Effect of dietary energy and phosphorus on nutrients digestibility, blood constituents, and ovarian structures in ewes

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Abstract

Forty five mixed breed ewes of 3-3.5 years of age and 40-50 Kg live body weight were used in this study. The ewes were housed inside an open yard with shade and concrete floor. They were fed on the control diet for one month before the beginning of the experiment. At the onset of the breeding season, the animals were classified randomly into nine groups five, per each. Nine diets including the control one were formulated with three levels of digestible energy (DE, 2.2, 2.5 and 2.8 Mcal/Kg diet), each at three levels of phosphorus (low, normal and high) in a 3x3 factorial design. The nine diets were designates as NENP, NELP, NEHP, HENP, HELP, HEHP, LENP, LELP and LEHP. First litter in each diet designates the energy level while, the third litter designates the phosphorus level (H, high, N, normal and L, low). The litters E and P stand for energy and phosphorus, respectively. The animals were fed the respective experimental diets and water ad-libitum for one month after the beginning of the breeding season. A metabolism trial was carried out during the last week of the experiment. Blood samples were taken regularly twice weekly for biochemical examination. Throughout the period of the experiment, the animals were examined regularly by using ultrasonography. The results of this study indicated that, levels of energy and phosphorus affect significantly ($P<0.05$) nutrients digestibility, some blood constituents and ovarian structure.

Keywords: Energy, Phosphorus, Digestibility, Ovarian activity, Ewe.

Introduction

Deficiency of a single nutrient or element has been induced experimentally to record the clinical signs and the related metabolic changes. Thus measurement of blood constituents is being widely used in veterinary medicine to study the health and nutritional status of domestic animals. However, in field conditions deficiency diseases or nutritional disorders are much more complicated (Underwood, 1977 and Essa, 1987) and a sound diagnosis is needed for accurate treatment. Also, a number of sheep diseases are directly related to deficiency or imbalance of nutrients which result in metabolic disorders and produce variable and non specific symptoms.

The extent to which varying levels of dietary energy and protein fed to tropical sheep breeds are utilized for maintenance, growth, reproduction and lactation has been reported (Adeneye and Oyenuga, 1976). Also other researchers have reported on feed intake and nutrient utilization of sheep under tropical conditions (Aregheore &Tembo, 1997). Reproduction in sheep had received much attention in Egypt owing to its high value as a source of animal protein. It was reported that the plane of nutrition in sheep affect conception rate, lambing rate, lamb birth weight and lamb mortality. Also, it significantly affected blood concentrations of minerals, proteins and hormones (Uriarte,et al., 1988 and Sabra 1992 &1994). Attempts have been made to formulate a nutritional strategy to improve fertility of local sheep breeds, but no practical success has been consistently achieved (Walker,et al., 1996). Restriction of energy intake has a major role in increasing the length of postpartum anoestrus in sheep and cattle. Prolonged and intense negative energy status delays resumption of oestrus cycles (Schillo, 1992). Reproductive problems such as low first service conception rates and silent heats have been related to wide Ca:P ratios and to phosphorus deficiency. Vitamin D has also been implicated through its effect on phosphorus utilization. Negative energy balance extends the interval from lambing to first ovulation, increase the number of medium but decrease the number of large follicles and reduces the function of corpora lutea (CL). Thus, energy balance affects

Table-1. Proximate analysis of the used ingredients.

Nutrients Ingredients	DM %	OM %	CP%	EE%	NFE %	CF%	Ash %	Ca %	P%	DE* Mcal/Kg
White corn, ground	89.0	97.8	10.0	4.0	81.4	2.4	2.2	0.03	0.31	3.53
Dried beet pulp	91.0	96.0	9.70	0.70	65.8	19.8	4.0	0.69	0.10	3.26
Soya bean meal	89.0	93.5	49.6	3.40	33.5	7.0	6.5	0.36	0.75	3.56
Wheat bran	89.0	95.6	18.0	4.0	62.6	11.0	4.4	0.12	1.32	3.08
Wheat straw	90.0	86.7	4.20	2.0	38.5	42.0	13.3	0.21	0.08	2.02
Lime stone	86.0	----	----	----	----	----	100	38.0	----	----
Monobasic Sod PO4	90.0	----	----	----	----	----	100	----	22.4	----

follicular growth and function. However, there is no evidence that energy balance affects fertilizability of oocytes. The purpose of this study is to examine the effects of energy and / or phosphorus deficiencies or excesses on digestibility, reproductive performance and some blood constituents in subtropical ewes.

Materials and Methods

Animals, housing and diets: Forty five mixed breed ewes of 3-3.5 years of age and 40-50 Kg live body weight were used in this study. The study were done at Governemental farm in El-Minia provints in upper Egypt. The animals were healthy and clinically free from external and internal parasites. The ewes were housed inside an open yard with shade and concrete floor. They were fed on the control diet for one month before the beginning of the experiment (the onset of breeding season). At the beginning of the breeding season, the animals were classified randomly into nine groups five, per each. Nine diets including the control one were formulated with three levels of digestible energy (DE, 2.2, 2.5 and 2.8 Mcal/Kg diet), each at three levels of phosphorus (low, normal and high) in a 3x3 factorial design (table 2).The nine diets were designates as NENP, NELP, NEHP, HENP, HELP, HEHP, LENP, LELP and LEHP. First litter in each diet designates the energy level while, the third litter designates the phosphorus level (H, high, N, normal and L, low). The litters E and P stand for energy and phosphorus, respectively. The animals were fed the respective experimental diets and water ad-libitum for one month after the beginning of the breeding season. The percentage of dietary ingredients composition and chemical analysis of the ingredients and diets are mentioned in tables 1&2. Digestible energy, crude protein, calcium and phosphorus levels of the control diet (NENP) were calculated with respective feed nutritive values published by the NRC (1984) for sheep.

A metabolism trial was carried out during the last week of the experiment, in which the animals were transformed in the last week of the experiment into a special pens with slatted floor covered with a very fine wire netting that allow only urine to pass through. The ewes were offered weighed quantity of feed and the total excreta voided were collected daily and weighed.

Table-2. Physical and chemical composition of the experimental diets.

Ingredients	Diets (%)								
	NENP	NELP	NEHP	HENP	HELP	HEHP	LENP	LELP	LEHP
Dried corn, ground	------	------	20.00	17.90	17.00	44.80	------	------	------
Dried beet pulp	26.00	30.00	------	33.0	38.3	------	------	------	------
Soya bean meal	6.50	8.00	4.40	3.30	4.90	2.00	9.60	11.70	9.30
Wheat bran	7.00	------	16.50	7.00	------	14.00	7.00	------	9.00
Wheat straw	59.70	61.20	55.9	38.00	39.00	36.00	82.20	87.20	78.10
Ground limestone	------	------	0.50	------	------	0.60	0.40	0.30	0.40
Monobasic Sod PO4	------	------	1.90	------	-------	1.80	------	------	2.40
Common salt	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Mineral mixture	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
Vit. AD3E	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
DM %	90.17	90.22	89.58	90.05	90.16	89.37	89.83	89.88	89.80
OM %	89.51	89.34	87.93	91.92	91.81	90.29	86.93	86.55	85.03
CP %	9.51	9.45	9.50	9.49	9.49	9.50	9.48	9.46	9.51
EE %	1.87	1.70	2.73	2.10	1.90	3.14	2.25	2.14	2.24
CF %	31.45	32.20	26.09	23.92	24.71	17.88	35.96	37.44	34.44
NFE %	46.65	45.98	49.60	56.40	55.70	59.76	39.24	37.49	38.82
Ash %	10.49	10.66	12.07	8.08	8.19	9.71	13.07	13.45	14.97
Ca %	.0.34	0.37	0.35	0.33	0.37	0.34	0.36	0.35	0.36
P %	0.22	0.14	0.78	0.24	0.16	0.77	0.23	0.16	0.79
Ca/P ratio	1.5	2.6	0.4	1.4	2.3	0.4	1.6	2.2	0.5
DE (Mcal/Kg)	2.50	2.50	2.50	2.81	2.81	2.81	2.23	2.19	2.19

Mineral mixture contains (g/Kg): 40 Fe, 6.3 Mn, 44.9 Zn, 0.5 Cu, 0.4 I, 0.03 Se, 0.5 Co, 154 Nacl and 123 Mg.
** Vitamin AD3E: Each gram of vitamin premix contains 20000 IU vit. A; 2000 IU vit.D3 and 400 IU vit. E.

Table-3. Feed intake and digestion coefficient (%) of nutrients during the experimental trials.

Items	NENP	NELP	NEHP	HENP	HELP	HEHP	LENP	LELP	LEHP
DM intake (kg/day)	1.26	1.11	1.31	1.40	1.30	1.50	1.09	1.02	1.15
Body weight gain, Kg	4.7	4.2	4.9	5.8	5.3	6.1	3.6	3.1	3.5
Dry matter, DC %	56.3b± 2.7	56.4b± 2.5	54.5b± 2.5	61.8 a± 3.1	61.6 a± 3.7	59.7 a± 2.6	48.2c± 2.7	48.0c± 2.7	49.0 c± 2.9
Organic matter, DC %	58.6b± 2.5	58.9b± 2.8	58.0b± 1.9	62.5 a± 2.8	63.2 a± 3.2	61.8 a± 3.6	51.4c± 2.5	51.0c± 2.4	52.8c± 2.1
Crude protein, DC %	61.0 a± 3.5	60.2 a± 1.9	60.7 a± 2.7	63.8 a± 3.2	62.7 a± 2.8	60.8 a± 1.2	52.6b± 1.6	52.2b± 1.6	55.9b± 2.4
Ether extract, DC %	70.3b± 3.7	71.3b± 2.5	70.1b± 2.8	75.1 a± 3.7	74.8 a± 2.9	73.4 a± 3.8	65.8c± 1.4	66.8c± 1.5	68.4c± 2.1
Crude fiber, DC %	45.5b± 2.1	44.9b± 2.7	44.7b± 3.1	49.0 a± 1.9	50.4 a± 2.7	48.7 a± 2.7	40.7c± 1.8	40.0c± 1.8	40.7c± 3.2
Nit.free extact, DC %	65.4 a± 4.2	67.0 a± 3.6	63.8 a± 2.9	69.2 a± 3.6	68.5 a± 4.2	66.8 a± 1.8	60.7b± 4.3	61.3b± 3.6	62.1b± 2.6

A representative samples of excreta was taken daily and dried in a hot air oven at 60 °C till a constant weight was obtained. The dried samples were pooled together, mixed, ground and stored till analysis. The feed ingredients and fecal samples were analyzed according to AOAC (1990) and the digestion coefficients were evaluated. The ewes were weighed at the beginning and at the end of the experiment.

Blood samples: Blood samples were taken regularly twice weekly before the morning meal from the jugular vien in a dry, clean and sterile centrifuge tubes. The samples were allowed to be clotted at room temperature. The clotted blood was centrifuged at 3000 rpm for 20 minutes. A clear non haemolysed sera were separated by Pasteur-pipette and transferred into a clean, dry and sterile stoppered glass vials till performing the biochemical analysis. The total protein, total lipids, total cholesterol, triglycerides and glucose were measured by Kits provided by Sentinel Ch., Milano, Italy, while, serum calcium and phosphorus, were measured by kits supplied by Bio-Merieux (Baines/France).

Concentrations of circulating Progesterone (P4) were determined by ELISA utilizing kits provided by Biosewoom, Inc. (Sungdong-gu, Seoul, Korea, catalogue No. BS1405). The range of the standards used was 0.3-35.0 ng ml-1. The inter- and intra-run precision had a coefficient of variation of 1.75 and 5.1%, respectively.

Ultrasonogaphy examination: Throughout the period of the experiment, the animals were examined regularly in a daily basis using a real time, B-mode Scanner fitted with 6/8 MHz linear probe (Pie Medical Scanner 100 LC, Pie Medical Co., Netherlands). Data collected during Ultrasonography included number of large, medium and small follicles (according to ALI et al., 2006). In addition the diameter of the largest follicles (dominant) and second largest (subordinate) follicles were measured to the nearest millimeter using the ultrasound built in the measuring ruler. Maximum diameter of the CL was also recorded on day 7 after ovulation for all animals.

Statistical analysis: Statistical analysis of the collected data was carried out according to procedures of completely random design, SAS (1995).

Results

Dry matter intake (kg/day) tended to increase with the level of energy intake in the treatments being highest with high phosphorus diets. Body weight gain was increased with increase in dietary energy and / or phosphorus (table 3). Apparent digestibility of dry matter, organic matter, crude protein, ether extract, nitrogen free extract, crude fibre and ash were significantly (P<0.05) increased with the increase in dietary energy among the different treatments, regardless the dietary phosphorus level. Similarly, an increase in TDN was observed with the increase in dietary energy, while, the digestible crude protein was not significantly affected in all groups.

The data in table 4 revealed that, serum total protein was insignificantly affected by the treatment. On the other hand, glucose and triglycerides were significantly ($p < 0.05$) decreased in ewes fed low energy diets with different levels of phosphorus. However, total lipids and cholesterol were significantly ($p<0.05$) increased in ewes fed either high or low energy diets with the three levels of phosphorus. Serum calcium concentration was significantly decreased in groups fed high phosphorus diets regardless to the level of dietary energy. On the contrary, serum phosphorus concentration was significantly ($p < 0.05$) increased in groups fed high phosphorus diets at any level of energy. With regard to serum progesterone level, the results indicated that, progesterone level was the highest in ewes fed on HEHP and HELP diets. However it was the lowest in ewes fed on LELP followed by LEHP diets. Serum progesterone levels were not significantly differed in groups fed on NENP, NELP, NEHP, HENP and LENP diets, respectively.
The results in table 5 show that, the number of large (>5mm), medium (4-5mm) and small (<3mm) follicles are significantly (P<0.05) decreased during the period of low energy diets compared with periods of high or control energy.

The results in table 6 recorded a significant increase in the size of the largest and second largest follicles in the animals during the period of high energy diets compared with periods of low or control energy diets. Also, a significant reduction in the size of corpus

Table-4. Blood serum biochemical changes during the experimental trials.

Parameters	NENP	NELP	NEHP	HENP	HELP	HEHP	LENP	LELP	LEHP
Total protein, g/dl	6.79± 1.43	6.52±1.35	7.01±1.81	6.50±1.62	6.70 ±1.83	6.20 ±1.90	5.29±1.87	5.61±1.37	5.18±1.63
Total lipids, mg/dl	238^{b}± 28	235^{b}± 31	232^{b}± 27	260^{a}± 23	267^{a}± 32	273^{a}± 35	290^{a}± 27	275^{a}± 23	279^{a}± 28
Total cholest, mg/dl	85^{b}± 7.6	85^{b}± 4.0	87^{b}± 4.3	111^{a}± 8.6	120^{a}± 6.5	115^{a}± 11.2	124^{a}± 9.4	114^{a}± 18.7	128^{a}± 9.8
Triglycerides, mg/dl	63^{a}± 7.2	63^{a}± 9.3	61^{a}± 7.6	60^{a}± 8.1	59^{a}± 8.5	63^{a}± 6.9	53^{b}± 8.7	48^{b}± 7.4	51^{b}± 6.2
Glucose, mg/dl	58^{a}± 5.2	60^{a}± 7.1	59^{a}± 5.7	55^{a}± 6.8	53^{a}± 6.3	52^{a}± 6.2	44^{b}± 4.1	38^{b}± 4.7	46^{b}± 4.9
Calcium mg/dl	11.48^{a}± 1.6	12.3^{a}± 1.1	8.2^{b}± 0.9	11.7^{a}± 1.3	11.95^{a}± 1.5	8.2^{b}± 1.4	10.7^{a}± 1.1	11.2^{a}± 1.3	7.9^{b}± 0.9
Phosphorus mg/dl	6.70^{b}± 0.73	6.20^{b}± 0.81	7.3^{a}± 0.69	6.9^{b}± 0.52	6.7^{b}± 0.73	7.2^{a}± 0.78	6.2^{b}± 0.96	6.0^{b}± 0.58	7.4^{a}± 0.74
Progesterone (P4) ng/ml	4.0^{b}±0.4	4.74^{b}±0.3	4.19^{b}±0.4	4.64^{b}±0.6	5.01^{a}±0.1	5.92^{a}±1.4	4.33^{b}±0.2	2.31^{c}±0.1	3.44^{bc}±0.61

*Means within a row with unlike superscripts significantly differ ((P < 0.05)

luteum was recorded during the periods of low energy diet.

Discussion

Feed intake and digestibility of nutrients: The results in table (3) indicated that, dry matter intake was differed among ewes fed on all diets. The results agreed with that reported by (Singh, et al., 1991, Bhavani,et al., 1997, Chauhan et al., 1997, Salkala and Baruah 1997, Mahgoub et al., 2000 and Haenlein, 2000). They reported that, daily feed intake was found to be increased with the energy level. The body weight gain was increased in ewes fed high energy diets in comparison with those fed on the control or low energy diets. The results also, showed that the body weight gain increased in high phosphorus diets either with normal or high energy levels. The results are in agreement with that reported by Read et al., (1986 a). They stated that, phosphorus deficiency causes decreased body weight and body condition, as a result of decreased intake of feed. The decreased intake of feed could be caused by decreased appetite, impaired locomotion, or both. It remains unclear whether reduced reproduction is caused by lack of phosphorus or is mediated throught decreased body condition. Usually, ovulation rates were influenced by body weight, body condition score or levels of feed intake within similar body condition scores (Dunn and Moss 1992).

Digestibility of DM, OM, CP, EE, CF, NFE and Ash were significantly increased (P< 0.05) in ewes fed on high energy diets compared to those fed on control or low energy ones. Similar results were obtained with other animals in the previous studies (Jindal et al., 1979; Kishan et al., 1981 and Hemanalini et al., 1999). They reported that, the digestibility of DM, OM, CP, EE, CF and NFE increased significantly with increasing energy level in the diets of goats and sheep. In addition, high energy diet was superior to low or medium energy in view of the better digestibility and utilization of nutrients. The results also supported by Mahgoub et al (2000) who found that, increasing the energy level of the diet from low then medium to high resulted in increased dry matter digestibility.

Serum parameters: The values of total serum proteins were not significantly different between groups as shown in table 4. These findings confirmed the concept of Payne (1989) that energy and protein metabolism are closely intertwined in ruminants. This complex balanced system is further complicated as most of the carbohydrates consumed by ruminants are fermented in the rumen to VFAs and limited glucose is available to absorption. Therefore, glucogenesis is of great importance to ruminants. Propionate is the major source of glucose (27-55%), and glucogenic amino acids supplies a significant amount (15-36) of the glucogenic materials (Yong, 1977).

The serum levels of total lipids and cholesterol recorded a higher significant (p< 0.05) values in ewes fed on high and low energy diet in comparison with that of the control diet. In contrast, the serum level of triglycerides in ewes fed on low energy diets recorded a significant decrease. In connection of the concepts of (Payne 1989) lipemia and hypercholesterolemia recorded in ewes fed on low energy diet may indicate inadequate protein and or energy diet. Serum glucose level was not significantly differed among ewes fed either control or high energy diets at different levels of phosphorus. However, it was significantly decreased (P<0.05) after feeding on low energy diets with three levels of phosphorus. The effect of nutrient intake upon glucose level in the ruminants is negligible because of the fermentation that takes place in the rumen. Fisher et al (1974) indicated that many factors could influence concentration of blood metabolites in ruminants, however blood glucose concentration could be used to predict energy intake and efficiency of utilization. In this trial the efficiency of energy utilization in diets seems to be responsible for the variations obtained in the concentration of blood glucose of ewes in the different treatments. The availability of oxidizable

Table-5. Effect of dietary energy/phosphorus levels on the number of Large, medium and small follicles of the studied animals during ultrsonography

Item	NENP	NELP	NEHP	HENP	HELP	HEHP	LENP	LELP	LEHP
LF	1.76a±0.02	1.78a±0.07	1.66a±0.01	1.82a±0.05	1.79a±0.03	1.92a±0.21	1.37b±0.41	1.52b±0.11	1.48b±0.24
MF	2.14 a ±0.14	2.16 a ±0.24	2.06 a ±0.17	2.18 a ±0.23	2.75 a ±0.41	2.38 a ±0.14	1.63 b ±0.15	1.54 b ±0.02	1.83 b±0.01
SF	4.28 a ±0.08	5.10 a ±0.12	5.32 a ±0.21	5.75 a±0.14	5.34 a ±0.04	6.48 a ±1.11	3.57 b±1.07	4.02 b ±0.74	4.18 b ±0.76

Table-6. Effect of dietary energy/phosphorus levels on the size (mm) of the dominant (DF) and subordinate follicles (Sub F) and CL of the studied animals.

Item	NENP	NELP	NEHP	HENP	HELP	HEHP	LENP	LELP	LEHP
DF	6.36 b ±0.2	6.02 b ±0.3	6.21 b ±0.4	6.97 a ±0.2	6.93 a ±0.5	7.36 a±0.2	6.12 b ±0.3	5.36 b ±0.4	5.93 b ±0.2
Sub F	4.71 b ±0.8	3.54 b ±0.3	4.29 b ±0.8	5.94 a ±0.5	5.71 a±0.7	6.71 a±0.3	4.52 b ±0.8	3.54 b ±0.3	3.66 b ±0.3
CL	12.7 b ±0.4	13.8 b ±0.6	13.7 b ±0.5	13.4 a ±0.3	12.7 a ±0.4	13.81 a ±06	11.7 b ±0.5	11.4 b ±0.3	11.39 b ±0.3

metabolic fuels, such as glucose may influence the activity of neurons that control LHRH release (Schillo, 1992). Therefore, the relationship between glucose and fertility may become significant only if the concentration of glucose in the blood fall below normal limits. Butler and Smith (1989) reported that lower availability of glucose may also decrease LH pulsability or limit ovarian responsiveness to gonadotropins.

The value of serum progesterone (P4) was significantly (P<0.05) increased in ewes fed on HELP and HEHP diets. on the contrary, it was significantly (P<0.05) decreased in those fed on LELP and LEHP in comparison with ewes fed on the other diets. The result of this study are in agreement with the reports of Donaldson et al (1970), Hansel (1972), Knutson and Allrich (1988) and Hill et al, (1970) who reported an immediate decrease in P4 in bovine serum within 5 days after intiation of the restricted feeding. The data are also in conflict with those of Dunn et al (1974), Corah, (1974) and Spicer et al, (1984) who showed increased systemic levels of P4 in the bovine during the first cycle following reduction of energy intake. However, the results do not support those indicating that restricting energy intake has no immediate effect on concentration of P4 in the cow (Gomb and Hansel, 1973). Imakawa et al (1986) reported that, concentration of P4 during the luteal stage were positively correlated with body weight changes in heifers fed on low or high energy diet. Results of the present study showed that, serum calcium concentration was significantly decreased in high phosphorus diet with different levels of energy. On the contrary, phosphorus level in the serum was significantly increased. The results are in agreement with that reported by Braithwaite (1984), Field et al (1983) and Dieter & Pfeffer (1993) who concluded that, plasma concentration of calcium was increased and that of inorganic phosphorus was decreased with decreased intake of phosphorus (Muschen et al., 1988). Osman et al.,(1970) and Shehata (1983) recommended that, serum calcium decreased significantly in cattle and buffaloes with inactive ovaries. In addition, Moustgard (1972) found that failure of oestrus in mature animals is the usual symptoms of phosphorus deficiency. The role played by phosphorus deficiency in reproduction is to be a blocking in the function of the pituitary gland and consequently the ovaries (Zintzen, 1972).

Ovarian findings: There was a trend for the corpus luteum of heifers fed low energy diets to be smaller. There is no obvious explanation for the difference in the size observed in the ovulatory ovary as the correlations between follicular volume and luteal volume with ovarian size were 0.175 and 0.173, respectively (Spitzer et al., 1978). In the non ovulatory ovary, level of nutrition did not appear to have any significant effect on ovarian size or follicular volume. In the present study, high energy diets were accompanied with a significant increase in the size of the largest and second largest follicles in comparison with low or control energy diets, however, the size of corpus luteum was significantly decreased (P<0.01) in ewes fed low energy diets. With regard to the number of large, medium and small follicles, the data represented in table (5) indicated that, feeding ewes on low energy diets was accompanied by a significant (P<0.01) decrease of their number compared with high or control energy diets. Our results are in agreement with that reported by Perry et al., (2009) who found that , low levels of energy post partum decreased appearance rate of small and large follicles in beef cows. Lucy et al (1991) reported that, diameter and number of the dominant follicles increased with more positive energy. In addition, cows placed on low energy before ovulation had preovulatory follicles that grew more slowly than follicles in cows that were fed on high energy (Lucy et al., 1990). However, Beam (1996) reported that, low energy content increase the number of medium but decrease the number of large follicles and reduces function of corpora lutea. In addition, altered the metabolic and hormonal status of cows. In cattle, analysis of data from a large group of early postpartum cows, in which follicular development and energy balance were measured also indicated that, increased energy balance was associated with movement of follicles into larger size classes (Lucy et al., 1991c). It seems to be the same in ewes fed high energy diets as the follicles were greater in size than follicles in ewes fed control or low energy diets. A harmful effect of low energy level on ovarian activity was also recorded with previous reports (Butler et al, 1981; Eldon et al., 1988; Huszenicza et al., 1988 and Miettnen, 1990). Our study indicated that, P level had no significant effect either on the size of follicles, corpus luteum or the number of different sized follicles, a finding which was supported by Fluharty (2008) who reported that, dietary P concentration had no effects on days to 1 st oestrus, days open, days to 1 st AI, services per conception or pregnancy rate. On the contrary, Pond, et al (2005) mentioned that, impaired fertility has been reported in P deficient cattle. Fluharty (2008) stated that, revisiting the literatures makes clear that there is no documented benefit to overfeeding phosphorus.

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