Effect Of Supplementation Of The Diet With Treated Rice Straw (Sulphuric Acid , Urea, And Tafla) On The Digestibility And Nutritive Value In Buffalo Bull Calves

***Mahmoud F.A.El-Gamal and **Mostafa I.Abd El-Rahim**

*Nutrition and Clinical Nutrition Dept. Fac. of Vet. Med., Zagazig University, Zagazig, Egypt

**Dept. of Animal Wealth, Institute of Efficient Productivity, Zagazig University, Zagazig, Egypt

ABSTRACT

This work was carried out to study the effect of feeding of treated rice straw with sulphuric acid, urea, and tafla when added at the rate of 1g/kg life body weight to the ration contained 50% CFM with *ad libitum* treated rice straw with or without tafla on digestibility and nutritive values of buffalo bull calves. Eighteen buffalo bull calves, were fed on different levels of concentrate feed mixture 100% and 50% (CFM) and treated rice straw. Animals were divided into three equal groups. Group1(gp1), Group2(gp2) and Group3(gp3), average body weight 205 kg at 6 months age.

The average total DM intake (CFM+RS) as kg/100kg and g/kg0.75) was significantly increased when the calves fed the control ration (gp1) than the other ration, which contained tafla (gp3). but, the highest value of rice straw intake was recorded with group gp3.

The DM,OM,EE and NFE digestibility of gp1 and gp3 were not significantly affected by the experimental rations. The CF and CP digestibility of gp3 were significantly higher than that of gp1. The nutritive values as TDN and SE scored significant differences among different experimental rations. While, DCP value was significantly higher in gp3 than gp1.

The treatment of rice straw with sulphuric acid 2.5% and urea 5% improved its nutritive values and the addition of tafla clay to the treated rice straw improved urea utilization..The treated rice straw plus tafla can be used to replace 40-50% of the concentrate feeds of growing ruminants without any adverse effect on the performance.

The obtained results showed improvements in digestibilities, the nutritive values of the tested rations which may be attributed to the reaction between the digestive system and the dietary ingredients .

Conclusion, feeding buffalo bull calves with 50% of their nutritional requirements from concentrate feeds with *ad libitum* H2SO4-urea treated rice straw with tafla can be covered the nutritional requirements of buffalo bull calves from energy and DCP without any adverse effects on growth performance of buffalo.

INTRODUCTION

The buffalo plays an important role in the rural economy in most Asian and African countries. The buffalo is vital for the economic life of millions of farmers in Egypt. Buffalo are the main productive farm animals (3,2 million animals) , which give the national economy around 40 and 60% of the total red meat and milk produced annually in Egypt, respectively. The most buffalo red meat production come from the small calves (60-70 kg) known as Betiello meats. In Egypt, country- side due to shortage in feedstuffs, we needed to raise these animals to older age and heavier weights The animal feed resources in Egypt covered only 75,6% of the self-sufficiency as TDN *(1).* Using all crop residues annually produced could realize the self-sufficiency from feedstuffs. Rice straw is one of the crop residues in Egypt and surplus amounts are produced annually, which is 3,410,833 million tons *(2).*

Hence, it is very important to recycle the wastes and by-products from the fields ,agro industries, manures and sweepings in livestock feeding. This recycling may need some treatments. chemical treatment is one of these treating methods as it improve the palatability,

digestibility and nutritive value of these poor quality roughage for increasing its utilization in ruminants feeding to cover the wide gap in animal feed requirements.

Acids and urea treatments of roughages are likely to be used in the regions of alkaline soils such as in Egypt ***(3,4).*** Also, natural clays such as tafla are used to improve urea utilization, feed intake, nutritive values and performance of animals ***(5-7).***

From the foregoing points of view, the present study was designed to determine the feed intake, nutritive values of buffalo bull calves when fed on rations, containing biochemically treated rice straw (R.S.)

MATERIAL AND METHODS

This study was carried out using eighteen buffalo bull calves, average body weight 205 kg and 6 months age.They were divided into 3 equal groups to evaluate the effect of feeding different levels of concentrate feed mixture (CFM) with *ad libitum* sulphuric acid- urea treated rice straw with or without tafla clay(on digestibility and nutritive values of buffalo bull calves).

Before start the experiment, all animals were injected by Fasciolid (antiparasitic agent). After 45 days they were administered Al-Bend-azol by orally (15 cm/50kg B.W.) for internal parasites.

The rice straw was offered to calves three weeks for adaptation period before the beginning of the feeding trial.

1.Preparation of sulphuric acid(H2SO4) urea treated rice straw

The rice straw was spread on cement flour and sprayed with 2.5% sulphuric acid solution(w/v). Treated rice straw was mixed and covered by plastic sheet for reaction period (7 days).

After 7 days the moisture in treated rice straw was estimated, for adjustment the moisture percentage at 65%. The content of the silo was sprayed by 5% urea solution and covered by plastic sheet for 7 days.

2.Experimental feeding

The 3 groups were fed as follows

Group I (gp.1) :-fed on CFM containing untreated rice straw (control gp).

Group II (gp.2): fed on 50% requirements of CFM containing rice straw treated with H2SO4 (2.5%) and urea 5% .

Group III (GP3):fed on 50% requirements of CFM containing rice straw treated with H2SO4(2.5%) and urea 5%+ tafla (1g/kg live body weight).

Maintenance and production requirements as SE and DCP of the buffalo calves were calculated according to the allowance ***(8).*** Animals were fed individually with feed mixture and group feeding with rouphage. The fed mixture allowances were adjusted every two weeks according to the body the weight changes and were offered twice daily at 8 a.m. and 4 p.m., then rice straw offered *ad libitum* and the residues were weighted .

3.Digestibility trials using buffalo bull calves

Three digestibility trials were carried out to determine the digestibility coefficients and nutritive values of the experimental rations by fitting harness and bags to the animals. Each trial lasted 28 days, 21 days as preliminary period, followed by 7 days collection period. The amount of feed mixture, which offered for buffalo bull calves, were estimated as maintenance requirements ***(8).*** The concentrate feed mixture which used in trials was estimated by digestibility trials to determine the TDN, SE, DCP. The estimated amount of concentrate feed mixture was weighted and offered twice daily at 8 a.m. and 4p.m.,while the untreated or treated rice straw were offered *ad libitum.* Animal feces were individually collected twice a daily in plastic bags. Composite samples were made for each animal and stored for chemical analysis.

The experimental animals were weighed through 3 successive days in the morning before drinking and feeding at the beginning of each trial and biweekly there after till its end. Weights were recorded for the nearest kg as the

average of the three consecutive fasting weights on 3 successive days.

4.Proximate analysis

The chemical analysis of feedstuffs, feces were carried out *(9)*.

5.Statistical analysis

Analysis of variance was carried out after transforming the percentage number into Aresin values, using F test, *(10)*. The differences among treatments means were tested using Duncan's multiple range test *(11)*.

RESUTS AND DISCUSSION

1.1.Chemical composition

The chemical composition of CFM, rice straw and rice straw treated with sulphuric acid and urea are presented in Table (1).

The result of chemical composition indicated that crude protein(CP) content of sulphuric acid-urea treated rice straw was increased by about three times (311%) compared to untreated rice straw (RS) due to the chemical treatment.

The increase of CP content may be due to urea treatment (5%) and high content of N (46.50%). furthermore, the adding of H2SO4 before urea treatment was captured the excess of ammonia *(12)*.

The same trend was previously reported *(13,14)* In contrast, it has been reported *(12)*, that DM,OM,CF and NFE contents, decreased by treatment, which may be due to the liberation of cellulose from the ponds with lignin (delignification) this renders cellulose more soluble *(12)*. Similarly, the decrease of CF content is related to decrease of hemicellulose content of roughages, might be due to its solubilization by sulphuric acid treatment and NH3 –N liberation from urea *(15)*. These results are in harmony with previous extensive studies *(13,15-18)*.

The ash content was increased by sulphuric acid and urea treatment than untreated one. Similar findings were previously observed *(13,16)*.

Table 1. Chemical composition of ingredients and experimental rations (on DM basis).

Items	DM	Om	Cp	CF	EE	NFE	Ash
Concentrate feed mixture (CFM)	91.50	86.01	16.52	11.94	4.45	53.10	13.99
Rice straw (RS)	91.00	78.35	3.25	34.56	1.97	38.57	21.65
Tafla	91.76	7.14	-	-	-	-	92.86

Calculated chemical composition of consumed rations

Trial period 12 weeks							
SAUR*	56.85	77.51	10.01	32.90	1.75	32.24	22.85
(Gp1) 100% CFM + RS.	91.29	82.68	10.75	21.77	3.38	46.78	17.32
(Gp2) 50% CFM + SAUR.	65.53	80.25	12.29	25.57	2.83	39.56	19.75
(Gp3) 50% CFM + SAUR + Tafla.	66.47	78.25	11.96	25.02	2.75	34.52	21.75

• Rice straw treated with 2.5%sulphuric acid and 5% urea

1.2.Digestibility trials

1.2.1.Feed intake

The data relevant to feed intake are summeraized in Table 2. The results of DM intake (g/head/day,kg/100kg L.B.W and kg/kg 0.75) showed that feed intake was significantly ($p<0.05$) decreased in animals which fed 50% CFM only plus treated rice straw with tafla (gp3) or without tafla (gp2) compared with those which were fed 100% CFM plus untreated rice straw (gp1). In contrast it was observed that daily rice straw intake significantly ($p<0.05$) increased in-group gp2 and gp3 than that in group gp1.

Similar results were reported with buffalo calves *(19)*, cows *(6)*, buffalo *(20)*, cows *(14)*, and dairy cows *(21)*.

Table 2. Feed intake ad libitum, of the experimental rations in the digestibility trials using buffalo bull calves.

Items	100% CFM +RS *ad libitum* (gp_1)	50% CFM +SAUR *ad libitum* (gp_2)	50% CFM + tafla+ SAUR *ad libitum* (gp_3)
Average B.W. (kg)	288.00	285.00	284.75
Dialy DM intake (kg/h/d)			
Concentrate feed mixture	6.530±0.20[a]	3.230±0.01[b]	3.210±0.01[b]
Rice straw	5.020±0.20[b]	6.010±0.01[a]	5.920±0.13[a]
Tafla	-	-	-
Total DM intake (kg/h/d)	11.550±0.39[a]	9.240±0.11[b]	9.390±0.19[b]
Total DM intake (kg/100kg B.W.)	4.010±0.03[a]	3.240±0.01[b]	3.300±0.05[b]
Total DM intake (kg/kg $w^{0.75}$)	0.165±0.01[a]	0.133.±0.01[b]	0.135.±0.01[b]

Means in the same row with different superscriptis are differ at <0.05.

1.2.2. Digestion coefficients

The data of digestible coefficients of the experimental rations are presented in Table 3.The OM,CP,CF and EE digestibilities of gp3 were significantly ($p<0.05$) higher than those of gp1 and gp2.The DM and NFE digestibilities of gp3 were significantly ($p<0.05$) higher than those of gp2. While the differences were not significant when compared with gp1.The same observation was reported bull ***(22)***, heifer ***(23),*** cows ***(24)***, buffalos ***(20)***, and male cattle ***(25)***.

The improvement of digestibility coefficients of ration supplemented with clays may be attributed to :

Improving feed utilization by slowing feed passage time through out the digestive tract ***(26),*** increasing the reactive surface area of nutrients ***(27),*** and improving of urea utilization which the clay play as a regulator of releasing ammonia in rumen ***(28).*** Similar findings were recorded in ruminants***(3,29).***

The improvement of digestible coefficients of the tested rations supplemented with tafla may be attributed to the role and benefit of clays as follow:

Improving feed utilization by slowing feed passage time through out the digestive tract which reflected on better digestion, ***(30).***

Improvement of the digestion by increasing the reactive surface areas of nutrients to the rumen microorganism enzymes ***(27).***

Improving of urea utilization as a result of its regulator mechanism of releasing ammonia in rumen ***(18)*** and also as a results of H2SO4 treated ,which improved the crude fiber digestion and captured the excess of ammonia in treated straw ***(3,31)***.

1.2.3.Nutitive value

The data of the nutritive values are presented in Table 4. The obtained results showed that the highest values of total digestible nutrients(TDN%) and starch equivelant (SE%) were significantly ($p<0.05$) higher in group gp1 than other groups gp2 and gp3 . But, the DCP value of ration gp2 and gp3 was significantly (0.05) higher than other rations (gp1).

It has been indicated that the addition of 3% kaolin to urea ration increased the DCP value ***(32,33)***. Also, the nutritive values as DCP was significantly increased by bull calves fed on ration contained 50% CFM + sulphuric acid urea treated rice straw with tafla than by those fed on the same ration without tafla ***(14).***

Table 3. Digestibility coefficients of the experimental rations by buffalo bull calves.

Item	100% CFM + RS *ad libitum* (gp_1)	50% CFM + SAUR *ad libitum* (gp_2)	50% CFM tafla+ SAUR *ad libitum* (gp_3)
Digestion coefficient (%)			
DM	63.54 ± 0.52^a	61.66 ± 0.27^b	64.45 ± 0.22^a
OM	64.09 ± 0.38^b	63.67 ± 0.60^b	67.17 ± 0.01^a
CP	65.20 ± 0.43^b	64.76 ± 0.27^b	67.06 ± 0.13^a
CF	54.73 ± 0.18^c	63.06 ± 0.39^b	66.24 ± 0.01^a
EE	74.84 ± 0.01^b	73.31 ± 0.49^b	77.68 ± 0.68^a
NFE	67.42 ± 0.58^a	64.25 ± 0.01^b	66.90 ± 0.01^a

Means in the same row with different superscripts are differ ($P<0.05$)

Table 4. Nutritive values by buffalo bull calves fed the experimental rations in the digestibility trials.

Item	100% CFM + RS *ad libitum* (gp_1)	50% CFM + SAUR *ad libitum* (gp_2)	50% CFM tafla+ SAUR *ad libitum* (gp_3)
Nutritive values (%)			
TDN	56.15 ± 0.31^a	54.24 ± 0.22^c	55.18 ± 0.04^b
SE	42.25 ± 0.32^a	38.15 ± 0.15^c	39.45 ± 0.01^b
DCP	7.02 ± 0.01^b	7.96 ± 0.04^a	8.02 ± 0.05^a

Means in the same row with different superscripts are differ $P<0.05$

1.2.4.Feed units intake

The results of feed units intake are presented in Table 5 .It could be showed that the feed units intake as TDN and SE(kg/h/d, kg/100kg L.B.W and kg/kg0.75) by buffalo bull calves for group gp1 were significantly higher ($p<0.05$) than those of other groups (gp1 and gp3), this might be due to the higher feed intake of CFM and or the higher nutritive values of ration gp1.Also, the feed units intake as DCP(kg/h/d and kg/100kg L.B.W) of buffalo bull calves for group gp1 were significantly higher than others. While the DCP intake as (kg/kg0.75) for group gp1 was significantly higher than those of group gp2 only. these results were in harmony with those reported in lactating cow *(16)*, ruminant *(34)* and adult ram *(31)*.

Generally, the obtained results showed improvements in digestibilities and the nutritive values of the tested rations which may be attributed to the reaction between the digestive system and the dietary ingredients in terms of changes in rumen liquor parameters , digesta flow, count and activity of the microorganisms and hence microbial digestion in addition to enzyme activity and secretion .

Table 5. Feed units intake by buffalo bull calves fed the experimental rations in the digestibility trials.

Item	100% CFM + RS *ad libitum* (gp_1)	50% CFM + SAUR *ad libitum* (gp_2)	50% CFM tafla+ SAUR *ad libitum* (gp_3)
Feed units intake			
TDN (kg/h/d)	6.480±0.212^a	5.010±0.0800^b	5.180±0.1020^b
TDN (kg/100kg B.W)	2.25±0.0200^a	1.790±0.0070^b	1.82±0.0270^b
TDN (kg/kg $w^{0.75}$)	0.093±0.0020^a	0.072±0.0004^b	0.075±0.0010^b
SE (kg /h/d)	4.880±0.1560^a	3.520±0.056^b	3.700±0.0720^b
SE (kg /100 kg BW)	1.690±0.0160^a	1.240±0.0050^c	1.300±0.0180^b
SE (kg/kg $w^{0.75}$)	0.070±0.0008^a	0.51±0.0003^c	0.053±0.0007^b
DCP (kg/h/d)	0.811±0.0240^a	0.736±0.0120^b	0.753±0.013^b
DCP (kg /100 kg B.W)	0.282±0.0021^a	0.258±0.0007^b	0.264±0.0030^b
DCP (kg/kg $w^{0.73}$)	0.0116±0.00030^a	0.106±0.00005^b	0.0109±0.00009^b

Means in the same row with different superscripts are differ P<0.05

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الملخص العربى

تأثير إضافة قش الأرز (المعامل بحمض الكبريتيك, اليوريا والطفلة) فى العليقة على الهضم والقيمة الغذائية فى العجول

***محمود فتحى الجمل – ** مصطفى عبد الرحيم**

* قسم التغذية والتغذية الإكلينيكية – كلية الطب البيطرى – جامعة الزقازيق

** قسم الثروة الحيوانية – معهد الكفاية الإنتاجية – جامعة الزقازيق

أجريت هذه الدراسة وذلك بهدف دراسة تأثير أستخدام معادن الطين (الطفلة) مع قش الأرز المعامل باليوريا وحامض الكبريتيك لتغطية ٥٠% من الاحتياجات الغذائية لعجول الجاموس المجتره على:-

١-معاملات الهضم والقيمة الغذائية فى العجول الجاموس المجتره.

٢-دراسة الكفاءة التحويليه فى عجول الجاموس المجتره.

وقد شملت الدراسة ثلاثة تجارب هضم (بعد الأسبوع ١٢) على عجول الجاموس النامية وذلك بأستخدام ٦ حيوانات فى كل تجربة لدراسة تأثير إضافة الطفلة إلى علائق الجاموس على كمية الغذاء المأكول و معاملات الهضم والقيم الغذائية وكانت العلائق التجريبية المستخدمة فى تجارب الهضم كالتالى:-

المعاملة الأولى: علف مركز ١٠٠% + قش أرز غير معامل حتى الشبع (عليقة مقارنة)

المعاملة الثانية : علف مركز ٥٠% من المعاملة الأولى + قش أرز معامل بحمض الكبريتيك(٥و٢%) واليوريا (٥%) حتى الشبع

المعاملة الثالثة: علف مركز (٥٠%) من المعاملة الأولى + قش أرز معامل بحمض الكبريتيك (٥و٢%) واليوريا (٥%) حتى الشبع +طفلة (١جم/ كجم وزن حى)

وكان العلف المركز يقدم لتغطية الاحتياجات الحافظة للعجول والطفلة كانت توضع بنسبة (١جم/كجم وزن حى) ويتم تقليبها مع العلف المركز

وكانت أهم النتائج المتحصل عليها من هذه الدراسة مايلى:-

١-تحسن التركيب الكيماوى لقش الأرز المستخدم وذلك نتيجة المعاملة الكيماوية بالحامض واليوريا حيث انخفض المحتوى من الألياف الخام وارتفع محتوى البروتين الخام والرماد.

٢-زاد المأكول معنويا من قش الأرز المعامل مع إضافة الطفلة أو بدونها وذلك عن القش الغير معامل.

٣-تفوقت معنويا قيم المادة الجافة المأكولة يوميا للعجول المغذاة على عليقة المقارنة معبرا عنها كجم/رأس/يوم او جم/كجم وزن الجسم الأيضى عن مثيلاتها المسجلة بواسطة العجول المغذاة على المعاملتين الثانية والثالثة.

٤-تحسنت معظم معاملات الهضم للمكونات الغذائية معنويا بأضافة الطفلة على المعاملة الخامسة.

٥-كانت المعاملة الغذائية الأولى أعلى معنويا عن باقى المعاملات الغذائية الأخرى فى قيم كلا من المواد المهضومة الكلية ومعامل النشا بينما تفوقت المعاملتين الثانية والثالثة معنويا فى قيمة البروتين المهضوم.

وتشير نتائج هذه الدراسة الى أمكانية أستخدام قش الأرز المعامل بحض الكبريتيك واليوريا وإضافة الطفلة (١جم/كجم وزن حى) ليحل محل ٥٠% من العليقة المركزة لتغطية الاحتياجات الغذائية من الطاقة والبروتين لعجول الجاموس النامية دون أية تأثيرات سلبية. مما يعطى مؤشرا لإمكانية أحلال القش المعامل محل العلف المركز بنسبة ٥٠% فى علائق العجول وانعكس ذلك على توفير كميات هائلة من العلف المركز مما يتيح أمكانية أفضل لتنمية الثروة الحيوانية والحد من تلوث البيئة بشكل أفضل.