

IMPACTS OF NATURAL SAPONIN PLANT EXTRACT WITHOUT OR WITH FRESH BAKER'S YEAST IN BUFFALOE HEIFERS RATIONS ON NUTRIENTS DIGESTIBILITY, SOME RUMINAL FERMENTATION AND BLOOD SERUM PARAMETERS.

Abdelmawla, S. M. S.

Animal production Dept., Faculty of Agric., Ain Shams University, Hadaek Shoubra 11241. Cairo, Egypt.

ABSTRACT

In a trial lasted for 90 days to assess the impacts of a saponin plus glyco components (defaunator and ammonia binder) containing plant extract SCPE without or with fresh *compressed (Baker's) saccharomyces cerevicia* yeast culture (FSCYC) (a probiotic) were used as feed additives to enhance rumen fermentation in buffalo heifer rations. Twenty buffalo heifers of an average weight of (248) Kg were allotted to four groups of five animals in each according to age and assigned at random to receive one of four dietary treatments. The treatments were: T1, received the basal ration BR (Control) that consisted of concentrate feed mixture: Egyptian berseem : rice straw (50:25:25 on dry matter basis), T2, received the BR plus 800 mg of saponin containing extract, T3, received the BR plus 800 mg saponin plus 10 g (FSCYC), and T4 received the BR plus 800 mg saponin plus 20 g FSCYC.

Results of the supplementation with saponin only (T2) improved ($P<0.05$) digestibility of organic matter (OM) , ether extract (EE) and nitrogen free extract (NFE), while the introduction of FSCYC at 10 or 20 g rates improved ($P<0.05$) nutrients digestibility for all nutrients in T4, and T3 as compared to T2 and the control. The T4 group maintained its superiority ($P<0.05$) above all groups for all nutrients except for DM digestion. Ruminal fluid pH tended to decrease with the introduction of additives in heifers rations where T4 was the lowest ($P<0.05$). Ruminal ammonia-N concentration for the saponin only, T2 group, exhibited the lowest ($P<0.05$) ruminal pH, while the control group was the highest. Total volatile fatty acids (TVFA's) highest concentration was recorded for T4 while the control group was the lowest ($P<0.05$). Heifers rations enrichment with SCPE and the FSCYC increased ($P<0.05$) blood serum total proteins, albumin (A) and globulin (G) and A/G ratio, where T4 was the highest and the control was the lowest. However additives introduction in the rations decreased ($P<0.05$) serum urea, creatinine, cholesterol, GOT and GPT, where T4 was the lowest ($P<0.05$) and the control was the highest ($P<0.05$).

It could be concluded that ration supplementation with saponin containing natural plant extracts plus 10 or 20 g's of FSCYC for buffalo heifers positively increased nutrient digestibility, with ruminal and blood serum indicator parameters were within the normal ranges for these biologics in buffaloes.

Keywords: fresh baker's *Saccharomyces cerevicia* yeast, natural saponin plant extract, buffalo heifers, nutrients digestibility, rumen fermentation parameters, blood .

INTRODUCTION

Many feed additives have been developed to improve the efficiency of nutrient utilization through decreasing the total amount of methane or ammonia -N produced, among which ionophore antibiotics have been very

successful (Hutjens, 1992). Legislators in Europe have moved to prohibit the use of growth-promoting antibiotics in animal feeds from the end of the year 2005 (Chesson, 2004). This decision was based on public and political concerns that the heavy use of antibiotics in general can give rise to transmissible resistance factors that can compromise the potency of therapeutic antibiotics in man. Whether many of the commonly-used growth promoters present such a threat is the subject of intense debate; nevertheless, livestock producers in many countries must face a future without antibiotic growth promoters. For this reasons, there is substantial interest in evaluating the potential of natural antimicrobials such as plant extracts, generally recognized as safe for human consumption (FDA, 2004), to modify rumen microbial fermentation. Many alternative additives that would improve the efficiency of nutrient use in the rumen are plant produced secondary metabolites such as phenolic compounds, essential oils, and sarsaponins (Chesson *et al.*, 1982; Wallace *et al.*, 1994; Kamel, 2001) that affect microbial activity.

Because protozoa in the rumen cause protein turnover by preying on bacteria, and in fact, 8 to 12% of the digestible energy ingested by ruminants is lost in the rumen as methane, whereas from 75 to 85% of the N consumed by dairy cows is excreted in feces and urine (Tamminga, 1992), defaunation increases the nitrogen utilization of the ruminant and may lead to an increase in growth, milk, or wool production. Defaunation is the selective removal of protozoa from the rumen microbial ecosystem by a cell membrane cholesterol-saponin interaction, which causes cell rupture. The growth-promoting effect was evident in the high roughage diet suggesting that the application of saponins or saponin-containing plant materials may be beneficial for the subsistence farmers in developing countries, Wina *et al.*, (2005). Also, Wina *et al.*, (2005) reported that saponins, the steroid or triterpene glycoside compounds were found in a variety of plants. Some saponin-containing plants, mainly legumes. The beneficial effects of saponins numerous, the defaunation of rumen and manipulation of the end products of fermentation are good examples.

Historically, bacteria and yeasts have served man very well in agriculture and nutrition. Well-known examples are the use of bacteria (mainly lactic acid bacteria) for production of silage, and the use of yeasts (mainly *Saccharomyces cerevisiae*) for production of bread and other important products for the life of human beings. Today, modern animal nutrition has at its disposal a whole range of defined strains of probiotics belonging to the groups of lactic acid bacteria, Bacillus spores and yeasts (Hutjens, 2005).

The rumen is the key compartment for the ruminant to breakdown the plant structure to produce energy available for the host animal, in the form of volatile fatty acids (VFA: acetate, propionate, butyrate) (Russell, 2002).

Also, live yeasts have a documented efficacy on intestinal villi height and crypt depth, enhancing the assimilation of nutrients, and enhance modulation of the immune system by stimulation of Ig-A response to pathogens (Qamar *et al.*, 2001).

Inclusion of yeast culture (*Saccharomyces cerevisiae*) in the diets of ruminants has been shown to increase nutrient digestibilities (Dawson, 1993, El-Waziry *et al.*, 2000, El-Ashry *et al.*, 2001, El-Talty 2001, and Marghany *et al.*, 2005), shift bacterial populations (Harris and Lobo, 1988 and Hutjens 2005), increase the number of ruminal bacteria (Dawson 1993, Edwards *et al.*, 1991; and Hutjens 2005), alter the flow of nitrogen fractions to the duodenum (Erasmus *et al.*, 1992, Harrison *et al.* 1988 and Wina *et al.*, 2005), and increase milk yield (Robinson and Garrett, 1999, Dann *et al.*, 2000, El-Ashry *et al.*, 2001, and Marghany *et al.*, 2006). Moreover, benefits of supplementing ruminant rations with SCYC are: neutralization of certain bacterial toxins (Castagliuolo *et al.*, 1999), adherence of flagellate bacteria, due to the presence of mannose receptors. Pathogens are eliminated by feces (Czerucka and Rampal 2002). Moreover, lactic bacteria, a beneficial flora, are increased, reinforcement of mucosal integrity and intestinal cells.

Therefore, the aim of the present experiment was to study effects of natural liquid containing saponin and glyco components extract (defaunator and ammonia binder) and the baker's SCYC (a probiotic) on feed intake, nutrients digestibility, some rumen and blood serum parameters using buffalo heifers.

MATERIALS AND METHODS

This study was conducted at the Agricultural Experiment Farm Station in Shalakan, at Kaluobeia Province which belongs to The Faculty of Agriculture, Ain Shams University, Cairo, Egypt.

Animals and rations: Twenty buffalo heifers of average live body weight of 248 kg were used in 90 days trial. Buffalo heifers were allotted to four groups of five animals each according to age and assigned at random to receive one of four dietary treatments supplemented without or with the additive Fresh baker's *Saccharomyces cerevisiae* yeast culture FSCYC. The Fresh SCYC containing total cell count of $2.5-2.7 \times 10^{10}$ and viable cell count of $1.3 \times 10^9 - 2 \times 10^{10}$ per gram (Grand Cairo Bakeries Company, Yeast Factory, Alsalam City, Cairo, Egypt). The second additive (saponin extract liquor) was a 50:50 (v/v) mixture of *Mohave Yucca* and *Quillaja saponaria* desert plants concentrated extracts from Nor-Feed, Denmark.

The experimental treatments were: (T1) - The control group received the basal ration BR, (T2) received the BR+ 800 mg saponin liquor (SL); (T3) - received the BR +10gm's+800 mg SL and (T4) - received the BR+ 20 gm's FSCYC+SL. The control ration consisted of concentrate feed mixture (CFM) : Egyptian berseem (EB) : rice straw (RS); (50: 25 : 25, dry matter basis). The CFM consisted of 25% undecorticated cotton seed cake, 35% wheat bran, 30% corn, 3% rice bran, 3% molasses, 2% limestone, 1% urea and 1% salt (NaCl). The natural extract from the desert plants *Mohave Yucca* and *Quillaja saponaria*, contain saponins and glyco components - which has been classified as natural feed flavoring materials (Valdez *et al.*, 1986), it is classified as a food grade material, it is non-toxic and highly biodegradable.

The extract is approved for use in food and beverages by the FDA under CFR 172.510, FEMA number 3121.

The chemical composition of the ration ingredients is shown in Table (1).

Management: Daily feeds were assessed to cover the requirements (of the heifers according to Shehata, (1970). The CFM was individually weighed for each animal and offered at 6.00 and 16.00 hr, while roughages were offered at 8.00 and 14.00 h. after accessing the animals to fresh water at 7.00 and 15.00 hr. The daily supplementary yeast was mixed with CFM twice daily just before feeding to ensure that each animal had consumed its own dose of additive. Saponin containing liquor dose were mixed with drinking water for each group in the drinking pool at times of water drinking. The treatments were extended for 90 days.

Table (1): The experimental feed ingredients (Concentrate feed mixture CFM, Berseem forage, Rice straw, (RS), and the fresh Saccharomyces Cerevisia yeast culture (FSCYC)* and the basal diet nutrients content.

Item	Dry matter (DM)	Organic matter (OM)	Ash	Crude protein (CP)	Crude fiber (CF)	Ether Extract (EE)	Nitrogen free extract (NFE).
CFM	92.6	90.1	9.0	14.1	13.4	2.7	59.9
Berseem	12.3	88.2	11.8	13.8	27.3	2.6	46.9
Rice straw	94.53	83.39	16.6	3.5	31.5	1.5	40.1
Fresh baker's yeast FSCYC	29.0	92.6	7.4	44.3	6.5	3.0	38.8

*S C Saccharomyces cerevisia (Compressed of fresh yeast).

Digestibility trials: Trial experimental periods were setup into three phases representing the first, second and third months of the trial study. By the end of each of the three months of the experimental periods, three animals from each experimental group were used in the digestibility trial. Feces was hand collected at 10.00 a. m. employing and following the Grab sample method for three successive days from each animal. The acid insoluble ash as internal marker was measured for determining the digestibility (Van Keulen and Young, 1977). Proximate chemical analysis was carried out according to the A. O. A. C. (1995) procedures, which were employed for the digestibility coefficients of studied nutrients calculations.

Sampling and analysis of rumen liquor: Rumen liquor (RL) samples were collected at the end of each month of the trial's three month periods, from the animals in the morning right before feeding (0 hour, (hr.), 2, 4, 6 hours (hrs.) post morning feeding using a rubber stomach tube with a vacuum pump . Rumen liquor was strained through 4 layers of cheese cloth. The strained RL samples were divided into two portions, the first was for immediate determination of ruminal pH using a digital pH meter (EH-7010) and ammonia nitrogen was determined according to Conway (1962). The second portion was saved in glass bottles and treated with 0.5 milliliter toluene and 1 milliliter paraffin oil as preservatives and stop microbial fermentation activities, well sealed and kept frozen at -20 OC for later analyses. The

ruminal total volatile fatty acids (TVFA's) were determined in the strained RL according to Warner (1964).

Sampling and analysis of blood serum : Blood samples were withdrawn, at the end of month of the trial's three month periods, from the jugular vein from each animal 4 hours (hrs.) post morning feeding (pmf.). Collected blood samples were centrifuged at 4000 r.p.m. for 20 min. and the blood serum was stored in clean glass vials at -20°C till analysis. Serum total proteins were determined as described by Armstrong and Carr (1964), albumin (Dumas *et al.*, 1971), urea (Patton and Crouch, 1977), and creatinine was determination Husdan (1968), transaminases (GOT and ,GPT) activities (Reitman and Frankel, 1957), cholesterol (Kostner *et al.*, 1979). Globulin and albumin/globulin ratio (A/G) were calculated.

Analysis of feed samples: Samples of CFM, Egyptian Berseem, Rice Straw and Fresh baker's yeast were analyzed for dry matter (OM), ash crude protein (CP), crude fiber (CF) and ether extract (EE) according to A. O. A. Q (1995). Nitrogen-free-extract (NFE) was calculated by differences.

Statistical analysis: The ANOVA for a two-way classification design employing the general linear model procedure of SAS (Statistical Analysis Systems) with the model being:

$$Y_{ijk} = U + T_i + e_{ik} + A_j + (T A)_{ij} + E_{ijk},$$

Where: Y_{ijk} : is the parameter under analysis of the ijk buffalo,

U : is the overall mean,

T_i : is the effect due to treatment,

e_{ik} : is the effect due to the animals within treatment, (treatment error),

E_{ijk} : is the effect due experimental error associated with the Y_{ijk} observation, according to Snedecor and Cochran, (1982).

RESULTS AND DISCUSSION

Nutrients digestibility: The results shown in Table (2) showed that the supplementation with saponin only (T2) improved ($P < 0.05$) digestibility of organic matter (OM) , ether extract (EE) and nitrogen free extract (NFE), while the introduction of FSCYC at 10 or 20 gm's FSCYC rates improved ($P < 0.05$) nutrients digestibility for all nutrients in T4, and T3 as compared to T2 and the control. The group of T4 (Saponin+20 g FSCYC) maintained its superiority ($P < 0.05$) above all groups for all nutrients except for DM digestion. These results could be attributed to the suppression of ruminal protozoa, where the saponins are considered to have detrimental effects on protozoa through their binding with sterols present on the protozoal surface, while sterols are absent on bacterial membranes. (Hussain and Cheeke, 1995), and activation of ruminal bacteria which lead to decreasing methane emissions that would also lead to improved energy retention in the animal (Davidson and Naidu (2000), Wallace, (2007), and Busquet *et al.*, (2006). The results exhibited that the additives enhanced the utilization of crude fiber, ether extract, and nitrogen free extract, which can be attributed to the increase in the production of VFA's which also may be attributed to the

enhancement of cellulolytic bacteria and its functions, These results are also supported by the findings of Hutjents (2005) who reported that yeast (a probiotic) and the natural extract from yucca plant (defaunator and ammonia binder) in ruminant rations supply metabolic compounds that destroy undesirable organisms, provide enzymes improving nutrient availability, or detoxify harmful metabolites.

Table (2): Mean values of live body weight, dry matter (DM) intake (I), nutrients digestibility and nutritive value of experimental rations fed to buffalo heifers.

ITEM	Experimental treatments				
	Control T1	T1+Saponin (sap.) T2	T1 + Sap+ 10 g yst T3	T1 +Sap+20 g yst T4	± SE
LBWT (Kg)	270	236	217	269	
DM intake:					
Total (Kg/head/day)	10.0	10.0	9.7	9.7	
Total % LBWT	2.48	2.98	3.25	2.6	0.177
From CFM	5.0	5.0	4.9	4.9	
From berseem	2.5	2.5	2.4	2.4	
From rice straw	2.5	2.5	2.4	2.4	
NUTRIENTS DIGESTIBILITY(%):					
Dry matter	67.23 ^b	67.87 ^b	75.36 ^a	76.32 ^a	0.290
Organic matter	69.43 ^d	73.35 ^c	77.56 ^b	79.53 ^a	0.185
Crude protein	66.44 ^c	67.69 ^c	69.84 ^b	72.11 ^a	1.259
Crude fiber	57.68 ^c	58.70 ^{cb}	58.98 ^b	60.80 ^a	0.273
Ether Extract	65.35 ^d	67.50 ^c	69.70 ^b	76.90 ^a	0.241
Nitrogen free extract	68.60 ^c	69.74 ^b	69.96 ^b	73.10 ^a	0.111

*Each value is a mean 3 animals; SE= Standard error of means; CFM=Concentrate feed mixture;

^{a,b,c,d} Values in the same raw with different superscripts differ (P<0.05) significantly

The improvement of CP digestibility (P<0.05) especially in T3 and T4 groups (saponin+FSCYC supplementation) which may be attributed to effect of saponin extract as reported by Makkar and Becker, (1997) where they found that saponins extract from plant Quillaja increased the efficiency of in vitro rumen-microbial protein synthesis and decreased degradability of feed protein. It is also important to mention that the inclusion of yeast culture *Saccharomyces cerevisiae* in the diets of ruminants has been shown to increase nutrient digestibilities (Dawson,1993), shift bacterial populations (Harrison *et al.*, 1988), increase the number of ruminal bacteria (Dawson 1993, and Edwards *et al.*, 1991), and alter the flow of nitrogen fractions, also, independent of the diet offered, a consistent effect of elimination of protozoa is a larger availability of amino acids for absorption at the small intestine - amino acids of bacterial origin (Ushida *et al* 1988) and sometimes dietary origin (Michalowsky, 1988) to the duodenum (Erasmus *et al.*, 1992, and Harrison *et al.*, 1988).

Wherever protozoa consume large quantities of bacteria in the rumen. The protein breakdown which results, causes the net yield of microbial protein resulting from rumen fermentation to be decreased by up to

50%. If the protozoa could be suppressed, there would be less ammonia formation and less need for dietary protein supplementation (Wallace, 2007).

Ruminal parameters: Ruminal fluid pH values (Table 3) tended to decrease with the introduction of additives in heifers rations where T4 was the lowest ($P<0.05$) which might be the result of the high ($P<0.05$) conc. of VFA's produced in the rumen, these results are similar with those reported by Soliman, *et al.*, (1997) on sheep received saponin powdered extract from *Yucca schidigera* at 500 mg/h/d on sheep.

Table (3): Mean values of the rumen fluid parameters, pH, Ammonia, and Volatile fatty acids withdrawn from the growing buffalo heifers at 0, 2, 4, 6 hours post morning feeding.

ITEM	Experimental treatments				
	Control T1	T1+Saponin (sap.) T2	T1 + Sap+ 10 g yst T3	T1 +Sap+20 g yst T4	± SE
Ruminal fluid pH:					
0 hour	6.88 ^a	6.12 ^b	6.29 ^b	5.88 ^c	0.125
2 hours	6.70 ^a	6.40 ^b	6.43 ^b	6.20 ^c	0.125
4 hours	6.90 ^a	6.00 ^b	5.72 ^c	5.70 ^c	0.125
6 hours	6.40 ^a	5.50 ^b	5.50 ^b	5.20 ^c	0.125
Ruminal ammonia-N, mg/100 ml.:					
0 hr.	13.69 ^a	12.18 ^c	12.59 ^b	11.78 ^d	0.297
2 hrs.	14.20 ^b	13.48 ^c	14.75 ^a	13.60 ^c	0.297
4hrs.	13.55 ^b	12.29 ^c	14.52 ^a	13.10 ^b	0.297
6 hrs.	17.59 ^a	15.39 ^b	15.40 ^b	14.65 ^c	0.297
Total Volatile fatty acids, mmol/ml.:					
0 hr.	77.80 ^c	83.10 ^b	83.20 ^b	85.30 ^a	0.630
2 hrs.	86.20 ^c	86.30 ^c	86.80 ^b	89.70 ^a	0.970
4 hrs.	82.50 ^c	84.20 ^b	84.70 ^b	87.50 ^a	0.330
6 hrs.	76.20 ^d	79.60 ^c	82.20 ^b	85.70 ^a	0.440

*Each value is a mean 3 animals; SE= Standard error of means; CFM=Concentrate feed mixture;

^{a,b,c,d} Values in the same raw with different superscripts differ ($P<0.05$) significantly.

Ruminal ammonia-N: Ammonia-N concentration for the (only saponin supplemented group (T2), exhibited the lowest ($P<0.05$) ruminal pH, while the control group was the highest. The reduction in ammonia-N in (T2) may be attributed to the effect reported by Hussain and Cheeke, (1995) who stated that the extract from *Yucca* desert plant can also bind NH_4 when ruminal NH_4 concentrations are high, and release it again when ruminal NH_4 is low, providing a continuous and adequate supply of NH_4 for microbial protein synthesis, which is supported in this study with addition of fresh yeast culture to the diets (T3, and T4) who achieved the highest ($P<0.05$) nutrients digestibility coefficients, (Soliman *et al.*, (1997), Dolezal and Dolezal (2005) and Jin *et al.*, (2007).

Ruminal total volatile fatty acids (TVFA's) highest concentrations (conc.) was recorded for T4 while the control group was the lowest. ($P<0.05$) which is supported by Dolezal and Dolezal, (2005)

Blood serum parameters: Results in Table (4) exhibited that heifers rations enrichment with additives (saponin or saponin+ FSCYC) showed increased ($P<0.05$) blood serum total proteins, albumin (A) and globulin (G) and A/G ratio, where T4 was the highest and the control group was the lowest.; however our additives introduction in rations decreased ($P<0.05$) serum urea, creatinine, cholesterol, GOT and GPT, where T4 was the lowest and the control was the highest. It is evident from our results that supplementation of saponin caused reduction ($P<0.05$) in heifers blood serum cholesterol which is supported by the study on the Masai people of East Africa who have low serum cholesterol levels despite a diet rich in animal fat. A number of studies, such as those of Malinow *et al.* (1977), have shown that alfalfa saponins have hypocholesterolemic activity in nonhuman primates. A number of synthetic saponins have been shown to be cholesterol absorption inhibitors (Harwood *et al.*, 1993; Morehouse *et al.*, 1999), causing reduction in plasma low-density-lipoprotein cholesterol fractions. Although it is generally accepted that the principal action of saponins on blood cholesterol is by sequestration of cholesterol and bile acids in the intestine, thus preventing the cholesterol from being recycled again into the blood stream again (Cheeke and Otero (2005) and Cheeke *et al.*, (2006).

Table (4): Mean values of the blood serum parameters of the growing buffalo heifers.

ITEM	Experimental treatments				± SE
	Control T1	T1+Saponin (sap.) T2	T1 + Sap+ 10 g yst T3	T1+ Sap+20 g yst T4	
Total proteins, g/dL	7.45 ^d	8.11 ^c	8.73 ^b	8.85 ^a	0.12
Albumin, g/dL.	3.97 ^d	4.45 ^c	4.90 ^b	5.00 ^a	0.08
Globulin, g/d/L.	3.48 ^d	3.66 ^c	3.83 ^b	3.85 ^a	0.03
Alb/glb ratio	1.14 ^d	1.22 ^c	1.28 ^b	1.30 ^a	0.02
Urea-N, mg, d/L.	35.45 ^a	32.35 ^b	28.74 ^c	22.65 ^d	1.31
Creatinine, mg/dL.	1.63 ^a	1.58 ^b	1.41 ^c	1.20 ^d	0.04
Cholesterol, mg/dL.	161.35 ^a	140.67 ^b	145.67 ^c	116.20 ^d	3.64
GOT, IU/L.	43.69 ^a	42.34 ^b	38.68 ^c	34.79 ^d	0.69
GPT, IU/L.	26.48 ^a	25.73 ^b	23.66 ^c	20.35 ^d	0.50

*Each value is a mean 3 animals; SE= Standard error of means; CFM=Concentrate feed mixture;

^{a,b,c,d} Values in the same raw with different superscripts differ ($P<0.05$) significantly.

Another possible mode of action is via increased intestinal cell turnover rate. An increased rate of exfoliation of intestinal cells caused by the membranolytic action of saponins could result in increased loss of cell membrane cholesterol contained in the exfoliated cells (Gee and Johnson, 1988). The reduced level of serum urea might be a result of the increased efficiency of utilizing diet and microbial proteins due to the effects of saponin and FSCYC supplementation. The results of GOT and GPT point out to normal livers functioning of the heifers.

It could be concluded that ration supplementation with saponin containing natural plant extracts plus 10 or 20 gm's of FSCYC for buffalo heifers positively improved nutrient digestibility, with ruminal and serum

indicator parameters were within the normal ranges for these biologics of buffaloes reported by El-Ashry *et al.*, (1994) and El-Ashry, *et al.*,(2001).

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تأثير مستخلص الصابونين النباتي الطبيعي بدون أو مع خميرة الخباز الطرية الطازجة في علائق عجلات الجاموس على هضم العناصر الغذائية ، وعومل التخمر في الكرش ، وعلى بعض عوامل سيرم الدم.

سليمان محمد سليمان عبد المولى

قسم الإنتاج الحيواني - كلية الزراعة - جامعة عين شمس - حدائق شبرا 11241 .

في تجربة إستمرت 90 يوما لتقدير آثار إستخدام مستخلص الصابونين النباتي الطبيعي بمفرده أو مع خميرة الخباز الطرية الطازجة في علائق عجلات الجاموس . إستخدم 20 عجلة جاموسى بمتوسط وزن حى (248 كجم. وزعت الحيوانات على 4 مجموعات من خمس حيوانات تبعا للعمر ثم وزعت عشوائيا على أربعة معاملات العلائق التجريبية . وكانت المعاملات التجريبية متمثلة في: T1 مجموعة المقارنة وغذيت على العليقة القاعدية (تكونت من علف مركز مكعبات:برسيم مصرى:قش أرز بنسبة 50:25:25 على أساس المادة الجافة) ، T2 تلقت العليقة القاعدية+800 ملليجرام (مجم) صابونين ، T3 تلقت العليقة القاعدية+ 800 مجم صابونين+10 جم خميرة خباز طرية طازجة ، ثم T4 التى غذيت على العليقة القاعدية+800 مجم صابونين+20 جم خميرة خباز طرية طازجة.

أظهرت نتائج المجموعة الثانية (800 مجم صابونين) T2 تحسن هضم المادة الجافة والدهن الخام والمستخلص خالى النيتروجين ($P<0.05$). أوضحت النتائج أن إمداد الحيوانات بمستخلص الصابونين بدون أو مع 10 أو 20 جم من خميرة الخباز الطرية أدى إلى تحسن ($P<0.05$) معاملات هضم العناصر الغذائية للمعاملات T2, T3, T4 مقابل مجموعة المقارنة.

أدت الإضافات إلى زيادة ($P<0.05$) تركيز عوامل الدم: البروتين الكلى ، الألبومين ، الجلوبيولين ونسبة الألبومين إلى الجلوبيولين ، وأدت إلى نقص ($P<0.05$) اليوريا والكرياتينين والكوليستيرول وال GOT و ال GPT .

تفوقت مجموعة T4 محققة أعلى ($p<0.05$) القيم لمعاملات هضم العناصر الغذائية ، كما أنها أظهرت أعلى تركيز ($P<0.05$) لعوامل سيرم الدم : البروتين الكلى ، والألبومين والجلوبيولين ، وأقل تركيز ($P<0.05$) لليوريا والكوليستيرول وال GPT وال GOT مقابل المجموعات الأخرى. أعطت مجموعة T2 (العليقة القاعدية+800 مجم صابونين) إستجابات أعلى ($P<0.0\%$) لهضم المادة الجافة والدهن الخام والمستخلص الخالى من النيتروجين متفوقة على المجموعة T1 المقارنة ، ولكنها لازالت أقل ($P<0.0\%$) من قيم أداء المجموعات T3 , T4 .

أوضحت الدراسة أن العلائق التى أغنيت بإضافة الصابونين مع 10 أو 20 جم من خميرة الخباز الطرية الطازجة حققت أعلى قيم لهضم العناصر الغذائية مع عدم وجود أى آثار غير طبيعية أو مرضية مما ظهر من نتائج عوامل التخمر في الكرش و سيرم الدم التى كانت فى المدى الطبيعي .