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EFFECT OF FEEDING NOODLE WASTE ON GROWTH PERFORMANCE OF CALVES

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Abstract

The insufficient supply of good quality feed in developing countries is the main limiting factor of livestock production, which accounts for approximately 70% of the investment in feed. Owing to the high cost of feed, farmers in Bhutan are unable to provide good quality feed to livestock; as a result, animals do not perform as needed. Some farmer heifers reach their body weight only at three years of age, which is supposed to reach 55 % of mature body weight 1t 13- 15 month of age. Therefore, it is necessary to find good alternatives to locally available feed resources to address this gap and reduce investment in heifer production. This study was conducted at Dorokha, where 18 calves were fed noodle waste for 12 weeks to evaluate the growth performance of the calves. The Experimental animals were assigned to three groups T1 (normal diet plus 0.5 kg of noodle per calf per day), T2 (normal diet plus 1 kg of noodle per calf per day) and C (maintain only on a normal diet), through stratified random selection method with a completely randomized design (CRD). ANOVA was conducted to examine weight gain among the treatment groups (C, T1 and T2) and significant differences in weight gain were detected, $F(2, 1) = 28.247$, $P<.05$. In contrast the weight gain in the T1and T2 treatments was significantly greater than that in the control (C), $t(213) = 8.579$, $p<.05$. The ADG of the control was 0.160 kg, that of T1 was 0.39 kg, and that of T2 was 0.43kg. Independent *t* test revealed that the average weight gain of the Yangku and Yangkum breeds was significantly greater than that of the Siri breed in yearling calves.

Keywords: Breeding age, Calves, CP, Growth, Noodle waste, Weight gain

INTRODUCTION

The world will need to feed an additional 2.4 billion people and require 60-70% more meat and milk than is consumed today by 2050. Moreover livestock farming is one of the fastest growing agricultural subsectors in developing countries, which will lead to an enormous demand for animal feed (Wadhwa & Bakshi, 2013). The insufficient supply of good quality feed in developing countries is the main limiting factor of livestock production (Lanyasunya *et al*., 2006).

In Bhutan, 79 % of Bhutanese people live in rural areas, and people from all six agro-ecological zones rear dairy cattle, as dairy farming is their main source of income (DOL, 2007). Farmers in Bhutan mostly grazed their cattle in the forest to meet the feed requirements (Tshering & Thinley, 2017), but grazing on herbaceous undergrowth in the forests did not meet their production requirements. According to the Bhutan livestock breeding policy of 2007, the majority of Bhutanese people own livestock for milk, draught power and manure. Bhutan has only 4% land for pasture land (LUPP 1997), which is insufficient due to rising population and demand for agricultural land. In the Bhutanese context heifer reach their breeding weight only at 3 years of age (K.-N. Dhakal Personal Communication, 2nd August 2019), which is supposed to occur at 13 to 15 months of age (Makkar *et al*.,2014), because farmers do not provide any concentrated feed owing to its cost but growing animals need a diet containing relatively high CP to achieve adequate growth. Therefore, farmers are at the loss of two years of investment in raising a heifer. According to Shaver (2014) raising one

heifer until it reaches the milking herd (24 months) it costs Nu 92,460 only for the feed that our farmers cannot afford, in line this Singh *et al*. (2003) who also reported that developing countries spend approximately 70% of the expenditure on feeding. Heifer production is one of most expensive factors in the dairy industry so it is necessary to find nutritious unconventional feed to meet the demand for milk and meat.

According to Tamang & Perkins (2005), the dairy cattle feeding system is an unbalanced system, as farmers are providing low quality feed in limited quantity, it is because of the high cost of feed is that farmers are unable to purchase commercial concentrated feed to achieve maximum production from their animals. Therefore, it is necessary to find some highly nutritious locally available feed to achieve maximum production as well as to increase farmer income. Noodle waste is an unconventional highly nutritious feed that can be given to livestock owing to its low cost and availability. Noodle waste (200 kg) every day at the Sersang Kebong Food Private Limited in Pasakha, Phuentsholing Bhutan, which are underutilized and contain 12.37% CP, 1. 25 crude fiber and 3779 kcl/kg of enegy, which are sufficient to meet the feed requirements of yearling calves. Therefore, noodle waste has an economic advantage for low- and middle-class people and enhances animal nutrition, health, welfare, and production performance. The use of noodle waste in animal diets decreases the cost of animal feed and increases livestock farmer income. Furthermore, these unconventional feed resources are good alternatives to maize and possibly other feed constituents that compete with human food. This study was undertaken to explore the use of noodle waste as supplemental feed and to evaluate the growth performance of calves.

MATERIALS AND METHODS

Study area

The study was carried out in Dophuchen geog under Dorokha Drungkhag, which has an area of approximately 255.51 square kilometer and its elevation ranging from 200-2200 m above sea level. This area falls under a humid subtropical climatic zone with good forest cover. The Temperature of Dorokha ranges from 15 degrees Celsius to 32 degrees Celsius in winter and summer respectively and the annual rainfall ranges from 1200-3000 ml.

Feed collection

Noodle waste was collected from Sersang Kbong Food Private Limited which is located at Pasakha, Phuntsholing. This single unit produces approximately 200kg of noodle waste every day. The raw material used to make noodles is “Maida” wheat flour along with other food ingredients. Waste is a mixture of Maida flour and its byproduct is noodles. The required quantity of waste was purchased at the rate of Nu 5/kg, transported to the study site at a rate of Nu 2/kg and dried in the sun for two days before feeding, to reduce the moisture content and reduce the microbial content.

Sample size and sampling method

A Feeding trial was conducted in 18 calves consisting of nine calves each of Siri and Siri strain 2 (F2) which is Yangku/Yangkum. The experimental animals were selected via a stratified random sampling method, to obtain equal numbers of animals from Siri the breed and Siri strain 2 in each treatment group. After the calves were separated into two groups according to breed, they were placed into the different treatment groups via a lucky draw. Each treatment group consisted of six calves of two different breeds. The ages of the selected calves were 10 months.

Experimental design

The CRD method was used for allocation of treatment and control animals, to avoid bias in treatment allocation; calves were selected through the names of their dams via lucky draws. The experiment consisted of three groups Treatment 1 (T1), Treatment 2 (T2), and Control (C). As a treatment group T1 and T2 were given noodle waste as supplemental feed for 84 days in addition to a normal diet, excluding 10 days of adaptation under different feeding regimes, and the control (C) was maintained on a normal diet (only fodder) as usual.

Table 1: Experimental design

Animal type	T1	T2	C
Siri	3	3	3
Siri strain 2 (F2)	3	3	3

The experiment was conducted one week after the experimental animals were dewormed, and they were provided 0.5 and 1 kg of noodle waste for treatments T1 and T2 respectively; however, control C was not provided any supplemental feed and was maintained as per the system of the farm. All the experimental animals were allowed to graze during the day and were given additional tree fodder. In the evening, all calves were provided with tree fodder, such as Seto chuletro (*Brassaiopsis hainla)*, Gayo *(Bridelia retusa),* and khasru (*Quercus semicarpifolia*) which are most commonly available on range land.

Table 2: Types of feed and quantity of feed

Types of feed and Fodder	Feeding time	Treatment (T1)	Treatment (T2)	Control (C)
Noodle wastes	8 am	0.5 kg/day/calf	1 kg/day/calf	Nil
Green fodder (Gayo, khasru, Chuletro)	7 am	2-5 kg /day/calf	2-5 kg /day/calf	2-5 kg /day/ calf
Water		Ad-libitum	Ad-libitum	Ad-libitum

Feed preparation

Dried noodle waste consists of a large hard chunk with some solidified fat attached to it, which decreases palatability; as a result, animals do not consume the required quantity of feed, so to increase the palatability, it must be made in gruel form before feeding.

- The required quantity of noodle waste was measured.
- Add water and measure quantity of waste in the pot.
- The solution was heated for approximately 15 minutes.

When dry noodles are soaked in water, they swell and become soft noodles. It is heated for at least for 15 minutes to melt down the solidified fat attached to it, to promote the palatability.

Data collection procedure

All three groups of calves were measured before the experiment to record their initial weight gain. After the initiation of the experiment, the weight gain of the calves in all three group was recorded on a weekly basis for three months (12 weeks). The calves were measured twice from the left and right sides to obtain the average value, and the measurements were taken from behind the shoulder using a Rondo measuring tape to determine the girth size, as

the girth size proportional to animal's live weight. The measurement calves were allowed to stand on a leveled floor.

Laboratory Analysis

The crude protein, crude fat, crude fiber and ash contents of the noodle waste samples were analyzed at the College of Natural Resources Laboratory. The Kjeldahl method, Soxhlet extraction and Weendes method were used for protein, fat and fiber extraction respectively. The CP content of the experimental diet was within the normal levels required by yearling calves.

Statistical analysis

The recorded data were re-entered in SPSS version 25 for analysis. Analysis of variance (ANOVA) was used to compare weight gain among the treatment groups of calves. Independent sample *t* tests were used to compare the mean weight gains among the breeds of calves. Puberty and breeding age of Siri were also estimated on the basis of their average daily gain.

RESULTS AND DISCUSSION

Chemical composition of noodle waste

A Laboratory analysis was performed to determine the chemical composition of the noodle waste. Table 3 shows the essential nutrient contents of the noodles.

Table 3: Nutrient content of noodle waste

Crude protein (%)	Crude fat (%)	Crude fiber (%)	Ashes (%)	Dry matter (%)	Moisture (%)
12.37	23.05	1.25	10.8	76.27	23.73

According to the laboratory findings, the CP content was approximately 12.37% which is similar to the findings of Ademola & Aarode (2011) but this value was relatively higher than that reported by Omole (2013), which was 10.02%, possibly because of the variety of wheat used for the production of noodles. According to Makkar and Moran (2014), the CP requirement for heifers and dry cows is approximately 10 to 12% , and this requirement of CP can be easily met by the consumption of noodle waste. The content of the crude fat is relatively high compared with the findings of Ademola & Aarode, (2011)**,** and amount of crude fiber is similar to that of other cereal grains, at 1.25%, which is lower than that of other cereals grains, indicating that noodle waste is more digestible.

The DM content of noodle waste in the present study was lower than that reported by findings of Laila (2010**),** who reported 89.00% DM, which could be due to differences in the drying period of waste in the sun. The ash content in the current study was approximately 11% which was lower than that reported by Omole (2013), possibly because of the variety of wheat used for the production of noodles.

Effect of feeding noodle waste on the weight gain of calves

Feeding with noodle waste had a significant effect on the weight gain of calves, as Table 4 shows that weight gain among the T1, T2 and C treatments was statistically significant, *F*

(2,213) = 37.5, p<0.05, which means that there was a significant difference in the weight gain of calves among T1, T2, and C, treatments; moreover, a contrast test was conducted to evaluate the differences in weight gain between the treatment groups.

Table 4: Effects of feeding noodles between groups

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5696.861	2	2848.431	37.500	.000
Within Groups	16179.097	213	75.958		
Total	21875.958	215			

The Contrast tests in table 5 and 6 show differences in weight gain between the groups (T1, T2) and the C group. Compared with the to control group (C), treatment groups (T1, T2) resulted in significantly greater weight gain in the calves than did the calves of control group (C)*, t (213) =8.579, p<.05*. Contrast test 2 between C and T1 revealed that the growth of calves was significantly greater at T1, *t (213) = 6.837, p=0.00***.** A Contrast test between C and T2 revealed that there was statistically greater weight gain in the calves at T2, *t (213) =8.022, p=0.00.* However, contrast test 4 revealed that weight gain in calves between T1 and T2 was not statistically significant, *t (213) = 1.186, p=.237*, which means there was not much difference in the weight gain of calves between T1 and T2.

Table 5: Contrast coefficients

Contrast	Control	Treatment 1 [0.5 kg]	Treatment 2 [1kg]
1	-2	1	1
2	-1	1	0
3	-1	0	1
4	0	-1	1

Table 6: Contrast test

	Contrast	Value of contrast	Std. Error	T	df	Significance
Weight of the calves	1	21.5833	2.51592	8.579	213	0.000
	2	9.9306	1.45257	6.837	213	0.000
	3	11.6528	1.45257	8.022	213	0.000
	4	1.7222	1.45257	1.186	213	.237

The results revealed that the effect of feeding of noodle waste on the growth performance of calves was statistically significant. This study was in line with the findings of Maneerat *et al*. (2015) who performed similar experiments in which fattening steers were fed with industrial byproducts. Eniolorunda *et al*., (2011) conducted similar experimental feeding trails on 20 growing Rams with variable levels (25%, 50%, 75% & 100%) of biscuit waste and *Leucaena leucocephala* in Nigeria and reported that a diet with 75% biscuits waste resulted in significant weight gain on rams compared with other levels of feeding.

Animashahun *et al.* (2018) performed similar experiment in which broilers were fed graded levels of instant noodles and reported significant growth.

A Number of feeding trials conducted using noodle wastes reported significant growth in the animals which could be due to constituents of noodle waste, as Animashahun *et al*. (2018) reported that noodle contain antacid minerals, sodium carbonate, potassium carbonate and phosphoric acid, which act as buffering agents so that the risk of bloating in ruminants is reduced. Furthermore, it was reported that noodle waste does not contain any known antinutritional factors and contain a greater amount of metabolizable energy than other cereal grains do. The starch present in wheat is readily fermentable by rumen microbes (NRC, 2000). The significant weight gain of calves in the current study could be due to the higher CP content (12.37%). This is due to the low-level of crude fiber (1.25%), which is readily digestible. Noodle waste contains relatively high levels of fats to combat cold winters and maintain high energy levels.

Average daily gain among the treatment (T1, T2) and control groups

The average daily weight gain was significantly greater in the treatment groups (T1, T2) than in the control group (C), but the ADG was not significantly between T1 and T2, as there was not much difference in the daily gain of calves between T1 and T2. The mean weight gain was greater in the T2 treatment than in in the T1 and C treatments. The lowest mean weight was in the control (C). The mean weight gain and SD of the control and T1 and T2 groups were as follows: C (*M=6.750, SD=4.26799),* T1 (*M=16.33, SD=10.05968),* and T2 (*M=18.0556, SD=10.41449)*. This shows that the average daily gain of calves in the treatment groups (T1, T2) was greater than that in the C group, but the difference in growth between the T1 and T2 groups was not statistically significant.

Table 7: Means and SDs of the treatment and control groups

Treatment groups	Mean ± SD
Control	6.4028 ± 4.26799
Treatment 1	16.3333 ± 10.05968
Treatment 2	18.0556 ± 10.41449

The average daily gain in the control (C) group was approximately 0.160 kg per day, and the average daily gains in the T1 and T2 groups were 0.39 kg and 0.43 kg per day, respectively. The average daily gain in the current study was in line with Cooper *et al*. (n.d.) that reported by, who compared yearling calves with native flooded meadows and reported that yearlings gain approximately 0.544 kg per day. In addition, the NRC reported that the target daily gain of yearlings should be 0.454 kg. Therefore, feeding noodle waste statistically achieved the standard set by NRC in terms of the average daily gain of calves.

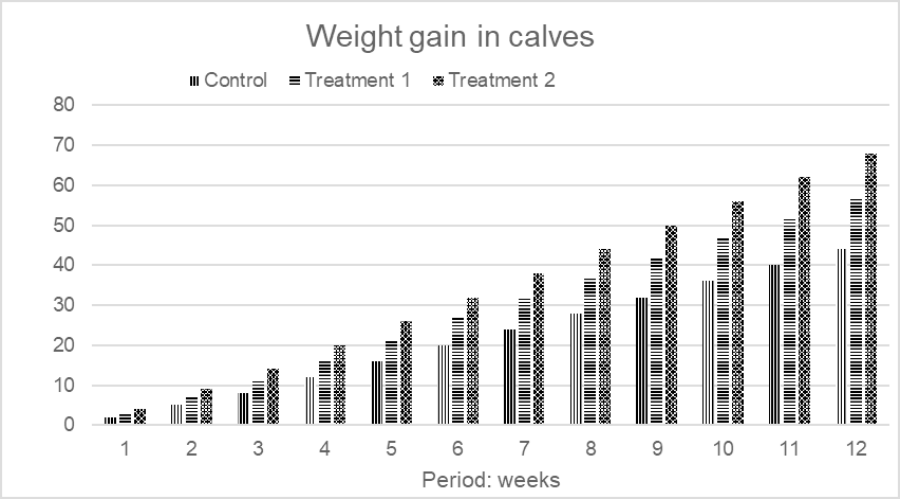

Figure 1: Average weekly gain between treatment groups

The mean weight gain of calves consistently increased in the treatment T1 and T2 treatments, as shown in Figure 1. but there was decrease in the weight gain of calves in the control group (C) at week 7, which could be due to the exhaustion of fodder and foraging grasses. It is also clear from the figure that the average gain was significantly greater in the T1 and T2 treatments than in the C treatment: these results revealed that the consumption of noodle waste significantly affected the growth of the animals.

Effects of breed on average daily weight gain

The weight gain between the breeds was statistically significant, $p < .05$. Figure 2 clearly shows that the mean weight gain given in Yangku /Yangkum, is greater than the mean weight gain in Siri breeds of cattle, which means that Yangku and Yangkum have significantly greater average daily gains than the Siri breeds of yearling calves. Phanchung and Roden, (1996) who characterized Mithun cross Siri in Bhutan, reported that Yangku and Yankum cattle are heavier than the indigenous Siri breed of cattle. Researchers further reported that Yangku and Yangkums are genetically superior to the Siri breed of cattle, as they are progeny of Jatsham. The significant weight gain in Yangku and Yangkum calves could be due to increased foraging and feed conversion ability.

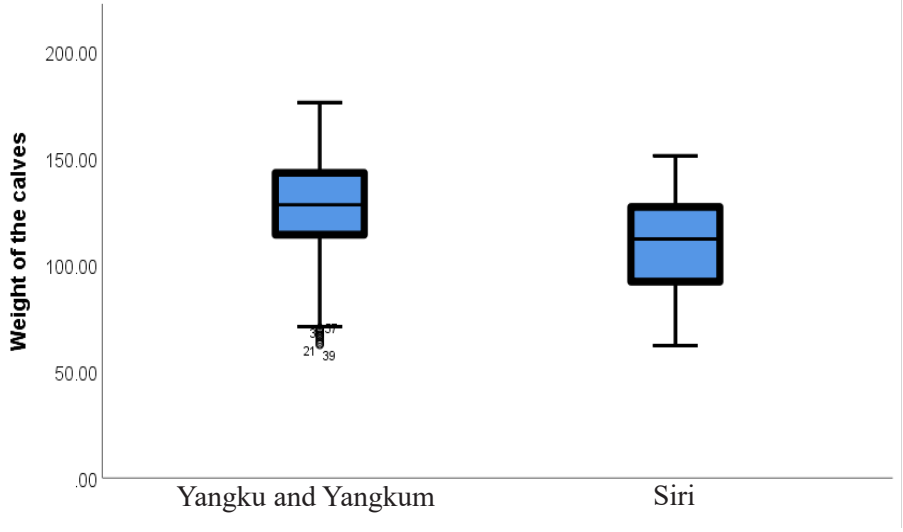

Figure 2: Comparison of weight gain between the breeds of calves

Level of noodle waste in the diet of weaned calves

The study revealed the recommended level of noodle waste that can be given to yearling calves without having any adverse effects on their growth or health. Two feeding regimens (0.5 kg/calf/day and 1 kg/calf/day) were used to examine their effects on weight gain, in addition to their effects on their normal diet. The results of the test presented in Table 6 revealed that there was no difference in the weight gain of calves between T1 and T2, *t (213) = 1.186, p=.237.* Therefore, Compared with T1 (0.5 kg/calf/day), feeding 1 kg of noodles per calf per day is waste of feed, as the weight of these animals did not significantly differ from that of T1 (0.5kg/calf/day).

CONCLUSION

The current study was performed to evaluate the growth performance of calves by feeding them noodle waste, which contains 12.37% of CP, which is a good source of protein that livestock owners can purchase at affordable cost at the village level. A study on effects of feeding noodle waste on the growth of calves revealed statistically significant results compared with those of calves raised on a normal diet, as hypothesized. The average daily weight gain was greater in calves given 1 kg of noodle per day per calf (T2) than in those given 0.5 kg per day per calf. Puberty and breeding age of calves can also be decreased by feeding noodle waste due to significant weight gain in calves. Therefore, the feeding of noodle waste to bovine calves at the recommended level has no adverse effect on health and can increase the growth of animals at relatively low cost.

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