J. of Animal and Poultry Production, Mansoura Univ., Vol 12 (1):39 - 46, 2021

Journal of Animal and Poultry Production

Journal homepage: www.japp.mans.edu.eg
Available online at: www.jappmu.journals.ekb.eg

The Potential Interaction between Nutrition of Twin-Bearing Ewes' and the Performance Growth of their Newborns

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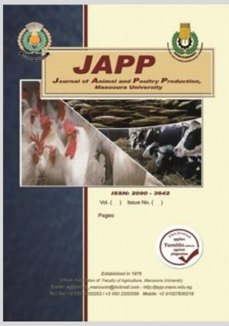

ABSTRACT

The purpose was to determine impact of nutritional treatments containing energy and protein on ewes body condition score (BCS), body weight (BW), milk production, newborn of lambs behavior and blood parameters of twin-bearing ewes. At trimester of pregnancy, one hundred-fifty shearing Rahmani ewes had been scanned to choose twin-bearing ewes. Then, twenty-four ewes had been diagnosed twin-bearing actually. They age from 3 to 4 years, BW 51.30±0.39 kg and BCS 2.54±0.16 (on a scale of 1 to 5). They were allocated to 3rd nutritional treatments (n=8/ treatment). Ewes in T1 were received rations consisted of concentrate fed mixture (CFM) + roughage included berseem hay (BH) + rice straw (RS). However ewes in T2 and T3 were fed the previous ration addition with protected fat (PF) and corn steep liquor (CSL), respictevely. Then, T1, T2 and T3 were offered from 100 day until weaning according to NRC (2007) . Resulting indicated that either T2 or T3 to twin-bearing ewe from trimester of pregnancy to weaning could be achieved the greatest (P<0.05) BW and BCS, improvement (P<0.05) of lambs behavior, more amount of suckling milk , composition, had more (P<0.05) lambs' body weight and verity serum blood metabolic than those ewes in T1 ration. Then, this study concluded that it is optimal for farmers to addition either energy (as 4% PF) or protein (as 20% CSL) to rations which have benefit for twin-bearing ewe without any losses in twin-bearing and performance growth of their newborns.

Keywords: Energy, protein, trimester of pregnancy, body condition score, live weight, lambs growth, twin-bearing ewes.

INTRODUCTION

Increasing the total weight of lamb available for sale per ewe depends number of lambs weaned and the weight of those lambs. Higher lambing rate are associated with greater efficiency of kg of meat produced per kg of feed consumed or per ewe BW. As both, the ewe body condition score (BCS) in late pregnancy and lactation can affect lamb birth weight, BW gain and weaning weight. It is likely that ewes of higher BCS comsumed greater level of nutritional in late pregnancy than ewes of poorer body condition Kenyon *et al.* (2012). Then, Kenyon *et al.* (2012) found that ewes BW at 89, 112, 136 and 142 days pre-partum was 61.0, 71.3, 78.6 and 81.8 kg within BCS 2.0, but it was 64.7, 75.2, 84.8 and 87.0 kg within BCS 2.5 and 69.0, 78.9, 87.3 and 89.6 kg within BCS 3.0, respectively. Then, BCS is a more meaningful way than BW change of assessing the adequacy of nutrition during late pregnancy because its evaluation is independent of fetus numbers (Mathias-Davis *et al*., 2013). Ewe's requirement from energy and metabolite protein rapidly during late pregnancy period especially during the final few weeks of pregnancy (Jalilian and Moeini, 2013). Hence, Cal-Pereyra *et al.* (2015) revealed that 70% of the fetal growth occurs during the final six weeks of pregnancy. Mohammadi *et al.* (2016) suggested that nutrition in pre-partum not only affects the growth of the developing fetus, but also supply the lamb with adequate amount of colostrum and milk post-partum. Cranston *et al*. (2017) found that the unrestricted feeding at 103 and 142 days (pre-partum) and at 45 and 95 days (post-partum) had BW 65.6, 81.6, 73.9 and 75.3kg, but in the restricted feeding were 64.6, 81.1, 73.0 and 74.2 kg, respectively. Otherwise, Schmitt *et al.* (2018) noticed that nutrition during the last third of gestation not only improves maternal BW and BCS , but also minimize BW and BCS loss immediately post-parturition. Increasing of ration protein and energy in rations during late gestation caused 80% of the fetal growth as well as growth of the dam (Pesántez-Pacheco *et al.* , 2019).

Therefore, the aims of the present study were to determine the impact of nutritional treatment by addition energy or protein on BCS, BW, milk production, newborn of lambs behavior and blood parameters of twin-bearing ewes.

MATERIALS AND METHODS

All ewes used in this experiment were provided by El-Serw Research Station belonging to Animal Production Research Institute (APRI), Agriculture Research Center, Ministry of Agriculture, Egypt. The experimental period was carried out with Rahmani ewes began from middle of April 2020 up to weaning their lambs on August 2020.

Experimental ewes, housing and feeding:-

One hundred-fifty shearing ewes had been scanned to choose twin-bearing. Then, twenty–four pregnant ewes of the flock had been diagnosed twin-bearing actually. They were allocated to three dietary treatments (T1, T2 and T3)

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DOI: 10.21608/jappmu.2021.149453

starting from trimester until weaning. Each treatment group containing equal numbers of twin-bearing ewes (n=8). They age from 3 to 4 years, average body weigh up to 51.30±0.39 kg and BCS until 2.54±0.16 (on a scale of 1 to 5). All ewe groups had been housed individually and managed together under same environmental conditions. Daily rations from T1, T2 and T3 were divided into two portions, one being fed in the morning at 8.0 am and the second in the afternoon at 3.0 pm. Also, ewes had free access to fresh water and salt block with mineral and trace elements. In general, ewes were received their rations according to NRC (2007) to meet recommended allowances for ewes in the trimester and suckling. The Chemical composition of CFM, BH and RS according to AOAC (2007) listed in Table (1). However, chemical composition of PF and CSL listed in Tables (2 and 3), respectively.

Table 1. Chemical composition of CFM, BH and RS.

Items	Chemical composition (% on dry matter basis)							
	DM	OM	CP	EE	CF	NFE	Ash	**ME
*CFM	89.91	87.77	14.40	7.09	2.41	63.87	12.23	3282
BH	88.65	88.43	14.12	2.15	23.29	48.87	11.57	3280
RS	92.83	80.23	3.08	1.49	36.88	38.78	19.77	3118

***The CFM consisted of 26 % undecortecatedi cotton meal, 40 % yellow corn, 27 % wheat bran, 3.5 % molasses, 2 % limestone, 1 % common salt and 0.5 % minerals mixture.**

****ME= metabolic energy (k cal/ kg DM), it determined by the formula according to Canbolat and Karabulut (2010).**

Table 2. Chemical composition of CSL as non-conventional energy.

	Chemical composition of CSL						
	DM	CP	Fat	Starch	NFE	Sugar	ME
CSL	43.00	33.50	1.00	17.40	Less 1.00	3.30	15.40

Source: Feed Guide Energy Products, Copyright © 2011 Castlegate James Australia Pty Ltd.

Table 3. Chemical composition of *PF as non-conventional energy.

%Items	Ingredient concentrations
Oil	84.00
Calcium	9.00
Moisture	5.00
Fatty acids profile%	
C12 Lauric acids and C:14.0 Myristic acids	1.2
C16 Palmitic acids	48.0
C18.0 Stearic acids	5.0
C18.1 Oleic acids	36.0
C18.2 Linoleic acids	9.5
ME MJ/kg/DM	33.25

***The PF is Megalac® consists of palm fats produced by reacting palm fatty acid distillate with calcium hydroxide to form calcium soap).**
Source: Richard Webster Nutrition L. td: Protected Fat and Omega-3 Fish Oil Supplements.

Otherwise, daily dry matter consumption during trimester of gestaion and sucking listed as below in Table 4:

Measurements and data collection Body weight (BW) and body condition scour (BCS) of ewes

Both BW and BCS of ewes were recorded fortnightly in the morning before offered morning rations pre-lambing and from lambing to weaning. The BCS is used a scale of 1 to 5 points as following Table (5).

Estimated of behavior and body weight of lambs:-

Lamb behavior was evaluated during the first 3 hours after birth, by an observer positioned near from the pen. The observer measured the time in minutes that the lamb took to stand up on four legs, to reach udder (lamb approaches ewe and nudges her in the udder region) and to suck milk (lamb mouth holds teat and suck). The ewe and lamb (s) remained in the individual pen for 3 days before rejoining the flock. At postpartum, lambs were weighed again at 10, 30 and up to weaning at 60 days.

Table 4.Daily dry matter intake

Item	Treatments		
Daily DM intake (g/h) during gestation period (6weeks)	**T1**	**T2**	**T3**
CFM (g \ h \ d)	825	825	825
BH (g \ h \ d)	324	324	324
RS (g \ h \ d)	256	256	256
BF (4%) (g \ h \ d)	-	4	-
CSL (20%) (g \ h \ d)	-	-	9
Total DM intake (g \ h \ d)	1405	1409	1413
Total ME intake	158	162	174
Total protein intake (g \ h \ d)	4536	4538	4534
DM intake, g/kgw$^{0.75}$	73.64	73.85	74.11
DM intake, % of BW	2.75	2.76	2.77
Roughage: Concentrate R/C ratio	42:58	41:59	42:58
Daily DM intake (g/h) during suckling period (8weeks)			
CFM (g \ h \ d)	1151	1151	1151
BH (g \ h \ d)	395	395	395
RS (g \ h \ d)	1786	1786	1786
BF (4%) (g \ h \ d)	-	4	-
CSL (20%) (g \ h \ d)	-	-	9
Total DM intake	3332	3336	3341
Total ME intake	10587	10589	10594
Total protein intake	276	276	283
DM intake, g/kgw0.75	178.28	172.76	172.75
DM intake, % of BW	6.72	6.44	6.44
Roughage: Concentrate R/C ratio	65:35	65:35	66:34

Table 5. Scales of body condition scoring.

Scales	Thin			Ideal weight			Overweight		
From 1 to 5 points	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0

Effect of experimental ration on Fat, protein, energy and amount of suckling milk:-

The fat, protein, energy and amount of suckling milk were evaluated in T1, T2 and T3 groups three times early (at 10 days), middle (at 30 days) and late (at 60 days) post-lambing during suckling period. Milk samples (20 ml /ewe/group) were collected in the morning pre-feeding. Immediately, milk samples were analyzed for fat and protein % using digital Lactoscans, Milk analyzer, Wide LCD 8900 Nova Zagora, Bulgaria. Then, suckling milk energy was calculated using the following equation by Bradley *et al*. (1992): Suckling milk energy (kcal/kg) = 203.8+ (8.36×fat %) + (6.29×protein %).

Also, the suckling milk amount was measured at 10, 30 and 60 days using the following equation= suckling milk amount (kg) obtained in 4 hours as the isolation time of lambs from their dams × 6 hours using the oxytosin method according to (Khalifa *et al*., 2013).

Blood parameters :-

The blood samples were evaluated at 145 days before parturition, at a day of parturition and one week after parturition using 3 ewes /group. Blood samples were taken from the jugular vein in the morning into tubes without anticoagulant for serum collection. After collection, the samples were kept at room temperature for 20 min, and then centrifuged at 3,500 x g for 20 min. The serum samples were stored in eppendrof tubes at -20 ˚C until analysis. Chemistry analysis was used to measure the concentration of metabolites using commercial kits, β-hydroxybutyrate (β-HB) using (D-3hydroxybutyrate kit), non-esterified fatty acids (NEFA) using (Randox Laboratories Ltd., Ardmore, UK), glucose using (glucose HK kit, Roche®), total protein using (total protein 400t kit, Roche®) and albumin using (albumin Gen2 kit, Roche®).

Statistical Analysis :-

Statistical evaluation of significant difference between means (mean ± SEM) was performed by one-way analysis of variance (ANOVA) followed by the Duncan post hoc test to determine significant differences in all the parameters using the SPSS/PC computer program (SPSS Statistics version 26, 2019). The significance level was P<0.05.

RESULTS AND DISCUSSION

Effect of feeding on BW and BCS pre-lambing :-

Ewes in the T2 and T3 had (P<0.05) greater BW and BCS than those ewes in the T1 pre-partum is represented in Tables (6) and (7), respectively. In this study, T1, T2 and T3 rations had similar ingredients and were designed to cover the ewes' energy and protein demands. In this context, Ólafsdóttir *et al.* (2012) stated that energy and protein in late pregnancy and early lactation of ewes could rarely be met without substantial concentrate feeding. Thorup *et al.* (2012) found that energy balance (EB) using daily BW measurements combined with frequent BCS measurements has recently been developed. Also, Thorup *et al.* (2013) noticed that the BW and BCS have been used for the evaluation and prediction of body energy reserves. Additionally, BCS has been used as an index of available body energy reserves in ewes Kenyon *et al.* (2014). Finding of, Mohammadi *et al*. (2016) who indicated that the main energy and protein for fetal development and colostrum/milk production are glucose and amino acids. Moraes *et al.* (2016) estimated that mean of ewes BW at lambing was 58.03 kg with BCS 2.03 also BCS 2.32 has lambs birth weight at 4.97 kg and BCS 2.72 with ewes weaning weight occurred 45.85 kg which attained lambs weaning weight 19.44 kg. Furthermore, Chay-Canul *et al.* (2016) reported that body energy content is influenced by animal breed, nutritional management and physiological state. On the other hand, Díaz-Lópeza *et al*. (2017) found that both BW and BCS peripartum improved the prediction from 2 to 7% and use of BCS and BW in ewes provides a good estimate of the muscle energy , fat energy and total energy. According to Manzoor *et al*. (2018) defined that BCS as an indicator of animal maintains energy reserves, reflective of the relationship between nutrition and milk production. Furthermore, Gronqvist *et al.* (2018) reported that during 115, 136 and 142 days of gestation the BW was 77.6, 86.2 and 90.7 kg with medium feeding while, it was 77.7, 89.3 and 92.0 kg with Ad libitum feeding also, BCS with medium feeding was 2.64, 2.40 and 2.51, but it was 2.52, 2.82 and 2.72 with Ad libitum feeding, respectively. Affirmation by Schmitt *et al.* (2018) who suggested that a higher level of dietary protein can raise production of microbial protein due to faster fermentation of carbohydrates peripartum. Low intake during late pregnancy and early lactation can give rise to negative energy balance, which substantially increases the risk of metabolic diseases particularly ketosis Pesántez-Pacheco *et al.* (2019). Generally, Shereef (2020) revealed that improvement of protein and energy in ration has significantly higher positive results on consumption of dry matter, organic matter and crude protein digestibility which consider a good indicator for animal healthy (as body weight) than control group.

Table 6. Average of body weight (BW) of ewes from 100 days to 145 days pre lambing as affected by T1, T2 and T3 rations.

Items	Treatments		
(days)	T1	T2	T3
At 100	51.40±0.88 a	51.20±0.59 a	51.30±0.55 a
At 115	53.80±0.96 b	56.10±0.53 a	55.90±0.50 a
At 130	56.70±0.82 b	59.80±0.42 a	59.60±0.49 a
At 145	61.70±0.68 b	63.60±0.48 a	63.40±0.50 a

Means of treatments within rows with different superscript letters observed differ significantly at P<0.05.
T1: control group T2: energy group T3: protein group.

Table 7. Average of body condition score (BCS) of ewes from 100 days to 145 days pre-lambing as affected by T1, T2 and T3 rations.

Items	Treatments		
(days)	T1	T2	T3
At 100	0.03±2.56a	2.54±0.01 ^{a}	2.53±0.02 ^{a}
At 115	2.67±0.05 ^{a}	2.74±0.04 ^{a}	2.73±0.03 ^{a}
At 130	2.77±0.07 $_{b}$	2.96±0.04 ^{a}	2.94±0.03 ^{a}
At 145	2.84±0.10 $_{b}$	3.35±0.08 ^{a}	3.25±0.08 ^{a}

Means of treatments within rows with different superscript letters observed differ significantly at P<0.05.
T1: control group T2: energy group T3: protein group.

Effect of feeding on BW and BCS of ewes from post-lambing to weaning :-

A greater (P<0.05) of BW in T2 and T3 groups than T1 group from post-lambing to weaning shown in Table (8). However, T2 , T3 rations on BCS was more (P<0.05) than those ewes fed T1 ration from post-lambing to weaning is presented in Table (9). Improving of nutrition plane by either protein or energy before lambing caused a positive lactation performance of ewes. Villeneuve *et al.* (2010) found the best change in ewes live weight at lambing (82.2 and 83.5 kg), BCS at lambing (3.5 and 3.7), live weight at end of lactation (73.4 and 76.8 kg) and BCS at end of lactation (2.9 and 3.0) for restricted and improvement quality ration, respectively. similar studies in ewes are observed with Corner-Thomasa *et al.* (2015) who indicated that modification feeding at lactation with three levels as 1st (low), 2nd (intermediate) and 3rd (high) can change BW of ewes up to 75.3, 76.4 and 77.5 kg at 18 day of lactation, but it was 74.9, 78.8 and 85.3 kg at 79 days of lactation, respectively. Also, the same authors defined that BCS at 2.0, 2.5 and 3.0 in 18 days of lactation has assured BW 73.4, 76.1 and 79.5 kg however, at 79 days of lactation, it was 77.7, 79.2, 82.2 kg, respectively. The effect of BW measured in pregnancy and lactation has been demonstrated in some previous studies which supplemented protein and energy (Hunter *et al*., 2015). Also, Ángeles Hernández *et al.* (2018) showed the most relationship between feeding and BW at mid-lactation when ewes had a greater energy intake, which determine greater availability of milk synthesis reaching the mammary gland and higher udder volume. Generally, Pesántez-Pacheco *et al*. (2019) foud that changes in the BW and BCS of ewes which, feeding the best rations that promoted high metabolizable energy intake (MEI).

Table 8. Average of body weight (BW) of ewes post-lambing to weaning as affected by T1, T2 and T3 ration.

Items	Treatments		
	T1	T2	T3
At lambing	49.60±0.51 [b]	51.80±0.37 [a]	51.90±0.50 [a]
At 15 days	48.80±0.48 [a]	51.42±0.44 [a]	51.48±0.53 [a]
At 30 days	48.50±0.45 [b]	50.70±0.30 [a]	50.50±0.50 [a]
At 45 days	47.90±0.48 [b]	50.20±0.33 [a]	49.80±0.57 [a]
At weaning up to 60 days	47.00±0.49 [b]	49.80±0.53 [a]	49.40±0.52 [a]

Means of treatments within rows with different superscript letters observed differ significantly at P<0.05.
T1: control group T2: energy group T3: protein group.

Table 9.Average of body condition score (BCS) of ewes post-lambing to weaning as affected by T1, T2 and T3 ration.

Items	Treatments		
	T1	T2	T3
At lambing	2.54±0.09 [b]	2.85±0.06 [a]	2.82±0.07 [a]
At 15 days	2.35±0.08 [b]	2.80±0.08 [a]	2.70±0.08 [a]
At 30 days	2.35±0.07 [b]	2.75±0.08 [a]	2.70±0.08 [a]
At 45 days	2.25±0.08 [b]	2.70±0.08 [a]	2.60±0.13 [a]
At weaning up to 60 days	2.15±0.07 [b]	2.70±0.07 [a]	2.55±0.09 [a]

Means of treatments within rows with different superscript letters observed differ significantly at P<0.05
T1: control group T2: energy group T3: protein group

Effect of ration on lambs behavior :-

A more improvement (P<0.05) of lambs behavior in T2 and T3 groups than those lambs in T1 group shown in Table (10). Then, T2 and T3 did not affect metabolic stress during peripartum of the ewe, but they did improve lamb vigor at birth. The same results in trended of Ólafsdóttir *et al.* (2012) who found that supplied energy and protein in late pregnancy and early lactation can be improved body reserves of ewes which refluxed on their lambs healthy. The body weight of birth lambs are affected by efficiency of energy and protein utilization (González-García *et al*., 2014).

Table 10. The effect of T1, T2 and T3 ration on lambs' behavior

Items (minutes)	Treatments		
	T1	T2	T3
From birth to standing	24.55±1.13 [a]	17.50±1.01 [b]	18.80±1.63 [b]
From birth to reach udder	27.45±1.94 [a]	20.50±1.12 [b]	20.65±0.84 [b]
From birth to suckling	48.70±1.75 [a]	35.35±1.69 [b]	36.55±1.16 [b]

Means of treatments within rows with different superscript letters observed differ significantly at P<0.05.
T1: control group T2: energy group T3: protein group

Supplementation energy or protein during peripartum do affect lamb vigor (Joy *et al*., 2014). Lambs' latency to stand and search for the udder was shorter in T2 and T3 lambs than T1 lambs. A similar finding has been described in other sheep breeds (Dwyer, 2014). In T2 and T3 ration ewes moved and cleaned their lambs more frequently and depending on their maternal experience this can enhance lamb activity. Similarly, Silva *et al.* (2015) noticed that lamb strength is influenced by nutritional reserves at birth (amount of brown adipose tissue) and locomotor ability. Brown adipose tissue supplies lambs with energy for thermoregulation and nutrition from birth until colostrum (Silva *et al*., 2016). The lamb's central nervous system affected by nutrition during gestation (Pedernera *et al*., 2017). It has been shown that supplementing different sources of fatty acids reduces the latency to suckle (Rocha *et al*., 2018) in pregnant ewes. Also, Kenyon *et al.* (2019) noticed that triplet-bearing ewe displayed a longer period of restlessness prior to lambing than both singleton and twin-bearing ewes.

Fat, protein and energy amount in suckling milk :-

The sucking milk amount, fat, protein and its energy in T1, T2 and T3 groups are presented in Table (11). Suckling milk in T1 ewes shown lower amount of fat, protein and energy compared to suckling milk in T2 and T3 ewes .

Table 11. The effect of T1, T2 and T3 rations on amount, fat, protein and energy of suckling milk.

Items	Treatments		
	T1	T2	T3
	At 10 days as early suckling		
Suckling milk amount (kg)	8.63±0.49 [b]	12.29±0.57 [a]	12.00±0.63 [a]
Fat (%)	6.43±0.15 [c]	8.63±0.13 [a]	7.96±0.07 [b]
Protein (%)	3.88±0.69 [c]	4.40±0.73 [b]	4.47±0.98 [a]
Milk energy (kcal/kg)	281.96±1.37 [b]	303.52±1.23 [a]	300.28±8.33 [a]
	At 30 days as middle suckling		
Suckling milk amount (kg)	6.53±0.43 [b]	9.40±0.49 [a]	8.90±0.51 [a]
Fat (%)	3.57±0.10 [c]	5.96±0.14 [a]	5.27±0.08 [b]
Protein (%)	3.40±0.12 [c]	4.71±0.09 [b]	4.92±0.07 [a]
Milk energy (kcal/kg)	237.11±0.78 [b]	247.74±0.68 [a]	248.37±0.52 [a]
	At 60 days as late suckling		
Suckling milk amount (kg)	3.89±0.36 [b]	5.81±0.57 [a]	5.54±0.55 [a]
Fat (%)	2.70±0.12 [c]	4.66±0.18 [a]	3.87±0.14 [b]
Protein (%)	2.90±0.11 [b]	4.01±0.16 [a]	4.02±0.15 [a]
Milk energy (kcal/kg)	244.69±1.47 [b]	267.98±2.12 [a]	261.43±1.89 [a]

Means of treatments within rows with different superscript letters observed differ significantly at P<0.05.
T1: control group T2: energy group T3: protein group.

There were no differences between sucking parameters in T2 and T3 ewes. Probably, lower amount of fat, protein and energy of sucking in T1 ewes was caused by the less milk secretion and udder-fill rate in their dams. This is consistent with reports that the amount, fat, protein and energy depend on nutrition status through suckling period (Khalifa *et al*., 2013). The best suckling lambs of behavior in T2 and T3 groups could be attributed to the ability of lambs to empty more completely the udder of their dams (Corner-Thomasa *et al*., 2015). Then, nutrition differences had a highly significant effect (P<0.05) on both milk yield and suckling milk components during suckling months. The same results were found by Gronqvist *et al*. (2018). In ancient times our results agreement with the same authors who worked with local Egyptian sheep breeds such as Morsy (2002) who reported that fat, protein and milk energy were 6.5%, 4.9% and 4.4 MJ/kg in Ossimi sheep, respectively. With Farafra sheep, Hamdon *et al*. (2006) reported that suckling milk components as fat, total solid, solid not fat, protein, and milk energy were 5.95%, 15.59%, 10.01%, 5.31% and 4.34 MJ/ kg, respectively. Also, Kassab *et al*. (2009) found that average daily suckling milk components as fat, protein and energy were 5.46%, 5.11% and 4.29 MJ/ kg in Sohagi sheep, respectively. In addition, Hamdon (2009) shows that average suckling milk such as , fat, protein and energy pre-weaning were 28.08 L, 4.93%, 434% and 3.54 MJ/L in Sohagi sheep, respectively. Moreover, Kenyon *et al*. (2019) found that increasing litter size was associated with a decline in the duration of suckling. Recently, Shereef (2020) found that either 17% of protein or 331 of calories were supplied to ewes' ration could be improved total protein, linoleic acid, omega 3 and unsaturated fatty acids in ewes' milk.

The effect of experimental diets on lambs' body weight :-

Lambs' body weight changing for ewes had fed T1, T2 and T3 rations are indicated in Table (12). Ewes fed either T2 or T3 rations had more (P<0.05) lambs' body weight than ewes received T1 ration. Currently, the improvement nutrition plane by energy and protein during lactation; could that produce more milk than control diet. Similarly, Villeneuve *et al*. (2010) who observed greater milk production in high protein and energy compared to moderately feeding from lambing to weaning.

Table 12. The effect of T1, T2 and T3 rations on lamb body weight

Items	Treatments		
	T1	**T2**	**T3**
No. of lambs at birth	15	16	T3
No. of live lambs at 30 days of birth	13	15	16
No. of live lambs at 60 days of birth	11	14	15
Body weight at birth (kg)	2.13±0.15	2.31±0.11	14
Body weight at 30 days of birth (kg)	4.44±0.59^{b}	6.49±0.63^{a}	2.41±0.09
Body weight at weaning at 60 birth (kg)	6.62±1.02^{b}	10.65±1.22^{a}	6.38±0.66^{a}

Means of treatments within rows with different superscript letters observed differ significantly at P<0.05.
T1: control group T2: energy group T3: protein group.

They also evaluated that birth weight improved up to 4.7 and 5.4 kg, weaning weight at 26.9 and 29.9 kg and average daily gain was 336 and 373 g/day in ewes received control and treated diet, respectively. The heaviest lambs' body weight in T2 and T3 rations may be attributed to milk production than T1 group through suckling period. Corner Thomasa *et al*. (2015) reported that a diet deficient in essential fatty acids (linoleic and linolenic acids) caused a reduction of mammary development . On the other hand, Hafez *et al*. (2015) noticed that ewes received either control or energy rations had positive significant udder volume during early suckling (106.17 and 140.73 cm3), middle suckling (105.81 and 123.27 cm3), late suckling (94.63 and 113.49 cm3) and the average suckling milk amount up to weaning was 997.5 and 1160.0 g, respectively. They also found that non- significant in birth weight (2.88 and 2.88 kg), but the heaviest significant weaning weight of lambs (12.63 and 16.00 kg) observed when ewes fed control and energy rations, respectively. Nevertheless, the difference in the fatty acid content of the diets was probably small and fatty acids were not protected from ruminal biohydrogenation. Therefore, the lowest feeding could be reduced the dam’s milk production (Moraes *et al*., 2016). They also defined that twins or triplets lambs imposes more demand on the mammary gland to meet the needs of the offspring and milk production for their growth. Indeed, the effect of nutrition on mammary gland development and suckling milk production appears to be independent of the milk amount (Hunter *et al*., 2015), the degradability (Antunovic *et al*., 2017) and dietary protein or energy concentration (Ángeles Hernández *et al*., 2018). In the current results, feeding ewes on ration contents protein or energy has more appositive results on number and growth of lambing from birth to weaning than control ration. These results are confirmed with Shereef (2020) who reported that ewes ration contained 17% protein increased Immunoglobulin (IgG) and protein of colostrum in milk which consider a good indicator for animal immune status and healthy milk for consumers.

Effect of diet on blood parameters :-

The serum blood in T1, T2 and T3 ewes through pre-lambing, at lambing and post-lambing are shown in Table (13). In the current study all the serum parameters were or closed to normal range values for healthy ewes (Moghaddam and Hassanpour, 2008). The present study is shown that lower (P<0.05) in serum metabolic values in β-HB, NEFA and globulin concentration in T2 and T3 ewes than those T1 ewes. However, T2 and T3 ewes had more (P<0.05) serum metabolic values in glucose, total protein, albumin and A/G concentration than T1 ewes. Among T1, T2 and T3 ewes, the serum NEFA and β-HB were higher before lambing; thereafter decreased (P<0.05). Serum glucose level were significantly lower at pre-partum period than post-lambing (P<0.05).

Table 13. The effect of T1, T2 and T3 rations on blood samples through pre-lambing, at lambing and post-lambing.

Items	Treatments		
	T1	**T2**	**T3**
		Pre-lambing	
β-hydroxybutyrate (mmol L-^{1})	0.87±0.02^{a}	0.74±0.04^{b}	0.77±0.05^{b}
Non-esterified fatty acids (mmol L^{-1})	0.52±0.01^{a}	0.44±0.02^{b}	0.46±0.02^{ab}
Glucose (mg dL^{-1})	76.50±1.53	80.07±0.78	78.83±0.71
Total proteins(g dL^{-1})	7.50±0.06^{b}	7.83±0.07^{a}	7.70±0.06^{ab}
Albumin (g dL^{-1})	4.13±0.14^{b}	4.80±0.06^{a}	4.67±0.09^{a}
*Globulin	3.37±0.08^{a}	3.04±0.12^{b}	3.03±0.03^{b}
**A/G ratio	1.23±0.00^{b}	1.58±0.00^{a}	1.54±0.00^{a}
		At lambing	
β-hydroxybutyrate (mmol L-^{1})	0.81±0.03^{a}	0.64±0.02^{b}	0.66±0.01^{b}
Non-esterified fatty acids (mmol L^{-1})	0.54±0.01^{a}	0.46±0.02^{b}	0.48±0.02^{b}
Glucose (mg dL^{-1})	82.50±1.53	84.07±1.63	82.83±1.37
Total proteins(g dL^{-1})	7.06±0.17^{a}	6.70±0.12^{ab}	6.40±0.06^{b}
Albumin (g dL^{-1})	4.03±0.06^{b}	4.66±0.12^{a}	4.63±0.07^{a}
*Globulin	3.03±0.23^{a}	2.03±0.03^{b}	1.77±0.03^{b}
**A/G ratio	1.34±0.00^{b}	2.29±0.00^{a}	2.63±0.00^{a}
		Post-lambing	
β-hydroxybutyrate (mmol L-^{1})	0.65±0.26	0.61±0.03	0.62±0.01
Non-esterified fatty acids (mmol L^{-1})	0.53±0.01^{a}	0.44±0.02^{b}	0.46±0.03^{b}
Glucose (mg dL^{-1})	85.83±0.33^{b}	88.40±0.82^{a}	86.50±0.75^{ab}
Total proteins(g dL^{-1})	6.60±0.15	6.44±0.06	6.47±0.09
Albumin (g dL^{-1})	3.47±0.08^{b}	4.40±0.11^{a}	4.30±0.12^{a}
*Globulin	3.13±0.24^{a}	2.20±0.10^{b}	2.17±0.17^{b}
**A/G ratio	1.12±0.00^{b}	2.01±0.00^{a}	2.03±0.00^{a}

Means of treatments within rows with different superscript letters observed differ significantly at P<0.05.
***Globulin= total protein – albumin**
****A/G ratio= albumin level÷ total protein level –albumin level**
T1: control group T2: energy group T3: protein group

Serum total protein and albumin concentrations were numerically decreased during pre-lambing period and reached the lowest level after lambing (P > 0.05). Serum β-HB concentration may thus be served as a useful method in monitoring the energy status of pregnant ewes. Mohammadi *et al*. (2016) reported that values of 0.80 to 1.60 mmolL-1 indicate a negative energy balance. In the present study, β-HB level was ranged from 0.60 to 0.87 mmol L-1 pre- and post-lambing (normal level of β-HB from 0.47 to 0.63 mmolL-1). The NEFA level is reflected the magnitude of fat mobilization from fat stores in response to negative energy balance. The gradual increase of plasma NEFA during the final days of pre-lambing period may be explained by the gradual depression of DMI observed during this time. This increase is due to the required energy for parturition and milk production (Antunovic *et al*., 2017). The NEFA levels (ranged from 0.42 to 0.46 mmol L-1) in T2 and T3 ewes during peri-lambing period take place in normal levels (NEFA, < 0.45 mmol L-1) described by Mohammadi *et al*. (2016). Serum glucose level in the present study was in accordance with previous experimental studies that recorded serum glucose levels to be higher in lactation than pregnancy in ewes (Silva *et al*., 2015).The previous authors defined that the increase of glucose may reflect the recovery of feed intake and improving energy status of the ewe after lambing. Negative energy balance appears to be related to the glucose demands of the fetal-placental unit in pregnant ewes (Mohammadi *et al*., 2016). Approximately 60.00% of fetal growth is known to take place during the last six weeks of pregnancy and within this period the most important etiological factor for pregnancy toxemia is decline in the plane of nutrition (Pesántez-Pacheco *et al*., 2019). Although, glucose is the primary metabolic fuel and is absolutely essential for vital organ function, fetal growth and milk production (Rocha *et al*., 2018). According to, Haffaf and Benallou (2016) who confirmed that glucose is an insensitive measure of energy status, as it is subject to tight homeostatic regulation. Serum total protein level was numerically decreased at the time of parturition and one week after parturition. These results were in agreement with Mohammadi *et al*. (2016) who reported that decreasing serum total protein may be related to the fact that the fetus synthesizes and growth of the fetus is increased exponentially reaching a maximum level, especially in muscles, during late pregnancy. However, serum albumin level was not significantly and globulins were responsible for variations of total proteins levels. Pesántez-Pacheco *et al*. (2019) found that less of serum total protein due to decrease in globulin especially alpha 1 and gamma fractions; this was thought to be due to the production of globulin-rich colostrum. On the other hand, Antunovic *et al*. (2017) found that the ability to synthesize milk appears in sheep three to four weeks before parturition and also drainage of globulins to mammary glands for colostrum synthesis may be considered as a main factor for serum total protein reduction. Recently, Shereef (2020) found that 17% protein in ewes' ration have positive results on immune globulin blood.

CONCLUSION

From the foregoing results, feeding twin-bearing ewe on good plane of nutrition contains sufficient protein and energy from trimester to weaning has compromise reproductive, body weigh, body condition score, lambs behavior and the goodness lactation to offspring growth performance. It would be interesting to evaluate that the abundance feeding of either protein or energy has positive effects on ewe blood metabolic from trimester to weaning.

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التفاعل المحتمل بين تغذية النعاج الحاملة للتوائم واداء ونمو حملانها حديثي الولادة

طارق مسلم محمود مهدى [1] ، هشام رجب بحيرى [1] ، عبد المنعم سيد محجوب[1] و نها تاج الدين حسن تاج الدين[2]

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تهدف هذه الدراسة إلى تحديد تأثير والمعاملات الغذائية التي تحتوي على إضافة الطاقة والبروتين ، درجة حالة الجسم للنعجة (BCS)، وزن الجسم (BW)خلال فترة الثلث الاخير من الحمل على أداء النعاج الحاملة للتوأم وايضا الحملان حتى فطامها .ففي اليوم 100من الحمل تم مسح مائة وخمسين نعجه رحماني لاختيار النعاج التى تحمل توأم و تم تحديد أربعة وعشرين نعجة تحمل توأم فى عمر من 3إلى 4سنوات بمتوسط وزن الجسم 51.30±0.39كجم وفى مقياس درجة الجسم) 2.54±0.16على اساس المقياس للجسم من 1إلى 5) BCS .وقد تم تقسيمهم الى ثلاث مجاميع 8)نعاج بكل معامله (على النحو التالي-: المعامله الاولى T1، وهى)المقارنه (وهى تتغذى على 75٪ مخلوط علف مصنع 25% +علف خشن 20%)دريس برسيم 5 %+قش ارز . (المعامله الثانيه T2وهى تتغذى على 75٪ مخلوط علف مصنع 25% +علف خشن 20%)دريس برسيم 5%+قش ارز 4%+ (دهن محمى. (PF) المعامله الثالثه T3وهى تغذى على 75٪ مخلوط علف مصنع 25% +علف خشن 20%)دريس برسيم 5%+قش ارز 20%+ (مركز نقع مياه الاذره تمت التغذية للمعاملات الثلاث 100يوم قبل الحمل حتى اليوم 60حتي الفطام .ولقد اظهرت النتائج الى -: المعاملتين الثانية والثالثه للنعاج التواميه فى الثلث الاخير من الحمل الى الولاده قد حققتا تحسن معنوى (P<0.05)فى وزن الجسم وكذلك مقياس الجسم الخارجى وايضا التحسن الواضح بمعنويه (P<0.05)فى سلوك الحملان من حيث كميات لبن الرضاعه والذى انعكس بدوره فى الزياده الوزنيه العاليه لحملان المعاملتين الثانيه والثالته عن الاولى)المقارنه (وبالاضافه الى ذلك التحسن المعنوى فى التمثيل البيوكيميائى باضافه كلا من مصادر الطاقه والبروتين عن نعاج المقارنه وخلاصة هذه الدراسة إلى أنه من الأمثل للمربين أن يضيفوا إما مصدرللطاقة)بنسبة (PF 4%أو مصدر للبروتين)بنسبة (20%CSLللنعاج التوأمية فى فترة الثلث الاخير من الحمل والذى ادى الى التحسن المعنوى فى وزن الجسم ومقياس درجة الجسم للامهات والمواليد الى الفطام دون حدوث فقد لهذه الاجنة قبل الميلاد ولا بعد الولادة الى الفطام .