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EFFECTS OF DIETARY PROTEIN AND ENERGY LEVELS ON PRODUCTIVE AND REPRODUCTIVE PERFORMANCE OF LACTATING BUFFALOES

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ABSTRACT

Twenty eight lactating buffaloes in the 2nd to the 5th lactating season, weighing 500-600 kg were used after one week of calving in a completely randomized design with 2×2 factorial arrangement of treatments to evaluate the effect of varying levels of protein and energy on nutrient intake, digestibility, milk yield, feed conversion and economic efficiency. The low and high protein diets (12 and 16% CP) and low and high energy diets (60 and 65% total digestible nutrients, TDN) were used in four experimental diets include low protein–low energy (LP-LE), low protein–high energy (LP-HE), high protein–low energy (HP-LE) and high protein–high energy (HP-HE). Results showed that the CP digestibility and digestible crude protein (DCP) values were increased (P<0.05) in high protein diet. While, the digestibility coefficients of either extract (EE) and nitrogen free extract (NFE) and TDN values were increased (P<0.05), but crude fiber (CF) digestibility decreased (P<0.05) in high energy diet. The HP-HE diet recorded the highest digestibility coefficients of CP, EE and NFE and nutritive values and HP-LE diet had the highest CF digestibility (P<0.05). Dietary DCP intake increased (P<0.05) in high protein diet and the intake of DM and TDN increased (P<0.05) in high energy diet. The HP-HE diet showed (P<0.05) the highest intake of TDN and DCP. The yield of actual milk and 7% fat corrected milk (FCM) increased (P<0.05) in high protein and high energy diet (HP-HE). The contents of protein, SNF and TS in milk increased (P<0.05) in high protein diet. While, the contents of protein, lactose, SNF and ash in milk increased (P<0.05) and fat decreased (P<0.05) in high energy diet. The HP-HE diet revealed the highest milk protein, lactose, SNF and TS contents and HP-LE diet had the highest fat content (P<0.05). The amounts of DM and TDN per kg 7% FCM decreased (P<0.05), but the amount of DCP per kg 7% FCM increased (P<0.05) in high protein diet. While, the amounts of DM, TDN and DCP per kg 7% FCM decreased (P<0.05) in high energy diet. The HP-HE diet showed the lowest amounts of DM and TDN per kg 7% FCM and LP-HE diet had the lowest amount of DCP per kg 7% FCM (P<0.05). Average daily feed cost and total revenue increased (P<0.05) in high protein diet. While, average daily feed cost and feed cost per kg 7% FCM decreased (P<0.05), but total revenue and economic efficiency increased (P<0.05) in high energy diet. The LP-HE diet recorded the lowest average daily feed cost, while HP-HE diet showed the lowest feed cost/kg 7% FCM and the highest total revenue and economic efficiency (P<0.05). Dietary protein level not affected postpartum reproductive performance of lactating buffaloes (P>0.05). However, the periods from parturition to first estrus and first service, service period, days open and number of services per conception decreased (P<0.05), but conception rate increased (P<0.05) in high energy diet. Moreover, buffaloes fed HP-HE diet showed the short periods from parturition to first estrus and first service, service period, days open, the lowest number of services per conception and the highest conception rate (P<0.05).

Keywords: Milk yield and composition, Feed conversion, Economic efficiency, Reproductive traits.

INTRODUCTION

Complex interrelationships exist among dietary protein and energy and the amount of protein that will be utilized by the dairy cow. These interrelationships have important ramifications on overall nitrogen efficiency of the dairy farm (Rotz *et al.*, 1999). Dietary protein supplies metabolizable protein by providing both rumen degradable protein (RDP) that is utilized for microbial protein formation and rumen undegradable protein (RUP) that is digested directly by the cow. High energy diets stimulate microbial protein synthesis, with providing the major source of metabolizable protein (Cadorniga and Satter, 1993). Thus, increasing dietary energy content may increase RDP requirement. It is uneconomical to over feed protein and energy. Moreover, over-feeding protein results in excessive urinary nitrogen, the most environmentally convertible form of excreted nitrogen (Varel *et al.*, 1999). Over feeding of concentrates will depress ruminal pH and may reduce ruminal fiber digestion, milk fat secretion and result in other metabolic problems for the cow (Weimer, 1992; Oliveira *et al.*, 1993 and Ekinci and Broderick, 1997).

A negative energy balance during early lactation delays the timing of first ovulation and exerts delayed carryover consequences on fertility during the breeding period (Butler, 2003). Kane *et al.* (2004) suggest that differing levels of CP supplementation in daily diet may alter pituitary and ovarian function, thereby influencing reproductive performance. The objective of this experiment was to quantify the dietary concentrations of protein and energy under standard feeding conditions that would maximize the productive and reproductive performance of lactating buffaloes.

MATERIALS AND METHODS

Experimental animals and rations

Twenty eight lactating buffaloes in the 2nd to the 5th lactating season, weighing 500-600 kg were used after one week of calving in a completely randomized design with 2×2 factorial arrangement of treatments according to body weight, milk yield and parity to evaluate the effect of varying levels of protein and energy on nutrient intake, digestibility coefficients, milk yield, feed conversion and economic efficiency. The low and high protein diets (12 and 16% CP) and low and high energy diets (60 and 65% TDN) were used in four experimental diets include. low protein–low energy (LP-LE), low protein–high energy (LP-HE), high protein–low energy (HP-LE) and high protein–high energy (HP-HE) as shown in Table (1).

Dietary CP was varied by stepwise replacement of 15% of concentrate feed mixture (dry matter basis) with an equal amount of soybean meal. Dietary energy was varied by stepwise replacement of 26% of concentrate feed mixture (dry matter basis) with an equal amount of corn grain. Corn silage was harvested at about one-half milk line, chopped to a theoretical length of 1 cm, and ensiled in horizontal silo without additives. Diets were fed after calving immediately for 150 days. The chemical composition of the experimental diets is presented in Table (2).

Table 1: Formulation of experimental rations (% on DM basis).

Feedstuffs	LP-LE	HP-LE	LP-HE	HP-HE
Concentrate feed mixture (CFM)*	50	35	17	10
Corn grain (CG)	-	-	26	20
Soybean meal (SBM)	-	15	7	20
Berseem hay (BH)	15	15	15	15
Corn silage (CS)	20	20	20	20
Rice straw (RS)	15	15	15	15
Total	**100**	**100**	**100**	**100**

* Concentrate feed mixture consisted of 34% undecorticated cotton seed cake, 24% wheat bran, 22% yellow corn, 10% rice bran, 5% line seed cake, 2% molasses, 2% limestone and 1% common salt.

Table 2: Chemical composition of the tested feedstuffs and experimental rations.

Item	DM%	Composition of DM %					
		OM	CP	CF	EE	NFE	Ash
Feedstuffs							
CFM	91.35	91.27	16.43	11.65	3.25	59.94	8.73
CG	91.15	96.85	8.75	2.91	3.41	81.78	3.15
SBM	92.24	92.65	43.78	4.58	1.64	42.65	7.35
BH	90.65	87.82	12.85	28.67	2.76	43.54	12.18
CS	27.80	92.45	8.36	24.38	2.45	57.26	7.55
RS	89.28	83.73	2.36	32.83	1.52	47.02	16.27
Experimental rations							
LP-LE	62.49	89.86	12.17	19.92	2.76	55.01	10.14
HP-LE	62.55	90.07	16.27	18.86	2.52	52.42	9.93
LP-HE	62.49	91.41	12.09	17.16	2.68	59.48	8.59
HP-HE	62.55	91.25	16.10	16.76	2.47	55.92	8.75

The animals were housed in open sheds and fed individually. Concentrate feed mixture, corn grain and soybean meal were offered two times daily at 8 a.m. and 4 p.m., berseem hay once daily at 11 a.m., corn silage at 12 a.m. and rice straw was given two times at 9 a.m. and 5 p.m. Buffaloes were allowed to drink water three times a day at 7 a.m. and 1& 7 p.m. and were kept under the routine veterinary supervision through the whole feeding trial.

Digestibility trials

Digestibility trial was conducted with 3 animals from each treatment to determine nutrients digestibility coefficients and nutritive values of the experimental rations using acid insoluble ash (AIA) as a natural marker (Van Keulen and Young, 1977). Feces samples were taken from the rectum of each animal twice daily with 12 hours interval during the collection period. Samples of tested feedstuffs were taken at the beginning, middle and end of collection period. The samples of feedstuffs and feces were composted and representative samples were analyzed according to AOAC (1995).

Milk yield and samples

Buffaloes were milked twice daily and individual milk yields were recorded at each milking. Milk samples were collected biweekly at two consecutive evening and morning milkings and analyzed for fat, protein, lactose, SNF and TS using Milko-Scan 133B Foss Electric (Foss Electric, Denmark). Yields of 7% FCM were computed using the formula of 7% FCM = 0.265 x milk yield (kg) + 10.5 x fat yield (kg) as stated by Raafat and Saleh (1962).

Feed conversion

Feed conversion was calculated as the amounts of DM, TDN (kg) and DCP (g) required to produce 1 kg 7% FCM.

Economic efficiency

Economic efficiency expressed as the daily feed cost, price of 7% FCM, feed cost per kg 7% FCM and the ratio between daily feed cost and price of 7% FCM. The price of one ton was 1800 LE for concentrate feed mixture, 1600 LE for corn grain, 1900 LE for soybean meal, 800 LE for berseem hay, 140 LE for corn silage, 80 LE for rice straw and 3 LE for kg 7% FCM according to prices of year 2009.

Reproductive traits

Reproductive parameters as the periods from calving to first estrus and first service, days open, calving interval, number of inseminations per service and conception rate were recorded for each animal.

Statistical analysis

The obtained data were statistically analyzed for the effect of dietary protein and energy levels using general liner models procedure adapted by SPSS (2008). The Duncan multiple range test was used to compare difference between means.

RESULTS AND DISCUSSION

Digestibility coefficients and nutritive values

The digestibility coefficients and nutritive values of experimental rations are presented in Table (3). The CP digestibility and DCP value increased (P<0.05) in high protein diet. While, the digestibility coefficients of EE and NFE and TDN value increased (P<0.05), but CF digestibility decreased (P<0.05) in high energy diet. The interaction between protein and energy levels showed that HP-HE diet recorded the highest digestibility coefficients of CP, EE and NFE and nutritive values and HP-LE diet had the highest CF digestibility (P<0.05). These results agreed with those obtained by Mathis *et al.* (1999) who found that digestion of NDF in poor-quality forages fed to beef cows was elevated with SBM supplementation. Weimer (1992) and Oliveira *et al.* (1993) reported that increased dietary nonfiber carbohydrates (NFC) is often observed to depress fiber digestion, partly by depressing ruminal pH. Broderick (2003) found that there was no change in apparent digestibility coefficients of DM and OM with increasing dietary CP; however, NDF and ADF digestibility both increased linearly with dietary CP. Also, he reported that as expected, there were linear increases in apparent DM and OM digestibility, and linear declines in apparent NDF and ADF digestibility and fecal DM output, with increasing dietary energy. El-Ashry *et al.* (2003) showed that buffaloes fed the highest energy level recorded the highest digestibility of DM, OM, CP, CF, EE and NFE.

Table 3: Digestibility coefficients and nutritive values of experimental rations by lactating buffaloes.

Item	Digestibility coefficients %						Nutritive values %	
	DM	OM	CP	CF	EE	NFE	TDN	DCP
Protein level								
LP (12%)	66.55	67.87	63.91^{b}	62.73^{b}	69.61	68.22	62.78	7.75^{b}
HP (16%)	66.77	68.03	66.44^{a}	64.08^{a}	70.14	68.33	63.17	10.75^{a}
Energy level								
LE (60%)	66.03^{b}	67.32^{b}	64.65	64.78^{a}	68.15^{b}	65.32^{b}	60.89^{b}	9.21
HE (65%)	67.29^{a}	68.58^{a}	65.70	62.03^{b}	71.60^{a}	71.22^{a}	65.06^{a}	9.30
Interaction (protein x energy)								
LP-LE	65.94^{b}	67.28^{b}	63.86^{c}	64.15^{b}	67.85^{d}	65.28^{b}	60.67^{b}	7.77^{c}
HP-LE	66.12^{b}	67.35^{b}	65.43^{b}	65.40^{a}	68.44^{c}	65.36^{b}	61.12^{b}	10.65^{b}
LP-HE	67.15^{a}	68.45^{a}	63.95^{c}	61.31^{d}	71.36^{b}	71.15^{a}	64.88^{a}	7.73^{c}
HP-HE	67.42^{a}	68.71^{a}	67.45^{a}	62.75^{c}	71.83^{a}	71.29^{a}	65.23^{a}	10.86^{a}

a, b, c, d: Means in the same column for each item with different superscripts differ significantly at 5% level.

Feed intake

Average daily feed intake by lactating buffaloes is shown in Table (4). Dietary DCP intake increased ($P<0.05$) in high protein diet, while the intakes of DM and TDN were not affected by dietary protein level ($P>0.05$). Moreover, the intake of DM and TDN increased ($P<0.05$) in high energy diet, but DCP intake was not affected by dietary energy level ($P>0.05$). Dietary protein and energy interaction revealed that HP-HE diet showed the highest intake of DM, TDN and DCP, but LP-LE diet had the lowest intake ($P<0.05$). These results are in agreement with those obtained by Broderick (2003) who found that intake of DM increased with increasing dietary protein and energy. El-Ashry *et al.* (2003) showed that buffaloes fed the highest energy level recorded the highest DM, TDN and DCP intakes.

Table 4: Average daily feed intake (kg/head) by lactating buffaloes fed experimental rations.

Item	DM	TDN	DCP
Protein level			
LP (12%)	15.64^{b}	9.82	1.21^{b}
HP (16%)	15.87^{a}	10.03	1.71^{a}
Energy level			
LE (60%)	15.58^{b}	9.49^{b}	1.44
HE (65%)	15.93^{a}	10.36^{a}	1.48
Interaction (protein x energy)			
LP-LE	15.46^{c}	9.38^{b}	1.20^{c}
HP-LE	15.69^{bc}	9.59^{b}	1.67^{b}
LP-HE	15.81^{ab}	10.26^{a}	1.22^{c}
HP-HE	16.05^{a}	10.47^{a}	1.74^{a}

a, b, c: Means in the same column for each item with different superscripts differ significantly at 5% level.

Milk yield

Average daily milk and 7% FCM yield are shown in Table (5). The yield of actual milk and 7% FCM increased ($P<0.05$) in high protein and high energy diets. The HP-HE diet recorded the highest actual milk and 7% FCM yield, however LP-LE diet had the lowest milk yield ($P<0.05$). Buffaloes fed high protein diet produced 1.57 kg/d more actual milk and 1.53 kg/d more 7% FCM. While, Buffaloes fed high energy diet produced 2.51 kg/d more milk and 1.89 kg/d more 7% FCM. These results revealed that dietary energy level is more effective on the yield of actual and 7% FCM than dietary protein level. These results agreed with those obtained by Broderick (2003) who found that increasing dietary protein and energy gave linear increases in milk yield and 4% FCM. Feeding greater amounts of more fermentable NFC would be expected to improve milk yield (Ekinci and Broderick, 1997; Wilkerson *et al.*, 1997; Kebreab *et al.*, 2000 and Valadares *et al.*, 2000). El-Ashry *et al.* (2003) found that buffaloes fed the high energy level showed higher milk yield and 7% FCM.

Milk composition

As shown in Table (5), the contents of protein, SNF and TS in milk increased ($P<0.05$) in high protein diet. While, the contents of protein, lactose and SNF in milk increased ($P<0.05$) and fat decreased ($P<0.05$) in high energy diet. Dietary protein and energy interaction obvious that HP-HE diet revealed the highest milk protein, lactose, SNF and TS contents and HP-LE diet had the highest fat content ($P<0.05$). These results may be due to the decrease of fiber content with increasing dietary energy (Table 2). These results agreed with those obtained by Broderick (2003) who found that increasing dietary protein and energy increased all milk components except fat, which decreased with increasing dietary energy. El-Ashry *et al.* (2003) found that buffaloes fed the high energy level showed higher fat, protein, lactose, SNF, TS and ash percentages.

Table 5: Average daily milk and 7% FCM yield and composition of lactating buffaloes fed experimental rations.

Item	Milk yield (kg/day)		Milk composition %					
	Actual	7% FCM	Fat	Protein	Lactose	SNF	TS	Ash
Protein level								
LP (12%)	13.70^{b}	11.57^{b}	5.53^{b}	4.16^{b}	5.60^{b}	10.46^{b}	15.99^{b}	0.70
HP (16%)	14.68^{a}	12.59^{a}	5.65^{a}	4.45^{a}	5.75^{a}	10.91^{a}	16.56^{a}	0.70
Energy level								
LE (60%)	12.94^{b}	11.14^{b}	5.68^{a}	4.17^{b}	5.53^{b}	10.41^{b}	16.08^{b}	0.71
HE (65%)	15.45^{a}	13.03^{a}	5.50^{b}	4.44^{a}	5.83^{a}	10.96^{a}	16.46^{a}	0.70
Interaction (protein x energy)								
LP-LE	12.34^{d}	10.53^{d}	5.60^{b}	4.01^{c}	5.45^{d}	10.17^{c}	15.77^{c}	0.71
HP-LE	13.53^{c}	11.76^{c}	5.75^{a}	4.34^{b}	5.60^{c}	10.65^{b}	16.40^{ab}	0.71
LP-HE	15.07^{b}	12.62^{b}	5.45^{c}	4.31^{b}	5.75^{b}	10.76^{b}	16.21^{b}	0.70
HP-HE	15.83^{a}	13.43^{a}	5.55^{b}	4.56^{a}	5.90^{a}	11.17^{a}	16.72^{a}	0.70

a, b, c, d: Means in the same column for each item with different superscripts differ significantly at 5% level.

Feed conversion

Feed conversion expressed as the amounts of DM, TDN and DCP per kg 7% FCM are shown in Table (6). The amount of DM and TDN per kg 7% FCM decreased ($P>0.05$), but DCP per kg 7% FCM increased ($P<0.05$) in high protein diet. Moreover, the amounts of DM, TDN and DCP per kg 7%

FCM decreased (P<0.05) in high energy diet. Dietary protein and energy interaction revealed that HP-HE diet showed the lowest amounts of DM and TDN per kg 7% FCM, but LP-LE diet had the highest amounts (P<0.05). While, LP-HE diet had the lowest amount of DCP per kg 7% FCM, but HP-LE diet had the highest amount (P<0.05). These results are in accordance with those obtained by Broderick (2003) who found that increasing dietary energy gave linear increases in milk/DM intake. Factors influencing utilization of dietary CP are complex and related to supplying sufficient RDP to meet the needs of ruminal microbes plus sufficient RUP of adequate intestinal digestibility (NRC, 2001). El-Ashry *et al.* (2003) found that buffaloes fed the high energy level showed the best feed efficiency.

Table 6: Feed conversion and economic efficiency for lactating buffaloes fed experimental rations.

Item	Feed conversion per kg 7% FCM			Economic efficiency			
	DM (kg)	TDN (kg)	DCP (g)	Feed cost (LE/day)	Feed cost (LE) / Kg7% FCM	Total revenue (LE/day)	Economic efficiency
Protein level							
LP (12%)	1.36	0.85^a	105.52^b	18.87^b	1.65	34.72^b	1.84
HP (16%)	1.27	0.80^b	136.05^a	20.26^a	1.62	37.78^a	1.87
Energy level							
LE (60%)	1.40^a	0.85^a	128.15^a	20.10^a	1.81^a	33.43^b	1.66^b
HE (65%)	1.23^b	0.80^b	113.41^b	19.03^b	1.46^b	39.07^a	2.05^a
Interaction (protein x energy)							
LP-LE	1.47^a	0.89^a	114.12^c	19.04^c	1.81^a	31.59^d	1.66^c
HP-LE	1.34^b	0.82^b	142.19^a	21.15^a	1.80^a	35.28^c	1.67^c
LP-HE	1.25^c	0.81^b	96.91^d	18.69^d	1.48^b	37.86^b	2.02^b
HP-HE	1.20^d	0.78^c	129.91^b	19.37^b	1.44^c	40.28^a	2.08^a

a, b, c, d: Means in the same column for each item with different superscripts differ significantly at 5% level.

Economic efficiency

Economic efficiency presented in Table (6), revealed that average daily feed cost and total revenue increased (P<0.05) in high protein diet. While, feed cost per kg 7% FCM and economic efficiency not affected by dietary protein level (P<0.05). Moreover, feed cost and feed cost per kg 7% FCM decreased (P<0.05), but total revenue and economic efficiency increased (P<0.05) with in high energy diet. Furthermore, LP-HE diet recorded the lowest feed cost, while HP-HE diet showed the lowest feed cost per kg 7% FCM and the highest total revenue and economic efficiency (P<0.05). These results may be attributed to the higher price of soybean meal (1900 LE/ ton) compared with corn grain (1600 LE/ ton).

Reproductive performance

Results in Table (7) showed that dietary protein level not affected postpartum reproductive performance of lactating buffaloes (P>0.05). However, the periods from parturition to first estrus and first service, service period, days open and number of services per conception decreased

(P<0.05), but conception rate increased (P<0.05) in high energy diet. Moreover, buffaloes fed HP-HE diet showed the shortest periods from parturition to first estrus and first service, service period, days open, the lowest number of services per conception and the highest conception rate, but buffaloes fed LP-LE diet had the opposite trend (P<0.05). These results are in accordance with those obtained by Chapa *et al.* (2001) who found that the reproduction of postpartum group cows was unaffected by protein supplements. Law *et al.* (2009) reported that there was no effect of dietary protein content on postpartum reproductive performance. Cumulative energy balance was positively associated with conception. El-Ashry *et al.* (2003) showed that buffaloes fed the high energy level recorded the shortest days open.

Table 7: Reproductive performance of lactating buffaloes fed experimental rations.

Item	First estrus (day)	First service (day)	Service period (day)	Days open (day)	No. service per conception	Conception rate %
Protein level						
LP (12%)	35.88	59.69	44.10	103.79	2.05	70.00
HP (16%)	34.29	58.36	43.03	101.39	1.95	70.00
Energy level						
LE (60%)	39.78^a	64.83^a	46.42^a	111.25^a	2.35^a	60.00^b
HE (65%)	30.39^b	53.22^b	40.71^b	93.93^b	1.65^b	80.00^a
Interaction (protein X energy)						
LP-LE	40.50^a	65.52^a	46.85^a	112.37^a	2.40^a	60.00^b
HP-LE	39.05^a	64.15^a	45.99^a	110.13^a	2.30^a	60.00^b
LP-HE	31.25^b	53.86^b	41.36^b	95.22^b	1.70^b	80.00^a
HP-HE	29.53^b	52.58^b	40.06^b	92.64^b	1.60^b	80.00^a

a, b: Means in the same column for each item with different superscripts differ significantly at 5% level.

Conclusion

From the present results it could be concluded that productive performance improved by increasing dietary protein and energy, while reproductive performance improved by increasing dietary energy.

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تأثير مستويات البروتين والطاقة فى العليقة علـــى الأداء الإنتــاجى والتناسـلى للجاموس الحلاب

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استخدم فى هذه الدراسة ٢٨ جاموسة حلابة فى مواسم الحليب من الثانى إلـــى الخـــامس ووزنها ٥٠٠-٦٠٠ كجم وزعت بعد الولادة بأسبوع عشوائيا إلى ٤ مجموعات، غـــذيت علـــى ٤ علائق تجريبية تتضمن منخفضة البروتين-منخفضة الطاقة، منخفضة البروتين-مرتفعـــة الطاقـــة، مرتفعة البروتين-منخفضة الطاقة، مرتفعة البروتين-مرتفعة الطاقة. أظهـــرت النتـــائج أن العليقـــة مرتفعة البروتين – مرتفعة الطاقة سجلت (معنويا) أعلى معاملات هـــضم لكـــل مـــن البـــروتين والمستخلص الإثيرى والمستخلص الخالى من الأزوت والقيم الغذائية والمـــأكول مـــن المركبـــات الغذائية المهضومة والبروتين المهضوم، بينما حققت العليقة مرتفعة البروتين – منخفـــضة الطاقـــة (معنويا) أعلى معامل هضم للألياف.

كذلك حققت العليقة مرتفعة البروتين – مرتفعة الطاقة (معنويا) أعلى إنتاج للـــبن الفعلـــى واللبن المعدل ٧% دهن ومحتوى كل من البروتين واللاكتوز والجوامد الصلبة اللادهنية والجوامـــد الصلبة الكلية، بينما سجلت العليقة مرتفعة البروتين – منخفضة الطاقة (معنويـــا) أعلـــى محتـــوى للدهن.

أظهرت العليقة مرتفعة البروتين – مرتفعة الطاقة (معنويا) أقل كمية مـــن المـــادة الجافـــة والمركبات الكلية المهضومة لإنتاج ١ كجم لبن ٧% دهن، بينما حققت العليقة منخفضة البروتين – مرتفعة الطاقة (معنويا) أقل كمية من البروتين المهضوم لكل ١ كجم لبن ٧% دهن. كذلك ســـجلت العليقة منخفضة البروتين – مرتفعة الطاقة (معنويا) أقل تكلفة تغذية، بينما أظهرت العليقة مرتفعـــة البروتين – مرتفعة الطاقة (معنويا) أقل تكلفة تغذية لكل ١ كجم لبن ٧% دهن وأعلى عائـــد كلـــى وكفاءة اقتصادية.

أظهرت الحيوانات المغذاة على العليقة مرتفعة البروتين – مرتفعة الطاقة (معنويا) أقـــصر فترة من الولادة حتى أول شياع وأول تلقيح، فترة التلقيح وفترة التلقيح المخصب وأقل عـــدد مـــن التلقيحات لحدوث الإخصاب وأعلى معدل خصوبة.

نستخلص من هذه الدراسة تحسن الأداء الإنتاجى بارتفاع محتوى البروتين والطاقـــة فـــى العليقة، بينما تحسن الأداء التناسلى بارتفاع محتوى الطاقة فى العليقة.

قام بتحكيم البحث

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