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EFFECT OF FEEDING BERSEEM HAY OR MAIZE SILAGE RATIONS WITH OR WITHOUT EL-MUFEED ON PERFORMANCE OF BUFFALO CALVES

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ABSTRACT

Thirty buffalo calves averaging 175 kg live body weight and aged 12 months were divided into 5 similar groups (6 animal in each) and randomly assigned to five rations during the 1st period (growing period, first 165 day of experiment) as follows:
R1: 67% concentrate feed mixture (CFM) + 33% rice straw (RS), as a control ration.
R2: 52% CFM + 25% RS + 23% berseem hay (BH).
R3: 41% CFM + 28% RS + 23% BH + 8% El-Mufeed.
R4: 33% CFM + 14% RS + 53% maize silage (MS).
R5: 22% CFM + 16% RS + 54% MS + 8% El-Mufeed.

During the 2nd period (finishing period) all animals in the different groups were fed the same ration consisted of 57% CFM + 17% RS + 20% MS + 6% El-Mufeed.

The obtained results indicated that inclusion of BH or MS with or without El-Mufeed increased digestion coefficients of all nutrients. However, the feeding values presented as TDN and DE tended to increase, while DCP decreased as results of inclusion of MS and El-Mufeed in the 4th and 5th rations. During the 1st and whole experimental periods, the highest daily TDN and DE and the lowest DCP intake detected with feeding MS with or without El-Mufeed.

In the 1st period the average daily gain in the 2nd, 3rd, 4th, and 5th groups were higher by 10.13, 13.92, 21.19 and 27.85% than the 1st group. The overall means of daily gain were higher in the 2nd, 3rd, 4th and 5th groups than the control group by 3.49, 6.98, 11.63 and 16.28% respectively.

The better feed and economic efficiency during 1st and whole experimental periods were attained by calves fed MS with or without El-Mufeed followed by those fed BH with or without El-Mufeed, while the control ration showed the lowest feed efficiency

There were significant differences in fasting body weight, hot carcass weight, boneless meat weight and boneless meat to bone ratio, color intensity and moisture capacity, ether extract and ash contents, while dressing percentage, physical characteristics and protein content were nearly similar for the different experimental groups.

Keywords: Growing fattening buffalo calves, berseem hay, maize silage, El-Mufeed, body weight gain, feed and economic efficiencies, carcass characteristics.

INTRODUCTION

The greatest managerial problem in Egypt is the provision of adequate nutrients to ruminants during the summer season. Under village conditions, farmers usually feed their animals with crop residues and only limited amount of concentrate feed mixture. However, the available feeds cover only 39 and 22% of animal requirements for energy and protein (El-Serafy, 1991).

Recently some attempts were carried out to improve productive performance and decrease the feed costs of fattening calves. Including berseem, maize silage, berseem hay and El-Mufeed as a liquid supplementation can be available feedstuffs for developing a high

performance and low-cost of animal production, using a relatively low level of purchased concentrate.

Maize silage is a good and relatively cheap feed, capable of a high output of digestible energy per feddan because of full utilizations of both the stem and the grains, instead of the grains alone (Bendary *et al.*, 2001).

Several workers (El-Sayes *et al.*, 1997; Khinizy *et al.*, 1997 and Mohamed *et al.*, 1999) reported that using maize silage for dairy cattle or fattening improved their performance and reduced cost of feeding and minimize the amount of expensive concentrates in daily ration.

The objective of the present study was to investigate the effect of feeding rations contained berseem hay or maize silage with or without El-Mufeed liquid supplementation on productive performance and carcass characteristics of growing and fattening buffalo calves.

MATERIAL AND METHODS

This work was carried out at Mehalt-Mousa experimental station, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture.

Experimental animals and rations:

Thirty buffalo calves of an initial LBW averaged 175 Kg±4.37 and age 12 month were randomly divided into five similar groups (six in each). Animals during the first 165 days of experiment (growing period) were fed the experimental rations and from 166 to 225 day (finishing period) all animals were fed on one ration as shown in Table (1).

Table (1): Formulation of the experimental rations (% on DM basis) fed to buffalo calves during the 1st and 2nd periods.

	1st period (165 day)					2nd period (60 day)
	R1	R2	R3	R4	R5	
Concentrate feed mixture*	67	52	41	33	22	57
Berseem hay	00	23	23	00	00	00
Rice straw	33	25	28	14	16	17
Maize silage	00	00	00	53	54	20
El-Mufeed*	00	00	8	00	8	6
Total	100	100	100	100	100	100

*** El-Mufeed is composed of 91% molasses, 2.5% urea, 1.5% minerals and vitamin mixture and 5% water.**

*** Concentrate feed mixture: 30% cottonseed meal, 10% linseed meal, 27% yellow corn, 15% wheat bran, 10% rice bran, 5% molasses, 2% limestone and 1% sodium chloride.**

Management procedure:

The experimental calves were weighed in the morning before drinking and feeding at the beginning of the trial and biweekly thereafter. The animals were fed individually their allowances to cover the recommended requirements according to Animal Production Research Institute Recommendation (1997) for growing buffalo calves being 0.71-0.77 kg CP and 3-4 kg TDN for (200-300 kg body weight) and adjusted every two weeks according to body weight changes. Concentrate feed mixture (CFM) was offered two times daily at 8 a.m. and 4 p.m., berseem hay (BH) or maize

silage (MS) once daily at 11 a.m. and rice straw (RS) with or without El-mufeed supplementation was given two times at 9 a.m. and 5 p.m. Calves were allowed to drink three times a day at 7 a.m. and 1& 7 p.m. and were kept under the routine veterinary supervision through the whole feeding trial.

Digestibility trials:

Five digestibility trials were conducted simultaneously using the same animals of the feeding trial (3 animals for each) fed the quantities of feedstuffs as shown in Table (4) during the growing period to determine nutrients digestibility coefficients and nutritive values of the experimental rations using acid insoluble ash (AIA) as a natural marker (Van Keulen and Young, 1977). Feces samples were taken from the rectum of each calf twice daily with 12 hours interval during the collection period. Samples of tested feedstuffs were taken at the beginning, middle and end of collection period. The samples of feedstuffs and feces were composted and representative samples were analyzed according to AOAC (1990).

Feed and economic efficiencies:-

Feed efficiency was calculated as the amounts of DM, TDN, DE and DCP (kg) required per kg live body weight gain. Economic efficiency expressed as the daily feed cost, price of daily weight gain, feed cost per kg gain and the ratio between daily feed cost and price of daily weight gain.

Slaughter traits:

At the end of feeding trials two calves were chosen randomly from each group and were slaughtered. Samples of eye muscles (*Longissimus dorsi*) at 9,10 and 11 ribs were used for determining chemical analysis according to AOAC (1990). The physical characteristics (eye muscle area was measured with planimeter (cm^2), tenderness and water holding capacity were measured according to (Grau and Hamm, 1957), color intensity by Husaini *et al.* (1950) and (pH) were also determined by Aitken *et al.* (1962).

Statistical analysis:-

The data were subjected to statistical analysis using general linear models procedure adapted by SPSS for windows (1999) with one-way ANOVA. Duncan test within program SPSS was done to determine the degree of significance between the means.

RESULTS AND DISCUSSION

Chemical composition of tested feedstuffs and rations:

Chemical analysis of feedstuffs and calculated composition of different rations (Table 2) indicated that the 1st, 2nd and 3rd rations containing on DM basis 67, 52 and 41% CFM and 33, 25 and 28% RS, characterized by high CP, CF and ash contents in addition of low content of OM and NFE compared with other tested rations. On the other hand, inclusion of MS in the 4th and 5th rations reduced their contents of CP, CF and ash %, while NFE increased. These results agreed with those obtained by Gaafar (2001) who found that ration contained high level of concentrate and berseem hay showed higher content of CP, CF and ash, while ration content maize silage and low level of concentrate had higher content of OM and NFE and lower CP and CF contents.

Table (2): Chemical analysis of feed ingredients and calculated composition of the experimental rations in the 1st and 2nd periods.

	DM %	Composition of DM %					
		OM	CP	CF	EE	NFE	Ash
Feedstuffs							
Concentrate mixture	92.61	91.43	16.50	13.02	3.17	58.74	8.57
Berseem Hay	91.21	88.95	12.67	25.18	2.84	48.26	11.05
Maize silage	30.01	94.50	8.20	19.88	2.93	63.49	5.50
Rice straw	90.31	83.59	2.56	31.79	1.09	48.15	16.41
El-Mufeed	60.87	85.31	8.40	-	-	76.91	14.69
Calculated composition of experimental rations %							
1st period							
Ration 1 (R1)	91.84	88.86	11.93	19.17	2.49	55.27	11.14
Ration 2 (R2)	91.70	88.88	12.10	20.54	2.57	53.67	11.12
Ration 3 (R3)	88.13	88.16	11.03	20.16	2.26	54.71	11.84
Ration 4 (R4)	43.68	92.02	10.19	19.21	2.76	59.86	7.98
Ration 5 (R5)	42.65	91.37	9.14	18.84	2.47	60.92	8.63
2nd period	63.85	90.34	11.99	16.85	2.58	58.92	9.66

Nutrients digestibility:

Results in Table (3) indicated that the digestion coefficients of DM, OM, CF, EE and NFE increased with inclusion of BH with El-Mufeed (R_3) and MS with or without El-Mufeed (R_5 and R_4). These results are in agreement with those obtained by Mohamed *et al.* (1999) and Mohsen *et al.* (2001). The reduced particle size of concentrate in contrast to maize silage may be resulted in increasing DM intake, faster rate of passage reduced ruminal digestion time and subsequently lowered the digestibilities of DM, OM, CF and NFE.

Table (3): Nutrients digestibility coefficient and nutritive values of experimental rations by buffalo calves.

Items	1st period					
	R1	R2	R3	R4	R5	±MSE
Digestibility coefficient %						
DM	60.45^{d}	62.51^{c}	66.47^{ab}	64.69^{b}	68.04^{a}	0.77
OM	64.15^{c}	65.07^{bc}	67.67^{ab}	68.06^{a}	70.41^{a}	0.68
CP	60.25^{ab}	61.03^{ab}	62.30^{a}	58.18^{b}	60.63^{ab}	0.52
CF	52.18^{c}	52.12^{c}	56.15^{b}	56.70^{b}	59.74^{a}	1.17
EE	63.34^{b}	60.22^{b}	69.44^{a}	63.33^{b}	72.56^{a}	1.30
NFE	69.32^{b}	71.27^{ab}	72.85^{ab}	73.59^{ab}	75.01^{a}	0.79
Nutritive values % (on DM basis)						
TDN	59.05^{d}	59.82^{cd}	61.58^{c}	64.81^{b}	66.52^{a}	0.84
DCP	7.19^{b}	7.38^{a}	6.87^{b}	5.93^{c}	5.54^{c}	0.18
DE Mcal/Kg	2.60^{c}	2.64^{bc}	2.71^{b}	2.86^{a}	2.93^{a}	3.71

a, b, c, d: Means in the same row with different superscripts differ significantly (P<0.05).
DE Mcal / kg DM = TDN % X 0.04409 (NRC, 1988)

The lower (P< 0.05) nutrient digestibility values produced by CFM+RS fed group (traditional summer fattening ration) R_1 than BH or MS with or without El-Mufeed fed groups. The CP digestibility of experimental rations were nearly similar, while there was significant (P<0.05) differences between R_3 and R_4 (Table 3) in contrast, the corresponding values of DM, OM and NFE digestibility were not significant among R_3 and R_4 respectively. The increased CP digestibility in the first three experimental rations containing the highest

CFM proportion was probably due to absorption of comparatively higher amounts of ammonia through the rumen wall (Tiwari *et al.*, 1990).

Nutritive values:

Nutritive values expressed as TDN, DE and DCP of the experimental rations during the 1st period are presented in Table (3). Results revealed that, inclusion of BH with El-Mufeed and MS with or without El-Mufeed in the 3rd, 4th and 5th rations tended to increase TDN to 61.58, 64.81 and 66.52% and DE to 2.71, 2.86 and 2.93 Mcal/kg DM, respectively compared with the 1st and 2nd rations. This may be due to the mutual associative effect of BH, El-Mufeed and MS with concentrate. Meantime rations contained maize silage with or without El-Mufeed (R_5 and R_4) had the lowest DCP (5.93 and 5.54%) while R_1, R_2 and R_3 contained higher percentage of CFM had the highest DCP content being 7.19, 7.38 and 6.87%. This mainly due to the lower CP content and lower cp digestibility of R_4 and R_5 which contained MS as shown in Table (2). These results are in accordance with those obtained by Mohsen *et al.* (2001) who found that nutritive values of rations contained maize silage was higher than that of ration contained berseem hay. Digestibility coefficients and nutritive values of experimental ration fed during the 2nd period agreed with obtained by Mohamed *et al.* (1999) with Friesian calves fed similar rations.

Feed intake:

Data presented in Table (4) indicated that DM intake was nearly similar for the different groups. The highest daily TDN and DE consumption during the 1st period were found for 4th and 5th rations being 5.45 and 5.53 kg/calf and 24.05 and 24.39 Mcal/Kg, respectively. The corresponding lowest feed consumption were found with the 1st, 2nd and 3rd rations being 4.88, 4.80 and 4.88 kg TDN and 21.50, 21.17 and 21.53 Mcal, respectively. The opposite trend was observed with DCP intake. It is interesting to recorded that daily feed units intake during the experimental period for all animals group were covered the recommended requirements of growing buffalo calves being 0.71-0.77 kg CP and 3-4 kg TDN (200-300 kg body weight) according to Animal Production Research Institute Recommendation (1997).

The DM, TDN, DCP and DE intakes by buffalo calves during the whole experimental period ranged from 8.63 to 8.98 kg, 5.32 to 5.85kg, 0.54 to 0.64 kg and 23.44% to 25.81 Mcal, respectively, with significant differences ($P<0.05$).

From the previous results, it was noticed that during the whole experimental period the intake of TDN and DE were significantly higher ($P<0.05$), while the intake of DCP was significantly lower ($P<0.05$) for maize silage rations compared with berseem hay rations. These may be the highest TDN and DE and lowest DCP contents of MS containing rations (R_4 and R_5) as shown in Table (4). These results are in agreement with those obtained by Ahmed *et al.* (2003) who found that the intake of TDN was higher, while DCP was lower for Friesian cows fed maize silage ration compared with those fed berseem ration.

Table (4): Average daily feed intake (kg/head/day) by buffalo calves fed experimental rations during the experimental period.

Items	Experimental rations					
	R1	R2	R3	R4	R5	±MSE
1st period						
Duration (day)	165	165	165	165	165	
Concentrate feed mixture*	6.00	4.50	3.50	3.00	2.00	
Berseem hay*	-	2.00	2.00	-	-	
Rice straw*	3.00	2.25	2.50	1.25	1.50	
Maize silage*	-	-	-	15.00	15.00	
El-Mufeed*	-	-	1.00	-	1.00	
DM (kg)	8.27	8.02	7.93	8.41	8.32	0.16
TDN (kg)	4.88^{b}	4.80^{b}	4.88^{a}	5.45^{ab}	5.53^{ab}	0.13
DCP (kg)	0.59^{a}	0.59^{a}	0.55^{ab}	0.50^{ab}	0.46^{b}	0.01
DE Mcal	21.50^{b}	21.17^{b}	21.53^{b}	24.05^{a}	24.39^{a}	0.57
The whole exp. period						
DM (kg)	8.87	8.69	8.63	8.98	8.91	0.17
TDN (kg)	5.38^{b}	5.32^{b}	5.38^{b}	5.79^{a}	5.85^{a}	0.12
DCP (kg)	0.64^{a}	0.63^{a}	0.60^{a}	0.57^{ab}	0.54^{b}	0.01
DE Mcal	23.70^{b}	23.44^{b}	23.72^{b}	25.54^{a}	25.81^{a}	0.52

* as fed.

a, b, c: Means in the same row with different superscripts differ significantly (P<0.05).

Body weight gain:

The average daily gain (Table 5) for experimental calves in the 1st period appeared to be more affected by TDN and DE intakes (Table 4). It was noticeable that R_5, R_4 and R_3 with the highest TDN intake (5.53, 5.45 and 4.88 kg/day, respectively) and DE intake (24.39, 24.05 and 21.53 Mcal/day, respectively) produced the highest daily gain (1.01, 0.96 and 0.90 kg) while calves fed R_1 and R_2 consumed the lowest daily TDN and DE intakes recorded the lower daily gain being 0.79 and 0.87 kg. Statistical analysis showed highly significant differences ($P < 0.05$) in daily gain among treatments.

However, average daily gain in the 2nd, 3rd, 4th and 5th groups were higher by 10.13, 13 .92, 21.19 and 27.85% than the 1st group fed control ration. It was clear that feeding BH or MS with or without El-Mufeed increased daily gain, which may be attributed to the comparatively higher digestible nutrients intake (TDN and DE). Mohamed *et al.* (1999) and Mohsen *et al.* (2001) indicated that Friesian calves fed rations containing MS achieved higher daily gain than other calves fed rations contained CFM and RS with or without berseem hay.

There was appreciable improvement in gain and feed efficiency as Kg DM, TDN, DCP and Mcal/kg gain in BH with or without El-Mufeed (R3 and R2), the maximum growth was attained by animals in groups fed R5 and R4 where MS with and without El-Mufeed incorporated in the diet. (Fouad *et al.*, 1997; Khinizy *et al.* 1997 and Mohamed et al., 1999), found that the consumption of MS or El-Mufeed by the growing calves accompanied with improvements in feed conversion efficiency. The inclusion of BH, MS and El-Mufeed in the tested rations serves three purposes; it reduce the fiber content (Table 2), improve nutritive values (Table 3), and also it provides more readily available energy which improves protein utilization. Similar results were also observed by several workers (Fouad *et al.*, 1997 and Khinizy *et al.* 1997).

Improvements in gain and feed efficiency in calves fed BH and MS with or without El-Mufeed could be attributed to a closer balance of protein / energy ratio required for tissue growth with that of the nutrients supplied (Sudana and Leng, 1986).

Table (5): Live body weight gain of buffalo calves fed experimental rations.

Items	Experimental rations					
	R1	R2	R3	R4	R5	±MSE
1st period (1-165 day)						
Duration (day)	165	165	165	165	165	
Initial body weight (kg)	174.75	176.75	176.50	175.00	174.75	4.37
Final body weight (kg)	304.50^{c}	321.00^{b}	324.50^{b}	333.25^{ab}	340.75^{a}	7.86
Total body weight gain (kg)	129.75^{c}	144.25^{b}	148.00^{ab}	158.25^{ab}	166.00^{a}	6.15
Daily body weight gain (kg)	0.79^{c}	0.87^{b}	0.90^{ab}	0.96^{ab}	1.01^{a}	0.04
The whole exp. period (1-225 day)						
Duration (day)	225	225	225	225	225	
Initial body weight (kg)	174.75	176.75	176.50	175.00	174.75	4.37
Final body weight (kg)	367.75^{c}	376.50^{bc}	383.00^{bc}	391.25^{ab}	400.75^{a}	6.60
Total body weight gain (kg)	193.00^{c}	199.75^{bc}	206.50^{bc}	216.25^{ab}	226.00^{a}	5.30
Daily body weight gain (kg)	0.86^{b}	0.89^{ab}	0.92^{ab}	0.96^{ab}	1.00^{a}	0.02

a, b, c: Means in the same row with different superscripts differ significantly (P<0.05).

The over all means of total body weight gains for the 2nd, 3rd, 4th and 5th groups were highly significant (P<0.05) differences compared with control group (Table 5). The average daily gain in this study seemed to agree with the general pattern observed by Khinizy *et al.* (1997) and El-Sayes *et al.* (1997) when fed buffalo calves maize silage with variable ratio of concentrate mixture and also Fouad *et al.* (1997) when feeding buffalo calves El-Mufeed liquid or dry in partial replacement of concentrate feed mixture. The increased biological active substances (minerals and vitamins) could be associated with the recovery of the losses nitrogen (Ames *et al*, 1980, Habeeb *et al*, 1995 and Fouad *et al*, 1997), or availability of fermentable N and available carbohydrates supplied by El-Mufeed and MS. Consequently, the growth of cellulolytic rumen microbes could have been improved, which might have result in better utilization of hay (Fouad *et al*, 1997) or MS (Khinizy *et al*, 1997).

Feed efficiency:

Feed efficiency as the amount of DM, TDN, DCP and DE required to produce one kg live body weight gain during the 1st period are presented in Table (6). Results indicated that, calves fed control rations (R_1) were the lowest feed efficiency (10.46 kg DM, 6.18 kg TDN, 0.75kg DCP and 27.24 DE Mcal/kg gain) compared with calves fed other rations. The differences among groups were highly significant (P<0.05). Better feed efficiency was attained by calves fed MS with or without El-Mufeed (R_5 and R_4) followed by calves fed BH with or without El-Mufeed (R3 and R_2), which may be due to the higher TDN and DE concentration in these rations compared to control ration. This is an indication of higher metabolizable energy in the DM of the 2nd, 3rd, 4th and 5th rations would be more efficiency utilized for growth (Blaxter, 1967).

The average feed efficiency over entire the experimental period (Table 6) indicated that kg DM, TDN, DCP and DE required to produce one kg daily

gain significantly (P<0.05) differ among all groups. These results may be due to the variations of the average daily gain and average feed intake during the 1st period as shown in Tables 4 and 5. Similar results obtained by El-Sayes *et al.* (1997) and Khinizy *et al.* (1997) who found that buffalo calves fed rations contained maize silage showed better feed efficiency.

Table (6): Feed efficiency of buffalo calves fed experimental rations.

Items	Experimental rations					
	R1	R2	R3	R4	R5	±MSE
1st period:						
Kg DM/kg gain	10.46[a]	9.22[ab]	8.81[b]	8.76[b]	8.23[b]	0.59
Kg TDN/kg gain	6.18	5.52	5.43	5.68	5.48	0.33
Kg DCP/ kg gain	0.75[a]	0.68[ab]	0.61[b]	0.52[bc]	0.46[c]	0.05
DE Mcal/kg gain	27.24[a]	24.33[ab]	23.93[b]	25.03[ab]	24.15[b]	1.45
The whole exp. period						
Kg DM/kg gain	10.32[a]	9.77[ab]	9.38[b]	9.35[b]	8.91[c]	0.41
Kg TDN/kg gain	6.25[a]	5.97[ab]	5.85[b]	6.03[ab]	5.85[b]	0.23
Kg DCP/ kg gain	0.74[a]	0.71[a]	0.65[ab]	0.59[bc]	0.54[c]	0.03
DE Mcal/kg gain	27.56[a]	26.34[ab]	25.78[b]	26.61[ab]	25.81[b]	1.00

a, b: Means in the same row with different superscripts differ significantly (P<0.05).

Economic efficiency:

Data of the economic efficiency during the 1st period (Table 7) indicated that, the lowest feed cost for producing one kg gain was achieved by calves fed MS with or without El-Mufeed (R_5 and R_4) being 4.44 and 5.26 LE/kg gain followed by calves fed R_3 and R_2 contained BH with or without El-Mufeed (6.01 and 6.87 LE/kg gain), while calves fed control ration recorded the highest feed cost / kg gain (7.90 LE/kg gain). Using MS and BH with or without El-Mufeed decreased the cost of feeding for producing one kg gain by 13.04, 23.92, 33.42 and 43.80 % for R_2, R_3, R_4 and R_5, respectively compared with control group.

The same trend was observed with the relative economical efficiency in the 1st period. Results showed that the best relative economical efficiency was obtained by calves fed MS with or without El-Mufeed (R_5 and R_4) being 2.93 and 2.47 followed by those fed BH with or without El-Mufeed (R_3 and R_2) being 2.16, 1.89, while those fed control ration recorded the lowest relative economical efficiency (1.65) with significant differences (P<0.05). These results mainly due to the higher daily gain (Table 5) and the lower feed cost of calves (Table 7) which increased the daily income (price of the daily live body weight gain) recorded with calves fed MS and BH with or without El-Mufeed compared with control group as shown in Table (7).

Data of economical efficiency during overall experimental period (Table 7) indicated that the highest feed cost for producing kg gain and the lowest relative economical efficiency were achieved by calves fed control ration (7.82 LE/kg gain and 1.67) followed by calves fed R_3 and R_2 contained BH with or without El-Mufeed while those fed MS with or without El-Mufeed (R_5 and R_4) recorded the lowest feed cost and the best relative economical efficiency. This may be due to the lower price of MS, BH and El-Mufeed compared with CFM. It is well known that forages conserved such as hay or silage are normally cheaper per unit of energy than concentrate (Hamilton,

1957). Using maize silage for fattening buffalo calves improved their performance and reduced cost of feeding and minimizes the amount of expensive concentrates in daily ration (El-Sayes *et al.*, 1997; Khinizy *et al.*, 1997 and Mohamed *et al.*, 1999).

Table (7): Economical evaluation of buffalo calves fed experimental rations.

Items	Experimental rations					
	R1	R2	R3	R4	R5	±MSE
1st period						
Duration (day)	165	165	165	165	165	
Daily feed cost (LE)	6.24^{a}	5.98^{ab}	5.41^{b}	5.05^{bc}	4.48^{c}	0.14
Price of daily gain (LE)	10.27^{c}	11.31^{bc}	11.70^{b}	12.48^{ab}	13.13^{a}	0.48
Feed cost (LE)/Kg gain	7.90^{a}	6.87^{ab}	6.01^{b}	5.26^{bc}	4.44^{c}	0.29
Economic efficiency	1.65^{c}	1.89^{bc}	2.16^{b}	2.47^{ab}	2.93^{a}	0.11
The whole period						
Duration (day)	225	225	225	225	225	
Daily feed cost (LE)	6.70^{a}	6.51^{a}	6.10^{b}	5.83^{bc}	5.41^{c}	0.13
Price of daily gain (LE)	11.18^{c}	11.57^{bc}	11.96^{b}	12.48^{ab}	13.00^{a}	0.31
Feed cost (LE)/Kg gain	7.82^{a}	7.33^{a}	6.58^{b}	6.08^{c}	5.38^{c}	0.20
Economic efficiency	1.67^{c}	1.78^{bc}	1.96^{b}	2.14^{ab}	2.40^{a}	0.06

a, b, c: Means in the same row with different superscripts differ significantly (P<0.05).

The prices in Egyptian pounds (LE/ton) were 1000 for CFM, 650 for BH, 80 for RS, 130 for MS, 410 for El-Mufeed and 13 for kg live weight gain during year 2004.

Carcass characteristics:

Data in Table (8) indicated that there were significant differences in fasting body weight, hot carcass weight, boneless meat weight and boneless meat to bone ratio among calves fed the different experimental rations. However, the differences in dressing percentage and bone weight among the different experimental groups were not significant (P>0.05). These results are in accordance with those obtained by Mahmoud *et al.* (2003) who found that dressing percentage were nearly similar in growing Friesian calves fed control and maize silage rations.

Physical characteristics:

Results in Table (8) revealed that tenderness and water holding capacity of eye muscle meat showed no significant differences between treatments. The slight increase of meat tenderness in some treatments might be due to the variations in moisture content of meat, differences of fiber diameter, amount of connective tissues and protein solubility (Etman, 1985). The decrease of water holding capacity could be due to the decrease of pH value towards the isoelectric point of muscle protein as well as the association of actin and myosin leading to decrease of protein solubility and decrease of free chemical groups that are able to bind water (Solovier, 1966).

Color intensity of eye muscle meat was between 0.649 and 0.789 O.D. with significant differences between treatments. Yamazaki (1981) found that marbling fat content of carcass was the most important factor affecting color intensity, while Binder *et al.* (1986) reported that, apart of darker lean color due to higher myoglobin concentration in the eye muscle of steers. The values of pH of eye muscle meat of buffalo calves fed different experimental

rations were not significantly (P>0.05) affected by different treatments, which ranged between 6.00 and 6.50. It is known that pH value of meat reflects the struggle of animals and the amount of glycogen content of muscle at slaughter (EL-Sharkawy, 2006). Eye muscle area of buffalo calves fed the experimental rations ranged from 55.68 to 63.83 cm^2 without significant differences between treatments. The differences among the groups of eye muscle area might be attributed to the variation in carcass weight, edible meat percentage and the marbling of carcass (Etman, 1985).

Table (8): Carcass characteristics, physical characteristics and chemical composition of eye muscle meat for buffalo calves fed experimental rations.

Items	Experimental rations					
	R1	R2	R3	R4	R5	±MSE
Carcass characteristics						
Fasting body weight (kg)	367.75^{c}	376.50^{bc}	383.00^{bc}	391.25^{ab}	400.75^{a}	6.60
Hot carcass weight (kg)	193.91^{b}	201.75^{ab}	208.20^{ab}	214.26^{ab}	221.29^{a}	3.77
Dressing percentage %	52.73	53.59	54.36	54.76	55.22	0.24
Boneless weight (Kg)	138.05^{c}	145.96^{bc}	152.80^{abc}	158.41^{ab}	165.01^{a}	3.05
Bone weight (Kg)	55.86	55.79	55.40	55.85	56.28	1.01
Boneless meat: bone ratio	2.47^{c}	2.62^{bc}	2.76^{ab}	2.84^{a}	2.93^{a}	0.04
Physical characteristics						
Tenderness cm^2)	2.34	2.00	2.11	2.37	2.46	0.15
Water holding capacity (cm^2)	4.15	4.66	4.30	4.11	3.90	0.12
Color intensity	0.734^{ab}	0.786^{ab}	0.789^{ab}	0.673^{b}	0.649^{a}	0.02
pH value	6.50	6.15	6.30	6.50	6.00	0.08
Eye muscle area (cm^2)	56.09	55.68	63.83	59.36	63.49	1.98
Chemical composition(%)						
Moisture	75.65^{b}	75.49^{b}	75.10^{ab}	73.80^{a}	73.67^{a}	0.31
Crude protein*	79.10	78.86	79.31	77.04	79.74	1.20
Ether extract*	10.00^{b}	9.78^{b}	10.51^{b}	12.60^{a}	12.89^{a}	0.46
Ash*	5.16^{ab}	5.45^{a}	5.21^{ab}	5.05^{ab}	5.66^{b}	0.10

***On dry matter basis**

a, b, c: Means in the same row with different superscripts differ significantly (P<0.05).

Chemical composition:

Chemical composition of eye muscle meat Table (8) indicated that moisture contents of fresh meat of buffalo calves fed different rations ranged from 73.67 to 75.6% with significant differences between treatments. It was observed that there was relation between moisture contents and water holding capacity. The moisture content increased significantly in meat of calves fed on R1 while moisture content in meat of calves fed R5 was lower than that the other treatments. The contents of crude protein (on dry matter basis) of eye muscle meat were nearly similar in all treatments without significant differences.

The contents of ether extract of eye muscle meat (on dry matter basis) showed significant differences among groups. Data revealed good agreement with the results of tenderness. Wood *et al.* (1999) indicated that a high intramuscular fat (ether extract) decreases the muscle resistance to shearing because of dilution of fibrous protein by soft fat. Ash contents of eye muscle meat showed significant differences among the treatments, which ranged between 5.05 in R4 and 5.66 in R5. These results indicated that buffalo calves fed ration R5 recorded the best values of carcass characteristics,

followed by calves fed ration contained R4.

From these results it could be concluded that introducing maize silage or berseem hay with or without El-Mufeed rations for growing buffalo calves improved digestibility and nutritive values, body weight gain, feed efficiency and reduced daily feed cost due to reducing the amount of concentrate feed mixture.

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تأثير التغذية على علائق دريس البرسيم أو سيلاج الذرة مع أو بدون المفيد على أداء العجول الجاموسى

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استخدم ٣٠ عجل جاموس متوسط وزنها ١٧٥ كجم وعمر ١٢ شهر قسمت إلى ٥ مجموعات متماثلة (٦ حيوانات فى كل مجموعة) وزعت عشوائيا وغذيت على ٥ علائق تجريبية خلال الفترة الأولى (فترة النمو، ١٦٥ يوم الأولى من التجربة) كما يلى:-

ع١: ٦٧% مخلوط علف مركز + ٣٣% قش ارز (المقارنة).
ع٢: ٥٢% مخلوط علف مركز + ٢٥% قش ارز + ٢٣% دريس برسيم.
ع٣: ٤١% % مخلوط علف مركز + ٢٨% قش ارز + ٢٣% دريس برسيم + ٨% سائل المفيد.
ع٤: ٣٣% مخلوط علف مركز + ١٤% قش ارز + ٥٣% سيلاج ذرة.
ع٥: ٢٢% % مخلوط علف مركز + ١٦% قش ارز + ٥٤% سيلاج ذرة + ٨% سائل المفيد.

وأثناء الفترة الثانية (فترة التسوية، من اليوم ١٦٦ حتى يوم ٢٢٥) غذيت جميع الحيوانات فى المجموعات المختلفة على عليقة واحدة مكونة من ٥٧% مخلوط علف مركز + ١٧% قش ارز + ٢٠% سيلاج ذرة + ٦% سائل المفيد.

توضح النتائج المتحصل عليها أن ادخال دريس البرسيم أو سيلاج الذرة مع او بدون سائل المفيد أدى الى زيادة معنوية معاملات هضم جميع العناصر الغذائية وبالتالى قيم كل من المركبات الغذائية المهضومة والطاقة المهضومة، بينما انخفض محتوى البروتين المهضوم معنويا فى العلائق المحتوية على سيلاج الذرة (ع٤،&ع٥) بالمقارنة ببالى العلائق.

أظهرت العجول المغذاة على العلائق المحتوية على سيلاج الذرة مع أو بدون سائل المفيد معنويا أعلى مأكول من المركبات الغذاية المهضومة والطاقة المهضومة وأقل مأكول من البروتين المهضوم خلال الفترة الأولى وفترة التجربة الكلية.

ارتفع متوسط معدل النمو اليومى للمجموعات الثانية والثالثة والرابعة والخامسة بنسبة ١٠,١٣، ١٣,٩٢، ٢١,٥٢، ٢٧,٨٥% بالمقارنة بمجموعة الكنترول خلال الفترة الأولى. ارتفاع المتوسط العام لمعدل النمو للمجموعات الثانية، الثالثة، الرابعة، الخامسة عن مجموعة الكنترول بنسبة ٣,٤٩، ٦,٩٨، ١١,٦٣، ١٦,٢٨% على التوالى.

حققت العجول المغذاة على العلائق المحتوية على سيلاج الذرة مع أو بدون سائل المفيد معنويا أفضل كفاءة غذائية خلال الفترة الأولى والفترة الكلية للتجربة، تلاها العجول المغذاة على دريس البرسيم مع او بدون المفيد، بينما أظهرت مجموعة الكنترول أقل كفاءة غذائية.

حققت العجول المغذاة على العلائق المحتوية على سيلاج الذرة مع أو بدون سائل المفيد معنويا أقل تكلفة تغذية لكل كجم نمو وبالتالى أفضل كفاءة اقتصادية خلال الفترة الأولى وفترة التجربة الكلية تلاها العجول المغذاة على دريس البرسيم مع او بدون المفيد، بينما أظهرت العجول المغذاة على عليقة الكنترول أعلى تكلفة تغذية لكل كجم نمو وبالتالى أقل كفاءة اقتصادية.

وجدت اختلافات معنوية بين المجموعات المختلفة فى الوزن الصائم ووزن الذبيحة ووزن اللحم ونسبة اللحم الى العظم وكثافة اللون ومحتوى كل من الرطوبة والمستخلص الخالى من الأزوت والرماد. بينا كانت نسبة التصافى والصفات الطبيعية ومحتوى البروتين متماثلة تقريبا للمجموعات المختلفة.

نستخلص من هذه الدراسة أن ادخال سيلاج الذرة أو دريس البرسيم مع أو بدون سائل المفيد فى علائق العجول الجاموس النامية أدى إلى تحسن الهضم والقيم الغذائية ومعدل النمو والكفاءة الغذائية بالإضافة إلى تقليل تكلفة التغذية اليومية نتيجة تقليل كمية العلف المركز.