

SOME BIOCHEMICAL STUDIES DURING ESTROUS CYCLE AND AFTER SYNCHRONIZATION IN BARKI EWES

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Abstract

A total number of 28 mature Barki ewes were divided into three groups according to the methods used for synchronization of estrous cycle with different drugs. Group I comprised 8 ewes received no drugs and served as control group. Group II included 10 ewes synchronized by 3 ml (15 mg) prostaglandin F₂ α injected i.m and repeated once after 9 days from the first injection. Group III comprised 10 ewes synchronized by application of intra vaginal sponge impregnated by 60 mg medroxy progesterone acetate for 13 days. Blood samples were taken from all groups during estrus and diestrus phases, twice a week during natural, synchronizing estrus and at the next one for ewes were not conceive. The results showed that, the percentage of conception rate were 75%, 30% and 87.5% in first estrus and 100%, 70% and 100% in the second one for group I, II and III, respectively.

Ewes synchronized by PGF₂ α (group II) showed a significant decrease in serum globulins and total lipids concentrations whereas the value of serum copper level and serum ALT activity showed a significant increase during the follicular phase in comparison with control group. Meanwhile, during the luteal phase, serum glucose, total lipids, copper and progesterone concentrations showed a significant decrease. But serum total cholesterol level, ALT activity, calcium and potassium concentrations were significantly higher when compared with the control group (group I). In ewes synchronized by Veramix vaginal sponge (group III) the obtained results showed that, during follicular phase serum total protein and total globulin levels were significantly decreased but the concentrations of serum total lipids, total cholesterol, calcium and ALT activity showed a significant increase. Moreover, during luteal phase serum glucose and copper levels, AST and ALT activities showed a significant decrease in comparison with control group.

However, Ewes synchronized by PGF₂ α showed low fertility at first estrus than second one. Also some blood parameters as glucose, total protein, total globulins, total lipids, calcium, sodium and progesterone concentrations showed a significant decrease, while serum AST and ALT activities showed a significant increase at first estrus than second one. The results indicated that, the use of vaginal sponge impregnated with medroxy progesterone acetate as an estrus synchronizing agent in ewes was effective and beneficial than the PGF₂ α injection in respect to conception rate.

Introduction

Sheep play an important role in animal productions especially in desert areas. Moreover, Barki sheep has a some sort of resistance against brucella infection, also the mortality rate is lower than other local breed (*Hassan and Younis, 1984*). The interest in synchronization of estrus in domestic animals has increased as one of the major steps towards the enhancement of reproductive and productive performance (*Ezzo and EL-Tohamy, 1992*). *Thimonier, (1981)* reported that, although the prostaglandin F₂ α is unable to induce estrus and ovulation during anestrus, it is very potent luteolytic factor in normal cycling ewes. Furthermore, the practical use of PGF₂ α and its synthetic analogues (Lutalyse) are limited for sheep compared to the extensive use for cattle and horse (*EZZO and EL-Tohamy, 1992*) whereas the progesterone impregnated intra vaginal sponge has received the greatest application in ewes (*Hafes, 1975*).

Several benefits of synchronization were recorded by *McDonald and D.V.M. (1980)* more economic utilization of supplementary feeding to pregnant ewes since all are the same stage of gestation, reduce labor costs and easier supervision of lambing due to more compact lambing, more efficient planning of Castration, docking, vaccination programs and aids planning and development of artificial insemination.

Accordingly, the interest arises to study some biochemical alterations which may occur in the blood of ewes during estrous cycle synchronization under the effect of different administration of PGF₂α (Lutalyse) and progesterone (Veramix) hormones with special reference to their effect on the reproductive performance of Barki ewes.

Materials and methods

The present study was carried out on twenty-eight mature Barki ewes of 3-5 years old at the experimental farm of the Animal Reproduction Research Institute at Alharm. The animals were housed in an open yard system under natural lighting with a common shaded manger and water troughs in which water was offered ad-libitum. Ewes were supplied daily with concentrate mixture contains crude protein 14% and crude fiber 11% and consists of (25% cotton seed cake, 3% soya bean meal, 55% wheat bran, 9% yellow corn, 5% rice bran, 2% lime stone and 1% common salts) in addition to green clover (Barseem) and wheat straw during the green season and green corn stems (Darawa) during the dry season. During the period of study the animals were proved to be clinically normal and free from internal, external and blood parasites.

Drugs: The medicaments used in the present work were:

1-Dinoprost-Thromethamine (Lutalyse): It is naturally prostaglandin- F₂α (PGF₂α), each vial contain 10 ml sterile solution lutalyse (5 mg /ml). It is manufactured by Upjohn Company, USA.

2-Medroxy progesterone acetate (Veramix): It is an intravaginal sponge each contain 60 mg medroxy progesterone acetate. Supplied by Upjohn Company, USA.

Experimental design: Animals were divided into three groups according to the drugs (hormones) used as follows:

Group I: Comprised 8 ewes received no drugs, each one was injected I.M. with 3 ml sterile normal saline solution and served as control group.

Group II: Contained 10 ewes, each one received 3 ml, (15 mg) of prostaglandin- F₂α (Lutalyse) injected I.M. and repeated once after 9 days in ewes that did not show response to the first injection.

Group III: Comprised 10 ewes each one was synchronized by applications of intra-vaginal sponge impregnated by 60 mg medroxy progesterone acetate for 13 days.

All ewes showed signs of estrus in the experimental groups were naturally served by clinically normal and healthy fertile rams (1 ram to 5 ewes) according to *Crosby et al., (1991)*. The day of successful mating was considered day zero of the estrous cycle according to *Elias (1991)*. Ewes, which did not conceive from the first mating and returned to next estrous cycle, were remitted again.

Sampling:

Blood samples were collected from the jugular vein from all animal groups, at day zero of estrus and periodically twice weekly for the duration of the complete cycle in experimental ewes. The sera were separated by centrifugation and processed directly for determination of glucose concentration and transaminases and alkaline phosphatase activities, then kept in a deep freeze at -20°C until used for subsequent biochemical analysis.

Analytical procedures:

Serum glucose concentration was determined enzymatically with glucose oxidase as described by *Trinder (1969)*. Serum total protein, albumin and globulins concentrations were determined by the methods described by *Henery (1968)*, *Drupt (1974)* and *Doumas and Biggs, (1972)*, respectively. Total lipids and total cholesterol were determined in serum by the methods of *Zollner and Kirsch, (1962)* and *Watson, (1960)*, respectively. Serum transaminases, and alkaline phosphatase activities were determined according to the methods reported by *King, (1965)* and *Belfield and Goldberg, (1971)*, respectively. Serum calcium, inorganic phosphorus were determined according to *Gindler and king, (1972)* and *Goldenberg, (1966)*, respectively. Serum sodium and potassium levels were measured by using the flame photometer according to the method of *Varley, (1969)*. Serum copper concentration was estimated by the method of *Zak (1958)*. Progesterone level was carried out by using progesterone I¹²⁵ radioimmunoassay technique according to *Hiller, (1990)*.

Statistical analysis of the obtained results was carried out using the method of *Snedecor and Cochran (1987)*.

Results

The obtained results Table (1) revealed a marked reduction of conception rate (CR) in ewes synchronized with PGF2 α 30% than control group 75%, while the percentage was much higher in ewes applicated by progesterone vaginal sponge 87.5%. The lowered CR in group II synchronized with PGF2 α 30% at first estrus raised up to 70% after second one following synchronization.

The obtained results Table (2) revealed that, serum glucose level was decrease during both follicular and luteal phases of ewes synchronized with PGF2 α whereas, ewes applicated by progesterone vaginal sponge (group III) had a lower serum glucose level during luteal phase. The value of serum total protein level showed a significant decrease in ewes applicated by progesterone vaginal sponge during follicular phase of estrous cycle. A non-significant increase in serum albumin level of both groups of ewes treated by PGF2 α and progesterone vaginal sponge during follicular and luteal phases. Meanwhile, during follicular phase there was a significant decrease in serum total globulins level in ewes treated by PGF2 α and progesterone vaginal sponge when compared with group I.

Serum total lipids concentrations were significantly decreased in ewes synchronized with PGF2 α during both follicular and luteal phases. Meanwhile, a significant increase in serum total lipids in ewes applicated by progesterone vaginal sponge during follicular phase. There was a significant increase in serum total cholesterol level in ewes injected with PGF2 α and in ewes applicated with progesterone vaginal sponge during luteal phase and follicular phase, respectively.

Serum AST activity during luteal phase was significantly decreased in ewes applicated with progesterone vaginal sponge. However, the value of serum ALT activity was significantly increased in ewes synchronized with PGF2 α and in ewes applicated by progesterone vaginal sponge during both follicular and luteal phases. A non significant decrease in serum alkaline phosphatase activity was observed in ewes injected with PGF2 α during both follicular and luteal phases and also in ewes applicated with progesterone vaginal sponge during follicular phase only whereas, during luteal phase serum alkaline phosphatase activity showed a non significant increase.

The obtained results Table (2) showed that, there was a significant increase in serum calcium level during luteal phase in ewes injected with PGF2 α compared with control group. The ewes applicated with progesterone vaginal sponge showed a significant increase in serum calcium level during follicular phase. On the other hand, there was no significant effect to the PGF2 α or progesterone vaginal sponge on serum inorganic phosphorus during both phases of estrous cycle.

In ewes received PGF2 α the value of serum potassium level showed a significant increase during luteal phase. Meanwhile, serum sodium and potassium levels did not undergo cyclic variations in untreated control ewes and those applicated by progesterone vaginal sponge.

A significant increase in serum copper level observed in ewes synchronized by PGF2 α during follicular phase. However, the obtained results showed a significant decrease in serum copper level in ewes applicated by progesterone vaginal sponge and ewes synchronized with PGF2 α during luteal phase.

The obtained data revealed that, the follicular phase did not show significant effect on serum progesterone concentrations in ewes injected with PGF2 α and the ewes applicated by progesterone vaginal sponge. Meanwhile, during luteal phase, there was a significant decrease in serum progesterone level of ewes injected by PGF2 α .

The obtained data Table (3) revealed that, the ewes suffered from lower fertility at first estrus after synchronization with PGF2 α had a lower serum glucose level than those at second one during luteal phase. The value of serum total protein and total globulins levels showed a significant decrease while serum albumin level showed a non significant decrease in low fertile ewes at first estrus when compared with second one during follicular phase. Serum total lipids concentrations during both

follicular and luteal phase was significantly decrease while serum total cholesterol level showed a non significant decrease in ewes with lower fertility at first estrus after synchronization with PGF2 α than the second one with higher fertility. The activities of serum AST and alkaline phosphatase were significantly higher during both follicular and luteal phases at first estrus with low fertility after synchronization with PGF2 α than those of the second one. While serum ALT activity showed a non-significant increase.

The obtained data Table (3) demonstrated that, during follicular phase, serum calcium level showed a significant decrease in ewes suffering from lower fertility at first estrus after synchronization with PGF2 α than the second one. While the value of serum inorganic phosphorus level showed a non significant change. During luteal phase there was a non-significant increase in serum inorganic phosphorus level was observed in ewes at first estrus with low fertility than those of second one.

Serum sodium level showed a significant decrease at first estrus than second one during luteal phases, while the value of serum potassium level showed a non-significant decrease in ewes with low fertility at first estrus during both follicular and luteal phases after synchronization with PGF2 α . A non-significant decrease in serum copper level was reported in ewes suffering from low fertility at first estrus following synchronization with PGF2 α during both follicular and luteal phases than ewes at second one whereas, a significant decrease in serum progesterone level was observed in ewes suffering from low fertility at first estrus after synchronization with PGF2 α during luteal phase than those at second one.

Discussion

The obtained results revealed that, the percentage of conception rate were 75%, 30% and 87.5% in first estrus and 100%, 70% and 100% in the second one for group I, II, and III, respectively. This finding coincided with *Mathur et al., (1987)* who found that, in ewes injected with PGF2 α the conception rate (CR) after mating at the first and second cycle were 20% and 45%, respectively. Moreover, PGF2 α treated ewes showed marked evidence of subfertility due to their greater susceptibility to the adverse environmental factors. The obtained results indicated a decrease level of serum progesterone in ewes suffering from lower CR after PGF2 α injection at first estrus. Similarly, *Agudo et al., (1984)* suggested that, the decrease in plasma progesterone concentration after PGF2 α induced luteolysis in ewes results in decrease in adenylate cyclase activity coupled decrease in intracellular C.AMP. This may be one of the early events resulting in lower progesterone concentration. Although, the response of ewes applicated by progesterone vaginal sponge to estrus was 80%, their CR was 87.5%. These results agreed well with that reported by *Mazzarri and Fuenmayor (1976)*. Moreover, *EL-Amrawi et al., (1993)* found that, the application of progesterone vaginal sponge caused an elevation in plasma progesterone concentration which lead to improve CR in ruminants.

The obtained results Table (2) revealed that, serum glucose level was decrease during both follicular and luteal phases of ewes synchronized with PGF2 α . These results agreed well with those reported by *Burr and Sharp (1974)* who claimed that, the prostaglandin stimulate the release of insulin hormone from rat islets which binding to plasma membrane that could be responsible for the insulin release. Also, *Goodman and Gilman (1980)* reported that, prostaglandin caused stimulation of insulin release and added that prostaglandin also have some insulin-like effects on carbohydrate metabolism.

The ewes applicated by progesterone vaginal sponge (group III) had a lower serum glucose level during luteal phase. Similarly, *Abdoon et al., (1993)* claimed that, serum glucose level was significantly decreased in medroxy progesterone acetate treated buffaloes during both follicular and luteal phases. Also, *Lenzen (1978)* recorded that, progesterone treatment stimulate glucose induced insulin secretion from isolated rat islets.

The value of serum total protein level showed a significant decrease in ewes applicated by progesterone vaginal sponge during follicular phase of estrous cycle. These results agreed well with

that obtained by *Ibrahim et al., (1984)* who recorded that, the higher level of serum total protein during progestational phase was associated with higher level of progesterone. Similarly, *Hafez (1975)* suggested that, progesterone synthesis may enhance the activation of membrane bound adenyl cyclase which causes an increase in the intracellular concentration of C.AMP that may act at the cytoplasmic level to stimulate protein synthesis. The decrease in serum total protein level may be attributed to the decrease level of progesterone during follicular phase and lower level of serum globulins. On the other hand, during follicular phase there was a significant decrease in serum globulins level in ewes treated by PGF₂α and progesterone vaginal sponge. These results were supported by *Goodman and Gilman (1980)* who recorded that, the prostaglandin have been implicated in the control of immunological response and decrease humoral antibody response that may explain the decrease in serum globulins level.

Serum total lipids concentrations were significantly decreased in ewes synchronized with PGF₂α during both follicular and luteal phases. PGF₂α inhibit both adenyl cyclase conversion to cyclic AMP and lipolytic activity *Karim (1975)*. Similar interpretation was reported by *Ramweel (1974)* who claimed that, PGF₂α has antilipolytic effects. Also, *Goodman and Gillman (1980)* cited that, PGF₂α inhibit the basal rate of lipolysis from adipose tissue. The obtained results showed a significant increase in serum total lipids of ewes applicated by progesterone vaginal sponge during follicular phase. These results were supported by *Youssef et al., (1986)* who reported that, the presence of estradiol increase the lipolytic factor which increase total lipids in the serum of goats. The authors also added that, estrogen stimulate lipid synthesis from glucose. Moreover, *Avpate et al. (1990)* found that, the increase of serum total lipids level during follicular phase may be due to the higher requirement of such active estrogenic phase to lipids for energy metabolism.

There was a significant increase in serum total cholesterol level in ewes injected with PGF₂α during luteal phase. Similar findings were recorded by *Abdel-latif (1993)* in buffalo- cows. Moreover, during follicular phase there was a significant increase in serum total cholesterol level in ewes applicated with progesterone vaginal sponge. Similarly, *Pareek et al., (1982)* reported that, an increase in serum total cholesterol level was noticed after synchronization with progesterone vaginal sponge and the authors attributed such increase to the progesterone treatment which influenced the lipid metabolism of the animal. Furthermore, *Purohit and Kohli (1977)* reported that, estrogen hormone had an effect on the carbohydrate metabolism intern cause increased production of cholesterol in endocrine gland tissue from acetate.

The obtained results declared that, the activity of serum AST during luteal phase was significantly decrease in ewes applicated with progesterone vaginal sponge. The reduced AST activity could be attributed to protein metabolism and amino acid utilization at condition of high circulating progestin *Anand and Madan (1978)*. Another possible explanation for the decrease in serum AST activity during the progestational phase may be due to the hormonal changes during estrous cycle (*Roussel and Stallcup, 1967*).

Regarding to serum ALT activity, the obtained data revealed that, serum ALT activity was significantly increased in ewes synchronized with PGF₂ α and the ewes applicated by progesterone vaginal sponge during both follicular and luteal phases. Similar findings were reported by *Ishwar (1994)* in black Bengal goat treated with PGF₂α. The increase in serum ALT activity was showed to be more specific for liver damage in goats and rabbits receiving high doses of contraceptive (estrogenic compound) which was shown to be the most harmful to the body, *Abdel Kader, et al. (1979)*. Moreover, the increased activity of serum ALT after progesterone vaginal sponge application may be as a result of normal tissue destruction in uterus. Furthermore, *Abdel-Aziz (1993)* recorded that, the increase in serum ALT activity may be due the role of liver in binding mechanism of anterior pituitary hormones according to the demand of ovaries.

The obtained results Table (2) showed that, there was a significant increase in serum calcium level during luteal phase in ewes injected with PGF₂α compared with control group with decrease level at follicular phase in the same group. Similarly, *Dhoble and Gupta (1986)* and *Noseir, et al.*

(1986) observed that, serum calcium concentration was higher during progesterational phase than estrogenic one however the decrease in serum calcium level during follicular phase could be due to the higher level of estrogen, which is responsible for the increase irritability of the uterine contractility. In addition to estrogen has an effect on an increase deposition of calcium level in bones, while depresses the blood calcium levels in mammals (*Dickson, 1970*). The ewes applicated with progesterone vaginal sponge showed a significant increase in serum calcium level during follicular phase. Similar findings were reported by *Abdoon et al., (1993)* in buffaloes. They attributed this increase in serum calcium level to the greater mobilization of calcium due to increase metabolic activity at follicular phase.

In ewes received PGF2 α the value of serum potassium level showed a significant increase during luteal phase. *Abdel Aziz (1993)* suggested that, ovarian hormone particularly estrogen causes water uptake and shift in water from intracellular phase to extracellular one with decreased potassium value in bovine endometrium. Under the effect of progesterone the results showed an increase in serum potassium levels.

The obtained data indicated that, there was significant increase in serum copper level of ewes synchronized by PGF2 α during follicular phase. The increase in serum copper level after PGF2 α injection may be attributed to higher level of estrogen during follicular phase. This may be related to estrogen induce synthesis of ceruloplasmin (copper containing globulin of blood plasma) as mentioned by *Brandes et al. (1980)*. Whereas, during luteal phase the results showed a significant decrease in serum copper level that may be due to decrease estrogenic effect under progesterational phase.

The ewes applicated by progesterone vaginal sponge showed a significant decrease in serum copper level during luteal phase. The decrease in serum copper concentration may be due to lower level of estrogen hormone under progesterational phase *Abdoon et al., (1993)*.

The obtained results showed that, during luteal phase, there was a significant decrease in serum progesterone level of ewes injected by PGF2 α . Similar finding was recorded by *Folman et al., (1990)* who observed that, the cows synchronized with PGF2 α had a lower plasma progesterone level.

The obtained data Table (3) revealed that, the ewes suffered from lower fertility at first estrus after synchronization with PGF2 α had a lower serum glucose level than those at second one during luteal phase. This decrease in serum glucose level may be due to the effect of PGF2 α which stimulate the release of insulin from islets lead to decrease plasma glucose level (*Burr and sharp, 1974*). Meanwhile, the increase in blood glucose level at second estrus could be attributed to higher rate of glycogenolysis in the liver of fertile ewes to fulfill their higher requirement to energy (*Daghash et al., 1994*).

The value of serum total protein and total globulins levels showed a significant decrease in low fertile ewes at first estrus when compared with second one during follicular phase. This increase in serum total protein level might be due to the lower serum globulins level and progesterone concentrations during this phase, and also may be attributed to the direct effect of PGF2 α which decrease adenylate cyclase activity and increase phosphodiesterase activity that lead to decrease intracellular C.AMP concentration (*Agudo et al., 1984*). Moreover, the decrease in serum globulins level may be due to the direct effect of PGF2 α which lead to decrease immune response and decrease humoral antibody response *Goodman and Gilman (1980)*.

Serum total lipids concentration during both follicular and luteal phase was significantly decrease in ewes with lower fertility at first estrus after synchronization with PGF2 α than the second one with higher fertility. The decrease in serum total lipids level at the first estrus may be due to the direct effect of PGF2 α injection which inhibits the basal rate of lipolysis from adipose tissue (*Ramwell, 1974*). Another suggestion is that, the decrease in serum total lipids in ewes suffered from low fertility may be attributed to reduction in serum progesterone and estradiol-17B concentrations

as recorded by *EL-Tohamy et al. (1991)*, because estrogen increase the synthesis of fat in both liver and blood (*Pearce and jophanson, 1986*).

The activities of serum AST and alkaline phosphatase were significantly higher during both follicular and luteal phases at first estrus with low fertility after synchronization with PGF2 α than those of the second one. The increase in serum AST activity of ewes with low CR was might be attributed to malfunction of the liver as confirmed by *Coles (1967)* who observed that, the activity of serum AST was increased in case of starvation. This well lead to mobilization of fat from its depot as source of energy and consequently the release of serum AST. Moreover, the increase in serum ALP activity in ewes with lower fertility at the first estrus might be attributed to the higher parathyroid activity which leader to rapid entry of calcium into bone and hypocalcaemia well occurs and the increase of serum ALP activity due to increase activity of parathyroid gland *Samy (1991)*.

The obtained data demonstrated that, during follicular phase, serum calcium level showed a significant decrease in ewes suffering from low fertility at first estrus after synchronization with PGF2 α than the second one. Similar results were reported by *Ibrahim, et al. (1984)* in buffaloes. This decrease of serum calcium level may be attributed to PGF2 α has parathyroid like effect which had rapid entry of calcium into bone and hypocalcaemia will occurred (*Samy, 1991*).

During luteal phase serum sodium level showed a significant decrease at first estrus than second one. in ewes with low fertility after synchronization with PGF2 α . Similar results was recorded by *Jindal et al. (1990)* who observed that, serum sodium level was significantly decreased during luteal phase of synchronized estrous cycle with PGF2 α . The authors attributed this decrease to the absence of estrogen effect during Progestational phase.

There was a significant decrease in serum progesterone level of ewes suffering from lower fertility at first estrus after synchronization with PGF2 α than those at second one. Similarly, *Folman et al., (1990)* cited that, lower CR of ewes treated by PGF2 α may be explained by the fact that, the cow under luteolysis had low plasma progesterone prior to PGF2 α injection. Moreover, *EL-Tohamy et al., (1991)* reported that, the infertile buffaloes showed a significant reduction in serum progesterone level compared with fertile one. The author attributed this decrease to luteal dysfunction. The lower progesterone concentration may be lead to failure of conception and implantation.

From the present work, it was concluded that, the use of vaginal sponge impregnated with medroxy progesterone acetate as an estrus-synchronizing agent in ewes was effective and beneficial than the PGF2 α injection in respect to conception rate. The lower conception rate observed after PGF2 α injection may be due to the lower serum progesterone concentration, which have an important physiological role in the processes of fertilization and implantation. In addition, PGF2 α injection lead to dramatic disturbance in some metabolic processes including decreased energy availability (glucose, total lipids) and mineral imbalance (calcium and sodium) as well as immune suppression (decrease globulins). On contrary, the use of progesterone vaginal sponge was an effective as synchronizing agent. It has mild effect on the blood parameter levels and may be act in the body as the endogenous progesterone. Finally, from the current work we can recommend the use of progesterone vaginal sponge as safe and effective methods of synchronizing agents in ewes.

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Table (1): Conception rate at first and second estrus after different types of synchronization in Barki ewes.

Animals group	Response to estrus	Conception rate at 1st estrus	Conception rate at 2nd estrus	Non conceived
I (n=8)	8(100%)	6(75%)	8(100%)	0(0%)
II (n=10)	10(100%)	3(30%)	7(70%)	3(30%)
III (n=10)	8(80%)	7(87.5%)	8(100%)	0(0%)

Group I: control (normal estrus).

Group II: synchronized by PGF2 α .

Group III: synchronized by Veramix (progesterone vaginal sponge)

Table (2): Effect of estrous cycle synchronization on some biochemical blood parameters in Barki ewes .

Statements Parameters	Estrous cycle						LSD
	Follicular phase			Luteal phase			
	GroupI	GroupII	GroupIII	GroupI	GroupII	GroupIII	
Glucose(mg/dl)	58.37 ± 1.72ab	53.25±2.95a	60.75±2.05b	54.35±0.84a	41.12±2.61c	42.12±1.78c	6.027
Proteins(gm/dl):							
Total proteins	7.40±0.37a	6.77±0.44ab	6.33±0.21b	6.48±0.23ab	7.74±0.27a	7.55±0.51a	1.005
Albumin	2.08±0.24	2.75±0.22	2.67±0.26	2.56±0.13	3.35±0.18	3.61±0.44	NS
Globulins	5.34±0.39a	4.02 ±0.22bd	3.41±0.45bc	3.91±0.21bcd	4.60±0.31ad	3.93±0.26bcd	1.045
A/G ratio	0.41±0.05	0.82±0.21	0.71±0.08	0.67±0.07	0.75±0.07	0.95±0.13	NS
Lipids(mg/dl):							
Total lipids	445.62±6.99a	299.37±11.0b	527.5±10.06c	345.62±4.63d	264.12±7.1c	320.12±14.5d	27.481
Total cholesterol	78.12±3.09bc	79.37±3.56bc	101.62±2.15a	72.12±2.60c	86.37±4.3b	74.00±3.39c	9.308
Enzymes:							
AST(IU/L)	37.37±1.79bd	42.06±4.47abc	44.21±2.61abc	40.12±3.27abc	47.78±4.81c	31.93±2.95d	9.792
ALT(IU/L)	8.81±0.56c	14.37±1.06a	11.18±0.80b	9.37±0.52c	11.75±0.78b	12.56±0.85b	2.093
ALP(U/L)	90.83±4.25	62.57±5.78	84.00±5.65	75.62±7.34	63.87±9.77	94.5±9.58	NS
Calcium(mg/dl)	9.77±0.29a	8.91±0.59a	12.18±0.55b	9.60±0.37a	11.62±0.85b	8.95±0.62a	1.565
Inorg.Phosphorus (mg/dl)	3.98±0.16	4.67±0.37	3.60±0.45	3.47±0.24	4.37±0.13	4.16±0.33	NS
Sodium (mEq./L)	192.35±2.29	188.24±2.80	195.35±1.45	195.01±5.1	170.62±8.53	186.91±3.14	NS
Potassium(mEq./L)	5.3±0.26abcd	5.4±0.15abcd	5.75±0.16abc	5.16±0.11bd	5.84±0.12c	5.19±0.25d	0.545
Copper (ug/dl)	143.1±7.59b	180.00±9.15a	145.4±11.8b	203.63±4.66a	144.13±12.5b	153.43±18.3b	32.863
Progesterone (ng/ml)	1.18±0.13a	1.20±0.10a	0.81±0.02a	5.56±0.48b	2.76±0.54c	4.94±0.28bc	0.929

Data are presented as Mean ± S.E

S.E =standard error

LSD: Least significant difference (P<0.05)

NS: Non significant.

Group I: control group (natural estrus)

Group II: synchronized by PGF2α.

Group III: synchronized by Veramix

N.B) within rows the differences between superscripts a , b , c , d ,are significant at p < 0.05.

Table (3): Mean values of some biochemical blood parameters during follicular and luteal phases at first and second fertile estrus following PGF2 α synchronization in Barki ewes.

Parameters	Follicular phase		Luteal phase	
	1st estrus (n=3)	2nd estrus (n=4)	1st estrus (n=3)	2nd.estrus (n=4)
Glucose(mg/dl)	42.33 \pm 1.45	45.75 \pm 2.53	38.00 \pm 0.58***	66.00 \pm 3.03
Proteins(gm/dl):				
Total protein	5.83 \pm 0.36*	7.95 \pm 0.35	7.85 \pm 0.47	7.63 \pm 0.68
Albumin	3.18 \pm 0.21	3.81 \pm 0.31	3.00 \pm 0.05	3.03 \pm 0.35
Globulins	2.65 \pm 0.20*	4.38 \pm 0.44	4.85 \pm 0.5	4.60 \pm 1.03
A/G ratio	1.20 \pm 0.07	0.92 \pm 0.18	0.64 \pm 0.08	1.05 \pm 0.44
Lipids (mg/dl):				
Total lipids	299.00 \pm 17.9**	404.5 \pm 27.21	264.0 \pm 6.43*	317.0 \pm 24.09
Total cholesterol	78.33 \pm 8.37	81.00 \pm 6.65	84.67 \pm 4.34	92.9 \pm 11.23
Enzymes :				
AST(IU/L)	60.67 \pm 5.46***	34.5 \pm 2.01	53.33 \pm 0.88**	37.13 \pm 4.59
ALT(IU/L)	16.00 \pm 1.73	13.5 \pm 0.5	13.5 \pm 0.29	10.37 \pm 3.04
ALP(U/L)	92.00 \pm 7.02*	63.25 \pm 7.82	102.0 \pm 7.23***	57.25 \pm 5.27
Calcium(mg/dl)	9.27 \pm 1.36*	13.18 \pm 1.17	10.17 \pm 0.66	9.70 \pm 1.08
Inorg.phosphorus(mg/dl)	4.29 \pm 1.18	4.29 \pm 0.18	5.12 \pm 0.20	4.72 \pm 0.53
Sodium(mEq./L)	195.00 \pm 2.89	198.9 \pm 1.10	143.73 \pm 1.07*	192.65 \pm 3.86
Potassium(mEq./L)	5.54 \pm 0.12	5.55 \pm 0.07	5.91 \pm 0.33	6.08 \pm 0.16
Copper (ug/dl)	190.47 \pm 0.76	195.40 \pm 3.24	177.5 \pm 8.43	190.4 \pm 13.96
Progesterone (ng/ml)	1.05 \pm 0.16	1.35 \pm 0.21	2.35 \pm 0.21*	4.71 \pm 0.71

Data are presented as Mean \pm S .E. S.E.= standard error *: (p <0.05) **: (p <0.01) ***: (p <0.001)