PE9.25 Fattening cattle & meat quality by tannery wastes as protein sources 165.00

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ABSTRACT: **A total of 12 young fattening cattle (6 young male and 6 young female heifer) were fed during the study period on a control diet (T1) with 10% commercial protein concentrate (CPC) and on 2 test diets in which 5% tannery waste protein concentrate (TWPC) + 5% CPC (T2) and 10% TWPC (T3) to assess whether it is feasible to substitute costly CPC by TWPC. The chemical composition of TWPC was 90.9 for DM%, 77.02 for CP%, 0.8 for CF%, 2.8 for EE% and 3450 Kcal/kg ME, respectively. The test diets affect significantly (P<0.05) on live weight gain, feed cost, and profitability compared to that of the control diet. TWPC contained more protein and essential amino acids than the CPC, so it helps to weight gain. Complete or partial replacement of CPC by TWPC reduced feed and production cost due to low cost of TWPC. The contamination of aflatoxin in TWPC was found to be negative. Color of meat was redish and normal. Fleshy and normal odor was present. Chemical composition was normal as other beef meat and it was non toxic especially chromium free. Total lipid contents were higher (p<0.05) in T3 and moisture, ash and crude protein contents were similar (p>0.05) among the three groups. It can be concluded that TWPC or equal mixture of TWPC and CPC may be economic and efficient in place of when only CPC used as protein source in the cattle ration. The above findings indicated that tannery wastes can be used efficiently as a substitute of CPC in cattle ration and gradually can minimize the environmental pollution.**

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I. INTRODUCTION

High price and shortage of feed ingredients are the main constraints for animal production. Cost of feed ingredients is increasing at an alarming rate and incurs about 60-65% of the total cost of cattle production, of which protein cost incurs about 13% of the total feed cost [2]. Certain amount of animal protein like fishmeal/meat meal/other protein concentrate must be added to the diet in order to satisfy essential amino acid requirements [20]. The tannery wastes are good sources of animal protein. The price of fishmeal and other protein concentrates are becoming very costly. Animal farmers are looking for some alternates. Tannery waste can be use as a cheap and alternative source of available market protein concentrate or fishmeal for feeding cattle. Commercial protein concentrate are collected from Jayson Agrovet Ltd. Which is made from fish, fish scales, fish bones, fish offal's, snails, oyster, crabs etc.

There may be a question arise related to bovine spongiform encephalopathy or mad cow disease. If the area is effected by BSE, then it is better to avoid but if the area is free of BSE, in that case we can use the tannery wastes as protein source. In the other hand according to the research hides and skins are not carriers of this disease agent. So we can utilize it after proper treatment and processing for livestock development. It is also observed that many of the Bangladeshi farmers are using these tannery wastes for their livestock as feed, though those are not scientific. But those animals which are feeding tannery wastes are still in good health. With the above views in mind the research was undertaken with the objectives of- to find out alternate protein source for cattle, to minimize the feed cost of cattle farmers and subsequently to pollution free environment.

II. MATERIALS AND METHODS

Preparation of tannery waste protein concentrates (TWPC)

Tannery wastes were collected from vegetable-tanning units but not from wet blue leather due to the presence of chromium. After collecting the tannery wastes washed to remove salt and dust or other foreign materials. Then washed and dried fleshings and trimmings mixed at a ratio of 17:83. Then samples boiled at 100^0C for 4-5 hours. Then sun dried properly. Then the dried mixture was ground properly. Finally the coarse, undesirable particles and hairs were sieved after grinding by a special type of net.

Analysis methods

Feed were analyzed to determine of DM, CP, CF, EE, Ash and ME [1]. Aflatoxin was tested in the toxicity laboratory of Bangladesh Council of Scientific and Industrial Research (BCSIR), Dhaka. The amino

acid level in the tannery wastes was also determined by HPLC of Agilent Technologies (1200 series) in the Analytical Laboratory of Degussa-Huls AG, Feed Additives Division, Applied Technology, D-63403 Hanau. Beef were grounded, homogenized, and analyzed in triplicate. Beef moisture and ash contents were determined according to AOAC [8]. Crude protein content was obtained through the kjeldahl method [8]. Total lipids were extracted through the Bligh and Dyer method [4] with a chloroform/methanol mixture. Chromium Cr (VI) toxicity in the beef was analyzed by a colorimetric method using the diphenylcarbazide (DPCZ) reaction [9].

III. RESULTS AND DISCUSSION

Collection of cattle

A total of 12 young crossed (Deshi x HF) cattle (6 young male and 6 young female heifers) of an average one year aged and initial average live weight were 149.95±3.51kg for T1, 149±4.29kg for T2 and 150.1±4.92 for T3 (Table5). The experiment was conducted for 75 days.

Preparation of experimental diets

Different feed ingredients used to prepare diet for T1 by concentrate whose final mixed feed composition with CP & ME content were 15.64% and 257.49kcal/100g; T2- 16.37% and 258.12kcal/100g and T3- 17.01% and 258.57kcal/100g (Table1).

Table 1. Composition of experimental concentrate feed

Ingredients (%)	**Diet for T_1**	**Diet for T_2**	**Diet for T_3**
Wheat bran	20	20	20
Rice bran	20	20	20
Maize crust(Broken)	20	20	20
Khesari bran	18	18	18
Sesame oil cake	10	10	10
CPC	10	5	--------
TWPC	-------	5	10
Di-Ca-Phosphate	1	1	1
Common salt	1	1	1
Total	100	100	100
Protein in mixed feed (%)	15.64	16.37	17.01
Energy ME(kcal/100g) in mixed feed	257.49	258.12	258.57

Where, T_1 = Control diet (10% CPC), T_2 = 5% CPC + 5% TWPC and T_3 = 10% TWPC; CPC= Commercial protein concentrate, TWPC= Tannery waste protein concentrate

Management

Concentrate feed 1.5 kg was supplied per day per animal according to their treatment. For dry Roughage a total 1.5 kg rice straw per animal mixed with molasses and urea was supplied in a whole day dividing into 2 parts. In case of green grass (succulent) *Ad* libitum native green grass was supplied.

Organoleptic, chemical and physical test

Slaughtered one animal from each treatment and observed the color, odor and outlook of the beef. Then collected beef sample of each animal were taken for chemical analysis.

Statistical analysis

All data were statistically analyzed using analysis of variance using a MSTAT statistical computer package programme (2000).

Preparation of protein concentrate

Protein concentrate from TW described by [3] was helpful for the preparation of TWPC in the present experiment. The texture, color, odor and duration of preservation qualities were almost similar to the CPC.

Chemical composition of prepared protein concentrates

The TWPC contained 90.63% DM, 77.02% CP, 0.77% CF, 2.83% EE and 7.19% ash (Table2). The contamination of aflatoxin in TWPC was found to be negative. The CP in CPC is 60% where as in TWPC was 77.02%. The composition of TWPC is close to the values reported by [18] and [12]. In the present study, the composition of raw fleshings was moisture 3.74%, crude protein 26.11%, crude fat 21%, crude fibre 2.81%, ash 38.43% found to be almost close to [19]. It is evaluated that all amino acids were more in TWPC than CPC and the amino acid content of TWPC (table3) is also nearly similar to [19]. So these higher amino acid values as well as protein content affect significantly on weight gain of the cattle.

Table 2. Chemical composition of CPC, TWPC, fleshings & shavings

Items	**Composition**					
	DM %	**CP %**	**ME Kcal/kg**	**CF %**	**EE %**	**Ash %**
TWPC	90.63	77.02	3450	0.77	2.83	7.19
CPC (Jasoprot)	93.00	60.00	3230	4.00	10.00	8.20
Fleshings	96.26	26.11	3250	2.81	21.00	38.43
Shavings	89.65	82.1	3400	0.78	1.30	7.50

CPC= Commercial protein concentrate, TWPC= Tannery waste protein concentrate

Table 3. Comparison of amino acid contents of TWPC and CPC

Amino acid	AA in TWPC (%)	AA in CPC (%)
Lysine	4.27	3.2
Methionine	1.39	0.91
Met+cys	2.35	1.96
Isoleucine	2.83	1.77
Histidine	1.72	1.20
Leucine	5.27	4.26
Phenylalanine	2.49	2.35
Threonine	3.53	2.21
Valine	3.11	2.61

Chromium toxicity and chemical composition in the beef

Chromium toxicity in the sampled meat was 1.95±0.6µg/1000cal. It was non toxic especially within recommended chromium level which result is followed by [9]. So the TW used feed which was supplied to the cattle is not harmful to human if taken as beef. Table4 shows the chemical composition results for T1, T2 and T3 group fattening cattle. Moisture, ash and crude protein contents were similar ($p>0.05$) among different treatments. There was no difference in moisture levels in the muscle among these groups. Average moisture content was 73.5%, which is similar to other studies [14]. Similarly ash content was not affected ($p>0.05$) to different treatment groups. The average ash content was 1% which was similar to the observation of [17], [16] and [5]. Thus ash content is little influenced by diet (Table4). The average protein level in the different treatment groups were 22.47±0.19, 22.56±0.10 and 22.93±0.15 in % by T1, T2 and T3 respectively with no significant differences ($p>0.05$) among them. In literature [17; 5 and 16], there are reports of average crude protein content in between 21 and 23%. Thus it can be concluded that diet group would not alter protein levels in the muscles of bovines. Total lipid content was greater ($p<0.05$) in the T3 group in comparison to animals from the T1 and T2 groups. However, there was no differences ($p>0.05$) observed in the muscle of T1 and T2 group. In general, total lipid levels in the muscle of steers finished is close to 3% [17and 16]. However, total lipid levels observed in all treatment groups were below the maximum level regarded as acceptable for the prevention of diseases related to fat content in beef, according to recommendations from the English Health Department [11].

Table 4. Moisture, ash, crude protein and total lipids in muscle of fattening cattle

Nutrients	T1	T2	T3	Level of significance
Moisture(%)	74.2±0.2	73.8±0.11	73.2±0.10	NS
Ash(%)	1.06±0.01	1.01±0.01	1.05±0.01	NS
Crude protein(%)	22.47±0.19	22.56±0.10	22.93±0.15	NS
Total lipids(%)	1.71±0.07[b]	1.96±0.04[b]	2.5±0.05[a]	*

Means within the same row with different letters (a-b) are significantly different; *, $p<0.05$; NS, no significant difference among means and Here, T_1 = Control diet (10% CPC), T_2 = 5% CPC + 5% TWPC and T_3 = 10% TWPC; CPC= Commercial Protein Concentrate, TWPC= Tannery Waste Protein Concentrate

Growth performance:

The initial live weights of cattle's were almost similar in all dietary groups (Table5). At the end of research period, highly significant ($P<0.05$) differences were observed in the different dietary treatment groups. The highest average body weight gain (530±40g) was observed in dietary treatment group T_3, followed by T_2 (510±40g) and T_1 (470±30g) in table5. Feed conversion ratio or efficiency was also better in T3 than T2 and T1 (Table5). Body weight gain and feed efficiency is correlated with each other. The findings obtained in the present study agree with the result of [15], [6], [12] and [10]. It is also evident from the above findings that the body weight gain of the farm animal were significantly influenced by the replacement of commercial protein concentrate with TWPC as in dietary treatment groups.

Table 5. Growth performance of cattle in different treatments

Items	T1	T2	T3
Initial Body Wt. (kg)	149.95±3.51	149.0±4.29	150.1±4.92
Final Body Wt. (kg)	185.4±4.83	187.0±7.39	190.35±4.76
Average Daily Gain(g)	470±30[c]	510±40[b]	530±40[a]
Dry Matter Intake(g)	2980±8.16	2945±9.13	2905±7.5
Feed Efficiency or G/I (g/g)	0.16±0.01	0.17±0.01	0.18±0.01

Means within the same row with different letters (a-c) are significantly different ($p<0.05$); Values are Mean±SD; G/I= Average daily gain/dry matter intake; T_1=Control diet (10% CPC), T_2 = 5% CPC + 5% TWPC and T_3 =10% TWPC (CPC= Commercial protein concentrate, TWPC= Tannery waste protein concentrate)

Organoleptic, chemical and physical test

Color of meat was reddish and normal. Fleshy and normal odor was present. Then collected sample of meat from each animal was taken for chemical analysis. Chemical composition was normal as other beef meat and it was non toxic which was tested in the laboratory especially for the chromium. These tested are followed to the findings of the [7] and [9].

Carcass and meat characteristics

Dressing percentage was nearly 56.6 which are similar to [7]. The muscle pH (5.4), shrinkage on chilling (2 percent), moisture (73.5 percent), protein (23 percent), and ash (1 percent) were all about the same in all beef cattle.

Feed Cost and profitability

It was clear that feed cost of T3 is lowest and this treatment is profitable for cattle rearing. These results are in agreement with the findings of [13] and [21] who found less feed cost per kg live weight gain, when commercial protein was replaced by TWPC.

IV. CONCLUSIONS

The test diets affect significantly ($P<0.05$) on live weight gain, feed cost, and profitability compared to that of the control diet. Body weight gained higher mainly by the high level of protein and availability of essential amino acids in the TWPC which is less in CPC. Feed conversion efficiency also found better in T3 than T2 and T1. Complete or partial replacement of CPC by TWPC reduced feed and production cost due to low cost of TWPC. The feed with tannery wastes may alter to increase quality of the carcass characteristics and chemical composition of the muscle of fattening cattle. The chromium toxicity and contamination of aflatoxin in TWPC was found to be within recommended value.

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