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NUTRITIONAL VALUE OF ROTTEN MARKET PRODUCTS AND UREA MOLASSES AS PARTIAL REPLACEMENT TO CONCENTRATES FOR SHEEP

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SUMMARY

Different concentrate: roughage: Mufeed Liquid Supplement (MLS) ratios (40:60:0, 20:60:20, 60:40:0, 40:40:20, 70:30:0 and 50:30:20) were compared to reach the optimum ratio to be used in comparison with rotten market products [dehydrated grapes(DG), dates(DD) and figs(DF)]. Control diet was 40% roughage:60% concentrates, of which 20% of starch value was replaced by DG, DD, DF, urea molasses block (UMB) and MLS. Total dry matter intake decreased as percent of concentrate increased. Digestibilities of dry matter and organic matter were low for control (59.28, 64.60%, in order) and 60:20:20 (59.18, 64.43%, in order) ratio and increased as concentrate portion increased. Rotten market products caused a decrease in total dry matter intakes (1081.9, 1080.9 and 1111.9 for DG, DD, and DF, respectively, compared to 1134.3 g/h/d for control. The UMB showed the lowest value of total digestible nutrients (57.89%) and starch value (44.36%) and had the highest DCP value (8.15%). Rumen total VFA concentration values were similar for all treatments. Ruminal ammonia concentration was higher for UMB. Blood urea, total protein, albumin, globulin and Ca and P. did not differ among different roughage:concentrate ratios. The UMB showed higher ($P<0.05$) blood urea (40.57 mg%) compared to MLS and rotten market products. It is concluded that rotten market produces may be used in ruminant rations. They compare well to concentrates and

cost effective.

Keywords: Rotten market products, urea molasses block, mufeed liquid supplement, concentrates, roughage, feed value, rumen, serum, sheep.

INTRODUCTION

Sizeable amounts of rotten fruits and vegetables (fresh, dried or processed) are common in large markets in Egypt. These wastes are discarded. According to the Agriculture Economic and Statistics Institute (1989), production amounts to almost 452,000 tons of dried grapes, 485,000 tons of dates and 24,000 tons of figs each year. Of these amounts, almost 15, 11, and 8%, respectively, rot because of bad storage practices and other reasons. However, these wastes are high in energy content and can be used in ruminant rations.

Mufeed liquid and urea molasses supplements have proven to be efficient supplements or replacements for concentrates in ruminant rations (Pearce, 1973; Ernest et al., 1975; Losada et al., 1979; Church and Santos, 1981; Leng, 1984; Dixon, 1984; Sudana, 1985; Kunju, 1986; Sansoucy and Aarts, 1986; Sudana and Leng, 1986; Soentanto et al., 1988; Gupta et al., 1988; El-Khidir et al., 1989; Schiere et al., 1989; Etman et al., 1989; Fahmy, 1990; Abdou, 1990; El-Faramawy, 1991; Fouad, 1991; Hafez, 1992 and Attia-Ismail, 1994).

Corn stalks is available in large amounts (Hathout, 1984) but is used as a fuel or discarded. It is, at least, equal if not superior to rice straw in feeding value (Fahmy et al., 1994). Studies by Morrison (1956), Obradovis and Stosic (1961), Shehata (1965), Jackson (1978), Mohammed (1981) and Fouad (1991) have evaluated its potential as a feed. The present study was conducted to evaluate the waste materials of markets as an energy replacement in diets for ruminants as well as comparing different concentrate:roughage ratios as fed to mature rams.

MATERIALS AND METHODS

Mechanical treatment of corn stalks

A local thresher was used to chop corn stalks to 3-cm in length.

Diets

This study was divided into two stages. In the first stage, three different concentrate:roughage ratios were compared, and Mufeed Liquid Supplement (MLS) was used as a replacement for 20% of the maintenance requirements for starch value (diets 1-6). The MLS was sprayed over roughage. The second stage involved the use of one of the followings: a control diet, MLS, Urea Molasses Block (UMB), dehydrated grapes(DG), dehydrated dates(DD) or dehydrated figs (DF) as a replacement for 20% of the maintenance requirements for starch value. Metabolism trials were conducted to evaluate the previously mentioned diets (Tables 1 and 2). Chemical analysis of the ration ingredients is shown in Table 3.

Table 1. diet ingredients offered to sheep at the first stage of the experiment*

Diet	Chopped corn stalks,%	Concentrate[a],%	MLS[b],%
1	60	40	----
2	60	20	20
3	40	60	----
4	40	40	20
5	30	70	----
6	30	50	20

a= Composed of :30%undecorticated cotton seed cake, 38% wheat bran, 23% yellow corn, 3%molasses, 2%limestone and 1%common salt.

b= Composed of: 93.86%cane venasses, 1.25%urea, 1.14%mineral premix, and 3.75%water.

*= Amounts are percentages of Starch Value maintenance requirements.

Animals and management

Nine crossbred Ossimi (a local Egyptian breed) X Finnish mature rams were used repeatedly in metabolism trials. Animals were allowed to rest and adapt to new rations between experiments for two weeks. All animals were drenched to control internal parasites (Bird et al., 1978). Animals were kept in metabolic cages fitted with stainless steel separators and divided into groups of three animals each according to weight and age. Diets were given once daily at 0900 h and water was available to animals all day.

Table 2. Diet ingredients offered to sheep at the second stage of the experiment*

Diet	Chopped corn stalks,%	Concentrate,%	MLS[a]	UMB	DG	DD	DF
Cont.	40	60	--	--	--	--	--
MLS40	40	20	--	--	--	--	--
UMB40	40	--	20	--	--	--	--
DG40	40	--	--	20	--	--	--
DD40	40	--	--	--	20	--	--
DF40	40	--	--	--	--	20	--

*= Amount are percentages of Starch Value of the maintenance requirements

a= Composed of: 43%cane molasses, 16%wheat straw, 16% rice bran, 25%sodium chloride, 2%mineral premix, 9% binding agent and 10% urea

Sampling techniques

Feed intake, feces and urine were measured daily at 0700 h. Ten percent of fresh feces was collected each day, kept in plastic bags and frozen at -4°C. Ten percent of collected urine (by volume) was sampled daily and mixed with 50 ml diluted sulfuric acid (1:1 v/v). Feces and urine daily samples were composited into one sample each and frozen for chemical analysis. Blood samples were withdrawn before feeding, allowing blood to flow into acid washed heparinized tubes. Blood samples were immediately centrifuged at 4000 rpm for 20 minutes. Plasma samples were then frozen at -20°C until analysis. Rumen liquor samples were taken by stomach tube at 0, 3 and 6 hours post feeding. Samples were filtered through two layers of cheesecloth and pH values were recorded. A few drops of a saturated solution of mercuric chloride were used to stop microbial activity. Some of the rumen liquid was used for ammonia determination; the rest of the samples was frozen for VFA determination. Both blood and rumen samples were taken on the last day of the collection period.

Table 3. Chemical compositions of ration ingredients fed to sheep

Ingredient	DM%	OM	CP	CF	EE	Ash	NFE	NDF	ADF	ADL	Hemicel.	Cellul
		DM basis,%										
Conc.	85.91	92.30	16.11	11.03	2.93	7.70	62.23	74.63	30.38	9.33	44.25	21.05
Corn stalks	85.14	83.32	4.63	33.83	1.30	16.68	43.56	82.39	48.1	15.02	34.28	43.09
MLS	89.11	83.17	10.08	1.41	1.11	16.83	70.57	1.03	0.68	0.06	0.35	0.62
UMB	88.13	66.83	40.31	4.42	1.83	33.11	20.33	35.83	11.62	3.01	24.21	8.61
DG	82.76	96.61	3.33	3.08	1.69	3.39	88.51	11.14	7.08	0.58	4.06	6.50
DD	80.19	97.81	3.62	3.00	0.69	2.19	90.51	25.21	15.65	3.82	9.56	11.83
DF	82.91	94.51	6.14	15.11	3.39	5.49	69.87	20.43	14.21	3.76	6.22	10.45

Analytical methods

Samples of feeds, feces, and urine were analyzed according to A.O.A.C. (1980). Analysis of fiber fractions was performed according to the procedures of Georing and Van Soest (1970). A special kit from Wiener, Argentina, was used to perform colorimetric determination of plasma calcium (Henery, 1964) and phosphorus (Fiska and Subbarow, 1925). Kits from BioMerieux, France, were used for colorimetric estimation of total protein (Weichselbeum, 1964; Henery, 1964 and Patters, 1968) and albumin (Doumas, 19971 and 1974). Globulin was estimated by subtraction (El-Nouty et al., 1984). Urea was detected colorimetrically using a kit from Bio Merieux, France, according to Fawcett and Scott (1960) and Patton and Crouch (1977). Ph values were measured immediately after collection using a pH meter. Total VFA was determined by steam distillation method (Warner, 1964). Ammonia nitrogen was determined in the filtered rumen liquid as mg% according to Abou-Akkada and Osman,(1967).

Statistical analysis

The data were analyzed statistically (Snedecor and Cochran, 1980). The significance between treatment means was tested by Duncan's (1955) multiple range test. Data from the two apparently repeated metabolism trials were taken from the first stage and used in comparisons made in the second stage.

RESULTS AND DISCUSSION

Dry matter intake (DMI)

Table (4) shows that dry matter intake (DMI) of concentrates increased as the ratio of roughage to concentrate decreased (307.04, 460.57 and 534.48 g/h/d for 60:40, 40:60 and 30:70 ratios, respectively. Total DMI showed the same trend as roughage intake did, which was a surprising phenomenon, since the starch value (SV) of roughage is almost one half as much as that of concentrates. The TDMI decreased as the percentage of concentrate in the rations increased. Dry matter intake of MLS was inevitably the same. Concentrate DMI increased regardless of the percent of MLS added, perhaps because of the increased concentrate portion in rations (Table 4).

Levels of DMI of roughage and concentrate (Table 5) were practically the same (673.86, and 307.04 g/h/d, respectively) as they were fixed, except for ration A, which had different roughage:concentrate ratio of 673.86 and 460.57 g/h/d, respectively. Intakes of replacements differed according to their different SV contents (140.92, 171.61, 100.69, 99.96 and 131.00 g/h/d for MLS, UMB, DG, DD and DF, respectively).

Digestibilities

Dry matter (DM) and organic matter (OM) digestibility levels (Table 4) were low for 60:40:0 and 60:20:20 ratios of roughage: concentrate: MLS. Their values increased significantly ($P<0.05$) as the concentrate portion of the rations increased from 20 or 40% to higher values. Digestibilities within higher percentages of concentrate were not significantly different. The DAD values ranged from 59 to 63% and those of OD ranged from 64 to 67%. On the other hand, values of both DAD (from 61 to 63%) and OD (from 66.39 to 66.86%) were similar (Table 5).

Crude protein (C) digestibility levels (Table 4) were also low for lower concentrate:roughage ratios. They were similar for higher ratios (59.61, 58.73, 60.98 and 60.81% for 60:40:0, 70:30:0 and 50:30:20 concentrate: roughage:MLS, respectively). When UMB was replaced at 20% level in the ration (Table 5), CPD had the highest value (62.26%) because of higher crude protein content (40.31%). Values of CPD for 20% replacement of DG

(53.28%), DD(53.42%) and DF (55.03%) were significantly ($P<0.05$) lower because of their lower C contents (3.33, 3.62 and 6.14% in order) than values for UMB and MLS (58.73%).

Table 4. Digestibility and feed value of diets composed of different roughage-concentrate ratios along with Mufeed liquid supplement

Ration	1	2	3	4	5	6
Intakes (g/h/d)						
TDMI	1317.56	1307.80	1134.43	1121.82	1042.01	1031.25
Concentrate	307.04	156.36	460.57	307.04	534.49	383.80
Roughage	1010.52	1010.52	673.86	673.86	507.53	507.53
MLS	-----	140.92	-----	140.92	-----	140.92
Digestibility,%						
DM	59.28^{b}	59.18^{b}	62.54^{a}	62.45^{a}	62.54^{a}	62.37^{a}
OM	64.60^{b}	64.43^{b}	66.66^{a}	66.80^{a}	66.03^{a}	66.01^{a}
CP	50.61^{c}	49.83^{c}	59.61^{ab}	58.73^{b}	60.98^{a}	60.81^{a}
NDF	68.75^{a}	67.24^{b}	67.24^{b}	66.67^{c}	66.34^{c}	65.61^{b}
Hemicellulose	77.74^{b}	78.34^{b}	80.71^{a}	81.24^{a}	80.95^{a}	81.25^{a}
Cellulose	66.40^{a}	63.11^{b}	63.42^{b}	61.18^{c}	60.71^{c}	58.60^{b}
Feeding value,%						
TDNO	56.41^{b}	55.57^{b}	59.70^{a}	58.96^{a}	59.47^{a}	58.19^{a}
SV	40.08^{c}	39.49^{c}	46.19^{ab}	45.61^{b}	47.55^{a}	46.63^{ab}
DCP	3.70^{a}	3.27^{c}	5.54^{bc}	4.96^{c}	6.40^{a}	5.84^{ab}
N. Balance	$+1.09^{c}$	$+0.85^{b}$	$+1.37^{a}$	$+1.26^{b}$	$+1.43^{a}$	$+1.34^{a}$

^{a,b,c,d,e} Values in the same row bearing different superscripts differ ($P<0.05$)

Neutral detergent fiber (NDF) digestibility levels (Table 4) were not significantly affected by the replacement of 20% MLS or by different roughage: concentrate ratios. The existing relationship between hemicellulose and cellulose (as hemicellulose digestibility increases, cellulose digestibility decreases) was predicted when the concentrate portion of the ration was increased (Table 4). This relationship was not clearly demonstrated when different replacements of MLS, UMB,DG, DD, and DF were used (Table 5).

Feeding value

As was the case with most nutrient digestibilities, the total digestible nutrients (TDN), starch value (SV) and digestible crude protein (DCP) values (Table 4) were low for lower concentrate: roughage: MLS ratios. The higher those ratios, the higher the values of TDN, SV and DCP. Nitrogen balance was positive for all rations (1-6). Notably, UMB had the lowest TDN and SV (57.89 and 44.36%, resp.), while its DCP value was the highest (8.15%) (Table 5). Values of rotten market products were identical, and nitrogen balances of all rations were positive.

Table 5. Digestibility and feed value of diets composed of different percentages of replacemrnt (MLS, UMB, dehydrated grapes, dates and figs)

Ration	Control	MLS	UMB	DG	DD	DF
Intakes (g/h/d)						
TDMI	1134.33	1121.78	1152.51	1081.86	1080.86	1111.90
Concentrate	460.57	307.04	307.04	307.04	307.04	307.04
Roughage	673.86	673.86	673.86	673.86	673.86	673.86
MLS	-----	140.92	-----	-----	-----	-----
UMB	-----	-----	171.61	-----	-----	-----
DG	-----	-----	-----	100.69	-----	-----
DD	-----	-----	-----	-----	99.96	-----
DF	-----	-----	-----	-----	-----	131.00
Digestibility, %						
DM	62.54	62.45	62.26	62.54	67.78	61.86
OM	66.66	66.80	66.86	66.39	66.62	66.56
CP	59.61^{b}	58.73^{b}	62.26^{a}	53.28^{d}	53.42^{d}	55.03^{c}
NDF	67.24^{a}	66.67^{b}	67.18^{a}	66.32^{b}	66.60^{b}	67.21^{a}
Hemicellulose	80.71^{b}	81.24^{a}	80.13^{b}	80.84^{b}	81.74^{a}	80.45^{b}
Cellulose	63.42^{a}	61.18^{c}	62.76^{b}	61.10^{c}	61.37^{c}	62.73^{b}
Feeding value, %						
TDN	59.70^{a}	58.96^{ab}	57.89^{b}	59.20^{a}	59.10^{a}	59.52^{a}
SV	46.19^{a}	45.61^{a}	44.36^{b}	45.34^{a}	45.53^{a}	45.62^{a}
DCP	5.54^{b}	4.69^{b}	8.15^{a}	4.13^{c}	4.15^{c}	4.39^{c}
N. Balance	$+1.37^{b}$	$+1.26^{b}$	$+1.57^{a}$	$+1.09^{c}$	$+1.11^{c}$	$+1.17^{bc}$

a,b,c,d, Values in the same row bearing different ssuperscripts differ ($P < 0.05$)
DG=dehy. grapes; DD=dehy dates; DF=dehy figs.

Rumen liquor parameters

The pH values of different roughage:concentrate:MLS ratios were within normal range (6.57-6.63) and did not differ significantly. The higher percentage of concentrate and the replacement MLS by 20% did not affect rumen pH values (Table 6). On the other hand, rumen pH values did not change for rotten market products. The MLS or UMB (ranged from 6.59 to 6.65) (Table 7). Total volatile fatty acids (TVFA) production was not affected by roughage:concentrate:MLS ratios (ranging from 8.28 ml eq% for 7. :30 ratio to 8.6 ml eq% for 60:20:20) (Table 6). Replacement of 20% of the ration SV as MLS, UMB, grapes, dates or figs did not affect rumen TVFA (ranging from 8.34 ml eq% for 40:40:20 roughage: concentrate: UMB to 8.56 ml eq% for 40:40:20 roughage concentrate: grapes (Table 7). These values, reported in tables 6 and 7, are higher than those obtained by Abdel-Aziz et al., 1993 (7.29 to 8.01 ml eq%) for MLS and UMB supplements; may be because of different percentages of supplements in rations. Ruminal ammonia values ranged from 16.88 for 30:50:20 roughage: concentrate: MLS ratios to 17.73 mg% for 60:40:0 ratio (Table 6). The differences were significant ($P<0.05$). Similar values were obtained for other replacements, ranging from 16.80 for DD replacement (having the highest CP content). These values are lower than those obtained by Abdel-Aziz et al., 1993.

Table 6. Some rumen and blood plasma parameters of diets composed of different roughage-concentrate ratios along with Mufeed liquid supplement

Ration	1	2	3	4	5	6
Rumen liquor parametres						
pH*	6.59	6.57	6.65	6.61	6.69	6.66
TVFA*,ml eq%	8.55	8.62	8.46	8.55	8.28	8.33
Ammonia*,mg%	17.78^{a}	17.72^{a}	17.60^{ab}	17.47^{b}	17.04^{c}	16.88^{c}
Blood plasma parameters						
Urea, mg%	40.84^{a}	40.17^{ab}	39.89^{b}	39.25^{bc}	39.93^{c}	38.38^{c}
TP, gm%	8.91^{a}	8.85^{a}	8.80^{a}	8.72^{ab}	8.67^{b}	8.61^{b}
Albumin, gm%	4.39^{a}	4.30^{ab}	4.32^{a}	4.23^{bc}	4.22^{bc}	4.16^{c}
Globulin, gm%	4.52	4.55	4.43	4.49	4.45	4.45
Alb/Glob. ratio	0.97	0.95	0.96	0.94	0.95	0.94
Ca, mg%	8.53	8.45	8.43	8.46	8.39	8.38
P, mg%	5.48	5.37	5.44	5.38	5.40	5.33

*Average of samples taken at 0,3 and 6 h post feeding

a,b,c Values in the same row bearing different superscripts differ ($P<0.05$)

Blood plasma parameters

Plasma urea values were within normal range although they were in the minimal range (Tables 6 & 7). Total protein concentrations in plasma were above 8.6 g for different roughage: concentrate: MLS ratios with some significance ($P<0.05$) for higher concentrate ratios

(Table 6). The replacement of 20% SV of the ration as rotten market products lowered plasma total protein concentrations, although values were still above 8.09 mg%, the minimal normal value in blood (Table 7). Albumin and globulin were above 4.09% (Tables 6&7). The albumin/globulin ratio in both trials did not exceed the unit. Plasma calcium concentrations in both trials were low (8.53 mg%), although, they were apparently within the normal range. Plasma P. concentrations were normal (Tables 6 and 7).

Table 7. Some rumen and blood plasma parameters of diets composed of different percentages of replacement (MLS, UMB, DG, DD, and DF)

Ration	Control	MLS	UMB	DG	DD	DF
Rumen liquir parameters						
pH*	6.65	6.61	6.67	6.59	6.59	6.63
TVFA*,ml eq%	8.46	8.55	8.34	8.56	8.54	8.51
Ammonia*,mg%	17.60^{b}	17.47^{b}	18.39^{a}	16.89^{cd}	16.80^{d}	17.11^{c}
Blood plasma parameters						
Urea, mg%	39.89^{ab}	39.25^{b}	40.57^{a}	38.23^{c}	38.21^{c}	39.11^{bc}
TP, gm%	8.80^{a}	8.72^{a}	8.79^{a}	8.30^{b}	8.36^{b}	8.43^{b}
Albumin, gm%	4.32^{a}	4.23^{a}	4.31^{a}	4.01^{b}	4.06^{b}	4.08^{b}
Globulin, gm%	4.48^{a}	4.49^{a}	4.48^{a}	4.29^{b}	4.30^{b}	4.35^{b}
Alb/Glob. ratio	0.96	0.94	0.96	0.94	0.94	0.94
Ca, mg%	8.43a	8.46^{a}	8.50^{a}	8.32^{ab}	8.27^{ab}	8.17^{b}
P. mg%	5.44	5.38	5.45	5.21	5.21	5.28

* Average of samples taken at 0.3 and 6 h post feeding

a,b,c Values in the same row bearing different superscripts differ ($P < 0.05$)

DISCUSSION

Diets in these studies were restricted. The DMI of ration ingredient was analyzed in order to assess the behavior of animals that were given ration of different concentrate: roughage ratios. As was expected, animals decreased their roughage intake in favor of concentrates. When MLS was substituted, animals consumed all of the amount presented perhaps because of the sugar content (higher palatability) of molasses. Virtually, all the dried rotten market products were consumed; animals selected rotten market products that had a high energy content and were dry. Rotten market products of high moisture content were ignored.

The lower the roughage:concentrate ratio, the lower the digestibility of most nutrients. The MLS is considered to be concentrate mixture because it is composed mainly (i.e. more than 93%) of cane venassess, a further sugar extracted molasses product. Therefore, it had little effect on nutrient digestibilities when it was substituted at 20% SV in the ration for concentrates. Thus, the overall effect of increasing the concentrate portion of the ration on nutrient digestibilities may not be attributed to MLS substitution. Despite the high percent of cane venasses in MLS and the expectancy of depressed fiber digestion, the digestibilities of fiber components (cellulose and hemicellulose) did not differ much among different roughage:concentrate ratios. Perhaps, animals preferred concentrates over treated roughage.

The substitution of dried rotten grapes, dates and figs did not improve nutrient digestibities over those of different roughage:concentrate ratios. Unexpectedly, the UMB, composed only of 43% cane molasses, did not affect most of the nutrient digestibilities over MLS. This may be because of increased rumen ammonia (18.39 mg%) for UMB over that of MLS (17.47%). However, this was reflected in higher CPD value (62.26%), and the lower but not significantly different TDN and SV values. Its DCP value was almost double that of MLS and other rotten market products.

The pH values and the TVFA content of rumen parameters were studied and found to have much variations among rations tested, although they were somewhat higher than values found by others (Fouad, 1991). Also, ruminal ammonia concentrations were not variable among rations.

Plasma urea concentrations were also similar in both stages of the study, as were plasma total protein, albumin and globulin concentrations. However, more studies on these products are recommended, so that their full potential in ruminant nutrition can be understood.

Implications

There is a lack of natural resources of feedstuffs in Egypt. In addition, because of the limited area of land (about 4% of the total area in Egypt) available for cultivation, there is a severe competition between humans and animals for grains. All these factors have led to a negative balance in animal feeds. Therefore, the search for nontraditional feedstuffs has been intense. The rotten market products are a potential source for animal feed. Therefore, whenever available, rotten dried market products can be used as substitutes for concentrates in ruminant rations. As indicated above, difference in feeding values between concentrates and these products were negligible. These market products are cost effective, compared well to concentrates, and seem to be safe for ruminants.

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القيمة الغذائية لبعض مخلفات الاسواق مع الاستبدال باليوريا والمولاس

صلاح عطية اسماعيل[1] – رافت طه فؤاد[2] – على عبد الحليم محمد فهمى[2]

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تم فى هذه الدراسة مقارنة عدة نسب من المادة الخشنة : المركزات : سائل المفيد وذلك للوصول إلى افضل نسبة منها ليتم مقارنتها مع مخلفات الاسواق (زبيب مجفف – بلح مجفف – تين مجفف) • وقد تكونت عليقة المقارنة من ٤٠٪ مادة خشنة : ٦٠٪ علف مركز مع استبدال ٢٠٪ من المركزات بمخلفات الاسواق او قوالب المولاس واليوريا او سائل مفيد•

لوحظ انخفاض كمية المأكول من المادة الجافة بزيادة نسبة المركزات وانخفاض معامل هضم المادة العضوية لعليقة المقارنة (٥٩,٢٨٪,٦٠,٦٤,٦٠٪على التوالى) وكذلك عند استبدال ٢٠٪ من المركزات بالسائل المفيد (٥٩,١٨٪ ، ٦٤,٤٣٪ على التوالى) مع ملاحظة زيادة هذة النسب الهضمية بزيادة نسبة المركزات فى العليقة •

وكان لاضافة مخلفات الاسواق اثر فى انخفاض كمية المأكول الكلى من المادة الجافة (١٠٨١,٩، ١٠٨٠,٩ ، ١١١١,٩ جم لكل من الزبيب والبلح والتين المجفف على التوالى) وذلك مقارنة بـ ١١٣٤,٣ جم/ راس/ يوم لعليقة المقارنة •

وقد كانت المركبات الكلية المهضومة اقل انخفاضا من الاستبدال بقوالب المولاس واليوريا (٥٧,٨٩٪) وكذلك معدل النشا (٤٤,٣٦ ٪) بينما كانت قيمة البروتين الخام المهضوم اعلاها مع إستبدال قوالب المولاس واليوريا (٨,١٥٪)• وبمقارنة قيم تركيزات الاحماض الدهنية الطيارة الكلية فى الكرش وجدت انها متشابه فى جميع المعاملات ولكن تركيز امونيا الكرش كان مرتفعا (١٨,٣٩ مللجم ٪) مع الإستبدال بقوالب المولاس واليوريا. وكذلك لم تختلف قيم التركيزات فى الدم لكل من اليوريا والبروتين الكلى والجلوبيولين وكذلك الكالسيوم والفوسفور وذلك فيما بين النسب المختلفة للمركزات والمادة الخشنة• ولكن يوريا الدم كانت عالية مع قوالب المولاس واليوريا (٤٠,٥٧ مللجم ٪) مقارنة بسائل المفيد ومخلفات الاسواق•

من ذلك نستخلص ان مخلفات الاسواق المختلفة يمكن استخدامها من علائق الحيوانات المجترة حيث كانت تقريبا فى نفس مستوى العلف المركز • كما ان أسعارها اقل بكثير من اسعاره•