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EFFECT OF PROTECTED FAT ON PRODUCTIVE AND REPRODUCTIVE PERFORMANCE OF FRIESIAN LACTATING COWS DURING POSTPARTUM PERIOD

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SUMMARY

The objective of this study was to evaluate the effects of adding protected fat (PF) in the ration of lactating cows on feed intake, digestibility coefficients and rumen activity as well as reproductive performance during the period from calving to six months of lactation. A total of 12 Friesian lactating cows between the 1st and 2nd parity and live body weight (LBW) of 532.7±23.5 kg were used. Cows in the 1st group were fed concentrate feed mixture (CFM) as control (G1), while cows in the 2nd group were fed CFM supplemented with 5% protected fat (G2).

Average daily DM intake was nearly similar in G1 and G2. Average daily TDN intakes were higher in G2 by about 4.7 % than G1. Higher digestibility coefficient was observed in G2 than G1. pH of rumen liquor were higher (P<0.001) in G2 than in G1 (6.06 vs. 5.83), while concentration of VFA's was not significant by treatment (13.63 and 14.15 mEq/100 ml). Concentration of NH_3-N was higher (P<0.0) in G1 than G2. Concentration of acetic acid in rumen liquor of cows of G2 was higher (P<0.001) in G2 than G1, while propunic acid showed a reverse trend (P<0.05). No significant difference was observed between the two studied groups concerning concentration of butiric and isobutiric acids. Changes of LBW was higher (P<0.05) in G2 than G1 (7.73 vs. 14.5 kg, respectively). Daily milk yield and fat corrected milk increased (P<0.05) by about 10.34 and 21.99% in G2 than G1. Percentage of fat and protein in milk cows were higher (P<0.05) in G2 than G1 and somatic cell count decreased (P<0.05) by about 19.52% in G2 than G1. Number of ovulatory cycles / cow during the experimental period decreased (P<0.05) in G2 than G1 Postpartum first estrous interval was not affected by treatment, while postpartum first service interval and service period length were shorter (P<0.001) in G2 than in G1. Cows in G2 showed shorter days open period (108.8 d) than G1 (150.5d).

In conclusion feeding Friesian cows during the 1st and 2nd parities on CFM supplemented with 5% protected fat improved milk yield and post partum reproductive traits.

Keywords: Friesian, protected fat, milk yield, postpartum, ovarian activity, reproductive performances

INTRODUCTION

Lactating dairy cattle expend more energy during peak milk production than what is consumed through their diets, creating a negative energy balance in the animal. Consuming an energy-dense diet is necessary in order to cover the nutrition requirements of high yielders dairy cows. Fat is added to the diet to increase energy density without decreasing fiber content. Concentrates are typically added to the diet as an energy source and substitute for forage content of the diet, which will decrease the fiber content of the diet, negatively affecting rumen bacteria (Andrew *et al*., 1991).

Excess fats added to the diet more than 5% of dry matter intake would reduce digestion in the rumen. Long-chain fatty acids interact with microorganisms in the rumen, interfering with their digestive actions, and creating toxic effects in the rumen (Chalupa *et al.*, 1986**)**. Ruminants depend on lipids as an energy source in order to sustain high milk output while maintaining body weight during high production. Research conducted by Palmquist and Jenkins (1980) observed that cows fed diets comprised of 4-7% fat experienced a 2-10% increase in milk production when compared to those cows fed diets comprised of only 1-3% fat.

This study was planned to investigate the effect of feeding protected fat diets on digestibility, rumen parameters, milk production and reproductive performance during early lactation of Friesian cows.

MATERIALS AND METHODS

The present study was carried out at Animal Production Department, Faculty of Agriculture, Kefr El-Sheikh University in cooperation with Sakha Animal Production Research Station, belonging to the Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Egypt.

Experimental Animals:

A total of 12 Friesian cows were used in this study. Cows average live body weight of 532.7±23.5 kg aged ranging between 2-4 years and were at 1st and 2nd parity. The experimental period extended from calving to six months of lactation. Cows were assigned into two groups according to live body weight (LBW), parity and age. Cows in the 1st group (G1) were fed on concentrate feed mixture (CFM) as control, while, cows in the 2nd group (G2) were fed on CFM supplemented with 5% protected fat (Magnapac, Ca-soap of fatty acids). Cows were free of any diseases with healthy appearance and they were housed in groups and were kept in yards semi-shaded.

Feeding system and management:

Concentrate feed mixture (CFM) used in feeding cows was composed of 37.5% yellow corn, 20% soybean meal, 15 % corn gluten, 22.5% wheat bran, 3% molasses, 0.5% premix and 1.5% common salt. Chemical composition of different feedstuffs used in formulation of the experimental rations is presented in Table (1).

Cows of G1 and G2 fed equal amounts of CFM, rice straw (RS), fresh berseem (BH) and corn silage (CS) (APRI, 2002) based on LBW, milk yield and fat percentage, which was about 10.5 kg DM containing 16 % CP on DM basis. The daily allowances were adjusted every 15 days according to LBW, milk yield and fat milk percentage. The animals were fed twice daily at 8:00 a.m. and 2:00 p.m., while fresh water was made available all daytime. The Magnapac (NOREISA, Madrid, Spain) supplemented to the diet as protected fat contained 84% palm oil (44% palmitic, 40% oleic, 9.5% linoleic, 5% stearic and 1.5% myrstic acid), 12.5% Ca-carbonate and 3.5% moisture). Representative monthly samples of foodstuffs were analyzed according to the official methods of the A.O.A.C. (1995).

Experimental Procedure:

Throughout the feeding period, changes in live body weight were monthly recorded for each cow. Three digestibility trials were conducted using three cows chosen randomly from each group during the 3rd month of lactation period. Cows were individually kept during the collection period and feces were collected from the rectum daily in the morning before feeding and at evening after milking for seven days. At the end of the collection period, representative samples (10% of fresh feces) were taken from each cow and dried at 60°C for 48 hours. After drying samples were grinded to pass through a 0.5 mm screen and kept in tight-plastic containers for chemical analysis.

Digestion coefficients of various nutrients of the experimental rations were determined using insoluble ash method based on the use of silica as a marker (Van Kulin and Young, 1977). Nutritive values as TDN and DCP of different experimental rations were calculated according to the obtained digestibility coefficients. Representative samples from CFM, CS, RS, BH and faces were also taken and prepared for the chemical analysis (A.O.A.C., 1995).

Rumen Liquor Aand Blood Sampling:

Three cows were randomly chosen from each group for rumen liquor collection (200 ml) using stomch tube at the 2nd, 3rd, 4th and 5th months of post partum, four hours post feeding. The ruminal fluid was strained through four layers of cheesecloth and pH values were immediately recorded by digital pH-meter (Model HI 8424). Two ml toluene and 2 ml paraffin oil were added to each rumen liquor sample of each animal and then stored at –20°C until determination of concentration of NH_3-N and volatile fatty acids /100 ml rumen liquor**.** Ammonia-nitrogen (NH_3-N) concentration was determined according to micro diffusion method (Conway, 1978), while concentration of total volatile fatty acids (VFA's) was determined by distillation according to Eadie *et al*. (1967). Individual volatile fatty acids were determined by liquid-gas chromatography (Intersmat, IGC 120 FBI).

Blood samples were collected from jugular vein from all experimental cows at 3 - 4 day-interval throughout an experimental period. Blood samples were centrifuged at 3000 rpm for 10 minutes to separate blood plasma which stored at -200C until analysis. Direct radioimmunoassay technique was performed for determination of plasma progesterone concentration using antibody-coated tubes kit (Diagnosis systems, laboratories Texas, USA) according to the procedure outlined by the manufacture. The standard curve of progesterone concentration ranged from 0 to 2.4 and 0 to 3.6 ng/ml. The intra-and inter assay coefficient of variation were 5.4 and 9.1%, respectively.

Detection Of Estrus And Insemination:

10 days postpartum experimental cows of G1 and G2 were exposed to an infertile bull to detect estrous cases. Teasing rounds (20 minutes) were conducted three times daily at 6, 12 and 15 h to recognize the onset of the 1st estrus. Estrus was identified when cows showed complete receptivity to the teaser and stood quietly to be mounted. Cows those be recognized to be on heat were artificially inseminated. Number and length of estrous cycles from calving up to conception were recorded. Postpartum 1st ovulation (PPOI), 1st

estrus (PPEI) and 1st service (PPSI) intervals, number of services per conception (NSC), service period length (SPL), days open (DO) and conception rate (CR%) were calculated. Conception rate was calculated as the proportion of conceived cows relative to inseminated cows multipliable by 100. Pregnancy was diagnose by rectal palpation after day 60 post-insemination.

Statistical Analysis:

Data obtained in this study were statistically analyzed according to T-test models procedure adopted by SPSS (1997).

RESULTS AND DISCUSSION

Feed Intake:

Results in Table (2) show the average of daily dry matter intake (DMI), total digestible nutrients (TDN) and digestible crude protein (DCP) intakes from the experimental rations during the feeding period. Animals were fed in group and not individually, therefore, it was not possible to test the significance of differences in feed intake among the experimental groups of animals. During the postpartum period, average daily TDN of intake was higher ($P<0.05$) in G2 than in G1, while average daily intake of DM and CP were nearly similar fin both groups (Table 2). Similar results were obtained by Jenkins (2000) in lactation Jersy cows, who found DMI did not affect by protected fat.

The increase in TDN intakes of G2 was probably due to the addition of protected fat, The R:C ration in these experimental diets lies between 58:42 on average and it could be considered suitable range for dairy cattle. Generally, the average DM, TDN and CP intakes (kg/d/h) during postpartum periods were higher than the recommended values of cows according to APRI (2002) (Table 2).

Digestibility coefficients and feeding values:

Crude protein and ether extract digestion were higher ($P<0.05$) in G2 than in G1 (Table 3). On the other hand, digestibility coefficients of DM, OM, CF and Nitrogen free extract (NFE) were not affected by supplementing CFM with protected fat (5%)

Voigt *et al*. (2006) reported that digestibility of organic matter was higher for diet with Ca-PFA than for diets with hydrogenated triacylglyceride from palm oil and fractionated triacylglyceride from palm oil, because of increased digestibility of ether extract. Supplemental fat is increasingly included in the diets Abd El-Hafeez *et al*. (2002) in cows low product yield. This allows to modify the fatty acids pattern of the milk fat (Precht *et al*., 2001) and to improve the energy supply of the cow. Furthermore, supplemental fat act as nutritional modifier of physiology and metabolism (Voigt *et al*., 2005). However, unprotected, unsaturated fatty acids can be toxic to the rumen microbes unless saturated by microbial hydrogenation (Harfoot, 1981).

Regarding the effect of protected fat on nutritive values of the tested rations (Table 3), it was clear that the total digestible nutrients (TDN %) was higher ($P<0.05$) in G2 than in G1. On the other hand, DCP value was not significantly affected by dietary supplementation. The improvement in the feeding values as (TDN) was 4.09 for G2 compared with G1. Generally, the improvement of feeding values in protected fat was attributed of higher digestibility coefficients in G2 than in G1.

Rumen Parameters:

Rumen pH of Friesian cows was affected significantly by dietary treatment ($P<0.001$). The pH value was higher ($P<0.001$) in cows of G2 than of G1 (Table 4). Differences in rumen pH is affected by production rate of VFA's via fermentation process of carbohydrates (Ahmed, 1996). It is also affected by feeding time and type (Omer, 1999). In accordance with the present results of pH of rumen liquor in G2, Chalupa *et al*. (1986) and Onetti *et al*. (2001) reported that pH of the rumen liquor is not affected by feeding protected fat.

The VFA,s concentration was not affect by dietary treatment. Overall mean of VFA's concentration was nearly in cows of G1 and G2 (Table 4). The insignificant differences in concentration of VFA's as affected by PF diet come in line with the results of Omer (1999) and Onetti *et al*. (2001)**.** Pattern of VFA's concentrations showed reversible trends to those of pH values (Table 4) in rumen liquor of each group, there are agreement with results obtained by Abu El-Hamd (2003).

The concentration of NH3-N (mg/100 ml) in rumen liquor tended to be lower ($P<0.05$) in G2 than G1 (Table 4). Present results are in agreement with, Onetti *et al*. (2001); Demeterova *et al.* (2002) and Abu El-Hamd (2003)**,** who found a significant reduction in NH_3-N concentration in rumen liquor of cows fed protected fat compared with the control group. On the other hand, Omar (1994) reported no effect of protected fat on rumen concentration of NH3-N.

The concentration of acetic acid in rumen liquor was higher ($P<0.001$) in G2 than G1, whereas, propunic acid was lower ($P<0.05$) in G2 than in G1. The concentration of butyric acid and isobutyric acid in rumen liquor showed no significant difference in G1 and G2 (Table 4).

In contrast, Chalupa *et al*. (1986) observed that adding 10% Ca-vegetable fat to rations of lactating cows decreased acetate concentration and acetate to propionate ratio, while increased propionate concentrations cows fed fat supplemented ration compared to control. Meanwhile, Kim *et al.* (1993) reported no effect of feeding ration containing protected fat on concentrations of acetate and propionate, and acetate to propionate ratio.

Body Weight Changes:

Change of LBW was higher (P<0.05) in G2 than in G1 (Table 5). The results in this study are similar to that obtained by El-Diahy (2004) in lactating Friesian cows when fed protected fat and supplemental oil.

Milk Yield:

Average daily milk yield (ADMY) was not affected by treatment, but, 4% fat corrected milk yield (FCMY) were higher (P<0.05) by 10.34 and 21.99 % for G2 than G1 (Table 6). It is of interest to note that ADMY peak was affected by dietary treatment, whereas lactation peak was during the 3rd month of lactation in G1, while it was during the 2nd month of lactation In G2 (Figure 1). Average of monthly milk yield (AMMY) or 4% fat corrected monthly milk yield (FCMY) of cows in G2 higher (P<0.05) by 12.92 and 25.06% than G1(Table 6). The improvement in the milk yield in G2 may be due to the increase of net energy intake.

The same trend was also reported by Schneider *et al*. (1988) and Garbswortuy (1996) who indicated that adding Ca-salts of fatty acids to Holstein cow's rations increased milk yield. El-Diahy (2004) found that supplementing diets of lactating Friesian cows with protected fat or supplemental oil, increased significantly ADMY and FCMY than control. Results of other studies indicated that a positive effect of diet supplementation with calcium salts of fatty acids on enabled to increase daily milk yield by 3.02 kg (34.77 vs. 31.75 kg), and levels of fat (by 0.41 percentage unit), especially at the peak of lactation (Schroeder *et al.*, 2004).

Percentage of fat and protein in milk cows were higher (P<0.05) in G2 than that in G1. However, percentages of lactose total solid and solid not fats were not affected by treatment (Table 6).

The SCC was lower (P<0.01) by about 19.52% for cows of G2 than G1 (Table 6). These results are similar to those obtained by Strusińska *et al*. (2006), who reported that somatic cell count decreased during the first 120 days of lactation by Megapro Plus® supplementation to diet.

Ovarian Activity:

G2 had lower (P<0.05) average number of ovulatory cycles compared with G1. On the other hand, no statistical differences were observed between the two studied groups in average number of total ovulations or ovulatory cycle length during the experimental period (Table 7). Average progesterone and concentration of progesterone at peak during the ovulatory cycles in G2 increased (P<0.05) compared to G1. Moreover, progesterone decreased (P<0.05) prior to estrus incidence in G2 compared to G1. However, interval to progesterone peak during the ovulatory cycles was not significantly affected (Table 7).

Reproductive Performance:

Postpartum estrus interval (PFEI) of cows was no affected by treatment (Table 8). Obtained PFEI is in agreement with those reported by El-Diahy (2004), who reported that the PFEI ranged between 33 to 42 days in cows fed protected fat. Although, Lu *et al.* (1992) indicated that the length of PFEI showed wide variation in Holstein cows (28.3 and 69.0 days), which may be due to the variation in frequency and regime of estrous detection. However**,** Wafa (2004) found that PPEI was altered in cows fed dry fat than those fed control diet.

The present results showed that G2 showed shorter post partum service interval (P<0.001), service period (P<0.01) and days open (P<0.001), as well as less (P<0.01) number of services per conception and higher (P<0.05) conception rate compared to G1 (Table 8).

El-Diahy (2004) reported close results to the present one. He reported service period length of 33 days for cows fed protected fat. Moreover, low number of services /conception agrees with that result of Wafa (2004).

Obtained higher conception rate in G2 comes in agreement with the findings of Schneider *et al*. (1988) and Wafa (2004) who reported that Holstein cow fed diets supplemented with Ca-salts of fatty acids were had conception rate than control one.. Dairy cows fed fat supplementation showed shorter interval to first service, higher conception rate as reported by Armstrong *et al*. (1990) and Carroll *et al*. (1994).

In conclusion feeding Friesian cows during the 1st and 2nd parities on CFM supplemented with 5% protected fat improved milk yield and post partum reproductive traits.

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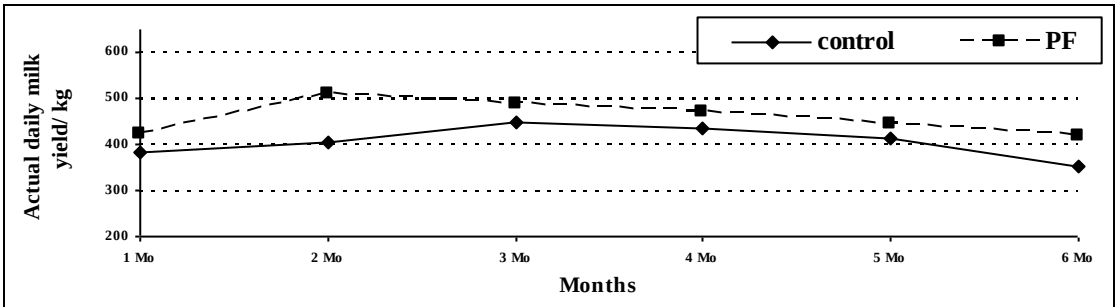

Figure 1: Averasge of monthly milk yield of Frisian cows during 6 post-partum months in different groups

Table 1. Chemical analysis of different feedstuffs (on DM basis, %) used in feeding cows in experimental groups

Item	Chemical composition (%)			
	CFM	Rice straw	Berseem hay	Corn silage
Dry matter, DM	90.12	88.74	88.52	36.14
Organic matter, OM	89.24	80.83	88.78	90.4
Crude protein, CP	15.34	1.61	14.57	15.5
Crude fiber, CF	11.46	37.36	24.62	2.1
Ether extract, EE	5.02	1.51	6.12	16.0
Nitrogen free extract	57.42	40.35	43.47	56.8
Ash	10.76	19.17	11.22	9.6

Table 2. Effect of feeding concentrate feed mixture (G1) and concentrate feed mixture supplemented with 5% protected fat (G2) on average daily DM intake (kg/head/day)

Item	Experimental rations (kg/day)			
	G1	G2	SE	Significance
Concentrate feed mixture	8.0	7.6	-	-
Berseem hay	4.2	4.1	-	-
Rice straw	3.1	3.2	-	-
Corn silage	15.4	15.7	-	-
Protected fat	-	0.40	-	-
Total DMI	19.25	19.35	1.24	NS
TDN	11.67	12.22	0.12	*
Digestible crude protein (DCP)	1.66	1.67	0.01	NS

NS: Not significant and * significant at (P≥0.05)

Table 3. Effect (X ±SE) of feeding concentrate feed mixture (G1) and concentrate feed mixture supplemented with 5% protected fat (G2) on digestion coefficient (%).

Item	Treatments		SE	Significance
	G1	G2		
DM	65.73	65.96	0.71	NS
OM	64.17	65.40	1.02	NS
CP	74.44[b]	77.11[a]	0.55	*
CF	59.22	64.29	3.03	NS
EE	71.56[b]	78.93[a]	1.9	*
Nitrogen free extract	63.44	61.89	1.14	NS
Ash	77.20	72.79	2.62	NS
Nutritive values				
TDN	60.60[b]	63.08[a]	0.67	*
DCP	8.62	8.64	0.09	NS

NS: Not significant and * significant at (P≥0.05)**.**

Table 4. Effect (X ±SE) of feeding concentrate feed mixture (G1) and concentrate feed mixture supplemented with 5% protected fat (G2) on rumen parameters and fermentation of VFA in rumen liquor

Item	Dietary group			Significance
	G1	G2	SE	
pH values	5.83	6.06	0.03	*
VFA's	14.15	13.63	0.22	NS
NH3-N (mg/100 ml)	22.2	20.56	0.34	*
Fermentation of VFA				
Acetic acid	41.24	44.42	0.60	***
Propunic acid	31.02	28.05	0.72	*
Butyric acid	22.65	22.97	1.02	NS
Isobutyric acid	2.76	2.37	0.61	NS

NS: not significant, * significant at (P≥0.05) and *** significant at (P≥0.001).

Table 5. Effect (X ±SE) of feeding concentrate feed mixture (G1) and concentrate feed mixture supplemented with 5% protected fat (G2) on live body weight (kg) and the LBW changes

Postpartum month	Treatments			
	G1	G2	SE	Significance
Live body weight	517.5	506.67	10.2	NS
Final live body weight	521.40	514.40	11.4	NS
Changes of LBW(kg)	3.90	7.73	1.2	*

NS: not significant and * significant at (P≥0.05)

Table 6. Effect (X ±SE) of feeding concentrate feed mixture (G1) and concentrate feed mixture supplemented with 5% protected fat (G2) on milk yield and milk compassion of Frisian cows during six months post-partum

Months	Dietary groups		SE	Significance
	G1	G2		
Milk yield				
Actual milk yield (kg/day)	13.54	14.94	0.81	NS
Fat 4% corrected milk yield (kg):	11.96	14.59	0.76	*
Monthly milk yield (kg):	406.3	458.8	13.4	**
Monthly Fat corrected milk yield (kg):	358.0	447.8	22.6	***
Milk compassion (%):				
Fat	3.21	3.85	0.09	**
Protein	2.33	2.51	0.06	*
Lactose	3.99	3.97	0.07	NS
Total solids	11.10	11.25	0.25	NS
Solids not fat	7.07	7.11	0.21	NS
Somatic cell count	381.69	307.19	24.2	**

NS: not significant, * significantly at (P≥0.05), ** significantly at (P≥0.01) and *** significantly at (P≥0.001).

Table 7. Effect (X ±SE) of feeding concentrate feed mixture (G1) and concentrate feed mixture supplemented with 5% protected fat (G2) on postpartum ovarian activity of cows

Item	Dietary groups		SE	Significance
	G1	G2		
Number of ovulatory cycles/cow	4.5	2.75	0.24	**
Number of ovulations /cow	5.00	3.25	0.43	NS
Ovulatory cycle length (day)	20.94	21.36	3.61	NS
Average of progesterone prior to estrus activity[1]	0.496	0.295	0.06	**
Average progesterone concentration (ng/ml)[2]	2.821	3.841	0.19	NS
Progesterone peak (ng/ml)[2]	6.090	7.221	0.56	NS
Interval to progesterone peak (day)[3]	11.56	10.73	1.53	NS

1 From time of treatment to estrus incidence, 2 During ovulatory cycles and 3 from the beginning the ovulatory cycle NS: not significant and** significantly at (P≥0.01).

Table 8. Effect (X ±SE) of feeding concentrate feed mixture (G1) and concentrate feed mixture supplemented with 5% protected fat (G2) on postpartum reproductive performance

Item	Dietary group		
	G1	G2	Significance
Postpartum first estrus interval	41.60±2.37	35.20±2.3	NS
Postpartum first service interval	104.7±3.4	82.5±2.6	***
Service period length	45.8±4.5	26.3±4.8	**
Number of services / Conception	2.75±0.365	1.60±0.298	**
Days open	150.5±14.86	108.8±12.14	**
Conception rate	66.67	83.34	*

NS: not significant, * significantly at (P≥0.05), ** significantly at (P≥0.01) and *** significantly at (P≥0.001).

أثر إضافة الدهن المحمى علي الكفاءة الإنتاجية والتناسلية للأبقار الفريزيان خلال فترة ما بعد الولادة

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تهدف هذه الدراسة معرفة تأثير إضافة الدهن المحمى في الغذاء على معدل الغذاء المأكول ومعاملات الهضم ونشاط الكرش وإنتاج اللبن والنشاط الميضى والكفاءة التناسلية للأبقار الفريزيان الحلابة. استخدم في هذه الدراسة 12 بقرة فريزيان متوسّط أوزانها 532.7 ±23.5 كجم وتتراوح أعمارها بين 2 – 4 سنوات من العمر وفى موسم ما بين 1-2. كلّ الأبقار كانت في الفترة المبكرة بعد الولادة. قسّمت الأبقار إلى مجموعتين متماثلتين في الوزن والعمر وموسم الحليب وإنتاج اللبن. كانت الأبقار في المجموعة الأولى بدون معاملة (كنترول) بينما المجموعة الثانية فيم استبدال 5% من العلقة المركزة ب 5% دهن محمى واستمرت التجربة 6 شهور بعد الولادة. ويمكن تلخيص النتائج المتحصل عليها فيما يلي:

- لم يختلف معدل الغذاء المأكول اليومى في المجموعتين وتراوح مابين 19.25 و19.35 كجم/رأس/يوم.
- أظهر الأبقار المعاملة في مجموعة الدهن المحمى تحسن في القيمة الغذائية TDN بمعدل 3.17% بالنسبة للكنترول.
- تحسنت القيمة الغذائية في مجموعة الدهن المحمى نتيجة ارتفاع معاملات الهضم مقارنة بالكنترول.
- ارتفعت قيمة الأس الهيدروجيني معنويا في مجموعة الدهن المحمى مقارنة بالكنترول (6.06 مقابل 5.83).
- لم يختلف تركيز الأحماض الدهنية الطيارة في سائل الكرش معنويا في مجموعتي الدهن المحمى والكنترول.
- ارتفع تركيز الأمونيا في سائل الكرش معنويا في مجموعة بالنسبة لمجموعة الدهن المحمى.
- ارتفع تركيز حمض الخليك في سائل الكرش معنويا بينما انخفض تركيز حمض البروبيونيك في مجموعة الدهن المحمى مقارنة بالكنترول. أما حمض البيوتيريك والأيزوبيوتيريك لم يتغير معنويا بالمعاملات.
- أظهرت مجموعة الدهن المحمى تغير معنويا في وزن الجسم مقارنا الكنترول (3.9 مقابل 7.73 كجم).
- زاد إنتاج اللبن اليومي وإنتاج اللبن المعدل 4% دهن لمجموعة الدهن المحمى بنسبه 10.34 و21.99% علي الترتيب مقارنا بالكنترول . وارتفعت نسبة الدهن معنويا في مجموعة الدهن المحمى مقارنا بالكنترول. وأظهرت الأبقار المعاملة الدهن المحمى نقص على مستوى ($P<0.05$) في عدد للخلايا الجسدية في اللبن 20.2% مقارنا مع الكنترول.
- انخفض مستوى هرمون البروجسترون معنويا خلال فترة ماقبل حدوث الشياع في مجموعة الدهن المحمى مقارنا بالكنترول, في حين أن المدة من أعلي مستوي للبروجسترون حتى حدوث الشياع لم تتأثر.
- وقصرت الفترة الفاصلة من الولادة وحتى الشياع وفترة التلقيح (SP) في مجموعة الدهن المحمى مقارنا الكنترول، في حين أن الفترة الفاصلة من الولادة وحتى أول تلقيح قصرت معنويا في مجموعة الدهن المحمى مقارنا بالكنترول. وكذلك قصرت فترة الأيام المفتوحة في مجموعة الدهن المحمى (108.8 يوم) مقارنا الكنترول (150.5 يوم). عدد التلقيحات كان أقل معنويا في مجموعة الدهن المحمى (1.6 تلقيحة) مقارنا بالكنترول (2.75 تلقيحة). وزاد معدل الحمل في مجموعتي الدهن المحمى بالمقارنة بالكنترول (66.67 مقابل 83.34%).