	8	4.88±1.64	8	11.63±9.93	0.097
NBD	4	1.25±0.96	6	0.83±1.33	0.606
LSB	4	9.00±2.94	6	8.83±4.36	0.949
LSW	4	8.25±2.50	6	7.00±2.45	0.455

BCS: body condition score; BF: back fat; WSI: wean to service interval; NBD: no. born dead; LSD: litter size at birth; LSW: litter size at weaning effect on the dry period of the sows.

3.2 Birth weight and litter size

Litter size and birth weight of piglets have direct impact on the number of weaned piglets and weaning weights (Akdag et al. 2009). For instance, large litter size weighed less and exhibited greater birth weight variation and lower survival rate until weaning (Prazeres et al. 2016). The birth weight was reported to be more important than litter size for survival until weaning (Almeida et al. 2014).

The lower birth weight piglets lead to poorer pre-weaning growth performance and survivability (Bergstrom et al. 2009). It was also reported that the birth weight of the piglets and sow parity influenced litter postnatal development during early life (Zotti et al. 2017). This study revealed that the litter size is inversely proportional to the birth weight of the piglets. The average litter size of about 9 for both groups, and the birth weights of about 1.41 kg and 1.39 kg were recorded for the experimental and control group respectively (Table 1&2). Similarly, 11.2 pigs per litter were reported for pigs fed with both dry and wet feeds in Irish (Lawlor and Lynch 2007). Correa et al. (2014) recorded that the lactation period, wean-to-service interval and farrowing-to-service interval greatly influenced the next litter size in sows. The present study findings revealed that pig diets that consisted 50 % Cassava as basal ingredient had no negative influence on the birth weight of the piglets and litter size.

3.3 Weaning weight, size and post-weaning performance

A number of piglets weaned and their weaning weights are important economic parameters in pig production (Akdag et al. 2009) as it determines the farm profitability. The average number of litters weaned and mean weaning weights recorded in this study were about 8 and 7; and 7 & 5 kg in the experimental and control group, respectively. A significant difference (p≤0.001) in post-weaning weight gain of piglets between the experiment and control group was recorded. The weight gain of piglets from the experimental and control group was about 9.24 kg and 6.94 kg respectively (Table 2). The drop in body weight gain after day 35 could be attributed to withdrawal of milk after weaning.

Table 2: Mean initial body weight and final body weight of pigs fed with cassava based feed and normal commercial sow ration

Age of piglets	Cassava-based feed		Commercial feed		*p*-value
	N	Mean ± SD	N	Mean ± SD	
Day 0	4	1.41±0.28	6	1.39±0.15	0.91
Day 7	4	2.36±0.46	6	2.14±0.23	0.329
Day 14	4	3.29±0.33	6	2.80±0.55	0.152
Day 21	4	4.63±0.59	6	3.65±0.85	0.084
Day 28	4	5.77±0.82	6	4.58±1.01	0.085
Day 35	33	6.94±1.51	42	5.37±1.52	0.039
Day 40	33	7.04±1.56	42	5.55±1.47	0
Day 45	33	7.39±1.53	42	5.82±1.44	0
Day 50	33	7.75±1.79	41	6.25±1.50	0
Day 55	32	8.46±1.88	41	6.64±1.61	0
Day 60	32	9.24±2.06	40	6.94±1.67	0

Day 0: Birth weight; Day 35: Weaning day; Day 60 trial termination day

Freeden and Plank (1962) reported that a difference in litter size at weaning had no measurable influence on the post-weaning traits of average daily gain of pigs. This indicated that the cassava-based pig diet contributed better amount of nutrients to the pigs as there was no adverse effect on its overall performance.

3.4 Body condition score and back fat thickness

Body condition score (BCS) of all sows were recorded on the mating day. Ideally, the BCS of 3 is desirable throughout the gestation period (CFSPH 2011). The average BCS of sows recorded in this study were 3.06 & 2.71 for the experimental and control group, respectively.

- 22.25 mm as compared to lower values. Similarly, Kim et al. (2016) reported that the sows with ≥20 mm backfat thickness at 107 days (final trimester) had better reproductive performance. However, Thitachot et al. (2021) reported that the depth of back fat does not affect the litter size, but a decrease in total number of live piglets born with increasing back fat depth was observed. Back fat levels are reported to vary significantly with breed and level of feeding (Maes et al. 2004). The average back fat thickness (BFT) of pigs at weaning, mating and farrowing were 17.03 & 15.90mm in experiment and control groups, respectively (Table 1). The study did not observe any negative impact on the body condition score and the backfat thickness of Sows fed cassava based diet.

***Table 3**: Pearson correlations between different production parameters and litter size*

Parameters	BCS M	BCS F	BF W	BF M	BF F	LSB	LSW	NBD	WSI
BCS W	.921**	0.495	.744**	.705**	0.208	-.654*	-0.528	0.316	0.422
BCS M		.596*	.693**	.882**	0.299	-.788**	-.677*	.667*	0.21
BCS F			0.365	.608*	.512*	-.636*	-0.487	0.47	-0.18
BF W				.530*	0.142	-0.579	-0.412	0.404	0.385
BF M					0.405	-0.629	-.708*	.754*	0.026
BF F						-0.552	-0.495	0.131	-0.139
LSB							.885**	-0.578	-0.238
LSW								-.677*	-0.344
NBD									0.216

*BCS W: Body condition score of sows at weaning; BCS M: Body condition score of sows at mating; BCS F: Body condition score of sows at farrowing; BF W: Back fat depth of sows at weaning; BF M: Back fat depth of sows at mating; BF F: Back fat depth of sows at farrowing; LSB: Litter size at birth; LSW: Litter size at weaning; NBD: Number born dead; WSI: Wean to service interval; **Correlation is significant at the 0.01 level; *Correlation is significant at the 0.05 level (2-tailed).*

Jeyakumar et al. (2012) reported that the thickness of the subcutaneous fat layer is an important parameter at all stages of pig production. Back fat thickness of sow influences reproductive parameters like puberty, total piglets born and farrowing rate and the replacement gilts should possess backfat thickness of 18.0-23.0 mm during the age at first service in order to have good conception (Roongsitthichai and Tummaruk 2014). The sows with back fat of about 22.25 mm resulted to better farrowing rates (Knecht et al. 2020) and higher number of piglets born with back fat thickness of 17.36

4. CONCLUSION & RECOMMENDATION

Feeding pigs with feed containing 50 % Cassava in their formulation did not have any adverse or negative effect on body condition score, back fat thickness of the pigs. Moreover, there were no compromise in breeding parameters such as conception rate, dry period, litter size, average birth weight, average weaning size, average weaning weights, post-weaning weights of piglets as a result of feeding feed consisting of 50 % Cassava in the diet when compared with commercial pig ration. More interestingly, a higher post weaning weight gain of the piglets born from sows fed with diet containing 50 % Cassava was recorded as compared to feeding commercial pig feed. Thus, the study is suggestive that Cassava can easily replace 50 % of maize in pig diets thereby reducing the cost of feed and import of maize for feed production. However, further in-depth study may need to be done with breeding animals and the fattening pigs including cost- benefit analysis in order to provide strategic recommendations for pig producers in the country.

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