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EFFECTS OF SUN DRIED RUMEN CONTENT AND LASALOCID IN FRIESIAN CALVES RATIONS ON PERFORMANCE TRAITS, RUMINAL AND BLOOD PARAMETERS AND CARCASS CHARACTERISTICS

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SUMMARY

Thirty Friesian calves of an average 155.8 kg live body weight (LBW) and aged 12 months were distributed among five experimental groups (six animals each) according to the average body weight. The experiment lasted for 9 months. The animals were fed as follow: T_1 control (no sun dried rumen contents and no lasalocid), T_2 and T_3 rations contained 20 % sun dried rumen contents (SDRC) and T_4 and T_5 rations contained 40% SDRC. Rations fed in groups T_3 and T_5 supplemented with 0.3 gm lasalocid/kg concentrates. Results showed that the values of digestibility coefficients of DM, OM, CP, CF, EE and NFE were the lowest in the control group. Values of pH, ammonia nitrogen, total nitrogen (TN), non protein nitrogen (NPN), true protein nitrogen (TPN) and total volatile fatty acids (TVFs) were increased in the ruminal fluid as the level of SDRC increased in the ration. No effects of lasalocid supplementation were observed. No significant differences were observed in the concentration of total protein and globulins in the blood plasma in the groups 2 and 3 (T_2 & T_3) as was compared to the control (T_1). The higher amount of SDRC in the rations (groups T_4 & T_5) resulted significantly higher ($P<0.05$) plasma total protein and globulins than both control and low level of SDRC in the rations (groups T_2 & T_3), while no significant differences were observed among all treatments in the case of blood plasma albumin and urea contents. Rations supplemented with sun dried rumen contents improved average daily gain, feed conversion and economic efficiency. Lasalocid supplementation improved feed conversion and economic efficiency without significant effect on ruminal and blood plasma biochemical parameters. No significant differences were observed among the treatment groups in dressing percentage, boneless meat, eye muscle area, tenderness and proximate analysis of eye muscle, heart and kidney.

***Keywords:** sun dried rumen content, Friesian calves, lasalocid.*

INTRODUCTION

There is a gap between animal requirements and the available animals feed, therefore, it is very important to search about non traditional sources of feed stuffs for ruminant rations. Rumen contents as a low cost by-product which is came from slaughter house as waste contain considerable amounts of nutrients and after certain inexpensive treatment, can be used in the nourishment of livestock. Rumen content is rich in vial nutrients specially those of microorganisms and fermentation products (Church, 1971). El-Deek *et al.*

(1975) found that rumen content represents 11.2 to 11.3 % of the live body weight, for that reason it can be taken about 30 – 45 kg of rumen content from a mature cow. El-Tahan (1991) calculated the total quantity of slaughter house wastes produced in Egypt between the years 1980 – 1989 and found as 26168.9 to 29420.1 tonnes fresh rumen contents, yearly. It was also found that growth rate and feed conversion efficiency in healthy ruminants can be improved by addition of ionophores, such as lasalocid (Potter *et al.*, 1976).

Therefore the present study was designed to evaluate the possibility of using sun dried rumen contents and ionophores (Lasalocid) and their effects as nutritional factors on the production traits and some ruminal as well as blood plasma biochemical parameters of growing Friesian calves.

MATERIALS AND METHODS

The present experiment was carried out at El-Karada experimental station, Kafer El-Sheikh governorat, which belong to the Animal Research Institute, Ministry of Agriculture.

Thirty male Friesian calves, about 12 months of age and about 155.8 kg live body weight were investigated. Animals were divided according to live body weight into five similar groups of six animals each. Five different experimental rations were tested which are included two levels of sun dried rumen content (SDRC) to replace 20 % (T_2 & T_3) and 40% (T_4 & T_5) of dietary crude protein without (T_2 & T_4) or with (T_3 & T_5) lasalocid (300 g/t concentrate), in addition, there was a control group (T_1) contained neither SDRC nor lasalocid.

The roughage : concentrate ratio in the treated groups was higher than control group because the rations of these groups contained high level of roughage (rumen contents). The ratios were: 29.9:75.1, 40.9:59.1 and 58.5 :41.5 for control, T_2 and T_5 groups, respectively.

The SDRC used in this experiment was obtained from Kafer El-Sheikh slaughter house. It was spread on plastic sheets in layer of about 10 cm thickness, sun dried and analysed daily for 14 days. The result of proximate analysis is shown in Table (1). It should be noticed that higher crude protein content was recorded at the 4th day of drying period, because a lot of larvae (house fly) were appeared in the bottom layer. Thus the layer was covered by plastic sheet on the 4th day for one day to kill these larvae in order to stop their life cycle and to increase crude protein percentage in the rumen contents. Then shuffled up and down every day to complete the sun drying process for the remaining 10 days. The SDRC was collected and stored in sacks. Component of the rations and proximate analysis are shown in Table (2).

Animals were kept under semi open sheets and fed individually according to NRC (1984). The amounts of CFM feed were offered at 8 a.m. and 3 p.m. daily. The hay and rice straw were offered after CFM feeding. Animals were allowed to drink twice daily and weighted for night after fasting period of 16 hours. The experiment lasted for 9 months.

Through the experimental period, three digestibility trials were applied (after 2, 4 and 6 months of the experiment). Three animals from each experimental group were used in each of these three digestibility trials. Grab sample method was used and the acid insoluble ash as an internal marker was applied for determining the nutrient digestibility (Maynard and Loosli, 1957). Feces grab samples and representative samples of the experimental rations were taken two times daily at 8.0 a.m. and 3.0

Table (1) : Chemical composition of sun-dried rumen contents through 14 days drying period (before and after covering).

Days	Without covering					With covering*				
	DM	CP	EE	CF	Ash	DM	CP	EE	CF	Ash
1	12.82	10.42	2.41	34.31	13.40	11.40	10.51	2.32	32.44	12.60
2	17.31	12.66	2.52	34.65	12.61	16.71	12.00	2.11	32.92	12.73
3	27.53	14.87	2.95	33.42	12.71	28.10	15.03	2.19	33.02	12.80
4	39.40	16.71	3.41	34.11	11.86	38.61	16.80	2.41	33.15	12.70
5	44.36	16.42	3.43	34.33	11.61	45.62	16.72	2.56	32.98	12.13
6	48.16	16.00	3.31	35.12	12.40	49.10	16.80	2.40	33.04	12.40
7	54.60	15.44	3.11	34.40	13.01	56.26	15.91	3.00	34.12	12.90
8	60.60	12.03	3.12	36.11	12.91	63.01	16.70	2.80	34.86	13.01
9	65.90	11.41	2.81	35.14	13.56	66.80	16.62	2.95	35.01	13.00
10	73.41	11.31	2.83	34.60	13.88	73.18	15.89	3.01	35.71	13.40
11	78.80	10.88	2.91	36.70	13.99	77.01	16.51	2.88	35.30	14.22
12	85.91	10.67	2.81	36.71	13.40	83.03	16.67	3.01	36.61	14.33
13	87.46	10.50	2.85	35.81	14.67	85.81	16.79	2.70	36.20	14.45
14	88.44	10.51	2.83	36.18	14.80	88.50	16.64	2.81	36.21	15.01

* Covering by plastic sheet.

Table (2) : Formulation of the experimental rations, proximate analysis of feedstuffs and experimental rations (% on dry matter basis).

Item	Control (T_1)	20% SDRC[1] (T_2 & T_3)	40% SDRC (T_4 & T_5)
CFM*	75.1	59.1	41.5
SDRC	-	14.8	31.1
Berseem hay	17.8	18.7	19.7
Rice straw	7.1	7.4	7.7

Nutrients	DM	OM	CP	EE	CF	NFE	Ash
CFM*	91.80	85.69	11.83	2.94	13.62	57.30	14.31
SDRC	87.40	84.67	16.80	3.26	35.42	29.19	15.33
Berseem hay	92.12	86.80	12.92	1.55	28.17	44.16	13.20
Rice straw	90.41	85.07	1.60	1.20	34.43	47.84	14.93
Control	91.76	85.84	11.29	2.58	17.68	54.29	14.16
T_2 & T_3	91.12	85.70	12.02	2.60	21.11	49.97	14.30
T_4 & T_5	90.39	85.54	12.80	2.63	24.87	45.24	14.46

[1]Sun-dried rumen contents, * CFM= concentrate feed mixture consisted of: undecorticated cotton seed cake 35%; coarse wheat bran 20%; yellow corn 17%; rice bran 25%; salt 1% and limestone 2%.

p.m. for five successive days. Solution of 10% H_2SO_4 and formalin were added to the representative samples, dried in oven at 60° for 24 hr., then mixed and saved for chemical analysis. Proximate analysis for the experimental rations, feces and meat were chemically determined according to A.O.A.C. (1995) methods. Fiber fractions for feed and feces were chemicals determined according to Georing and Van Soest (1970).

Three animals from each experimental group (the same as were used for the digestibility trials) were used to obtain rumen fluids every two months at 0, 2, 4 and 6 hours post-feeding by stomach tube. The samples were strained through four layers of cheese cloth. The actual pH values determined using an electronic pH meter (Orion research model 2010, Orion, Oy, Finland) and ammonia-N according to the method of A.O.A.C. (1995) immediately after filtering, then the samples were centrifuged at 400 rpm for 15 min. The upper phase fraction of the samples were stored in glass bottles (40 ml) with addition of two ml tollween and 2 ml paraphen oil and stored at -20° C till analysis. Total nitrogen and non-protein nitrogen content of the rumen fluid were determined by the semi-microkjeldahl digestion method (A.O.A.C., 1995). Ruminal total volatile fatty acids were determined by steam distillation as described by Warener (1964). Fractions of volatile fatty acids were analyzed according to Erwin *et al.* (1961).

At the end of the feeding trials, two calves of each group were slaughtered with average weights of 403, 418, 425, 404 and 406 kg for groups 1, 2, 3, 4 and 5, respectively. Dressing percentage and weight of boneless meat for each animal were also estimated. Samples of eye muscle at the 9^{th} to 11^{th} rib were taken for chemical analysis and physical characteristics. Also, samples of liver, heart, kidney and spleen were taken for chemical analysis.

Plasma total protein content was measured as described by Armstrong and Carr (1964), albumin according to Doumas *et al.* (1971) and urea based on the method of Husdan (1968). Globulin content and albumin / globulin ratio were calculated.

The pH value was measured in eye muscle by electronic pH meter with glass electrode as described by Aitken *et al.* (1962). Tenderness and water holding capacity were determined according to the method described by Grau and Hamm (1957). The color intensity of meat water extract was determined according to the method described by Hussaini *et al.* (1950).

Statistical analysis was performed using least squares method described by Snedecor and Cochran (1982). General Linear Models procedure of S.A.S. (1987) was employed.

Two main effects were studied in relation to animal performance, digestibility and blood plasma biochemical analysis data as indicated by the following model :

$$Yijk = \mu + Ai + Bj + (AB)ij + eijk$$

Where:

Yijk : is the observation on the k^{th} animal in the i^{th} experimental period.

μ : common effect to all animals. In this model, the constant μ is assumed to represent the population mean.

Ai : a common effect to all animals given i^{th} experimental nutritional treatments I = 1 to 5.

Bj : an effect common to all animals during j^{th} experimental period j = 1 to 3.

(AB)ij : an effect particular to ith experimental nutritional treatment and jth experimental periods.

Eijk : is a randomized error of all the unidentified factors that may affect the dependent variables and not included in the model.

In the case of rumen liquor analysis, a time effect (H) was added to the previous model (H = 1 to 4 times of feeding), the first and second order interaction of this parameter with the others were introduced in the model. However, in the case of carcass characteristics, the effect of experimental period (Bj) was neglected. So no interaction was introduced.

The Duncan's new multiple range test was used to test the significance among means (Duncan, 1955).

RESULTS AND DISCUSSION

Nutrients intake:

Data presented in Table (3) showed that the intake of DM, OM and TDN expressed either as kg / head / day or kg / $w^{0.75}$ were gradually decreased with increasing the level of SDRC. This result may be due to the high crude fiber content in SDRC. However, the results showed a gradual increase in DM, OM, TDN and CPI with period progress, which possibly related to the increase in animal requirements as a result of increasing live body weight.

Digestibility of nutrients:

The highest values ($P<0.05$) of DM, OM, CP, CF and EE digestibilities were recorded in the 20 % SDRC level diets (T_2 & T_3), that probably attributed to the SDRC is considered partly digested material, may contained partially inactivated microbial enzymes and/or several unknown factors presented in SDRC that enhance rumen microorganism to improve nutrients utilization specially crude fiber (Khattab *et al.* 1996). This result is supported by the results of some previous studies, e,g, Patra and Ghosh (1991); Eleraky (1991); Gupta *et al.* (1992) and Singh *et al.* (1994).

Beside the lower SDRC content rations (groups T_2 & T_3) lasalocid significantly ($P<0.05$) increased in OM, CP, CF and EE digestibility and non significantly ($P>0.05$) increased the DM and NFE digestibility. These results are in line with those obtained by Delfino *et al.* (1988) and Khattab *et al.* (1997b). However, no significant effect of lasalocid addition was observed beside the higher amount of SDRC in the rations (groups T_4 & T_5).

It should be noticed gradual increase in the digestibility of NDF, ADF, cellulose and hemicellulose with increasing level of SDRC (Table 3). That finding is in agrees with the results of Gupta *et al.* (1992). The increasing of crude fiber and fiber fraction digestibility may be due to that rumen contents contain partly digested fiber material. Otherwise, increased digestion of NDF, ADF, cellulose and hemicellulose was found as effect of lasalocid in the case of both low (T_2 & T_3) and high (T_4 & T_5) levels of SDRC.

The present results indicated that the digestibility of the nutrients including fiber fractions increased significantly ($P<0.05$) at the 2^nd^ and 3^rd^ digestibility trial also as was compared the 3^rd^ trial with the 1^st^ one but not-significantly increased between 2^nd^ and 3^rd^ trial. These increasing tendencies in the digestibilities with the period progress possibly due to the aging of animals and for that reason the higher amount of feed intake that enhance the degradation capacity of rumen microorganisms.

Ruminal fluid parameters:

pH value:

No significant differences among treatments in ruminal pH were noticed (Table 4). Such result agrees with those reported by, Katz *et al.* (1986), Zinn (1992) and Khattab *et al.* (1996).

Table (3): Feed intake and nutrients digestibility of different experimental treatments

Items	Experimental treatments						Experimental periods*			
	T_1	T_2	T_3	T_4	T_5	± SE	P 1	P 2	P 3	± SE
Nutrients intake:										
DMI/head/day, kg	6.23^{a}	5.96^{a}	5.96^{a}	5.65^{b}	5.65^{b}	0.06	5.56^{c}	5.70^{b}	7.41^{a}	0.05
DMI, gm/kg MBS/day	106.68^{a}	101.04^{b}	97.65^{bc}	94.89^{c}	95.59^{c}	0.88	103.41	96.85	97.25	0.68
OMI/head/day, kg	5.35^{a}	5.14^{a}	5.44^{a}	4.81^{b}	4.81^{b}	0.05	3.93^{c}	4.86^{b}	6.35^{a}	0.04
OMI, gm/kg MBS/day	91.52^{a}	87.32^{ab}	84.41^{bc}	80.82^{c}	81.42^{c}	1.05	89.26	82.62	83.41	0.81
TDNI/head/day, kg	3.52^{a}	3.12^{b}	3.12^{b}	2.72^{c}	2.72^{c}	0.05	2.32c	2.93^{b}	3.86^{a}	0.04
TDNI, gm/kg MBS/day	60.29^{a}	52.87^{b}	51.09^{b}	45.49^{c}	45.83^{c}	0.47	52.73	49.87	50.74	0.36
CPI/head/day, gm	699.51^{b}	710.47^{ab}	710.47^{ab}	714.60^{a}	714.57^{a}	2.55	555.76^{c}	675.47^{b}	898.54^{a}	1.98
CPI, gm/kg MBS/day	11.99	12.06	11.65	12.01	12.10	0.12	12.61	11.48	11.80	0.09
Nutrients digestibility:										
Dry matter	73.84^{c}	75.58^{ab}	76.86^{a}	74.62^{bc}	74.86^{bc}	0.38	72.95^{b}	76.02^{a}	76.49^{a}	0.29
Organic matter	74.18^{c}	74.91^{bc}	77.93^{a}	76.64^{ab}	75.33^{bc}	0.46	73.95^{b}	76.27^{a}	77.17^{a}	0.36
Crude protein	71.54^{c}	72.99^{bc}	76.10^{a}	74.83^{ab}	74.70^{ab}	0.45	72.59^{b}	74.57a	74.95^{a}	0.35
Crude fiber	57.19^{b}	58.13^{b}	62.80^{a}	62.24^{a}	61.58^{a}	0.54	58.78^{c}	60.24b	62.15^{a}	0.41
Ether extract	62.14^{b}	62.79^{b}	64.64^{a}	63.81^{ab}	63.59^{ab}	0.45	61.46^{b}	63.99a	64.73^{a}	0.35
Nitrogen free extract	62.16^{c}	63.73^{bc}	64.99^{ab}	65.83^{a}	63.84^{ab}	0.50	62.38^{b}	64.53a	65.43^{a}	0.39
NDF	48.45^{d}	52.91^{c}	55.63^{ab}	56.81^{b}	62.84^{a}	0.79	53.21^{b}	54.75b	57.90^{a}	0.62
ADF	43.82^{d}	47.28^{c}	51.64^{b}	54.72^{b}	56.18^{a}	0.80	49.09^{b}	50.37b	52.73^{a}	0.62
Cellulose	54.48^{c}	60.61^{b}	62.86^{b}	62.66^{b}	67.85^{a}	0.63	59.50^{c}	61.36b	64.22^{a}	0.49
Hemicellulose	45.52^{c}	53.41^{b}	56.05^{b}	55.84^{b}	59.18^{a}	0.6	51.72^{c}	53.88b	54.4^{a}	0.52

a, b, c and d: means of different letters in the same raw are significant different ($P<0.05$).

*** each period lasted (90) days.**

Table (4) : Effect of SDRC[1] and lasalocid on ruminal parameters

Items	Treatments						Sampling time					Periods			
	T_1	T_2	T_3	T_4	T_5	±SE	0 hr.	2 hr.	4 hr.	6 hr.	±SE	P1	P2	P3	±SE
pH	6.29	6.08	6.21	6.36	6.28	0.07	6.84^{a}	6.13^{b}	5.94^{c}	6.07^{bc}	0.04	6.59^{a}	5.84^{b}	6.35^{a}	0.06
NH_3-N, mg/100 ml	14.86^{c}	16.80^{b}	16.35^{b}	17.71^{a}	17.78^{a}	0.15	15.48^{d}	17.99^{a}	17.40^{b}	15.93^{c}	0.09	16.60	16.52	16.98	0.14
VFA's mM/100 ml	14.09^{c}	15.57^{bc}	16.96^{ab}	17.82^{a}	18.66^{a}	0.37	14.99d	16.54^{c}	17.99^{a}	16.96b	0.09	16.09	16.39	17.39	0.15
TN, mg/100 ml	53.45^{c}	61.50^{bc}	65.17^{b}	88.83^{a}	88.81^{a}	2.33	60.81d	68.44^{c}	75.15^{b}	81.81^{a}	0.36	68.10^{c}	70.58^{b}	75.97^{a}	0.68
NPN, mg/100 ml	26.58^{c}	31.29^{b}	31.64^{b}	37.62^{a}	37.70^{a}	1.00	26.17d	30.57^{c}	35.21^{b}	39.92^{a}	0.18	30.89^{c}	33.15^{b}	34.86^{a}	0.26
TPN, mg/100 ml	28.87^{b}	30.27^{b}	33.44^{b}	51.06^{a}	51.16^{a}	1.80	34.57^{d}	37.8^{c}	39.94^{b}	41.94^{a}	0.33	37.08^{b}	37.50^{b}	41.11^{a}	0.68

[1]Sun-dried rumen contents, a, b, c and d: means of different letters in the same raw are significant different (P<0.05).

Table (5) : Effect of SDRC[1] and lasalocid on individual volatile fatty acids

Items	Treatments						Sampling time				Periods			
	T_1	T_2	T_3	T_4	T_5	±SE	0 hr.	2 hr.	4 hr.	±SE	P1	P2	P3	±SE
Acetic acid	42.12	39.84	38.52	43.34	39.17	1.48	40.45	40.90	40.44	40.18	40.18	40.37	41.24	0.82
Propionic acid	24.09^{b}	25.28^{b}	30.02^{a}	23.91^{b}	29.37^{a}	0.72	26.32	26.33	26.95	24.98^{b}	24.98^{b}	26.93^{ab}	27.69^{a}	0.62
Isobutyric acid	2.48	2.52	3.39	2.49	2.34	0.38	2.62	2.84	2.74	2.44	2.44	2.70	2.79	0.27
Butyric acid	17.56	18.48	15.61	18.39	16.16	0.76	17.64	17.71	16.38	19.57^{a}	19.57^{a}	15.71^{b}	16.45^{ab}	0.85
Isovalyric acid	5.69	4.91	5.31	4.90	5.39	0.81	5.07	4.83	5.82	5.26	5.26	5.89	4.57	0.59
Valyric acid	8.03	8.93	7.11	6.94	7.96	0.98	7.89	7.60	7.90	7.55	7.55	8.35	7.49	0.72

[1]Sun-dried rumen contents, a, b, c and d: means of different letters in the same raw are significant different (P<0.05).

Investigating the effect of sampling time on ruminal pH (Table 4) the highest value was recorded at the initial sampling (0 h), before feeding, while the lowest value was that at 4 h post feeding. These results caused by the intensive fermentation process of both nonstructural and structural carbohydrates and the production of volatile fatty acids. Such results are supported by the finding of Khattab *et al.* (1996).

The highest value of rumen pH was recorded in the first period and the lowest value was noticed in the second period that may be because of increasing feed intake by time progress. These results are similar to that reported by Khattab *et al.* (1996).

Ruminal NH_3-N concentration:

Ammonia-N concentration (Table 4) was increased with increasing SDRC level in the rations. No effect of lasalocid supplementation on ruminal ammonia-N concentration was detected. This result is in agrees with the previous findings of Morries *et al.* (1990).

The lowest value of ruminal ammonia-N was recorded before feeding (0 h), and the highest value was recorded 2 hours post feeding and decreased gradually with the time progress. These results may be possibly related to the easily degradable dietary protein together with moderate energy deficiency. No significant differences among the different periods of the digestibility trials were observed.

Ruminal VFAs, RTN, RNPN and RTPN concentrations:

The results of present study showed (Table 4) a linear significant ($P<0.05$) increase in TVFA, RTN, RNPN and RTPN content of the ruminal fluid with the increasing level of SDRC in the rations. That effect caused by the relatively high partly decomposed material content of the SDRC for that reason high amount of TVFA was released within a short period of time. This result is agree with that of Khattab *et al.* (1996).

The results also showed that the TVFA, RTN, RNPN and TPN were increased with the time progress and that effect may be related to the degradation of dietary protein as was also found by Khattab *et al.* (1996). The values of TVFA, RNPN and RTP were increased with period progress, which may be related to increase of the feed intake because of the increasing live body weight. These results are agree with those reported by Khattab *et al.* (1996).

Lasalocid caused not-significant increase in TVFA in the treatment groups and that result is agree with those of Neundroff *et al.* (1985), Morris *et al.* (1990) and Harmon *et al.* (1993). With regard to RTN, RNPN and RTP, also not significant effects were detected for adding lasalocid either together with low (T_2 & T_3) or high level of SDRC (T_4 & T_5) in the ration.

Data of Table (5) showed no significant effect for either SDRC or lasalocid on acetic, isobutyric, butyric, isovaleric and valeric acid content of ruminal fluid.

Otherwise lasalocid caused significant increase in propionic acid and not significant decrease in acetic acid content of ruminal fluid in the case of both the low (T_2 & T_3) and high (T_4 & T_5) levels of SDRC. These results are agree with those reported by Bartley *et al.* (1979); Thonney *et al.* (1981); Spears and Harvey (1984) and Khattab *et al.* (1997b), who reported that lasalocid increased ruminal propionic acid and decreased acetic acid proportion, because of the changes in the composition of ruminal microflora as effect of the ionophore treatment.

Results of Table (5) also showed not significant increase in acetic, isobutyric acids and but significant increase in propionic acid content of the ruminal fluid with the age progress. These changes may be related to the relative increase in feed intake according to the increase in live body weight. That result is agree with that reported by Khattab *et al.* (1997b). No significant differences were observed in valeric and isovaleric acid content of the ruminal fluid with age progress.

Blood plasma parameters:

The results of present study showed no significant differences in the content of blood plasma total protein and globulins between the control and low level of SDRC (T_2 & T_3) groups, while values of the high level of SDRC (T_4 & T_5) were significantly ($P<0.01$) higher than other treatments (Table 6). The increase in plasma total proteins in some of the experimental treatments may be due to the parallel increase in crude protein digestibility (see Table 3) and ruminal true protein nitrogen (see Table 4) that indicated better utilization of dietary protein in the digestive tract. Values of plasma total protein are in good agreement with those obtained by several other researchers (Varley, 1969 and O'Kelly, 1973). No significant effect of lasalocid supplementation was observed on either plasma total protein or globulins. Otherwise plasma total protein and globulins were increased with age progress and the reason was not clear.

No significant differences were observed among treatments in plasma albumin and urea nitrogen. Plasma total albumin and plasma urea were increased with age progress. Mean values of A/G ratio were decreasing with increasing level of SDRC except that of T_3. No significant differences for lasalocid were detected (Table 6). These results are nearly similar to those obtained by Duff *et al.* (1994) and Khattab *et al.* (1997a).

Body weight and weight gain:

Values of absolute weight gain and calculated average daily weight gain were higher in both the low (T_3 & T_4) and high (T_4 & T_5) levels of SDRC groups as compared to the control (Table 7). These results are in parallel with the previously obtained results of digestibility trials that showed higher dry matter digestibility for both the low and high levels of SDRC than control group (see Table 3). Higher digestibility of nutrients resulted higher energy and nutrient supply for the animals for that reason caused better performance.

Lasalocid caused significant increase in absolute weight gain together with the low level of SDRC in the ration. That effect probably caused by the higher rate of fermentation as caused by lasalocid on the composition of rumen microflora but it is manifested only together with appropriate amount of partly decomposed feed particles and/or nutrients.

The absolute weight gain was significantly increased with the age progress. The calculated ADG values followed the same trend as that of absolute weight gain. It is of interest to observe that the present results concerning digestibility coefficients, ruminal true protein, plasma total protein, absolute weight gain and ADG all had the same trend among the different treatments and the different periods.

Feed conversion:

Results in Table (8) showed that the efficiency of utilization of DM, OM, TDN and CP were increased with increasing level of SDRC in the ration. This result is agree with those Patra and Ghosh (1991), Gupta *et al.* (1992) and Khattab *et al.* (1996). Lasalocid caused only slight improvement on DM, OM, TDN and CP utilization.

Table (6): Effect of SDRC[1] and lasalocid on blood plasma parameters

Items	Treatments						Periods				
	T_1	T_2	T_3	T_4	T_5	±SE	P_1	P_2	P_3	P_4	±SE
Total protein, gm/100 ml	6.36^{b}	6.57^{b}	6.43^{b}	6.88^{a}	6.93^{a}	0.07	6.19^{d}	6.44^{c}	6.81^{b}	7.09^{a}	0.07
Albumin, gm/100 ml	3.32	3.49	3.51	3.43	3.52	0.06	3.15^{c}	3.29^{c}	3.57^{b}	3.79^{a}	0.05
Globulin, gm/100 ml	3.04^{b}	3.08^{b}	2.92^{b}	3.43^{a}	3.41^{a}	0.08	3.03	3.15	3.24	3.30	0.07
Albumin: globulin ratio	1.16^{ab}	1.13^{ab}	1.21^{a}	0.99^{b}	1.04^{ab}	0.05	1.08	1.05	1.12	1.19	0.04
Urea-N, mg/100 ml	26.72	27.08	27.07	26.88	27.44	0.48	26.04	26.78	27.29	28.03	0.43

[1]Sun-dried rumen contents, a, b, c, d: means of different letters in the same raw are significant different ($P<0.05$).
P_1: After 2 months, P_2: After 4 months, P_3: After 6 months and P_4: After 8 months.

Table (7) : Effect of SDRC[1] and lasalocid level on absolute and daily weight gain.

Periods	Treatments (T)					Overall mean
	T_1	T_2	T_3	T_4	T_5	
Period (1): 90 day						
Initial wt (kg)	155.5	155.8	155.8	155.8	155.8	
Final wt (kg)	221.7	223.8	240.0	232.8	226.8	
Absolute gain (kg)	66.2	68.0	84.2	77.0	71.0	73.4 ± 1.67
A.D.G. (kg)	0.74	0.76	0.94	0.86	0.79	0.82 ± 0.02
Period (2): 90 day						
Initial wt (kg)	221.67	223.8	240.0	232.8	226.8	
Final wt (kg)	310.5	319.3	342.67	322.3	321.0	
Absolute gain (kg)	88.8	95.5	102.7	89.5	93.7	94.0 ± 1.67
A.D.G. (kg)	0.99	1.06	1.04	0.99	1.04	1.04 ± 0.02
Period (3): 90 day						
Initial wt (kg)	310.5	319.3	342.67	322.3	321.0	
Final wt (kg)	400.6	409.1	429.8	405.6	406.2	
Absolute gain (kg)	90.2	89.8	87.2	83.3	85.2	87.1 ± 1.67
A.D.G. (kg)	1.00	1.00	0.93	0.93	0.95	0.97 ± 0.02
Overall mean						
Initial wt (kg)	155.5	155.8	155.8	155.8	155.8	
Final wt (kg)	400.5	409.1	429.8	405.6	406.2	
Absolute gain (kg)	245.2^b	253.3^b	270.0^a	249.8^b	250.0^b	
	±6.34	±6.34	±6.34	±6.34	±6.34	
A.D.G. (kg)	0.91	0.94	1.01	0.93	0.927	
	±0.02	±0.02	±0.02	±0.02	±0.02	

[1]Sun-dried rumen contents,

a, b and c: means of different letters in the same raw and column are significant different (P<0.05).

Values of feed conversion expressed as DMI, OMI, TDNI and CPI/kg weight gain in the third period were significantly less than the first and the second period possibly because of the different periods of age at the three consecutive periods. These results are positively related to the average daily gain through the experimental periods (see Table 7).

Economical feed efficiency:

Values of economic efficiency calculated as a ratio between cost of the weight gain an the cost of feed consumed. The results showed (Table 8) higher values for the 40% SDRC level than the low level of SDRC and control groups. It may possibly be attributed to the lower cost of SDRC (practically free) as compared to the other feedstuffs were used and to improvements of ADG with the amount of SDRC in the ration. Lasalocid slightly increased economic efficiency using the low levels of SDRC. Economic efficiency in the three digestibility trials was the highest at the first followed by second and third ones.

Carcass characteristics:

Results in Table (9) showed that no significant differences were observed among treatments in dressing percentage, boneless meat (with offals) and eye muscle area.

Lasalocid supplementation caused significant increase ($P<0.05$) in the amount of boneless meat (without offals) together with the low level of SDRC, while no significant differences were observed for lasalocid supplementation together with the higher amount of SDRC in the ration.

The highest significant pH value was recorded for T_3, while the lowest significant value was recorded for T_5. The highest significant value of color intensity was recorded for T_2 while the lowest one was recorded for T_1, no significant effects for lasalocid either within the low or the high level of SDRC were observed either in pH value or color intensity (Table 9).

Results in Table (10) showed that no significant differences were observed among treatments in chemical composition of eye muscle, heart and kidney of the experimental animals. However, protein contents of spleen and liver were significantly ($P<0.05$) higher in T_5 compared with T_1. Ash content of spleen and liver were significantly ($P<0.05$) higher in T_1 than in T_3 and T_5.

It should be noticed that the high levels of SDRC (T_4 & T_5) recorded significant higher values of water holding capacity than control. Lasalocid treated groups recorded higher values of water holding capacity than untreated groups within both the low and high levels of SDRC. No significant differences were observed among treatments in tenderness.

CONCLUSION

It could be concluded form the results of present study that SDCR can be use as component of the rations of growing Friesian calves and the crude protein may replace up to 40% without any adverse effects on the production traits. Moreover, lasalocid at level 0.3 gm/kg together with 20 % crude protein replacement using SDCR improved the weight gain of the Friesian calves.

Table (8): Effect of SDRC[1] and lasalocid on feed conversion and economic efficiency.

Items	Treatments						Periods			
	T_1	T_2	T_3	T_4	T_5	±SE	P_1	P_2	P_3	±SE
DMI/kg gain (kg)	6.81	6.29	5.96	6.08	5.99	0.21	5.62[b]	5.41[b]	7.65[a]	0.17
OMI/kg gain (kg)	5.84	5.43	5.14	5.18	5.11	0.18	4.85[b]	4.62[b]	6.56[a]	0.14
TDNI/kg gain (kg)	3.85[a]	3.29[b]	3.12[b]	2.92[b]	2.88[b]	0.11	2.87[b]	2.79[b]	3.98[a]	0.08
CPI/kg gain (gm)	765.3	751.34	711.13	770.09	759.76	26.96	684.31[b]	641.30	928.95[a]	20.89
Price of gain/cost of feed: (Economic efficiency)	1.46[c]	1.87[bc]	1.97[abc]	2.43[a]	2.37[ab]	0.11	2.29[a]	2.21[a]	1.56[b]	0.09

Sun-dried rumen contents, a, b and c: means of different letters in the same raw are significant different (P<0.05).

Table (9): Effect of SDRC[1] and lasalocid on carcass characteristics.

Items	Treatments (T)					± SE
	T_1	T_2	T_3	T_4	T_5	
Y1	52.60	52.20	53.20	52.55	52.30	0.225
Y2	55.05	54.50	55.40	54.85	54.70	0.235
Y3	62.20	62.35	63.85	63.60	62.50	0.425
Y4	65.10	65.05	66.55	66.40	65.40	0.362
Y5	81.65^{ab}	79.56^{b}	82.60^{a}	81.50^{ab}	81.15^{ab}	0.392
Y6	87.05	84.05	86.85	85.75	85.75	0.680
Y7	114.00	120.00	104.35	108.25	120.35	4.0117
pH	5.85^{ab}	5.75^{ab}	5.95^{a}	$5.55b^{c}$	5.30^{c}	0.063
Color intensity	0.258^{b}	0.289^{a}	0.283^{ab}	0.271^{ab}	0.263^{ab}	0.005
Water holding capacity (cm^2)	9.05^{b}	8.45^{b}	12.35^{a}	10.85^{a}	12.40^{a}	0.293
Tenderness (cm^2)	4.35	4.55	5.35	5.00	5.25	0.205

[1]Sun-dried rumen contents, a, b and c: means of different letters in the same raw are significant different ($P<0.05$).
Y1: Dressing % on fasting weight without offals.
Y2: Dressing % on fasting weight + edible offals.
Y3: Dressing % on empty body weight without offals.
Y4: Dressing % on empty body weight + edible offals.
Y5: Boneless meat % without offals.
Y6: Boneless meat % + edible offals.
Y7: Eye muscle area (cm^2).

Table (10): Chemical composition of eye muscle, spleen, liver, heart and kidney of the experimental animals.

Items	Treatments (T)					± SE
	T_1	T_2	T_3	T_4	T_5	
			Eye muscle			
Dry matter	23.80	24.55	23.65	23.80	23.95	0.160
Protein	79.70	80.10	80.20	80.15	80.25	0.235
Ether extract	15.20	14.90	14.80	15.00	14.95	0.086
Ash	5.10	5.00	5.00	4.85	4.80	0.280
			Spleen			
Dry matter	20.20	17.70	19.90	19.80	19.95	0.291
Protein	79.55^{b}	79.95^{ab}	80.20^{ab}	80.05^{ab}	80.65^{a}	0.148
Ether extract	7.80	7.95	8.00	7.90	7.90	0.169
Ash	12.40^{a}	12.10^{ab}	11.80^{bc}	12.05^{ab}	11.45^{c}	0.105
			Liver			
Dry matter	26.30	26.10	26.85	27.10	27.55	0.285
Protein	78.20^{b}	78.45^{ab}	80.20^{ab}	80.20^{ab}	80.65^{a}	0.413
Ether extract	6.60	6.30	5.80	5.80	5.65	0.313
Ash	15.20	15.45	14.00	14.00	13.70	0.314
			Heart			
Dry matter	23.65	23.90	24.00	24.10	24.60	0.169
Protein	79.95	80.75	80.50	80.75	80.75	0.276
Ether extract	15.20	14.95	14.95	14.75	14.70	0.252
Ash	4.85	4.30	4.55	4.50	4.55	0.363
			Kidney			
Dry matter	23.10	23.45	22.95	23.35	22.95	0.369
Protein	74.00	73.85	74.70	74.15	73.80	0.448
Ether extract	16.80	17.20	16.95	16.85	17.30	0.217
Ash	9.20	9.00	8.35	9.00	8.90	0.356

a and b: means of different letters in the same raw are significant different ($P<0.05$).

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تأثير إدخال محتويات الكرش المجففة شمسيا واللاسالوسيد فى علانق العجول الفريزيان على الأداء ومقاييس الكرش والدم وخصائص الذبيحة.

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أجريت هذه التجربة على 30 رأسا من العجول الفريزيان النامية وزعت عشوانيا على (5) مجاميع (6 عجول/معاملة) وكان متوسط الوزن الابتدائي هو 155.8 كجم وقسمت المجاميع التجريبية كالتالي:

1- المجموعة الأولى : مقارنة لم تحتوى عليقتها على أي إضافات تجريبية.
2- المجموعة الثانية والثالثة: استبدل فيها 20 % من بروتين العليقة ببروتين محتويات الكرش المجفف شمسيا.
3- المجموعة الرابعة والخامسة: استبدل فيها 40 % من بروتين العليقة ببروتين محتويات الكرش المجففة شمسيا. المجموعة الثالثة والرابعة احتوت على منشط نمو لاسالوسيد بمعدل 0.3 جم/كجم مادة مركزة.

و كانت النتائج كما يلي:

- كانت معاملات الهضم للمادة الجافة والمادة العضوية والبروتين الخام والدهن والمستخلص الخالي من الازوت للمجاميع المعاملة أعلى من المجموعة المقارنة.
- بالنسبة لمقاييس الكرش فقد زادت كل من الـ pH والأمونيا والنيتروجين الكلي والنيتروجين غير البروتيني والبروتين الحقيقي والأحماض الدهنية الطيارة بزيادة محتويات الكرش في العليقة.
- لم يلاحظ فروق معنوية بين المجموعة المقارنة والمستوى المنخفض (المجموعة الثانية والثالثة) لمحتويات الكرش فى كل من بلازما البروتين الكلى والجلوبيولين ، المستوى المرتفع لمحتويات الكرش (المجموعة الرابعة والخامسة) أظهرت قيما أعلى معنويا من المستوى المنخفض والمقارنة فى كل من بلازما البروتين الكلي والألبومين. ولم تكن هناك اختلافات معنوية بين المجاميع المختلفة فى كل من ألبيومين الدم واليوريا.
- أدت محتويات الكرش إلى تحسين معدل النمو اليومي والكفاءة التحويلية والكفاءة الاقتصادية في المجاميع المعاملة.
- أدى اللاسالوسيد إلى تحسين كل من الكفاءة التحويلية والكفاءة الاقتصادية للمجاميع المعاملة.
- لم تكن هناك اختلافات معنوية بين المجاميع المختلفة فى كل من نسبة التصافي ونسبة التشافي ومساحة العضلة العينية والطراوة والتركيب الكيماوي لكل من العضلة العينية والقلب والكلية.