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Impact of Probiotic Fermented Milk, Palm Date Extract and Their Mixture Supplementation on Neonatal Traits and Hematological Parameters of Late Pregnant Najdi Ewes

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ABSTRACT

As pregnant ewes require more nutrients during their late stage of pregnancy, the current study aimed at investigating the supplementation of late pregnant Najdi ewes with a probiotic fermented milk, sukkary date fruit extract and their mixture on the neonatal traits and maternal hematological parameters. Twenty mature late pregnant Najdi ewes were randomly allocated into four treatment groups ($n = 5$ group^{-1}). Group 1 (C) ewes served as control and given normal saline in a similar program as treated ewes, group 2 (D) ewes were administered 50 mL date extract every other day for the last eight weeks of pregnancy, group 3 (M) ewes were given 50 mL of probiotic fermented cow's milk for the same period and group 4 (DM) ewes were given 50 mL of a mixture (date extract: fermented milk, 1:1) for same period. A blood sample was collected via the jugular venipuncture at the commencement of the experiment and thereafter once a week for the first four consecutive weeks of the treatment. Data were collected after lambing for the neonatal traits. Whole blood samples were analyzed for hematological parameters. Results exhibit no variation for maternal lambing weight among treatments. Mean litter size was not different among treatments (1.2, 1.2, 1.4 and 1.4 lambs/ewe for C, D, M and DM, respectively). Percent lamb survival at birth was highest in D (100%) and lowest in C (67%) ewes with values of 85.7 and 71.4% in M and DM ewes, respectively. Mean litter weight at birth increased ($p<0.01$) in D (6.50±0.3 kg) than control and other treatments. This increase comprised about 85% over the control litter weight. A slight increase ($p>0.05$) in litter weight was found in DM ewes (4.0±1.5 kg), whereas ewes given fermented milk alone gave birth of a litter weight comparable to that of control. Date extract significantly ($p<0.01$) increased hemoglobin concentration (10.74±0.2 g dL^{-1}) as compared to control (9.53±0.2 g dL^{-1}). Fermented milk resulted in the highest White Blood Cell count (11.12±0.5×10^{3} μL^{-1}) and the lowest Red Blood Cell count (7.84±0.4×10^{6} μL^{-1}). All treatments tended to decrease the percentage of segmented neutrophils, meanwhile treatments tended to increase the percentage of lymphocytes with similar percentages of other types of leukocytes. In conclusion supplementing pregnant ewes with dates extract might represent an available source of simple sugars that provide the fetus/fetuses with energy requirements.

Key words: Dates, hematology, probiotics, neonates, sheep, pregnancy

INTRODUCTION

Date palm (*Phoenix dactylifera* L.) is a fruit representing an important component of the diet in most hot arid and semi arid regions of the world. Date palm fruits were found to contain

carbohydrates (44-88%), fats (0.2-0.4%), proteins (2.3-5.6%), fibers (6.4-11.5%), minerals and vitamins (Al-Shahib and Marshal, 2003). Carbohydrates in dates are mostly in the form of fructose and glucose which are easily absorbed by the human body (Al-Farsi *et al*., 2005). Interestingly, dates contain higher concentrations of proteins when compared to other type of fruits such as apples, oranges, bananas grapes (containing 0.3, 0.7, 1.0 and 1.0% proteins, respectively) (Al-Showiman, 1998).

Twenty-three different amino acids were found in dates proteins, many of which are not found in the most popular fruits (Al-Shahib and Marshal, 2003). Several studies in the literature concluded that the aqueous extracts of dates have potent antioxidant and antimutagenic activity (Mansouri *et al*., 2005; Mohamed and Al-Okabi, 2004). Date was reported to have the second highest antioxidant activity among 28 fruits commonly consumed in China (Guo *et al*., 2003).

Probiotics, prebiotics and synbiotics are useful bacteria, natural herbs and compounds which are primarily used to enhance intestinal health and immunity. Currently they represent the largest segment of the functional foods in the market. Evidence continues to emerge demonstrating that these ingredients have a potential impact to improve human health in specific intestinal disorders (Fabian and Elmadfa, 2006). Al-Sobayil *et al*. (2010) found an increase of pregnancy rate and mean lamb birth weight in Najdi ewes given a mixture of fermented cow's milk plus natural herbs. Therefore, the aim of the present study was directed towards evaluating the effect of supplementing a mixture of sukkary palm dates extract to a stirred yoghurt on the lamb birth weight and hematological traits of Najdi ewes at their late stage of pregnancy.

MATERIALS AND METHODS

Animals and experiment design: Twenty mature late-pregnant (≈60 days prepartum) *Najdi* ewes were randomly allocated into four treatments (5 ewes/treatment). Treatment 1 animals were served as control group, given the regular ration (400 g commercial pellets head^{-1} day^{-1}, plus alfalfa hay). Animals in group two were orally supplemented by 50 mL palm sukkary dates aqueous extract each other day for eight consecutive weeks. Group three ewes were orally supplemented by 50 mL stirred yoghurt every other day for same period. Ewes in group four were orally administered by 50 mL of a mixture of palm dates and stirred yoghurt (1:1) for the same period. All ewes in the treated groups were given the same regular ration. Also, clean tap water and integrated salt licks were available as free choice.

Blood sampling and hematological parameters: In a heparinized Vacutainer® tube, a weekly blood sample was taken via the jugular vein for four consecutive weeks. Samples were transported in an ice box to the physiology laboratory for further analyses. The samples were analyzed on the same day for the blood hematological parameters in addition to the leukocytes differential count (Mindray BC 3000, China).

Data of birth: Data of mother lambing birth weight, litter size per ewe, number lambs born alive per ewe, litter weight, number lambs weaned per ewe were all determined.

Date fruits samples and probiotic bacteria: Date fruits (Sukkary type) commonly grown in Qassim region were purchased from the local dates market in Buraidah, Qassim, Saudi Arabia. Also, cow's milk samples were donated from the University experimental station, Qassim, KSA.

Probiotic stirred yoghurt cultures of *Streptococcus thermophilus, Lactobacillus acidophilus* and *Bifidobacterium bifidum w*ere obtained from Chr. Hansen`s Laboratory, Copenhagen, Denmark.

Preparation of probiotic stirred yoghurt: Probiotic stirred yoghurt was prepared according the method described by Tamime and Robinson (1999) and Al-Wabel *et al.* (2007). Milk samples were standardized to contain 9% total solids, heated at 85°C for 5 min and cooled to 5°C to kill pathogens. Probiotic cultures (*Streptococcus thermophilus, Lactobacillus acidophilus* and *Bifidobacterium bifidum*) were inoculated and incubated for 4-8 h at 42°C. After coagulation, the curd were tested for pH, then stirred in an electric blender and stored refrigerated (4-6°C) until used.

Preparation of date's fruit mixture: Dried fresh sukkary date fruits after removing the seeds were milled and standardized to contain 7% total solids. The powder was dissolved in distilled water, homogenized in an electric blender, heated at 85°C for 5 min, cooled to 5°C to kill pathogens and finally stored refrigerated (4-6°C) until used.

Preparation of probiotic stirred yoghurt mixed with date fruits: Fresh milk was standardized to contain 9% total solids and then mixed with dates (after removing the seeds) as 7% (70 g pitted date fruits per a liter of cow milk). The mixture was then homogenized with an electric blender, heated at 85°C for 5 min, cooled to 5°C to kill pathogens, then stored refrigerated (4-6°C). Probiotic cultures (*Streptococcus thermophilus, Lactobacillus acidophilus* and *Bifidobacterium bifidum*) were inoculated and incubated at 42°C for 4-8 h . After coagulation, the curd were tested for pH, then stirred in an electric blender and stored refrigerated (4-6°C) until used.

Date fruits analyses

Sugars: To 0.1 g of date flesh, 4 mL of 50% ethanol extraction solution was added. The mixture was sonicated for 15 min at 60°C and cooled to room temperature. The solution was then completed to 50 mL total volume with the extraction solution and filtered through 0.43 μm filter. The concentrations of glucose, fructose, maltose, sucrose and lactose were read in HPLC (Shimadzu, Model 2001, Japan), results are shown in Table 1.

Amino acids: Determinations of amino acids composition of fresh as well as dried sukkary dates were carried out according to the method described by Kondo *et al.* (1984) using a HPLC (Shimadzu, Model 2001, Japan) and results are shown in Table 2.

Antioxidants: Total phenolics were determined according to the method of Makkar (2005). Total flavonoids were estimated by the method of Kim *et al.* (2003). Antioxidant activity was determined according to the method of Sanchez-Moreno *et al.* (1998). Antioxidant capacity was quantified as microgram Trolox equivalents using a standard curve.

Chemical composition of dates and fermented milk: The percentages of chemical composition of dates and milk samples were performed by the conventional Proximate Analysis Techniques (AOAC, 2000).

Organoleptic evaluation: The organoleptic evaluation of palatability of date-stirred yoghurt mixture was performed by panel from the staff members of the Department of Food Science and Human Nutrition. The evaluation criteria were appearance, color and flavor. Results were expressed as: (+++) very good, (++) good, (+) acceptable, (-) unacceptable, as described by NASA (1999).

Table 1: Sugar contents in fresh and dried sukkary dates (g 100 g^{-1})

Sugar	Fresh sukkary	Dried sukkary
Fructose	9.17	11.46
Glucose	12.45	15. 54
Sucrose	35.94	44.93

Table 2: Amino acids contents in sukkary fresh and dried date fruits (mg g^{-1})

Amino acid	Fresh sukkary	Dried sukkary
Aspartic acid	0.34	0.425
Threonine	0.10	0.125
Serine	0.13	0.1625
Glutamic acid	0.49	0.6125
Glycine	0.17	0.2125
Alanine	0.16	0.2
Valine	0.14	0.175
Methionine	0.06	0.075
Isoleucine	0.10	0.125
Leucine	0.20	0.25
Tyrosine	0.08	0.1
Phenylalanine	0.15	0.1875
Histadine	0.10	0.125
Lysine	0.07	0.0875
Arginine	0.07	0.0875

Statistical analyses: Hematological parameters were analyzed by the procedure of the least square analysis of variance for repeated measures (SAS, 2000). Data for ewe productive traits were analyzed by the least square analysis of variances. Mean differences among treatments were tested by the Duncan Multiple Range Test (DMRT, Steel and Torrie, 1980). Significance level was considered at $p<0.05$.

RESULTS

Sugar contents of dates: Sugar contents in the fresh and dried Sukkary dates are shown in Table 1. The contents of fructose, glucose and sucrose were 9.17, 12.45 and 35.94 g/100 g, respectively, in fresh Sukkari, However, these figures increased in the dried dates to be; 11.46, 15.54 and 44.93 g/100 g, respectively.

Amino acids content of sukkary dates: Fifteen amino acids were detected in the Sukkary dates. The contents of all detected amino acids increased in case of dryness (Table 2).

Antioxidants activity (teac) and phenolics and flavonoids content of the sukkary dates: The antioxidants activity TEAC, phenolics and flavonoids contents in Sukkary dates are shown in Table 3.

Chemical composition of dates, fermented milk and date/milk mixture: The proximate analyses of dates, milk and their mixture were carried out in the food analysis laboratory; the results are shown in Table 4.

Table 3: Antioxidant activity TEAC, total phenolics and total flavonoids content of the sukkary dates (Mean±SEM)

Type of dates	Antioxidant activity (μ mol Trolox equivalents/100 g DM)	Total phenolics (mg gallic acid equivalents/100 g DM)	Total flavonoids (mg quercetin equivalents /100 g DM)
Dried sukkary	3603±197	88±9.3	11.3±1.03

Table 4: Chemical composition of dried dates, milk and their mixture

Composition	Dates	Milk	Milk+Dates
pH	7.25	4.63	4.73
Moisture	13.84	90.99	86.26
Total solids	86.16	9.01	13.74
Proteins	0.94	2.04	2.59
Carbohydrates	67.57	3.45	7.49
Ash	1.53	0.52	0.66
Fat	0.00	3.00	3.00

Table 5: Effect of supplementation of milk and dates on productive traits of Najdi ewes during late pregnancy period

Trait	Control (C)	Dates (D)	Fermented milk (M)	Dates+fermented milk (DM)
No. ewes	5	5	5	5
No. ewes delivered twins	1	1	2	2
Twinning (%)	20	20	40	40
Lambing weight (kg)	51.42±1.7	56.02± 3.4	53.9±6.1	55.08±6.3
No. lambs born/ewe	1.20±0.2	1.20±0.2	1.40±0.3	1.40±0.2
No. lambs born alive/ewe	0.80±0.3	1.20±0.2	1.00±0.2	1.20±0.3
Survival at birth (%)	67	100	71.4	85.7
Mean litter weight at birth (kg)	3.52±1.6^{b}	6.50±0.3^{a}	3.26±1.1^{b}	4.00±1.5^{ab}
No. lambs weaned	0.60±0.4	0.80±0.2	0.60±0.2	0.80±0.3
Survival at weaning (%)	50	67	43	57

Table 6: Effect of supplementation of milk and dates on hematological traits of Najdi ewes during late pregnancy period

Trait	Control	Date	Milk	Date+Milk
WBC (10^3 μL^{-1})	10.29±0.5^{ab}	9.16±0.4^{b}	11.12±0.5^{a}	9.00±0.4^{b}
RBC (10^6 μL^{-1})	8.62±0.2^{a}	9.15±0.1^{a}	7.84±0.4^{b}	8.51±0.2^{ab}
HGB (g dL^{-1})	9.53±0.2^{b}	10.74±0.2^{a}	10.07±0.4^{ab}	10.24±0.3^{ab}
HCT (%)	29.19±0.6	32.44±0.5	31.04±1.56	30.58±1.1
MCV (fL)	34.08±0.1^{a}	34.33±0.4^{a}	32.73±0.5^{b}	34.74±0.4^{a}
MCH (pg)	11.07±0.1^{b}	11.26±0.1^{b}	11.10±0.1^{b}	11.82±0.3^{a}
MCHC (g dL^{-1})	32.67±0.2^{b}	32.77±0.4^{b}	33.92±0.5^{a}	33.89±0.7^{a}
RDW (%)	10.65±0.1^{b}	10.78±0.1^{ab}	10.13±0.1^{c}	11.03±0.1^{a}
PLT (10^3 μL^{-1})	763.36±34.7^{ab}	720.87±41.2^{b}	852.00±24.6^{a}	603.21±28.2^{c}
MPV (fL)	7.18±0.2	7.41±0.2	7.53±0.4	7.47±0.3

As shown in Table 5, the administration of date extract resulted in the highest percentage of survived lambs at birth (100%), followed by those given the date-milk mixture (85.6%), fermented milk (71.4%) and control ewes (66.7%). Likewise, mean litter weight increased significantly ($p<0.01$) in ewes given dates alone (~85% more kilograms than control). However, fermented milk or its mixture with dates didn't significantly ($p>0.05$) increase the litter weight, although a slight increase was observed in ewes given the mixture (4 kg) as compared with control ewes (3.52 kg). Fermented milk alone didn't show alteration in the litter birth weight. Number lambs weaned per ewe was similar (0.8) and higher in ewes given dates alone or dates with fermented

milk. Fermented milk alone resulted in similar number of weaned lambs as control ewes (0.6). Ewes lambing weight didn't differ among treatments. Percentages of newborn survival at birth and at weaning were highest in ewes given dates (100 and 67%, respectively), lowest in ewes given fermented milk (71.4 and 43%) and intermediate in ewes given milk/dates mixture (85.7 and 57%, respectively). In all treatments percent survival at birth was higher than in control, similar results were obtained for the survival rate at weaning, except in ewes given fermented milk (50, 67, 43 and 57% for control, dates, fermented milk and dates/milk mixture, respectively).

Table 6 exhibits hematological parameters of ewes within treatments. Dates and dates/milk mixture resulted in slight, but not significant, decrease in leukocyte (WBCs) count, however fermented milk alone didn't change this value. On the contrary, erythrocyte (RBCs) count was similar to control in case of dates and the date/milk mixture, but significantly ($p<0.01$) lower in ewes given fermented milk, the decrease approached 10% of the control value. Treatment with date extract resulted in a significant ($p<0.01$) increase in hemoglobin concentration by about 13% than its level in control ewes. However, slight ($p>0.05$) decreases in hemoglobin concentration were achieved in ewes given milk or mixture. Packed cell volume (HCT) was not affected by treatment. Mean corpuscular volume was not affected except it decreased in milk treatment. Mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) were highest in the ewes treated with the mixture. Percentage of red cells distribution width (RDW) was highest in the mixture and lowest in the milk, but not affected in dates. In all treatments this parameter has fallen within the normal range (10.2-14.5%). Platelet number was only reduced in the mixture as compared with its value in control. Percentage of reduction was about 21% of the control value. However, no significant changes were found in platelet numbers due to dates or milk treatment. Mean platelet volume was not influenced by treatment.

Differential leukocytic count (Table 7) revealed that no changes were happened in the percentages of monocytes, basophiles or eosinophils. Contrariwise, there exist a significant ($p<0.01$) decrease in neutrophils in ewes given the mixture, a decrease account for 26% of the control value. While there found slight ($p>0.05$) decreases of neutrophils in dates and milk treatments. On the other hand the first largest percentage of leukocytes were lymphocytes which represent about three quarters the white blood cells in sheep. Opposite trend to what was found in neutrophils was obtained for lymphocytes. The highest percentage of lymphocytes was found in ewes given the mixture (77.33%). Dates or milk didn't significantly affect this parameter. As depicted in Fig. 1, percentage of neutrophils gradually increased by the progress of the time of treatment, however an opposite trend was attained for lymphocytes (Fig. 2).

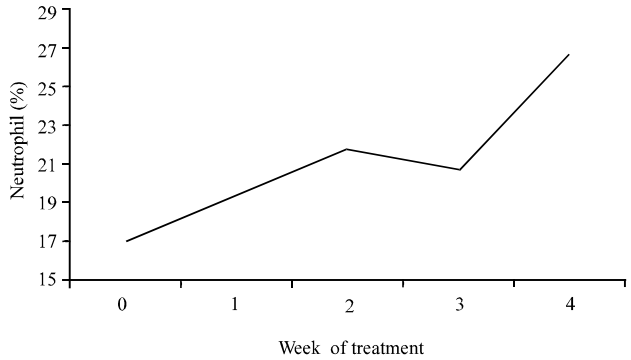

Fig. 1: Effect of time of supplementing dates, milk and their mixture on the percentage of Neutrophil in Najdi ewes

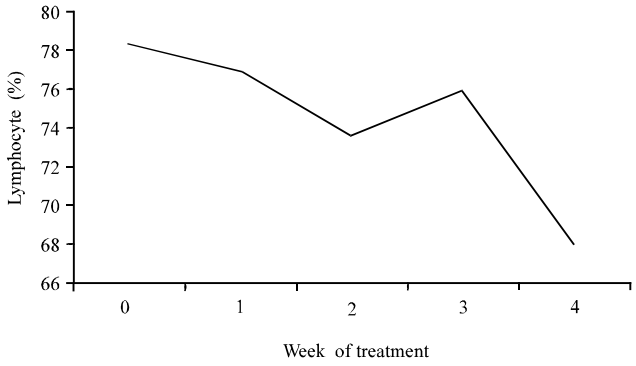

Fig. 2: Effect of time of supplementing dates, milk and their mixture on the percentage of Lymphocyte in Najdi ewes

Table 7: Effect of supplementation of milk and dates on percentage of differential leukocytes of Najdi ewes during late pregnancy period

Leukocyte type	Control	Date	Milk	Date+Milk
Neutrophil	26.92±3.71[a]	20.04±2.08[ab]	21.19±2.46[ab]	18.29±2.35[b]
Lymphocyte	68.59±3.92[a]	75.53±2.43[ab]	74.20±2.69[ab]	77.53±2.68[b]
Monocyte	3.63±0.53	3.52±0.54	3.71±0.45	3.33±0.44
Eosinophil	0.39±0.06	0.33±0.04	0.36±0.06	0.41±0.09
Basophil **	0.51±0.04	0.57±0.03	0.54±0.05	0.45±0.03

DISCUSSION AND CONCLUSION

According to the American Sheep Industry Association (2013), the last four to six weeks of gestation in sheep is a critical nutritional period, because at least two-thirds of fetal growth occurs during this period. Nutrient restrictions at this time will result in lighter weight lambs at birth, unequal birth weights of twin and triplet lambs, reduced mothering instinct, lowered milk production, increased early lamb loss and possibly pregnancy toxemia. Because of the increased fetal growth during this period of the ewe's biological cycle, ewes carrying a single lamb require 50% more energy (ewes carrying multiple lambs require 75% more energy) than in early gestation ration. The potential supply of glucose, which is one of the major metabolic substrates required by the fetus is indispensible for the fetal growth at late gestation (Battaglia and Meschia, 1981; Mellor, 1983). At this critical time the ewe's energy and protein requirements increase rapidly, more than doubling for those carrying twins. However, as the lambs grow and take up more room, ewe appetite reduces by about 30%. It is therefore important to increase the nutrient density of the ration to keep pace with fetal growth. This motivated the researchers to augment the ration energy by not adding extra amount of feed, rather by supplementing pregnant ewes by an available and cheap source of simple sugars (dates). As the chemical analysis of sukkary dates revealed that the dried fruits contain around 72% sugars (i.e., sucrose, glucose and fructose), this might serve as a rich source of energy for both the fetus and mother at this time of fetal logarithmic growth. Moreover, the existence of high antioxidant activity per unit of dry dates would offer a convenient atmosphere for the fetal growth and development. El-Sohaimy and Hafez (2010) found that each 100 g of dried dates fruits gave 284 calories. The current data revealed that providing pregnant ewes at their late pregnancy (6-8 weeks prepartum) with either a source of energy (sukkary dates) or a source of a prophylactic immunity enhancer (probiotic) confirmed the elective ability of the mother for the most priority nutrient necessary at this time. In early ninetieth McCrabb *et al.*

(1991) demonstrated that the placenta in pregnant ewe might play a role in partitioning the nutrients between the fetus and mother. According to Sawaya *et al.* (1983) date flesh contains 733 g total sugar kg^{-1}. This parallel our finding of sukkary dates chemical analysis. However, Guessous *et al.* (1985) reported a mean of 461 g hydrosoluble carbohydrates kg^{-1} DM in wasted dates, which might contains other byproducts (i.e., stones, leaves, stems). Genin *et al.* (2001) found a dry matter digestibility of 74.4% in Tunisian dates. The analysis of sukkary dates for amino acid contents in the current study exhibited the dominance of glutamic acid followed by asparatic and leucine. This was confirmed recently in Egyptian dates by Abd El-Rahman *et al.* (2012). Also, they reported a higher weight gain for growing goat kids fed on 100% cull dates, which they attributed to the measured higher production of volatile fatty acids in the rumen. This finding was previously confirmed by the increase of volatile fatty acids in sheep rumen when Al-Owaimer *et al.* (2011) replaced the *Atriplex halimus* with various levels of date pits. It appears from the current study results that supplementing pregnant ewes with fermented milk (enriched with lactic acid bacteria) didn't enhance the fetal growth as was anticipated. This could be attributed to the timing of gestation at which this mixture was given. When cow's milk probiotics were given at early pregnancy, just after mating in Najdi ewes, a considerable increase in fetal growth, resulting in heavier lamb birth weight by about 62% more than control lambs (Al-Sobayil *et al.,* 2010). It has been found that the inclusion of probiotics in the diets of pigs at their early ages (before weaning) increased the activity of the small intestine contents of sucrase, lactase and tripeptidase (Collington *et al.,* 1990).

In date extract-fed ewes a higher hemoglobin (Hb) was found in maternal blood giving rise to about 13% more than in control mothers. This increase in Hb coincided with a slight increase in erythrocyte number. The second highest Hb concentration was found in ewes given dates/milk mix, followed by those given fermented milk and the lowest Hb concentration was found in control ewes. Apparently, the inclusion of dates in the diet would appear to increase hemoglobin synthesis as it contains about 2.69 mg iron/100 g dates (El-Sohaimy and Hafez, 2010). The date is exceedingly rich in folic acid, a B vitamin of great importance to pregnant females. Folic acid (B9) is a vitamin which serves crucial functions in the construction of new blood cells and of amino acids and in cell renewal. The need for folic acid rises significantly during pregnancy when the daily requirement doubles. When folic acid levels are insufficient, red blood cells become larger than normal with lower functionality, along with appearance of the symptoms of anemia. Folic acid plays a particularly important role in cell division and in the formation of the genetic structure of the cell and is the only substance daily requirements of which double during pregnancy. However, the exceeding consumption of folic acid might causes genetic disturbances to the fetus (Hoyo *et al.,* 2011).

Up to the knowledge of the researchers there were no physiological explanations for the significant decreases and increases of platelet count in ewes given the mix and fermented milk, respectively. Differential leukocyte count showed the only significant differences were found on neutrophils and lymphocytes in ewes given the date/milk mix. Ewes given the mix revealed a significant decrease in percent of neutrophils with a concurrent increase in percent of lymphocytes by about 8-9%. Inclusion of date extract as a source of nutrients for the lactic acid bacteria in the fermented milk might modulates the activity of these bacteria to enhance the production of antibody-producing white blood cells (i.e., lymphocytes). The elevation of lymphocytes in ewes given the mix resulted in a subsequent high number of lambs weaned which is comparable to that found in ewes given dates extract alone. Irrespective of the treatment, as gestation period progressed there was a tendency of increase in neutrophils and a decrease in lymphocytes. Apparently, as

parturition approaches, this must represent a stress on the mother delivering a message to the immune system as to increase the population of the neutrophils which are prepared to engulf the bacteria and foreign bodies attacking the mother at lambing. On the contrary the decrease in percentage of lymphocytes as gestation progressed might be ascribed to the formation of colostrums in the mammary gland for the coming neonate (Kaneko *et al*., 2008). Moreover, Antunovic *et al*. (2011) concluded that sheep at late stage of pregnancy requires a modulation of the metabolic criteria to accommodate for the higher energy requirements and the change of immunoglobulins pattern.

In conclusion, supplementing pregnant ewes at late stage (6-8 weeks preparturition) of pregnancy with a rich source of energy and rapid delivery to the blood stream (i.e., dates fruits) would be of great beneficial impact on the fetal growth, survival and subsequent postnatal health status. However, administering probiotics at this late stage wouldn't cause a merit on either the fetal or maternal level. Further studies are required as to monitor the exact timing of gestation term, specific nutrients must be provided to maximizing the productivity of the ewes.

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