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Research Article

Effects of Urea Treated Sugar Beet (*Beta vulgaris*) Pulp Feeding on Weight Gain of Bulkhi Sheep

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Authors' Contributions
SAR conducted the research. SSA supervised the research. MIM wrote the manuscript. SU and SMKS co-supervised the research and provided guidance. FR helped in research design and statistical analysis of data. AK and Wasimullah provided technical support. ID helped in conduction of work. HAR helped in lab tests and analysis.

Keywords
Bulkhi lambs, Economics, Sugar beet pulp, Weight gain

Abstract | In current study, the effects of urea treated sugar beet pulp feeding versus simple in different concentration on weight gain of Bulkhi breed's lambs were carried out. The trials were done on 12 lambs of age under 24-30 weeks and also have weight about 30 ±1.5kg. Lambs were grouped as A, B, C and D and each group contained 3 lambs. Groups were fed by four rations as ration containing 4% urea, 2% urea treatment, only sugar beet pulp, and control ration, respectively. After adaptation period of 10 days, the experimental period continued for 35 days. On daily basis, the average intake of feed and increase in weight gain was noted which was statistically not similar [Group A: (947.3± 5.114 and 147.33 ± 2.058), Group B: (964.0 ± 6.233 and 131.91± 1.699), Group C: (1176.7 ± 6.299 and 123.24 ± 1.056) and Group D: (944.7 ±3.065 and 118.28 ± 0.543)]. For group A, weight gain was higher than the B, C and D. Group C feed conversion ratio was higher than the A, B and D group as 9.1 ± 0.066, 6.6 ± 0.119, 7.7 ± 0.046 and 7.9 ± 0.053, respectively. The highest net return cost was highest for group A (RS 13575 ± 0.1220) while for the group D was lowest (RS 12804 ± 0.712). The profitability of other 3 groups was less as compare to group A which was about RS 1575 ± 0.1240. Results indicated that 4% urea treated sugar beet pulp has excellent effect for weight gain of lambs.

Novelty Statement | D.I.Khan is an agriculture based area and majority of people's economy depends on the livestock. Due to enhancement in input rates farmers need economical and efficient source of feeding. After sugar cane, sugar beet is major crop of area and its pulp is easily available as there are four function Sugar Mills in the district. Its first study to check the effects of urea treated sugar beet (*Beta vulgaris*) pulp feeding on weight gain of Bulkhi sheep.

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Introduction

Livestock being one of the major sections contributing 55.9% of agriculture have vital part in economics of Pakistan (Pasha and Khan, 2010) while its contribution in GDP of Pakistan was about 11.8% in 2013-14. The gross

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value of livestock in 2012-13 was Rs. 757.2 billion but it has increased up to Rs. 775.6 billion in 2013-14 (Economic Survey of Pakistan, 2013-14). About 30 to 35 million villagers are related with livestock (Sarwar *et al.*, 2002). According to (Zaheer *et al.*, 2001) 28 different breeds of sheep are present in Pakistan. Small ruminants contribute nearly 57% of whole ruminants and its contribution in red meat provision is about 27% (Sarwar *et al.*, 2010). Small ruminant population has increased within last 4 years about 80.3 to 85.7 million with 1%/year growth rate. From 2011 to 2015, the population of sheep has increased about 28.4 to 29.1 million animals. The contribution of sheep in meat production is approximately 117 thousand tons. Province wise %age of sheep in Punjab, Sindh, Baluchistan and KP is 25%, 15%, 42% and 18%, respectively. The number of breeds in Punjab is 7, Sindh 3, Baluchistan 7, KP and northern areas 4 and AJK is 7 (Isani and Baluch, 1996). Bulkhi sheep breed was migrated to KP from the Afghanistan, Bulkhi area. Its color is tan/brown but in few cases it is white or black. It has fatty tail and is also a heavy breed. According to (GOP, 2006) the population of this breed is 0.3 million. The farming of sheep mostly depends upon grazing but it is not sufficient for better growth performance (Mahajan *et al.*, 1976). The lambs grow well when fed with byproducts of agroindustry, fodders and concentrates (Mahajan *et al.*, 1976). The low-quality feed and shortage of feed during dry period throughout the year is the major problem in production of livestock. Therefore, it is needed to achieve forage from other cheap and easily available resources in that area. For the production of sugar, Beta vulgaris (Sugar beet) is produced in the areas of hot climate next to sugarcane cultivation and is a rich source of sucrose (Springer, 2012). As a fodder of livestock, beet pulp is obtained from the sugar beet industries. High level of fiber and energy content is present in sugar beet pulp but it has low sugar level. Its proximate analysis tells that it contains 6% sucrose, 9% CP, 3% insoluble ash, 0.5% EE and 4% soluble ash and according to another study (Talha *et al.*, 2002) it has 6 % dry matter. These values also vary due to some factors like region, soil fertility, seed varieties, date of harvesting and fertilizer's usage (Broughton *et al.*, 1995). The nutritional value of lamb's diet increased with addition of sugar beet pulp and also it is economical (Crawshaw, 1992). In developing countries, the scarcity of animal's feed leads to low production of livestock. To overcome this problem, we need to import the energy and protein rich feed ingredients from other countries but its cost is too high. So, we have to search the ingredients which fulfill our requirements in economical way in local areas. So, we have to observe the byproducts of agroindustry to fulfill our needs (Fayed *et al.*, 2009).

Sugar beet pulp (SBP) has low concentration of crude protein (CP) but high crude fiber (CF) (Papadomichelakis *et al.*, 2004). Digestibility of sugar beet pulp is more because it contains low level of lignin (Ashry *et al.*, 2000). When SBP is added in animal feed, its energy level increases (Sherien, 2005; El-Badawi *et al.*, 2003). SBP is cultivated in various countries but not used for animal's feed. To increase the nutritional value of feed, many scientists (Omer *et al.*, 2011; Fayed *et al.*, 2009) worked to increase the digestion and palatability of roughages of low quality by treating them with biological or chemical treatment. Urea was utilized for chemical treatment of roughages. Urea exposed the structural carbohydrates to microorganisms which increase the digestion of feed stuff (Singh, 2004). Some microbes are also utilized for improving feed stuff digestibility as biological treatments (Mohamed and Abou-Zeina 2008; Fayed *et al.*, 2009).

This study was planned to check out the effects of urea untreated versus treated beet pulp feeding in different levels of concentration on the Bulkhi sheep breed in sense of weight gain and to estimate the economic value of various rations used for this purpose.

Materials and Methods

Collection of SBP

According to NRC, 2007 recommendation, the diet was iso nitrogenous and iso caloric. From the Al-Moeez Sugar Industries, Dera Ismail Khan, KP, Pakistan, it was collected.

Treatment of SBP

Collected SBP (300kg) was exposed to sunlight for drying about seven days. 100 kg of SBP was sprayed by the solution of 2% urea while other 100 kg by 4 % urea but remaining 100 kg was simple. The treated SBP was covered by a plastics sheet which produce anaerobic environment for 21 days. Later to this period the plastic sheet was removed to release the ammonia gas for 2 h. After that the ration was ready to use.

Experimental lambs

12 bulkhi breed's lambs (male) of similar age and weight were selected for experimental purpose. A, B, C and D groups were constituted, each contained 3 lambs. These lambs were disease free and prior to experimental trial they were dewormed.

Experimental ration

There were four types of rations as control ration, sugar beet pulp (untreated), sugar beet pulp treated with 2% urea and sugar beet pulp treated with 4% urea and fed to lamb's groups D, C, B and A, respectively. According to NRC 2007 recommendation, the diet was ISO nitrogenous and ISO caloric. Each diet was mixed with basal Feed as supplement and was weighed and offered to lambs individually. The basal feed consists of following ingredients Shandar Wanda and 1-2 inch chopped green maize with 2 time grazing on daily basis with the plenty of

fresh water supply for 24 h (Tables 1 and 2).

Table 1: Ration chemical formation.

Ingredients	Shandar wanda	Dry sugar beet pulp	Maize fodder
Ash %	8.2	7	6.71
Ether extract %	2.5	0.5	1.23
Crude fiber %	16.4	22	30.1
Crude protein %	13	9	6.99
Dry matter %	85.1	88.8	28.9

Table 2: Ration combination for each group.

Ration combination	Groups			
	A	B	C	D
Maize fodder (gm) (CP in gm) (Mj E)	403 (28.21) (2.29)	500 (35) (2.61)	600 (42) (3.12)	400 (28) (2.21)
Shandar Wanda (gm) (CP in gm) (Mj E)	245 (31.7) (4.41)	350 (45.5) (6.3)	300 (39) (4.44)	690 (89.63) (10.21)
4 % urea treated SBP (gm) (CP in gm) (Mj E)	432 (60.04) (6.39)	----	----	----
2 % Urea treated SBP (gm) (CP in gm) (Mj E)	----	300 (33) (4.44)	----	----
Untreated SBP (gm) (CP in gm) (Mj E)	----	----	400 (36) (5.6)	----
Total CP (gm 0r %)	119 or 11.96%	113 or 11.35%	117 or 11.74%	117 or 11.76%
Total energy (Mj/day/animal)	13.01	13.35	13.16	13.25

Experimental trial

The effect of every experimental diet was checked in term of intake of feed and increase in weight of bulkhi breed's lambs. After the period (adaptation) of 10 days, the experimental period was lasted about 35 days. The experimental trial was conducted in October and November (2015).

Parameters

Data regarding the following parameters was recorded;

1- Daily total feed intake
2- Weekly weight gain
3- Daily average weight gain
4 FCR (Feed Conversion Ratio)
5 Experimental rations' Economical value

Proximate analysis of feed

Samples for proximate analysis were collected from SBP (urea treated) and analyzed in laboratory. Three samples were used for DM analysis and remaining was dried for 72 h at 70°C. These samples were ground by Wiley grinding mill (Thomas Scientific U.S.A) to 1mm size and placed for proximate analysis like Dry Matter, Crude Protein, Crude Fiber, E.E, Ash determination in bottles (labelled), according to the AOAC (2000) protocols.

D.M determination

To check the D.M in sample, the crucible was weighed again and values were put in the following formula.

$$\text{DM (\%)} = \frac{C - B}{A} \times 100$$

Calculation of ash

To check the Ash in sample, again crucible was weighed and obtained value was put in following formula.

$$\text{Ash (\%)} = \frac{B - A}{C} \times 100$$

Determination of crude protein (C.P)

C.P in sample was checked by Kjeldahl method (AOAC, 1995). Percentage of nitrogen in distilled sample was detected by following formula.

$$\text{N(\%)} = \frac{(T1 - T2) \times 14.01 \times \text{D.F.} \times \text{N}}{\text{Sample weight}} \times 100$$

C.P was calculated by following formula; CP= N× 6.25

Determination of crude fiber (C.F)

The C.F in sample was checked by following formula.

$$\text{(Sample) \%CF} = \frac{\text{(Crucible weight + Dried residues) - (Crucible weight + Ash residues)}}{\text{(sample + Crucible weight) - (Empty Crucible Weight)}} \times 100$$

Determination of acid detergent fiber

To check the ADF, values were put in following formula. (Goering and Van Soest, 1970).

$$\text{\% ADF in the sample} = \frac{C - A}{B - A} \times 100$$

Determination of neutral detergent fiber

To check the NDF in sample, values were put in following formula (Van Soest *et al.*, 1991).

$$\text{\% NDF in the Sample} = \frac{C - A}{B - A} \times 100$$

Determination of organic matter

To determine the O.M following formula is used.

$$\text{OM} = \text{DM in sample ĞAsh in sample}$$

Statistical analysis

By the use of statistical analysis system (version 2000) variance analysis of each parameter was calculated with general linier model. While significant level ($P < 0.05$) was estimated through comparison of mean values by LSD values.

Results and Discussion

Daily feed intake

The total intake of feed for Group D: (944.7^{d}±3.065), group C: (1176.7^{a}±6.299), Group B: (964.0^{b}±6.233) and Group A: (947.3^{c}±5.114) was noted.

More SBP (untreated) was consumed by the lambs of group C (Figure 1), but the average of consumed feed on daily basis was different. These observations were also discussed in research which was carried out to check the effect of 90% SBP in the diet of Egyptian sheep breed, Ossimi lambs in accordance with increase in weight, (Abdel-Magid *et al.*, 2013).

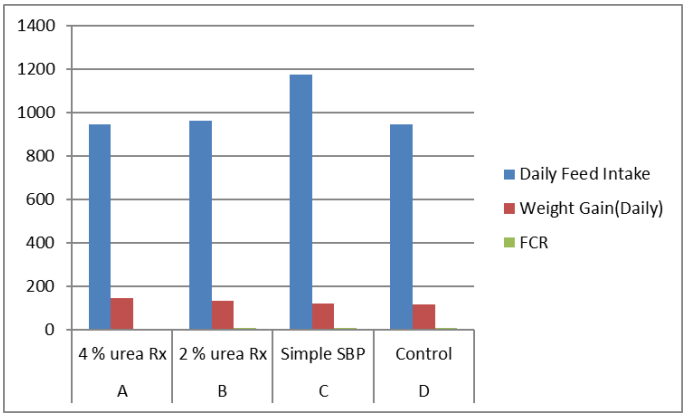

Figure 1: Average daily feed intake (grams), weight gain (grams) and feed conversion ratio (FCR).

The current study concluded that digestion and intake of feed increased by feeding diet containing SBP due to its water holding capacity (El-Badawi *et al.*, 2003). Results of current study also linked to the research work which concluded that if only SBP was fed by ruminants, due to good water holding capacity of SBP, intake of feed increased (El-Badawi *et al.*, 2003). These observations were opposite to research work carried out in another study (Hall *et al.*, 1998). According to that study the effect of SBP feeding and NDS fiber (fermented by microbes of rumen) and concluded that SBP is an energy source because it contains insoluble and soluble NDF, which have high digestibility and increases the intake of feed on daily basis.

Daily weight gain average

The average increase in body weight of Group D: (118.28 ^{d} ± 0.543), C: (123.24^{c}±1.056), B: (131.91^{b}±1.699) and A: (147.33^{a}±2.058) was noted, highest for the lambs of group A (Figure 1), but increase in weight on daily basis was different. The results of current study were similar to the research work carried out by (Okab *et al.*, 2012). He offered ration 1: control ration, 2: sugar beet pulp (untreated), 3: sugar beet pulp (treated with 2% urea), 4: sugar beet pulp (treated with fungus) to the (growing) lamb's groups A, B, C and D, respectively and observed that body weight and increase in weigh on daily basis were higher significantly (P<0.05) in group that fed with SBP (treated with 4% urea).

The observation of current study was also related to observation which concluded that nutritive value, palatability, utilization of Nitrogen and digestibility of urea (chemical) treated byproducts of agroindustry e.g. SBP is high and cause increase of weight in ruminants (Mohamed and and Abou-Zeina,2008). Our findings were also related to the research work which concluded that 50% SBP (treated with urea) when offered to growing lambs by replacing concentrate feed mixture, the weight of body and percentage of dressing were very good and this study was carried out by El-Badawi *et al.* (2003). According to Galbraith and Mandebvu (1999) increase in weight of body is due to high concentration of butyrate and acetate while low concentration of propionate (ruminal) but good results shown while ruminants fed with SBP (treated with urea).

FCR

FCR of the group A, B, C and D was noted as 6.6^{c}±0.119, 7.7^{b}±0.046, 9.1^{a}±0.066 and 7.9^{b}±0.053, respectively (Figure 1). For group C, highest FCR was noted than the others. Among all of the groups there was a significant difference. The results of current study were similar to the research work carried out in 2013 by the Abdel-Magid, concluded that SBP (untreated) and SBP (treated with urea) have difference in its FCR values. Because the FCR of animals fed with SBP (treated with urea) was low as compare to the FCR of animals fed with SBP (untreated or control) and this difference was significantly (P<0.01).

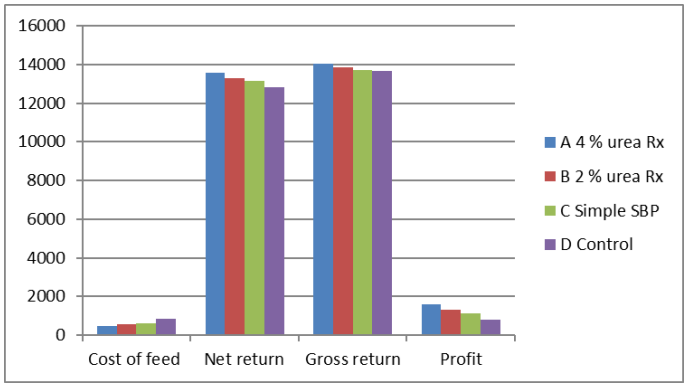

Figure 2: Economics of the experiment.

Economics of the ration

Economical value was evaluated by checking the increased body weight of live animal and the cost of feed (ingredient's market price). The daily basis cost of feed of one lamb of group D (Rs.24.37), group C (Rs.16.91), group B (Rs.15.84) and group A (Rs.13.93) was noted (Figure 2). The total cost of feed in 35 days per one lamb of group D (Rs.852.95^{a}±0.702), group C (Rs.591.85^{b}± 0.2413), group

B (Rs.554.40^{c}±0.2912) and group A (Rs.487.55^{d}±0.1230) was noted.

Lowest cost of feed was observed for the A group and highest for the D. Gross return of group D (Rs.13657^{d}±0.706), C (Rs.13726^{c}±0.2469), B (Rs.13847^{b}±0.2914) and A (Rs.14063^{a}±0.1235) was noted. Lowest gross return of feed was noted for D group and highest for the A group. The net return's value for group A was Rs. (13575^{a}±0.1220), B (13293^{b}±0.2903), C (13134^{c}±0.2496) and group D (Rs.12804^{d}±0.712) was noted. Net return rate was noted highest for the group A than the remaining groups. The mean profit of group A (Rs.1575^{a}±0.1240), B (1292.8^{b}±0.2918), C (1134.0^{c}±0.702) and D (804.32^{d}±0.721) was noted. So, the highest profitability was seen for group A than the other 3 groups. According to Ibrahim *et al.* (2013), 10% SBM mixed SBP in the diet of sheep, lowers the cost of daily consumed feed about 45.03% as compare to control diet. When the ration of lambs contained SBP, treated by biological agents the feeding cost will be very low and profit will be too high (Mousa, 2011).

Conclusions and Recommendations

The current study concluded that the ration mixed with SBP (treated with 4% urea) which was offered to the lambs of group A, showed more increase in body weight, high profitable, more economic and high feed intake as comparative to other groups which were offered by the SBP (untreated), SBO (treated with 2% urea) and control diet.

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Availability of data and materials

Data and material are available for verification or further processing

Consent for publication

All authors gave their consent for publication

Ethics approval consent to participate

Not applicable

Statement of conflict of interest

The authors have declared no conflict of interest.

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