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PRODUCTIVE AND REPRODUCTIVE PERFORMANCE OF EWES AND GROWTH RATE OF LAMBS AS AFFECTED BY NON-CONVENTIONAL ENERGY SUPPLEMENT TO RATIONS

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ABSTRACT

The study included two experiments to compare efficiency of using basic and untraditional energy sources on productive and reproductive performance of ewes and growth rate of lambs. At first experiment, twenty-four Rahmani ewes aged 3.0- 3.5 years and weighed 46.19±8.56 kg were divided into two similar groups (N=12 each). The 1st group (L) received 4021 kcal/kg/DM while the second (L1) received 4469 kcal/kg/DM Both treatments started 28 days prior-breeding season until weaning the lambs. In this experiment, live body weight (LBW) of ewes was measured during different stages of gestation. At postnatal, eight ewes and their lambs were chosen (N=4 in each energy level) to determine their LBW, suckling milk (quantity and quality) and some udder measurements. At second experiment, fourteen male Rahmani lambs (average body weight 22.72 kg at 14 weeks of age) were divided into two groups, 7 lambs / energy level (L1 and L2), to record growth rate and their blood parameters. Results in 1st experiment indicated that, LBW of ewes was significantly (P<0.05) higher with L2 than L1 at days 96 to 140 of pregnancy. The calculated reproductive parameters as pregnancy rate and litter size of ewes fed L2 were significantly (P<0.05) higher (100.00% and 1.92 %) than ewes fed L1 (83.33% and 1.40%), respectively. Ewes and their lambs in L2 group achieved booster (P<0.05) values in LBW, suckling milk (amount and composition) and udder measurements than that of L1group. However, in 2nd experiment it shown that male lambs fed L2 had lower feed intake, higher daily gain, better feed conversion and economical efficiency. Serum glucose and cholesterol of male lambs in L2 were significantly (P<0.05) higher than L1 lambs while, urea level of L1 lambs was significantly higher (P<0.05) compared to L2 lambs. Other serum parameters as total protein and triglyceride were slightly higher in the blood of L2 lambs compared to L1 lambs. Generally, it could recommend to use protected fat (PF) and corn steep liquor (CSL)as energy supplement for improvement of productive and reproductive performance of ewes and their suckling offspring, growth rate of lambs and their blood metabolites.

Keywords: *Ewes reproduction, production, suckling milk, growth rate of lambs, blood parameters, untraditional energy.*

INTRODUCTION

In ruminants, non-classical energy sources played an essential role in improving productive and reproductive animals' performance. Notter *et al.* (2012) concluded that diet with higher concentration of energy is recommended for finishing lambs, producing greater body weight gain, better corporal condition and a shorter time spent in feedlot. Flushing is widely accepted practice in sheep husbandry to provide ewes with extra energy supply (flushing) prior to and during breeding season, for the purpose of increasing the number of lambs produced (Shad *et al.*, 2011). Failure of flushing resulted in delayed estrus activity, ovulation rate, fertilization disability and embryonic mortality (Hafez *et al.*, 2011). Lambs could have high productive indexes when their nutritional requirements are adequte, especially in their first six months of life. Feeding high concentrate to young animals tended to increase growth rate, carcass yield and carcass quality (Furusho-Garcia *et al.,* 2010). In feedlot status, the diet used and the genotypes indicated for these systems are responsible for the biological and economic performances (Shivambu *et al.*, 2011). It allows producers to maintain production to achieve rapid growth with a balanced energy in rations. Thus, several studies explained that non-conventional energy source takes interest in goats (Khalifa *et al.*, 2013) and ewes (Khalifa *et al.,* 2015).

The goal of this study was to investigate the effect of two levels of energy addition to the ration on productive and reproductive performance of ewes and their lambs during suckling months. Growth performance and some blood parameters of male lambs' were also recorded.

MATERIALS AND METHODS

The present study was carried out at El-Serw Experimental Research Station belonging to Animal Production Research Institute (APRI), Agriculture Research Center, Egypt.

1. The first experiment (as welfare)

Twenty-four Rahmani ewes aged 3.0- 3.5 years and 46.19±8.56 kg body weight, were allocated into two groups (12 each). The 1st ewe group was given basic energy L1 and 2nd group (L2) non-conventional energy at rates 4021 and 4469 Kcal/kg /DM, respectively. The L1 energy source consisted of concentrate feed mixture (CFM) and rice straws (RS) while, L2 energy source included CFM, RS and a mixture between protected fat (PF) and corn steep liquor (CSL). Both L1 and L2 rations were offered to ewes at 28 days prior-mating season until weaning . At postnatal, four ewes of each group were used to estimate changes in body weight of ewes and their lambs, amount and composition of suckling milk and udder measurements. Fresh water and mineral blocks were available all times. The chemical analysis and energy amounts of feed consumption were determined using standard procedures of AOAC (2007) and given in Table 1.

The parameters measured on all experimental ewes were; live body weight (LBW), pre-flushing, pre-breeding, post-breeding, at 96 days of last third of pregnancy and prior-partum at 140 days and postnatal were estimated; reproductive performance which represented **by** pregnancy rate (calculated as number of pregnant ewes/ number of ewes mated) and litter size (calculated as number of total lambs born/ number of ewes lambed).

The parameters measured on the selected 4 ewes and their lambs of each group were; changes in body weight of ewes and their lambs (at postnatal (0 day), 15, 30, 45 and 60 days, then average daily gain was calculated for ewes and their lambs from birth to weaning), suckling milk amount and composition and udder measurements.

The suckling milk was measured at 15, 30, 45 and 60 days using oxytocin methods as described by Khalifa *et al.* (2013). Suckling milk were analyzed for fat (%) and protein (%) at early (15 days), middle (30 days) and

Table 1: Chemical composition of basal and experimental rations.

Item	Basal diets		Experimental rations	
	CFM	RS	L1	L2
Organic matter (OM), %	87.86	81.11	85.54	91.23
Crude protein (CP), %	14.43	3.09	13.75	14.44
Ether extract (EE), %	3.44	1.48	3.14	6.92
Crude fiber (CF), %	12.17	36.89	19.42	16.96
Nitrogen free extract (NFE), %	57.82	39.65	49.23	52.91
Ash, %	12.14	18.89	14.46	8.77
***Gross energy (kcal /kg/DM)**	4118	3638	4021	4469

*Gross energy calculated according to MAFF (1975).

late (60 days) of suckling period using Milko-Scan (133B N. Foss Electric, Denmark). In addition, the energy value of suckling milk (SMEV, kcal/kg) was calculated as= 203.8+ (8.36×fat %) + (6.29×protein %) according to Baldi *et al*. (1992).

Udder measurements

The udder conformation traits were taken early (at 15 days), middle (at 30 days) and late (at 60 days) of suckling period. The udder linear measured in the morning prior to any feed intake using flexible tape. These udder conformation traits included; udder length (UL), measured from abdominal attachment to end of udder; the udder width (UW), determined by the width of the udder from the maximum dimension; udder volume (UV), calculated using the following formula UV = 4/3 (π×r×3) as described by Amao (1999). The values of π = 22/7 and r = [udder length + udder width ÷4].

The second experiment (growth rate of lambs):

Fourteen male Rahmani lambs aged14 weeks and weighed 22.73 kg body weight were divided into two groups (7 each) . The first group considered as control and received L1, while the second group was fed L2. The growth performance was recorded for20 weeks starting at week 14th post-weaning of lambs. Both L1 and L2 fed lambs housed under the same condition and placed in an open shaded barn, the ceiling of barn covered with asbestos. Body weight of lambs were measured biweekly.

Feed intake was estimated every 2 weeks in the same days of weighing lambs. Allowances was offered according to NRC (2007).It was calculated by weighing the refused diet collected every next morning at 07:00 am.

Some blood characteristics of lambs

At the end of the experimental work, blood samples were collected from the jugular vein of lambs nourished L1 and L2. The blood samples (without heparin) were centrifuged at 3000 *g* for 20 min. and serum was harvested and stored at –20 °C for later analysis. Serum concentrations of total protein, glucose, urea and cholesterol were determined using commercial enzymatic colorimetric kits (Diamond Diagnostics, Egypt). Serum triglycerides concentration was determined using commercial kit (Bio-Systems S.A. Costa Brava 30, Barcelona, Spain).

Statistical analysis

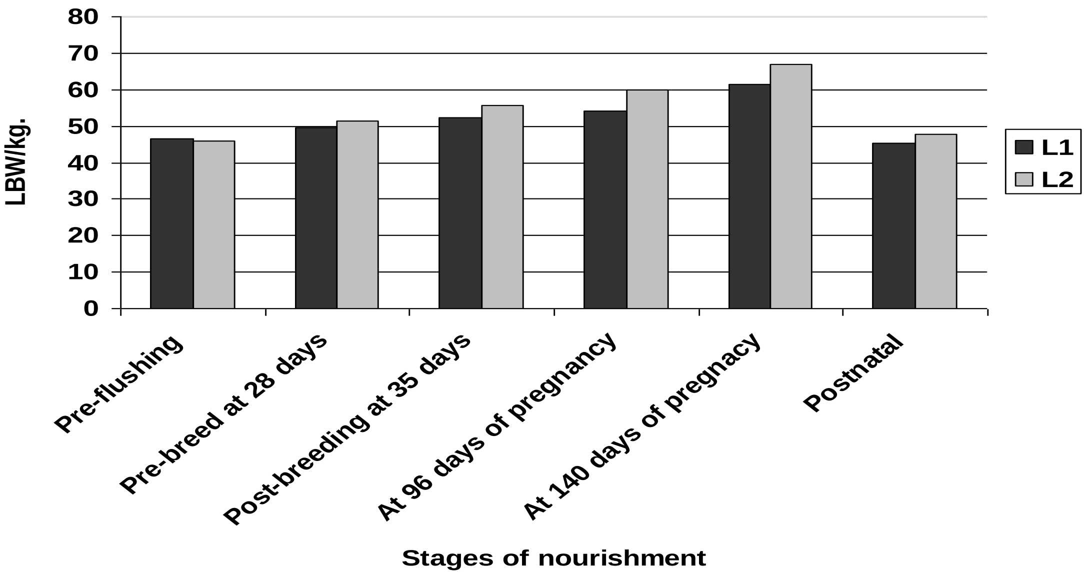
Data were statistically analysed as one-way ANOVA, using general linear models procedure adapted by IBM SPSS Statistics (2013). The significant differences among means were declared at $P<0.05$ according to Duncan's New multiple-range tests of the same program. All statements of significance based on a probability $P<0.05$. Correlation coefficient was calculated using the Pearson's coefficients of SPSS program.

RESULTS AND DISCUSSION

The first experiment (as welfare):

Live body weight (LBW) of ewes did not show significant difference between L1 and L2 fed groups, unless at days 96 to 140 of pregnancy, where LBW was significantly ($P<0.05$) higher in L2 than L1. Thus it seems that the high energy level compensate losses in weight recorded during pregnancy period. This is consistent with Meyer *et al.* (2010) who verified that energy restriction during the last third of gestation affected LBW of ewes at lambing and any deficiency in energy nutrients during these activities may compromise the survival and wellbeing of maternal and offspring. Likewise, Chay-Canul *et al.* (2011) concluded that feeding energy to ewes during pre-partum led to improve body weight condition at lambing and lactation at the first fifteen days, but reduction of energy intake resulted in a great loss in body reserves, consequently reproductive performance diminish. El-Nour *et al.* (2012) reported that the positive LBW accompanied using protected fat may be due to that rumen by-pass fatty acids, thus can be used by sheep as a supplement which prevent their biohydrogenation to reach the intestines as pre‑formed long‑chain fatty acids to be absorbed and metabolized by the animal.

Fig. 1:Live body weight (LBW) of ewes nourished L1 and L2 energy pre-flushing up to postnatal.



Reproductive performance

Data presented in Table 2 show that pregnancy rate and litter size with L2 energy were significantly ($P<0.05$) higher than those with L1 ration. These results demonstrate that changes in energy intake pre-mating have a beneficial effect on reproductive characteristics of ewes. Increasing pregnancy rate, type of bearing and litter size were observed on L2 ewes compared with L1 ewes. Sultana *et al.* (2011) found that 60% of the increase of energy during pregnancy go to the gravid uterus and the remaining 40% to increased maternal metabolism. The same authors noted that during pregnancy, energy metabolism changed to support the gravid uterus and the timing of these changes is a function of both gestational length and fetal number. Moreover, Costa *et al.* (2011) confirmed that energy intake increase the number of ovulations and increase hepatic metabolization of steroid hormones in ewes, consequently release gonadotropins such as follicle stimulating hormone (FSH) and luteinizing hormone (LH). These results are in accordance with those of Verbeek *et al.* (2012) who reported that LH and FSH pulses are critical for follicle development and steroid secretion, then, elevation of energy level had positive feedback on GnRH and LH and these actions of energy are required for the LH surge, which triggers ovulation.

Ewes and their lambs Changes in body weight of ewes and their lambs

Body weights of ewes and their lambs nourished L1 and L2 energy levels are shown in Figures 2 & 3 and changes in body weight gain in tables 3 & 4. It was noticed that at the beginning of suckling period, ewes in L2 tended to have better body weight than those in L1. As suckling advanced, ewes in L2 were heavier than those fed L1. By the end of suckling period, L2 ewes were significantly ($P<0.05$) higher in average daily gain, being 41.33g/day versus 35.67g/day. These results are in identity with those reported by Antunović *et al.* (2010) who found that energy restriction produces harmful consequences on growth, reproduction and other metabolic processes, through the effect of some neuroendocrine hormones such as leptin that has high effect on food intake. Furthermore, the results explained that high energy level used in this experiment did not interfere with rumen microorganisms and rumen function. This is in consonance with what was found by Gadekar *et al.* (2011) that dietary energy modify the ruminal microbial population and improves energy efficiency due to the lower rumen production of methane. In addition, those authors suggested the direct use of long-chain fatty acids in the metabolic pathways of fat synthesis, without a need for acetate and glucose. The L2 energy may improve nutrient digestibility that has a positive correlation with body weight compared to L1 energy. Similar results were reported by Helander (2014) who observed that nutrition affects mammary development during pregnancy and lactation in ruminants; deficiencies in dietary energy in early and late lactation markedly reduced milk yield which is reflected on body weight of offspring.

Results presented in Table (4) and Fig 2 show that lambs had non-significant difference in birth weights. From the beginning of suckling up to 60 days, lambs fed L2 energy resorted to have better body weights (P<0.05) than those fed L1 energy. Daily gain achieved was 217.75 and 161.15 g /day with suckling lambs nursed by L2 and L1 fed ewes, respectively (P >0.05). Changes in performance of suckling lambs are mainly related to differences in milk yield, as well as, milk fat and protein levels (Helander, 2014). These results are in accordance with those reported by Hosam and Al-Fataftah (2013) who concluded that addition of 3% soybean oil as energy source to ration led to improve suckling milk of ewes (2.18 kg/day for treatment group versus 1.38 kg/day for control group), and improved lambs weaning weights and daily growth rate, being 20.00 kg and 0.26 kg for tested group vs. 19.34 kg and 0.25 kg for control group, respectively.

Table 2: Reproductive performance of ewes nourished L1 and L2 energy levels.

Items	Energy levels	
	L1	L2
No. of mated ewes	12	12
Pregnant ewes	10	12
Pregnancy rate, %	$83.33^{b} \pm 6.42$	$100.00^{a} \pm 7.51$
No. of total ewes lambed	10	12
No. of total lambs born	14	23
Litter size	$1.40^{b} \pm 0.11$	$1.92^{a} \pm 0.33$

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

Fig. 2: Changing in body weight of ewes nourished L1 and L2 energy during suckling months.

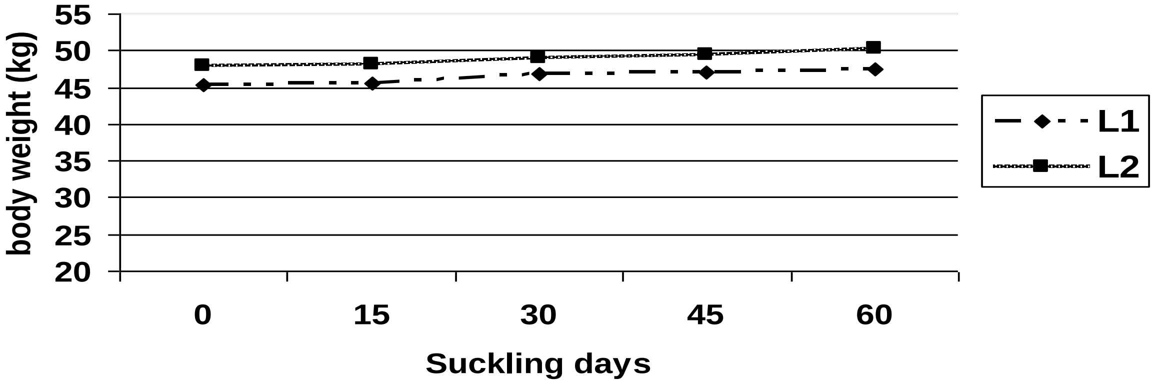


Table 3: Changing of body weight of ewes nourished L1 and L2 energy levels.

Items	Energy levels	
	L1	L2
Body weight at postnatal, kg	45.42±1.66	47.81±1.72
Body weight at weaning, kg	47.56±2.11	50.29±3.81
Total body gain, kg	2.14±0.59	2.48±1.15
Average daily gain, g/day	35.67[b] ±3.84	41.33[a] ±14.26

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

Fig. 3: Changing in body weight of suckling lambs nursed by ewes nourished L1 and L2 energy.

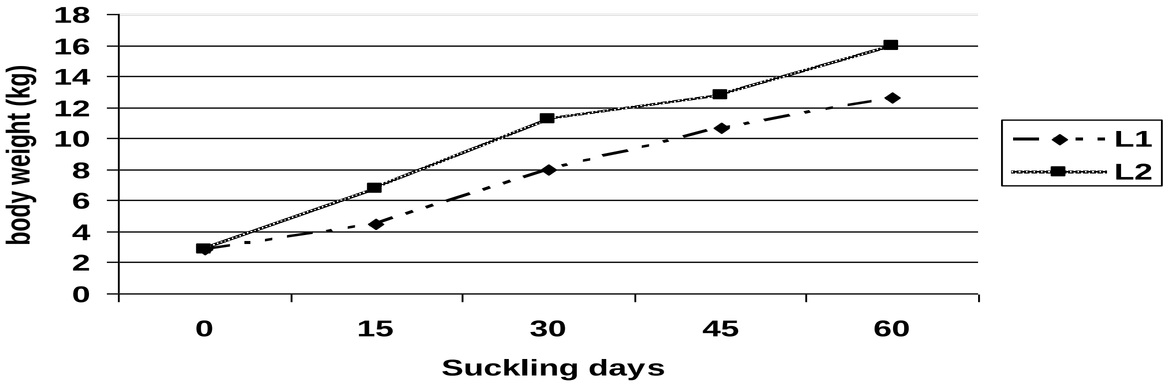


Table 4: Changing of body weight of lambs nursed by ewes nourished L1 and L2 energy levels.

Items	Energy levels	
	L1	**L2**
Birth weight, kg	2.88±0.13	2.88±0.12
Weaning weight, kg	12.63[b] ±0.38	16.00[a] ±1.68
Total body weight gain, kg	9.75[b] ±0.75	13.12[a] ±1.59
Average daily gain, g / day	162.50[b] ±4.17	218.67[a] ±26.44

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

Suckling milk amount and composition

Suckling milk production was recorded four times at days 15th, 30th, 45th and 60[th] of lactation for ewes fed L1 and L2 energy (Fig. 4). Data of milk composition at early (15 days), middle (30 days) and late (60 days) of suckling stages for L1 and L2 ewes are presented in Table 5. The amount of suckling milk tended to be greater with L2 fed ewes than L1 fed ewes, difference was significant only at day 15th of suckling (Fig. 4). Data presented in Table (5) revealed that fat, protein and suckling milk energy for ewes fed L2 were significantly (P<0.05) higher than ewes fed L1 during different stages of suckling period. Moreover, fat, protein and suckling milk energy slightly increased by progress of suckling. Many studies examine fat supplement to diet where it assess the effect of protected forms on milk yield and modify fat content and fatty acid composition in lactating ruminants (Berthelot *et al.*, 2012). Energy supplementation before lambing (prenatal nutrition) affects the milk production, leading to greater average daily milk production during the whole lactation period (He *et al.*, 2014).

Fig. 4: Suckling milk amount of ewes nourished L1 and L2 energy.

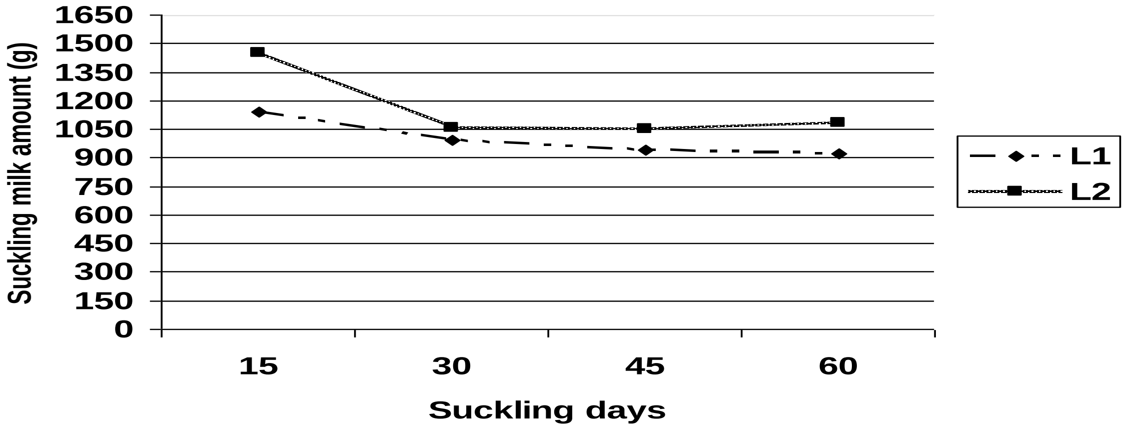


Table 5: Suckling milk composition of ewes nourished L1 and L2 energy levels.

Items %	Energy rations	Stages of suckling milk		
		Early (at 15 days)	Middle (at 30 days)	Late (at 60 days)
Fat	**L1**	6.23^{b} ±0.12	6.60^{b} ± 0.05	6.70^{b} ±0.06
	L2	6.50^{a} ±0.11	7.87^{a} ±0.03	8.40^{a} ±0.05
Protein	**L1**	4.19^{b} ±0.09	4.18^{b} ±0.04	4.14^{b} ±0.04
	L2	4.45^{a} ±0.05	4.59^{a} ±0.03	5.47^{a} ±0.18
***Suckling milk**	**L1**	282.31^{b} ±0.56	285.31^{b} ±0.43	285.83^{b} ±0.24
energy, kcal/kg	**L2**	286.11^{a} ±1.02	298.44^{a} ±0.09	308.41^{a} ±1.43

a, b . Means within same columns with different superscripts are significantly different ($P < 0.05$).
* According to Baldi *et al*. (1992).

Udder measurements

Udder measurements had significantly affected by the energy consumption levels (Table 6). Thus, ewes under control diet (L1) had significantly ($P<0.05$) lower udder diameter than those under trial diet (L2) through all suckling months (8 weeks). Mammary type scores tended to decrease with advance of lactation stage. Mammary size in the early, middle and late suckling stages were 106.17, 105.81and 94.63 with L1 versus, 140.73, 123.27 and 113.49 cm^3 with L2, respectively. In an early study, energy level or level of feed intake were the main factors affecting milk yield and milk composition in dairy ruminants. Adewumi *et al*. (2011) indicated that feed types could report some effects on milk, body weight and udder parameters. In the current study, L2 energy might cause better udder formation than L1 energy that could attribute to the strong relationship between energy balance and leptin hormone. Previously, Antunović *et al.* (2010) demonstrated a positive relationship between leptin and energy. Leptin produced primarily by fat cells but the presence of leptin was also stated in tissue of the mammary gland and thus in milk of different mammalian species. In the present study, energy supplied in L2 could cause mammary gland development due to anequilibrium between hormones secretion and energy balance. The recent results suggests concordant with Zielniok *et al.* (2014) who reviewed that hormones control food intake, energy expenditure, regulate insulin secretion, nutrient homeostasis, required for growth morphogenesis of the mammary gland and it is also essential for mammary epithelial proliferation and differentiation.

Correlation coefficients

Phenotypic correlations among feeding and weight of ewes, weight of lambs, suckling milk amount, suckling milk energy and udder volume at weaning are given in Table 7. The correlation between feeding and the five traits were significantly (P<0.05) positive. Several workers found positive correlation among feeding and body weight, milk secretion, milk composition and udder formation (Ayadi *et al.*, 2014). Meanwhile, weaning weight and growth rate until weaning increased significantly with increasing udder linear. El-Gendy *et al.* (2014) found positive correlations between milk yield, weaning weight and growth rate until weaning of kids. In the current study, much association was found between body performance and dairy performance traits. Regarding correlations among production and body conformation, animals that produced more milk tended to be larger because of their need to increase food intake to cope with the higher energy requirements for milk production (Merkhan, 2014).

The second experiment (as growth)

Growth rate of lambs.

The production response of lambs fed L1 or L2 is shown in Table 8. Final body weight significantly (P < 0.05) increased with L2 than those given L1. Lambs fed higher energy (L2) had reached better marketing weight (LBW) than lambs received the lower energy (L1).

The non-conventional energy could improve rumen fermentation in terms of the fermentation end-products and eliminate the protozoa from rumen of sheep show improve in growth rates. Carvalho and Medeiros (2010) observed that energy enhances efficiency of feed utilization and causes stimulation of weight gain that can attribute to improve emulsification of fat. The beneficial effect of non-conventional supplementation in current study can be explained by the finding of Shivambu *et al.* (2011) who noted possibility to improve digestibility by increasing microbial activities.

The obtained results in Table 8 show that growth rate, feed efficiency and feed conversion were better with L2.. Though price of kg gained for lambs fed L2 (5.95 LE) was higher than gain for those fed L1 (5.02 LE), the feed conversion rate and feed economic efficiency were better for lambs nourished L2 (supplied with PF and CSL) than those received L1 (control ration).

Table 6: Udder measurements of ewes nourished L1 and L2 energy levels.

Items	Energy rations	Udder measurements		
		Early (at 15 days)	Middle (at 30 days)	Late (at 60 days)
Length, cm	L1	21.00[b] ±2.00	21.67[b] ± 0.88	19.00[b] ±1.15
	L2	28.33[a] ±1.45	25.00[a] ±1.53	23.00[a] ±0.58
Width, cm	L1	17.33[b] ±1.85	14.33[b] ±0.33	14.33[b] ±0.33
	L2	21.00[a] ±0.57	17.67[a] ±0.67	16.33[a] ±0.32
Udder volume, cm^3	L1	106.17[b] ±10.36	105.81[b] ±3.97	94.63[b] ±4.54
	L2	140.73[a]±11.69	123.27[a] ±6.21	113.49[a] ±2.12

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

Table 7: Correlation coefficients among feeding and weight of ewes, their lambs, suckling milk and udder volume.

Items	Feeding	BWE	BWL	SMA	SME	UV
Feeding	1	0.996	0.994	0.999*	1.000*	0.998*
BWE		1	1.000*	0.999	0.995	1.000*
BWL			1	0.998*	0.992	0.999*
SMA				1	0.998*	1.000*
SME					1	0.997

BWE = Body weight of ewes at weaning, BWL= body weight of lambs at weaning, SMA= suckling milk amount at weaning, SME= suckling milk energy at weaning and UV= udder volume at weaning.

*Correlation is significant at the (P<0.05).

Table 8: Growth rate of lambs nourished L1 and L2 energy levels.

Items	Different energy levels	
	L1	L2
No. of lambs	7	7
Duration of growth rate (weeks)	20	20
Initial body weight (kg)	22.67	22.78
Final body weight (kg)	42.73[b] ±3.65	46.57[a] ±2.54
Total body gain (kg)	20.06[b] ±3.41	23.79[a] ±2.23
Average daily gain (ADG), g /h	143.29[b] ±2.36	169.93[a] ±3.12
*Metabolic mid-weight (MMW), kg	17.09	17.68
Feed intake		
Concentrate (g/day)	776	732
Roughage (g/day)	671	622
Feed intake of concentrate and roughage , g/day	1447	1354
Concentrate : roughage ratio	54: 46	54: 46
Energy substance (g/day)	-	60.00
Total feed intake (TFI), g/day	1447	1414
Feed conversion ratio (FCR) TFI / ADWG	10.09	8.32
Calculation of economical efficiency		
Price of CFM /h/ d, EGP	2.33	2.20
Price of RS /h/d, EGP	0.17	0.16
Price of energy substance/h/d, EGP	-	0.05
Total price of feed cost consumed (TPFC) [A]	2.50	2.41
Cost of unit gained (TPFC÷ADWG),	17.45	14.18
Price of daily gain (Price of kg LBW × ADWG)[B]	5.02	5.95
**Feeding Economic efficiency(FEE) B ÷ A,	2.01	2.47
Relative improve, %	100.00	122.89

a, b means within the same rows with different superscripts are significantly different ($P < 0.05$).
Price of kg LBW is 35 (EGP). Price in year 2013 for CFM, RS bales, energy substance =3000, 250 and 800 EGP /ton, respectively.
* Metabolic mid-weight (MMW) calculated as: (Initial body weight (kg) + Final body weight (kg) ÷ 2) $^{0.75}$ according to Willems *et al.* (2013).
**Economic efficiency (%) = money out put (price of meat marking) ÷ money input (total price of feed consumed) ×100.

Table 9: Some blood parameters of lambs nourished L1 and L2 energy levels.

Parameters	Energy levels	
	L1	L2
Total protein (g/100 mL)	6.67 ± 0.05	6.86 ± 0.03
Glucose (mg/100 mL)	54.05[b] ± 1.59	63.68[a] ± 1.33
Urea (mg/100 mL)	53.46[a] ± 1.61	37.81[b] ± 1.19
Triglycerides (mg/100 mL)	53.51 ± 1.46	55.58 ± 1.35
Cholesterol (mg/100 mL)	14.74[b] ± 1.86	24.82[a] ± 1.62

a, b . Means within same rows with different superscripts are significantly different ($P < 0.05$).

Some blood characteristics of lambs

Data presented in Table 9 revealed that serum total protein had no significant change due to energy levels tested. Nagy *et al.* (2014) indicated also no significant effect for dietary energy variations on serum total proteins. Serum glucose level was significantly ($P<0.05$) higher with lambs fed L2 than L1, while urea was significantly higher with L1 than L2 groups.. The highest level of protein intake with energy-restricted condition causes an increase in energy deficiency, which may eventually result in reduced serum glucose with concomitant increase in serum urea. These finding are in agreement with the finds of Caldeira *et al.* (2007) who stated that the best parameters for predicting energy balance and metabolic protein in sheep are glucose and urea level in blood. Otherwise, increasing glucose may due to diet containing high amount of long chain fatty acids that increased hepatic gluconeogenesis due to the increment in propionate production in the rumen. These results are similar with those recorded by Ghattas and Nasra, (2010).

The decrease in level of urea in serum L2 lambs is similar to that reported by Abdel-Ghani *et al.* (2011) who showed that addition of fat reduced NH_3 in rumen, particularly with higher levels, which need N supplement. For this reason, urea in combination with fat might cause increase of NH_3 production in rumen, which enhance microorganism's activity, consequently reflect on lambs' performance.

Although, serum triglycerides concentrations not recorded significant difference between those fed L2 or L1, no negative health recognized for lambs. This result agrees with that obtained by El-Nour *et al.* (2012) that ewes received hyper-energy had increased levels of serum total triglycerides without significant change in health. Lambs fed L2 have higher ($P<0.05$) concentration of serum cholesterol than L1 lambs. This result is in agreement with those obtained by Bhatt *et al.* (2011) that increase in dietary fat stimulated intestinal cholesterol synthesis to meet the increased demand for absorption and transport of fat in ruminants. Generally, Singh *et al.* (2013) concluded that reduced density of metabolizable energy significantly affects the growth performance, blood metabolic profile and immune response of lambs.

CONCLUSION

Supplementation with mixture of non-conventional energy to the ration could improve productive and reproductive performance of ewes and work as valuable tool to reduce the cost of nutrition. In addition, non-conventional energy had successfully supposed to feedlot lambs, where it cause acquirable economic benefits and beneficial effects on blood metabolites.

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الملخص العربى

مدى تأثر الأداء الإنتاجى والتناسلى للنعاج ومعدل نمو الحملان بإضافة الطاقة الغير تقليدية فى العلائق

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اشتملت الدراسة على تجربتين لمقارنة تأثير استخدام مصادر الطاقة الأسياسية والغير تقليدية على الأداء الإنتاجى والتناسلى للنعاج ومعدل النمو فى ذكور الحملان. فى التجربة الأولى استخدم ٢٤ نعجة فى عمر ٣- ٥و٣ سنوات عند متوسط وزن ١٩و٤٦ كجم قسمت إلى مجموعتين مج١ ،مج٢ (١٢ نعجة بكل مجموعة) وغذيت على مستويين من الطاقة م١ ،م٢ حتى ٤٠٢١، ٤٤٦٩ كيلو كالورى /كجم/ مادة جافة على التوالى.وكلا من م١، م٢ قدمت للنعاج قبل موسم التلقيح ب٢٨ يوم واستمرت التغذية حتى الفطام وفى هذة التجربة تم قياس التغيرات فى وزن النعاج خلال فترة الحمل. وبعد الولادة تم اختيار ٨ نعاج متماثله (٤نعجة /مستوى طاقة) لقياس التغير فى وزن النعاج بعد الولادة، تقديرلبن الرضاعة (كمية وتركيب) وبعض مقاييس الضرع. فى التجربة الثانية اجريت مع ١٤ حولى فى عمر ١٤ اسبوع بمتوسط وزن ٧٢و ٢٢ كجم وقسمت الى مجموعتين (٧ حولى / مستوى طاقة) لتقدير معدل النمو وأيض الدم .

والنتائج فى التجربة الأولى اوضحت ان النعاج لم تظهر فروق خلال فترة الحمل ومن اليوم ٩٦ الى يوم١٤٠ ظهرت الفروق المعنوية لصالح م٢ مقارنة مع م١. والأداء التناسلى اظهرفروق معنوية لمعدل حمل للنعاج ١٠٠%، ٣٧و ٨٣ % وحجم البطن ٩٣و ١، ٤٠و١ لكلا من م٢، م١ على التوالى. وأظهرت النعاج وحملانها مع م٢ تفوق معنوى فى معدل الأوزان للنعاج وحملانها، كمية وتركيب لبن الرضاعة، مقاييس الضرع مقارنة مع م١.

التجربة الثانية ذكورالحملان مع م٢ اظهرت قلة فى استهلاك العليقة، زيادة فى معدل النمو، وافضل استفادة غذائية وافضل كفاءة اقتصادية مقارنة مع م١.مقاييس الدم كانت معنوية لكلا من الجلوكوز والكوليستيرول وزيادة غير معنوية لكلا من البروتين الكلى والجليسريدات الثلاثية مع م٢ مقارنة مع م١. ولكن مستوى يوريا الدم كان زائد معنويا مع م١ مقارنة مع م٢ .

عموما يمكن ان نوصى بإستخدام مصادر الطاقة الغير تقليدية لتحسين الأداء الإنتاجى والتناسلى للنعاج وحملانها الرضع ومعدل النمو للحوالى ومقاييس الدم.