J. Animal and Poultry Prod., Mansoura Univ., Vol. 2 (7): 231 - 242*,2011*

EFFECTS OF SEAWEED SUPPLEMENTATION TO DAIRY FRIESIAN COWS' RATIONS ON:
2- MILK YIELD, BLOOD PARAMETERS AND FEED EFFICIENCY.

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ABSTRACT

The effect of supplemented seaweed meal as from *Ascophyllum nodosum* (S) to concentrate feed mixture (CFM) fed together with rice straw (RS) on milk production and composition, some blood constituents, feed efficiency and economic efficiency of lactating Friesian cows was studded. Four lactating Friesian cows were used in a "Swing-over" design, with mean metabolic body size ($BW^{0.75}$) of 98 kg. All animals were in the 2^{nd} to 4^{th} lactation season.

The experimental rations were formulated as follows:

R1: ration 1: 69.3 % (CFM) + 30.7% (RS), (as a control ration).

R 2: ration 2: 68.3% CFM + 30.7 % (RS) + 1.0% (S).

R 3: ration 3: 67.5 % CFM + 31.0 % (RS) + 1.5% (S).

These proportions were chosen to achieve approximately iso-nitrogenous and iso-caloric rations. The obtained results showed that there was no significant effect of experimental rations on total protein concentration of blood serum, protein concentrations were 7.22, 6.87 and 7.44 g / 100 ml for R1, R2 and R3 respectively. Albumin concentration was highest (P<0.05) with R2 and R3 than feeding on R1, while globulin concentration decreased (P<0.05) with supplemented S. Enzyme activity AST decreased (P<0.05) with R2 than R1 or R3, while ALT decreased (P<0.05) with feeding on R2 than R1. Cholesterol concentration was increased (P<0.05) with R2 than R1.

The urea-N concentration ranged from 18.73 to 26.80 mg/100 ml in the blood-serum, and its levels was significantly (P<0.05) increased when feeding on R2 or R3 than R1. The average glucose concentration ranged from 42.2 to 47.7mg/100 ml blood serum, and its level increased when feeding on R2 or R3 than R1, but without significant effect. The average daily fat corrected milk (FCM, 3.5%) yield was higher with feeding on R1 or R3 (17.36 and 19.15 kg/h/d, respectively) than feeding on R2 (16.55 kg/h/d), but without significant differences. Regarding the milk composition, the total solids (TS) was significantly increased (P<0.05) when feeding on R3 than feeding on R1 or R2.

Lactose% significantly increased (P<0.05) when feeding on R3 than R1, while there was no significant effect with feeding on R1 and R2 or R2 and R3. The fat % was higher (P<0.05) when feeding on R1 than R2, but there was no significant effect between R1 and R3 or R2 and R3. The whey protein nitrogen (WPN) or whey protein (WP) concentrations increased (P<0.05) when feeding on R1or R3 than feeding on R2. The feed efficiency was better (P<0.05) with feeding on R3 than R1 and R2, but the economic efficiency was higher (P<0.05) with feeding on R1 than feeding on R2 or R3. So, the price of seaweed must be reduced if the product should have some economical value.

Keywords: Lactating cows, Seaweed, Rice straw, Milk yield, Production efficiency

INTRODUCTION

The small farmers of developing countries have limited resources available for feeding their ruminant livestock. They do not have the luxury of being able to select the basal diet but whatever available at no or low cost. The available resources are essentially low digestibility roughages such as straw and other crop residues. The major criterion for improvement in production is to optimize the efficiency of utilization of the available fodder resources and maximize animal productivity. It is imperative, however, to understand the requirements for supplements that will provide nutrients which will optimize the efficiency of utilization of that feed resource (Leng, 1982).

When diets for the dairy cows are formulated, energy, protein and minerals are often the primary factors to be balanced. A negative energy balance with many dairy cows occurs during the first few weeks of lactation as milk production increases at a faster rate than feed intake. The mineral content of a ration is important for the dairy cow, thus seaweed meal is added as supplement (Weller and Jackson, 2006).

Marine plants have evolved unique biochemical processes and structure in adapting to their chemical, physical, and biological environments.

Seaweed is a totally natural multi-mineral supplement. In contrast to conventional mineral supplements, seaweed is unique in being of plant origin containing a wide range of naturally balanced chelated minerals, trace elements, amino acids and vitamins. Seaweed contains all the minerals and trace elements an animal requires for a normal healthy life. Being totally natural and of vegetable origin seaweed is easily digested and is safely fed to animals of all ages (Sykes, 2009). Seaweed contains laminar an oligosaccharide, which acts as elicitor for β-glucanase. β-glucanase is an important immune stimulator in animals. The chemical compositions of an ordinary seaweed meal, as from Ascaphyllum nodosum, immediately characterize the material as low-energy content.

Scott (1990) found that , in the prevailing conditions 200 g of seaweed meal as from *Ascophyllum nodosum* (fortified with K , P and Cu) seem to be a more effective additive than 100 g of the standard mineral mixture, from his experiment with identical twin cows. The mineral content of 200 g of this seaweed meal is equivalent to that 100 g of the mineral mixture.

The main objective of this study was to evaluate the effect of supplemented seaweed meal to concentrate feed mixture fed together with rice straw on milk production and composition, some blood constituents, feed efficiency and economic efficiency with lactating Friesian cows.

MATERIALS AND METHODS

This study was conducted at El-Karada Animal Production Research Station, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture and Department of Animal Production, Fac. of Agric., Mansoura University.

Experimental animals and rations:

Four lactating Friesian cows were used in "swing-over" design as described by Lucas (1956) and Abou Hussein (1958). The average body weight was about 457, all animals were in the 2nd to 4th lactation season, to study milk production and composition and some blood parameters (Maklad *et al*., 2006). The animals were individually fed according to NRC (2001) recommendations, based on their live body weight and milk yield (requirements for maintenance were 1% of live body weight LBW concentrate +1% of LBW roughage and requirement for lactation was ½ Kg concentrate per 1Kg milk yield).

The experimental rations were formulated as follows:

R 1: ration 1: 69.3 % concentrate feed mixture (CFM) + 30.7% rice straw (RS), (as a control ration).

R 2: ration 2: 68.3% CFM + 30.7 % (RS) + 1.00% seaweed (S).

R 3: ration 3: 67.5 % CFM + 31.0 % (RS) + 1.5% (S).

The experimental rations were formulated to be almost iso-nitrogenous and contained about 13.0 % crude protein as recommended by ∅rskov *et al.* (1972) to ensure maximal rate of fermentation in the rumen. Such value is recommended for dairy cows of medium production level (Ministry of Agriculture, 1996).

The intake of tested ration by cows was fixed and calculated as the percentage of roughage to concentrate ratio to satisfy their maintenance and production requirements (Ghoneim, 1967). The concentrate feed mixture (CFM) used contained 44% yellow corn , 23% soybean meal (44% protein), 14% wheat bran, 11.5% rice bran , 4.5% molasses, 2%, limestone and 1% salt.

The supplement seaweed meal was from *Ascophyllum nodosum* manufactured by Acadian Sea Plants Limited, Canada. The approximate label analysis showed that it contains of protein, fiber, carbohydrates, vitamins and minerals.

The animals were milking by machine twice daily at the morning and evening, about 0.5% of the total milk yield produced were taken for analysis from each animal individually during the experimental periods of the tested rations.

Chemical analysis:

The daily fat, lactose content was assessed as described by Barnett and Tawab (1957), protein, SNF, NCN, NPN, CN, casein, WPN and WP percentage was determined during the experimental periods. In the middle day of each experimental period, daily representative samples were taken at morning and evening then mixed in proportion to yield. The chemical analysis of milk samples was determined according to Ling (1963).

Blood samples were taken from each animal individually during the experimental periods of the tested rations. These samples were taken at 3 hrs post-feeding from jugular vein. Blood samples were immediately separated by centrifugation at 4000 r. p. m. for 10 minutes. The serum samples was stored at (–20^{o}C) until analysis were done. The analysis included total protein (Gornall *et al*, 1949), albumin (Hill and Wells, 1983), globulin (calculated by differences between the total protein and albumin concentrations), urea (Freidman *et al*., 1980), creatinine (Ullmann, 1976), Glucose (Teuscher and Richterich, 1971), AST and ALT (Reitman and Frankel, 1957).

Statistical analysis:.

The statistical analysis was performed using the least squares method described by Likelihood programme of SAS (1994). The obtained data were subjected to one way analysis of variance according to the following model:

$Y_{ij} = \mu + T_i + e_{ij}$

Where: Y = Observation of the tested factor

μ = Overall mean

T_i = Treatment effect

e_{ij} = Error

The differences among means were carried out according to Duncan's New Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Data in Table (1) showed that there were no significant effects on serum total protein, creatinine and glucose concentrations when animals were feeding on the experimental rations. The obtained T.P. values were in the normal rang, but the highest values were recorded with R1 and R3 (7.22 and 7.44 g/100 ml, respectively) and the lowest value with R2 (6.87 g/100ml). The values of serum albumin were higher (P<0.05) when feeding on R2 or R3 than feeding on R1. The values were (2.56, 4.27 and 4.67 g/100 ml) with feeding on R1, R2 and R3 respectively, while the globulin concentration was decreased (p<0.05) with feeding on R2 or R3 (2.6o and 2.77 g/100 ml respectively) than feeding on R1 (4.66 g/100 ml). Urea-N concentration ranged from 18.73 to 26.80 mg/100 ml in the serum, and its level was significantly (P<0.05) increased when animal were feeding on R2 and R3 than feeding on R1. The concentration of urea-N in blood is affected by balance between energy and protein in the diet (Hoffman and Steinhofil, 1990).

The AST and ALT activities were significantly (P<0.05) increased with feeding animals on R1 and R3 than feeding on R2. The higher levels of AST and ALT enzymes could be due to increase of protein utilization and amino acids transamination, (El-Bana *et al.*, 2005).

As shown in Table (1), the serum glucose ranged between 42.2 to 47.7 mg/100 ml with different rations. The mean values were not significant affected by the treatments, however the highest values were recorded when fed on R2 or R3 (47.7 and 47.2 mg/100 ml, respectively) than feeding on R1 (42.2 mg/100 ml).

Increasing starch digestion in the rumen increases the proportion of propionic and produced, which might result in higher energy absorption, higher glucose synthesis in the liver, lower utilization of amino acids (Chen *et al*., 1994), and hence enhanced animal performance.

Witt *et al* (2000) showed that the hourly synchronization of energy and N decreased plasma urea concentration during the day.

Table (1): Effect of experimental rations on some blood serum parameters

Items	Experimental rations				
	R 1	R 2	R 3	SEM	*P*
Total protein (T.P.) g/100ml	7.22	6.87	7.44	0.5148	0.9300
Albumin (A) g/100 ml	2.56^{b}	4.27^{a}	4.67^{a}	0.3781	0.0855
Globulin (G) g/100 ml	4.66^{a}	2.60^{b}	2.77^{b}	0.2664	0.0266
Creatinine (Cr) mg/100 ml	1.35	1.45	1.52	0.0492	0.2545
Urea-N mg/100 ml	18.73^{b}	26.80^{a}	25.33^{a}	0.5521	0.0027
AST IU/L	60.00^{a}	52.67^{b}	59.67^{a}	1.7266	0.1333
ALT IU/L	24.33^{a}	22.33^{b}	23.00^{ab}	0.5091	0.2490
Cholesterol (mg/100 ml)	135.60^{b}	157.43^{a}	153.67^{ab}	3.8169	0.0454
Glucose (mg/100 ml)	42.20	47.70	47.20	4.5981	0.3766

a, b : Means within the same raw with different superscripts are significantly different (P<0.05).

Regarding the milk yield and its composition in Table (2), milk total solid (TS %) was increased (P<0.05) when feeding on R1 or R2. The lactose % and solids non fat (SNF %) were higher (P<0.05) with feeding on R3 than R1, while there was no significant differences between R2 and R1 or R2 and R3. The fat % was increased (P<0.05) when feeding on R1 than feeding on R2, but without significant differences when feeding on R1 or R3 and R2 or R3. The whey protein nitrogen (WPN %) and whey protein (WP %) were significantly higher (P<0.05) when feeding with R1 or R3 than feeding on R2. The milk yield (kg/h/day) and lactose yield (kg/h/day) were higher (P<0.05) when feeding on R3 than R1 or R2.

Wachirapakorn (2004) reported that most dairy raised by small holder farmers in Thailand are cross breeds between Holstein-Friesian and Zebu breed. Most of them produce around 2500 to 3000 kg per lactation. Average milk production of dairy cows is 11 kg/day with 3.95% fat, 3.1% protein, 4.51% lactose, 8.76% solids-non-fat, 12.68% total solids and protein / fat ratio is 0.78.

The presented results were related to rumen fermentation and blood metabolites. Microorganisms convert much of the dietary carbohydrate to VFA, which are absorbed into the blood stream and become the primary source of energy for the cow. The VFA also serve as important building blocks for milk fat, as well as lactose. In early lactation, milk fat content declined from 2.84 to 2.37 % as the concentrate level in the diet was increased from 50 to 75% of dietary dry matter. Protein concentration also increased but protein yield was unaffected as milk yield tended to be lower in cows fed the high concentrate diet. Milk protein to fat ratio ranged 1.09 to 1.45. Reduced milk fat percent has also been attributed to lower ruminal production of fat precursors (acetate and β-OH-butyrate) and on inhibitory effect of methymalonyl COA (produced from propionic acid) on fatty acid synthesis in the mammary gland (Buckley *et al*, 2003).

Table (2): Effect of feeding lactating cows on experimental rations on milk yield and composition

Items	Experimental rations				
	R 1	R 2	R 3	SEM	*P*
Total solids (T.S%)	11.46[b]	11.24[b]	12.94[a]	0.2345	0.0182
Fat%	3.83[a]	2.79[b]	3.51[a b]	0.2624	0.2128
Lactose%	4.03[b]	4.30[a b]	4.60[a]	0.1426	0.1617
Total N	0.49	0.44	0.51	0.0235	0.1993
Protein%	3.10	2.81	3.28	0.1518	0.2050
Solids non fat (SNF%)*	7.96[b]	8.57[a b]	9.45[a]	0.3545	0.2186
Non casein nitrogen (NCN%)	0.17[a]	0.09[b]	0.18[a]	0.0116	0.0275
Non protein nitrogen (NPN%)	0.03[b]	0.03[b]	0.04[a]	0.0025	0.1265
Casein nitrogen (CN%)**	0.32	0.35	0.34	0.0265	0.532
Casein%***	2.04	2.21	2.17	0.1645	0.5222
Whey protein nitrogen (WPN%)****	0.14[a]	0.06[b]	0.13[a]	0.0116	0.0292
Whey protein (WP%)*****	0.87[a]	0.39[b]	0.84[a]	0.0779	0.0403
Milk yield kg/day	16.45[b]	18.76[a]	19.14[a]	0.5924	0.0440
FCM****** kg / day	17.36	16.55	19.15	0.9059	0.2134
Fat yield kg/h/day	0.63	0.52	0.67	0.0482	0.2637
Protein yield kg/h/day	0.51	0.52	0.63	0.0354	0.2247
Lactose yield kg/h/day	0.67[b]	0.81[a]	0.88[a]	0.0386	0.0346
NE (Mcal / kg)	0.68[a]	0.58[b]	0.69[a]	0.0304	0.1886

a, b: Means within the same raw with different superscripts are significantly different (P<0.05). *** Solids non fat (SNF%) = TS – fat**
**** Casein nitrogen (CN%) = TN – NCN** ***** Casein% = CN * 6.39**
****** Whey protein nitrogen% (WPN%) = NCN – NPN ***** Whey protein (WP%) = WPN * 6.39**
******** FCM : Average of dairy production of calculated 3.5% fat corrected milk (Kg/day) = 0.432 x milk (kg) + 16.23 x fat (kg) (Britt *et al*., 2003).**
********* NE (Mcal / kg) = (0.0929 x Fat%) + (0.0547 x Protein%) + (0.0395 x Lactose%) (NRC, 2001).**

Harris and Bachman (1988) showed that feeding extra energy to high producing cows may increase the SNF by about 0-2% units. For example, by increasing levels of concentrate feeding, SNF increased from 8.3 to 8.6%. A higher SNF content in milk is easier to maintain under good feeding and management practices.

Data in Table (3) showed the production efficiency of feeding on R1, R2 and R3. The highest value of production efficiency was recorded with R1 and R3 (84.69 and 84.43% respectively). However the lowest value was with R2 (70.71%).

Data in Table (4) showed the feed efficiency of the feeding R1, R2 and R3. The feed efficiency (as net energy efficiency) was higher (P<0.05) with R3 than R1 or R2. However the lowest prosperity continues to improve and more affluent rations traditionally demand and more foods of animal origin (Roche and Edmeades, 2004). Thus, worldwide consumption of dairy products is increasing, and meeting this demand requires improvements in feed efficiency. High producing cows consume more nutrients and direct these for milk synthesis rather than excessive fattening. Maintenance requirements are relatively constant regardess of milk production level. Thus, high producing cows have a greater nutrient intake in order to support additional milk production, but a larger portion of total nutrient intake is used to synthesize milk (Bauman *et al*., 2004).

Table (3): Production efficiency with lactating cows fed the experimental rations.

Item	R1	R 2	R 3	SEM	*P*
DOM%	60.48[a]	54.94[b]	52.32[b]	1.6340	0.0142
MEI (Mj/d)	168.11	164.90	152.03	10.8127	0.5707
*ME (Mj/d)$_{increment}$	55.60	54.42	50.18	3.5667	0.5704
**ME$_m$ (Mj/kg)	0.96[a]	0.87[b]	0.83[c]	0.0243	0.0107
***ME$_m$ (Mj/d)	16.98	15.24	13.14	1.2509	0.3481
****ME$_p$ (Mj/d)	95.90	95.24	88.74	6.0053	0.5989
****ME$_p$ (Mcal/d)	22.93	22.77	21.22	1.4352	0.5989
*****NE$_p$ (Mcal/d)	14.77	14.67	13.67	0.9232	0.5977
******Milk(FCM)kg/d (calculated)	22.04	21.89	20.40	1.3815	0.5994
Milk(FCM)kg/d (observation)	18.54	15.43	17.16	1.0663	0.3137
*******Production efficiency	84.69	70.71	84.43	5.8112	0.4939

a, b and c : Means within the same raw with different superscripts are significantly different (P<0.05).

DOMD% , MEI (Mj/d) Maklad *et al.,* (2006)

***ME (Mj/d)$_{increment}$ = 33% of MEI VanDeHaar (1998)**

****ME$_m$ (Mj/kg) = 0.016 * DOMD McDonald *et al* (1995) ***ME$_m$ (Mj/d) =ME/kg*DMI**

******ME$_p$ (Mcal/d) = TME - ME$_{increment}$ – ME$_m$ ******NE$_p$ (*Mcal/d) = MEp * 0.644 Moe (1981)**

******** Milk(FCM)kg/d (calculated)= NE$_p$ (Mcal/d) / 0.67 NRC(1989)**

********* Production efficiency% =FCM kg/d / FCM kg/d (calculated)**

Table (4) : Feed efficiency with lactating cows fed the experimental rations.

Item	R1	R2	R3	SEM	*P*
DMI kg/day	18.70	20.69	20.49	0.9994	0.3857
FCM kg/day	17.36	16.55	19.15	0.9926	0.3559
DMI kg/kg FCM	1.07[b]	1.25[a]	1.07[b]	0.0114	0.0009
TDN%	60.41[a]	53.55[b]	49.83[c]	1.062	0.0148
TDN kg/day	11.30	11.07	10.21	0.7259	0.5703
TDN kg/kg FCM	0.65[a]	0.66[a]	0.53[b]	0.0139	0.0141
NED Mcal/kg*	1.36[a]	1.19[b]	1.10[b]	0.0256	0.0140
NEL Mcal/kg**	0.72[a]	0.57[b]	0.68[a]	0.0177	0.0246
NEL / NED%	52.94[b]	47.90[b]	61.81[a]	1.8313	0.0373

a, b and c : Means within the same raw with different superscripts are significantly different (P<0.05)

*** NED (Mcal / kg) = (TDN%) × 0.0245) – 0.12 (NRC, 2001)**

**** NEL (Mcal / kg) = (0.0929 × fat %) + (o.o547 × protein%) + (0.0395 × lactose%) (NRC, 2001)**

The results of return (profit L. E.) in Table (5) showed that the highest return was obtained when feeding on R1 (8.40) than feeding on R2 or R3 (3.11 and 5.85, respectively).

Scott (1990) told that, one has to wonder when kelp is not more widely used. Availability is one factor, another is cost. He hopes that the price will come down as the product becomes more widely known.

On the other hand, Kellems and Church (1998) reported that dietary nutrients densities are minimized when feed consumption in maximized, making it easier to formulate rations that are adequate in nutrients. The amount of feed that a dairy cow consumes is highly correlated to its nutrient intake. Every effort should be made to maximize feed consumption when feeding dairy cattle.

They also showed that the most cost-effective feeding programmes can be implemented when feed consumption is maximized. Maximized feed consumption minimizes the cost of providing required nutrients because higher level of forages and by-product feeds can be incorporated into the ration. The quality of forage has a dramatic effect on feed consumption. Feeding the highest quality forage will maximize feed consumption and nutrient intake and minimize dietary nutrients densities, ration cost and the quantities of concentrates that used to be incorporated into a ration.

Table (5): Economic efficiency with lactating cows fed the experimental rations.

Item	R1	R 2	R 3	SEM	*P*
Average daily feed consumption (as fed)					
Concentrate feed mixture, kg (CFM)	14.67	16.00	15.67	0.7698	0.4080
Seaweed , kg	0.00[c]	0.22[b]	0.34[a]	0.0053	0.0001
Rice straw, kg	6.33	7.00	7.00	0.3849	0.5000
Average daily milk production					
Fat corrected milk Kg FCM	18.54	16.84	19.26	0.9926	0.3559
Price of FCM daily yield (LE)	24.66	22.40	25.26	1.3200	0.3559
Cost of total daily feeds intake / cow	16.26[b]	19.29a[b]	19.77[a]	0.8642	0.1413
Profit (LE)	8.40[a]	3.11[c]	5.85[b]	0.5038	0.0111
Economic efficiency %	52.04[a]	16.09[c]	29.51[b]	1.5626	0.0006

a, b and c : Means within the same raw with different superscripts are significantly different (P<0.05).
Market price Pt./kg of : Concentrate feed mixture = 107.5
FCM = 133 Corn grains = 94 RS = 7.8

From the presented study, it could be concluded that the supplemented 1.5% seaweed of the total dry matter intake when feeding on the concentrate feed mixture as a basal diet in lactating cow rations increased the feed efficiency, but the economic was decreased compared with the control or supplemented with 1% seaweed of the total dry matter. So, the price must come down as the product becomes more used.

On the other hand, to maximize feed consumption and minimize the cost of providing required nutrients, it could supplement seaweed for lactating cow rations when feeding the highest quality forage as a basal diet, while it needs some studies in the future.

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تأثير إضافة الطحالب البحرية فى علائق الأبقارألفريزيان الحلابة على :
2- إنتاج اللبن , قياسات الدم والاستفادة الغذائية.

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أجرى هذا البحث بهدف دراسة تأثير إضافة نسبتين من الطحالب البحرية *Asc*ophyllum nodosum (0 ,1 و 1,5 %) من المادة الجافة المأكولة الكلية على انتاج اللبن ومكوناته وبعض قياسات الدم والاستفادة الغذائية والكفاءة الاقتصادية.

وتم تكوين ثلاث علائق على النحو التالى:
(عليقة أولى) : 3, 69 % مخلوط علف مصنع + 7 ,30 % قش أرز
(عليقة ثانية) : 3, 68 % مخلوط علف مصنع + 7 ,30 % قش أرز + 0 ,1 % طحالب بحرية
(عليقة ثالثة) : 5, 67 % مخلوط علف مصنع + 0 ,31 % قش أرز + 5 ,1 % طحالب بحرية

وتم تكوين الخلطات بحيث تكون نسبة البروتين حوالى 13% هى النسبة التى تلبى احتياجات الحيوانات الحلابة تحت الظروف المصرية وفقا لمقررات وزارة الزراعة المصرية (1996) واستمرت التجربة لمدة حوالى 12 أسبوع استخدم فيها 4 أبقار فريزيان حلابة بين الموسم الثانى إلى الرابع وأجريت التجارب بطريقة العودة الى زى بدء وتم تسجيل اللبن مرتين يوميا مع أخذ عينة بعد مرور أربع اسابيع من بداية التجربة للتحليل وكذلك أخذ عينة دم لإجراء القياسات المطلوبة بعد التغذية بحوالى 3 ساعات

وكانت أهم النتائج المتحصل عليها كما يلى :

1- تشير قياسات الدم إلى عدم وجود فرق معنوى عند التغذية على العلائق المختبرة على تركيز البروتين الكلى (22 ,7 و 87 ,6 و 44 , 7جم / 100 مل عند التغذية على العليقة الاولى والثانية والثالثة على الترتيب) بينما زاد تركيز الألبيومين معنويا (05 و0) عند التغذية على العليقة الثانية والثالثة (27 ,4 و 4,67 حم / 100 مل على الترتيب) مقارنة بالتغذية على العليقة الأولى (56 ,2 حم / 100 مل) وانخفض تركيز الجلبيولين معنويا (05 ,0) (60 ,2 و 77 ,2 حم / 100 مل عند التغذية على العليقة الثانية والثالثة على الترتيب) مقارنة بالتغذية على العليقة الأولى (66 ,4 جم / 100 مل). كما إنخفض نشاط إنزيم AST معنويا (05 ,0) عند التغذية على العليقة الثانية (52,67 وحدة دولية / لتر) مقارنة بالتغذية على العليقة الاولى والثالثة (0 ,60 و 67 ,59 وحدة دولية / لتر على الترتيب).

زاد تركيز الكولسترول معنويا (0,05) (43 ,157 مللجم / 100 مل) عند التغذية على العليقة الثانية مقارنة بالعليقة الاولى (60, 135 مللجم / 100 مل).

زاد تركيز اليوريا معنويا (05 ، 0) عند التغذية على العليقة الثانية والثالثة (8 ,26 و 33, 25 مللجم /100 مل على الترتيب) مقارنة بالعليقة الاولى (73 ،18 مللجم / 100 مل).

لم تظهر فروق معنوية على تركيز الجلوكوز بالدم عند التغذية على العلائق المختبرة ولكن زاد التركيز بالتغذية على العليقة الثانية والثالثة (7 ,47 و 2 ,47 ملجم / 100 مل على الترتيب) مقارنة بالعليقة الأولى (2, 42 ملجم / 100 مل).

2- زاد إنتاج اللبن المعدل اليومى عند التغذية على العليقة الأولى أو الثالثة (36 ,17 و 15 ,19 كجم / يوم على الترتيب) مقارنة بالتغذية على العليقة الثانية (55 ,16 كجم / يوم).

3- زاد تركيز المواد الصلبة معنويا (0,05) بالتغذية على العليقة الثالثة (94 ,12 %) مقارنة بالتغذية على العليقة الأولى أو الثانية (46 ,11 و 24 ,11 % على الترتيب). كما زاد تركيز اللاكتوز معنويا (0,05)عند التغذية على العليقة الثالثة (6 ,4 %) مقارنة بالتغذية على العليقة الأولى (4,03 %).

زاد تركيز الدهن معنويا (0,05) عند التغذية على العليقة الأولى (3,83 %) مقارنة بالتغذية على العليقة الثانية (79 ,2 %) .

4- تحسن معدل الإستفادة الغذائية معنويا على مستوى (0,05) عند التغذية على العليقة الثالثة (81 , 61 %) مقارنة بالتغذية على العليقة الأولى أو الثانية (94 ,52 و 9 ,47 % على الترتيب) بينما إنخفضت الكفاءة الإقتصادية معنويا (0,05) عند التغذية على العليقة الثانية والثالثة (16,09 و 29,51 % على الترتيب) مقارنة بالتغذية على العليقة الأولى (04 ,52 %)

توصى الدراسة أنه عند إضافة الطحالب البحرية لعلائق الحيوانات الحلابه بهدف معظمة الإستفادة من المركبات الغذائية فإنه يمكن إضافة الطحالب البحرية بنسبة تصل الى 5 ,1 % من المادة الجافة المأكولة مع مراعاة خفض ثمن الكجم من الطحالب البحرية لزيادة الكفاءة الإقتصادية عند التغذية على مثل هذه العلائق.

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