

## POST-PARTUM PERFORMANCE OF PREGNANT BUFFALOES SUPPLEMENTED WITH VITAMIN AD3E DURING SUMMER SEASON

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### ABSTRACT

Twenty eight buffaloes at late pregnancy period were divided into four equal groups and subjected during prepartum (one month) and post-partum (two months) periods to four treatments. The first group (T0) had no treatment (control group), group T1 fed on chopped corn plants as partial replacement (20% as DM) of concentrate feed mixture (CFM), whereas the other two groups were subjected to vitamin AD3E intramuscular injection (T2) or dietary supplement treatment (T3). For each animal of group T2, 7 ml weekly dosage of injected vitamin AD3E contained 80,000 IU/ml, 40,000 IU/ml and 20 mg/ml of vitamins A, D3 and E, respectively, while each animal in group T3 received 10 ml weekly dosage of dietary supplement contained 50,000 IU/ml, 5,000 IU/ml and 20 mg/ml of the same vitamins, respectively. Immunoglobulin analysis of colostrum indicated insignificant differences in Ig M fraction among treatments. Fractions of Ig A and Ig G were relatively higher ( $P < 0.05$ ) in vitamin AD3E injected group T2 in comparison with other groups. The control group T0 had minimal ( $P < 0.05$ ) concentration of Ig A and Ig G than other treated groups.

Buffaloes of group T2 had the least ( $P < 0.05$ ) calving interval (367.2±24.1 days) due to the shorter intervals for uterine involution, onset of the 1<sup>st</sup> postpartum heat and days open. Group T2 achieved greater calf birth weight and weaning weight in comparison with other groups. Relative growth rate of weaned calves were almost similar for all groups.

Group T1 exhibited greater ( $P < 0.05$ ) total milk production in comparison with other groups. Supplementation of vitamin AD3E (in both groups T2 and T3) was not effective to maintain milk productivity over that of the control group. Days in milk were the greatest in T1 group

Mean concentrations of blood total protein, globulin, calcium and AST activity of group T2 were significantly ( $P < 0.05$ ) higher than that of other groups. Group T1 characterized by a significant ( $P < 0.05$ ) elevation of blood glucose, total lipids and phosphorous. Concentrations of blood globulin of groups T0 and T1 were significantly ( $P < 0.05$ ) less than that of vitamin AD3E treated groups during pre and postpartum periods.

**Keywords:** Vitamin AD3E, buffaloes, immunoglobulins, production, metabolism, reproduction.

### INTRODUCTION

The common feeding pattern of ruminants in Egypt depends mainly on clover (*Trifolium alexandrinum*) feeding in winter (November–May) followed by a dry feeding season of animals on concentrates, straws or byproducts in summer. In consequence, animals that reach late pregnancy period in summer may suffer from inadequacy of fat soluble vitamins concomitant with insufficient production of immunoglobulins in colostrums at time of parturition. This phenomenon leads considerably to increased percentage of mortality

among newborn buffalo calves. The importance of vitamins AD3E supplementation in summer may also refer to their availability and utilization rate which in turn increases by inflammation as well as dietary and environmental factors (Herdt and Stowe, 1991). Furthermore, some literatures pointed out that infertility and incidence of post partum reproductive disorders are partially related to decreased concentrations of fat soluble vitamins (Ezzo, 1996, Qureshi *et al.*, 1997 and Kolb and Seehawer, 1998). Therefore, the present work aimed to study the effect of vitamin AD3E treatment (either by injection or dietary supplement) on immunoglobulin status, milk production and reproductive performance of Egyptian buffaloes.

## MATERIALS AND METHODS

### The experimental work:

The experimental work lasted 3 months during the period from mid August to mid November. Twenty eight buffaloes at late pregnancy period were divided into four equal groups. The first group (T0) had no treatment and served as a control group, group T1 fed on shopped corn plants as 20% partial replacement of the concentrate feed mixture (CFM) on DM basis, whereas the other two groups were subjected to vitamin AD3E either as intramuscular injection (T2) or dietary supplement treatment (T3). The treatments commenced approximately one month before the expected parturition date and continued for two months after calving. Intramuscularly injection of AD3E (group T2) was applied at the rate of 7 ml/head/week, whereas dietary supplementation of liquid vitamin AD3E (group T3) was applied at the rate of 10 ml/head/week. Both forms of vitamin AD3E are products of Dutch Farm, LTD, Netherlands. Details of dosage application for the treated groups are presented in table (1).

Table (1): Dosage application of vitamin AD3E by injection or dietary supplement.

| Item                                  | AD3E injection (T2) | Dietary AD3E (T3) |
|---------------------------------------|---------------------|-------------------|
| Treatment period (days)               | 90                  | 90                |
| Dosage application (ml / head / week) | 7                   | 10                |
| Overall dosage per animal during:     |                     |                   |
| Pre-partum period (ml)                | 28                  | 50                |
| Post-partum period (ml)               | 56                  | 100               |
| Total dosage (ml)                     | 84                  | 150               |
| Vitamin content of dosage :           |                     |                   |
| Vitamin A (IU / ml)                   | 80,000              | 50,000            |
| Vitamin D3 (IU / ml)                  | 40,000              | 5000              |
| Vitamin E (mg / ml)                   | 20                  | 40                |

### Feeding and management :

During the experimental period, each animal of the control group (T0) as well as vitamin AD3E treated groups (T2 and T3) were individually fed according to their live weight on 6 kg concentrate feed mixture (CFM) along

with 5 kg rice straw (APRI, 1997). Each animal of group T1 were fed on 5 kg CFM and 5 kg rice straw along with 4 kg chopped corn plant (2-3 cm in length) to replace part of CFM (20% as DM). Buffaloes were fed on CFM twice daily at 9 a.m. and 3 p.m.. The CFM composed of 33% un-decorticated cotton seed, 22% corn, 21% wheat bran, 14% rice bran, 3% molasses, 3% limestone, 1.2% common salt and 2.8% calcium. Chemical composition of used feeds was determined at the beginning of the experiment as shown in table (2).

Table (2) Chemical analysis of feed ingredients (on DM basis).

| Item                | DM % | Composition of DM (%) |      |     |      |      |      |
|---------------------|------|-----------------------|------|-----|------|------|------|
|                     |      | OM                    | CP   | EE  | CF   | NFE  | ASH  |
| Concentrate mixture | 89.9 | 88.7                  | 16.1 | 4.8 | 18.4 | 49.4 | 11.3 |
| Rice straw          | 92.5 | 83.9                  | 3.7  | 1.3 | 36.4 | 42.5 | 16.1 |
| Shopped corn plant  | 22.4 | 88.9                  | 5.0  | 2.7 | 27.4 | 53.8 | 11.1 |

The experimental buffaloes were housed in open sheds and subjected to the regular managerial practices of the breeding stock. Buffaloes were kept during the dry off period in their shed up till time of delivery where they transferred to the maternity house. After delivery the dams were kept for one week with their new born calves for colostrums feeding then transferred to the milking unit.

All the experimental buffaloes were commencing their 3<sup>rd</sup>-4<sup>th</sup> lactation. The buffaloes were hand milked twice daily and milk yield was recorded for each animal. Water was freely available in water troughs except at the milking time. Multi mineral licking blocks were available for animals in the stalls.

One month after delivery, buffaloes were regularly observed for postpartum ovarian activity, uterine involution and heat symptoms. The reproductive efficiency parameters implied days of uterine involution, days open, calving interval and number of service per conception were recorded.

#### Colostrums and blood analysis :

Colostrum samples were collected at 8 am from each dam at the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> day postpartum for immunoglobulin determination. Blood samples were collected every 15 days via the jugular vein from each buffalo cow then plasma was separated and analyzed for glucose (Tietz, 1986), total protein (Weichselbaum, 1946), albumin (Drupt, 1974), creatinine (Henry, 1965), aspartate aminotransferase (AST, Reitman and Frankel, 1957), total lipids (Frings and Dunn, 1970), calcium (Sarkar and Chauhan, 1967) and phosphorus (Goodwin, 1970).

Determination of immunoglobulins Ig A, Ig M and Ig G in colostrums was applied by Bovine radial immunodiffusion (RID) kit according to the procedure outlined by the manufacturer (The Binding Site Ltd, Birmingham, UK). The principle of the technique was derived from the work of Mancini *et al.* (1965) and Fahey and McKelvey (1965).

**Statistical analysis :**

Statistical analysis was carried out using GLM procedure of SAS statistical package (1988). Differences were subjected to Duncan's Multiple Range Test (Duncan, 1955).

**RESULTS AND DISCUSSIONS****Concentrations of immunoglobulins in colostrum :**

As shown in table (3), concentrations of all Immunoglobulin (Ig) fractions in colostrum of buffaloes showed a descending trend within the 1<sup>st</sup> three sampling days following parturition. Despite, insignificant differences in Ig M fraction were detected among treatments, groups T1, T2 and T3 had relatively greater values of Ig M than that of group T0. Fractions of Ig A and Ig G were significantly higher ( $P < 0.05$ ) in vitamin AD3E injected group T2 in comparison with other groups. The control group T0 had minimal ( $P < 0.05$ ) concentration of Ig A and Ig G than other treated group particularly within the first two days after parturition. Estimates of Ig in the current study are greater than those obtained by Salama *et al.* (1997) who observed that Ig contents in colostrum of Egyptian buffaloes at 24, 48 and 72 hr after calving were 26.1, 20.0 and 16.4 mg/ml in preparturient and 26.0, 14.3 and 10.9 in pluriparous buffaloes. Hidiroglou *et al.* (1992) did not determine Ig content in colostrum but they found no significant differences in milk content of Ig classes between the control and treated group of cows that supplemented with vitamin E (1000 IU per cow daily) at dry off and 90 days postpartum.

**Table (3) Immunoglobulin content (mg/ml) in colostrums of buffaloes as affected by vitamin AD3E treatments.**

| Ig fraction | Sampling Day    | Treatments         |                    |                     |                     | ±SE  |
|-------------|-----------------|--------------------|--------------------|---------------------|---------------------|------|
|             |                 | T0                 | T1                 | T2                  | T3                  |      |
| Ig A        | 1 <sup>st</sup> | 3.28 <sup>b</sup>  | 3.67 <sup>ab</sup> | 4.25 <sup>a</sup>   | 3.75 <sup>ab</sup>  | 0.34 |
|             | 2 <sup>nd</sup> | 3.19 <sup>b</sup>  | 3.26 <sup>b</sup>  | 4.16 <sup>a</sup>   | 3.67 <sup>ab</sup>  | 0.29 |
|             | 3 <sup>rd</sup> | 2.95               | 3.05               | 2.65                | 3.25                | 0.24 |
|             | Overall mean    | 3.07               | 3.42               | 3.67                | 3.57                | 0.29 |
| Ig M        | 1 <sup>st</sup> | 4.24               | 4.88               | 4.71                | 4.58                | 0.57 |
|             | 2 <sup>nd</sup> | 3.75               | 4.25               | 4.50                | 5.03                | 0.49 |
|             | 3 <sup>rd</sup> | 3.36               | 3.85               | 4.31                | 3.64                | 0.39 |
|             | Overall mean    | 3.78               | 4.58               | 4.53                | 4.50                | 0.49 |
| Ig G        | 1 <sup>st</sup> | 34.53 <sup>c</sup> | 46.67 <sup>a</sup> | 42.50 <sup>ab</sup> | 40.0 <sup>b</sup>   | 2.03 |
|             | 2 <sup>nd</sup> | 33.98 <sup>c</sup> | 35.75 <sup>c</sup> | 40.20 <sup>a</sup>  | 38.50 <sup>ab</sup> | 2.02 |
|             | 3 <sup>rd</sup> | 32.81 <sup>b</sup> | 34.00 <sup>b</sup> | 39.00 <sup>a</sup>  | 38.00 <sup>a</sup>  | 1.65 |
|             | Overall mean    | 33.77              | 38.50              | 40.18               | 38.79               | 2.05 |

Means bearing different superscripts in the same row are significantly different ( $P < 0.05$ ).

**Reproductive aspects :**

Mean values of some reproductive traits of the experimental dams as well as growth velocity of the offspring are presented in table (4). Buffaloes of group T2 had significant shorter intervals for uterine involution, onset of the 1<sup>st</sup> heat and days open when compared with other groups. In consequence, group T2 had the least ( $P < 0.05$ ) calving interval ( $367.2 \pm 24.1$  days). Contrary

to that, the control group T0 exhibited longer time to attain its uterine involution ( $52.6 \pm 9.16$  days) or reaching conceptive date ( $93.2 \pm 18.28$ ). Estimates of reproductive traits did not significantly differ between groups T1 and T3. Almost group T3 was superior than group T1, however it required greater number of services/conception being similar to that of the control group (2.25). Buffaloes in group T2 required only one service to conceive. Gestation periods for vitamin AD3E treated groups were relatively less than that of the other groups, presumably due to amelioration in fetal growth imposed by increased metabolism and storability of fat soluble vitamins. In coincidence with these findings, Ezzo (1996) found that the intervals of the 1<sup>st</sup> postpartum heat were 35.0 vs. 40.5 and 63.0 days in buffaloes given vitamin E-Se, vitamin AD3 or none supplemented, respectively. Qureshi *et al.* (1997) found that prepartum injection of Nili-Ravi buffaloes with vitamin E + selenium reduced ( $P < 0.05$ ) the uterine involution period, the interval from calving to the 1<sup>st</sup> estrus and the length of the service period compared to the control group. There was no difference in the number of services per conception among the groups.

It seems that positive impact of AD3E vitamins on reproduction may be realized by its combined effect rather than by the sole vitamin treatment *per se*, since Kim *et al.* (1997) did not find any differences in postpartum conception rate, number of services per conception and oestrus rate among groups of pregnant cows given an injection of 500 IU vitamin E, 40 mg selenium, 500 IU vitamin E + 40 mg selenium or (control) 20 days before the expected calving date. However, days open interval was shorter for cows given vitamin E + selenium than controls ( $P < 0.05$ ), vitamin E-treated or selenium-treated cows. Arechiga *et al.* (1994) found that prepartum injection of vitamin E and selenium reduced the number of services per conception and the days open interval, while it increased pregnancy rate at the 1<sup>st</sup> service. Also, Tharnish and Larson (1992) indicated that vitamin A supplementation at levels higher than NRC recommendations did not improve most measures of reproduction. Iwanska and Strusinska (1997) concluded that beta-carotene plays an important specific role in bovine reproduction that cannot be replaced by vitamin A. They found that the number of inseminations per cow decreased and the conception rate was significantly higher in cows supplemented with beta-carotene with or without vitamins A, D3 or E. Contrary to that, Manickam and Balagopal (1993) recorded service intervals of 90.8 and 112.4 days as well as number of services per conception 2.5 and 3.1 for crossbred cows treated with 7 injections of 600 000 IU vitamin A over 21 days or without treatment, respectively.

In the present work, none of the experimental groups imposed postpartum body loss in weight. Differences among studied groups in calf birth and weaning weights were highly significant ( $P < 0.01$ ). Group T2 achieved greater ( $P < 0.05$ ) values of calf / dam body weight %, calf birth weight and weaning weight in comparison with other groups. This finding may indicate some improvement in foetal growth rate achieved by AD3E injection in group (T2). However, relative growth rate (RGR) of weaned calves was almost similar for all groups. In this respect, Atreja *et al.* (1992) recommended that buffalo calves may be fed additional vitamin A up to 3 months old to maintain

adequacy of vitamin A in serum above 12-15 µg/100 ml. They found that average serum vitamin A (µg/100 ml) were 5.95, 10.06 and 7.73 in the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> month of age of Murrah buffalo calves, respectively.

**Table (4): Means of some postpartum reproductive traits of buffaloes and growth performance of born calves as affected by vitamin AD3E treatments.**

| Item                          | Treatments          |                     |                    |                     | SE    |
|-------------------------------|---------------------|---------------------|--------------------|---------------------|-------|
|                               | T0                  | T1                  | T2                 | T3                  |       |
| Uterine involution (days)     | 52.6 <sup>a</sup>   | 43.1 <sup>b</sup>   | 31.1 <sup>c</sup>  | 39.4 <sup>b</sup>   | 9.16  |
| Onset of 1 <sup>st</sup> heat | 47.5 <sup>ab</sup>  | 54.3 <sup>a</sup>   | 44.7 <sup>b</sup>  | 47.9 <sup>ab</sup>  | 7.98  |
| No services / conception      | 2.25                | 1.71                | 1.00               | 2.25                | 0.58  |
| Days open                     | 93.2 <sup>a</sup>   | 86.1 <sup>b</sup>   | 62.2 <sup>c</sup>  | 91.1 <sup>ab</sup>  | 18.28 |
| Gestation period (days)       | 325.6               | 328.6               | 305.0              | 305.0               |       |
| Calving interval (days)       | 418.8 <sup>a</sup>  | 414.7 <sup>a</sup>  | 367.2 <sup>b</sup> | 396.1 <sup>ab</sup> | 24.07 |
| Dam weight at delivery        | 532.5               | 555.7               | 529.2              | 553.8               | 27.26 |
| Final dam weight              | 605.0               | 619.0               | 624.7              | 641.6               | 23.17 |
| DWG                           | 0.81                | 0.68                | 0.89               | 0.79                | 0.11  |
| Calf birth weight (kg)        | 32.50 <sup>ab</sup> | 31.86 <sup>b</sup>  | 36.00 <sup>a</sup> | 33.38 <sup>ab</sup> | 0.90  |
| Calf / dam % in weight        | 6.10                | 5.83                | 7.21               | 6.04                | 0.42  |
| Calf weaning weight (kg)      | 89.22 <sup>b</sup>  | 91.50 <sup>ab</sup> | 98.67 <sup>a</sup> | 91.58 <sup>ab</sup> | 0.73  |
| RGR of born calves %          | 1.94                | 2.08                | 1.93               | 1.94                | —     |

Means bearing different superscripts in the same row are significantly different (P < 0.05).

RGR : relative growth rate %

#### Milk production :

No significant differences were detected in milk productivity of the experimental groups during the 1<sup>st</sup> 13 weeks of lactation period (Table 5). However, group T1 exhibited greater (P < 0.05) milk production during the remainder period of lactation in comparison with the other groups. This finding may be attributed to stimulatory effect of feeding buffaloes of group T1 on shopped corn plants. Supplementation of vitamin AD3E (in both groups T2 and T3) was not significantly effective to maintain milk productivity over that of the control group. The shorter length of lactation period of groups T0, T2 and T3 may refer to the combined effects of dry feeding regimen and environmental heat stress. In accordance with these findings, Abo El-Nor (2000) found that milk yield was significantly higher (P < 0.05) with buffalo group fed on diet containing 30 g AD3E plus mineral mixture for 105 days than for other groups fed on either 15 g AD3E or non supplemented.

**Table (5): Milk productivity of buffaloes as affected by vitamin AD3E treatments**

| Item                       | Treatments          |                     |                      |                     | SE    |
|----------------------------|---------------------|---------------------|----------------------|---------------------|-------|
|                            | T0                  | T1                  | T2                   | T3                  |       |
| Milk yield of 13 weeks     | 729.5               | 737.1               | 764.4                | 709.8               | 29.3  |
| Daily average (kg)         | 8.0                 | 8.1                 | 8.4                  | 7.8                 | 0.92  |
| Milk yield of 26 weeks     | 1321.2 <sup>b</sup> | 1547.0 <sup>a</sup> | 1492.4 <sup>ab</sup> | 1310.4 <sup>b</sup> | 38.5  |
| Daily average (kg)         | 7.3                 | 8.5                 | 8.2                  | 7.2                 | 0.84  |
| Total milk yield (kg)      | 1455.5 <sup>b</sup> | 1977 <sup>a</sup>   | 1553.9 <sup>b</sup>  | 1442.1 <sup>b</sup> | 234.9 |
| Days in milk               | 206                 | 231                 | 205                  | 209                 | 25.45 |
| Overall daily average (kg) | 7.10                | 8.56                | 7.58                 | 6.90                | 0.65  |

Means bearing different superscripts in the same row are significantly different (P < 0.05).

#### **Metabolic status :**

Data of blood metabolites are presented in table (6). This data generally indicate that concentrations of plasma total protein, albumin and total lipids were relatively greater in postpartum period than that in prepartum period. Mean concentrations of blood total protein, globulin, calcium and AST activity of buffaloes injected with vitamin AD3E were significantly ( $P < 0.05$ ) higher than that of other groups. On the other hand, group T1 characterized by a significant ( $P < 0.05$ ) elevation of blood glucose, total lipids and phosphorous as compared to those of group T3. It was noticeable that concentrations of blood globulin of groups T0 and T1 were significantly ( $P < 0.05$ ) less than that of vitamin AD3E treated groups during pre and postpartum periods. No differences were detected in concentrations of albumin and creatinine among studied groups within the examined periods. In agreement with our results, Abo El-Nor (2000) found that serum total protein, globulin and glucose were increased in response to inclusion of AD3E or AD3E plus minerals in lactating buffalo diet. However, transaminases activity and inorganic phosphorus were slightly reduced. In buffalo heifers injected with 20 ml i.m. of vitamin AD3EC twice a week for 3 months, Daghash *et al.* (1993) observed that total protein and serum albumin did not change. The authors also found that blood levels of vitamin A and E, serum glucose, calcium and phosphorus increased in the treated group, while a negative correlation was found between vitamin E and total lipids.

#### **CONCLUSION**

This experiment was conducted during late summer as a poor feeding season for ruminants in Egypt. Therefore, supplementation of vitamin AD3E for animals in such non grazing period especially at late pregnancy and early lactation period would be of great importance to protect animal's tissues from oxidative destruction and to improve immune enhancement (Nockels and Blair, 1996 and Kolb and Seehawer, 1998).

In the current study, supplementation of vitamin AD3E by injection was more effective to improve postpartum reproductive aspects and production of immunoglobulins required for neonate calves. In a study concerning microbial degradation of vitamin A in rumen fluid Rode *et al.* (1990) recommended using intramuscular injection of vitamin A to avoid its extensive destruction in the rumen particularly with feeding on high-concentrate diets.

The combined effect of fat soluble vitamins A, D3 And E was manifested in the present work by different positive responses of immune and reproductive systems in pregnant buffaloes particularly when compared with non supplemented animals. In agreement Kolb and Seehawer (1998) reported that vitamin E is required for fertility, and, in combination with vitamins A, D and C augments the performance of the immune system. Another proof for the combined effects of AD3E is the significant higher birth and weaning weights of calves born from treated dams. Quigley and Bernard (1995) found that addition of vitamin E alone (100 or 1000 IU) to colostrum had no effects on body weight gain of neonatal calves, intake, feed efficiency or scours from birth up to 35 days of age.

The significant increase in concentrations of blood total protein, globulin, calcium and AST activity of buffaloes injected with vitamin AD3E may reflex acceleration in protein turnover in response to vitamin E as well as calcium metabolism in response to vitamin D3 treatment. The necessity of vitamin D3 supplementation for dairy cows during non grazing period was confirmed by Flachowsky *et al.* (1993) who observed that 25-OH-vitamin D3 plasma concentration decreased rapidly to 11.4 ng/ml when cows left the pasture, adding that 26.6 µg vitamin D3 per liter milk was found 2 days after injection of 1 m IU vitamin D3.

Table (6): Mean concentrations of some blood metabolites as affected by vitamin AD3E treatments during late pregnancy (LP) and postpartum period (PP).

| Item                     | Assay period | Treatments          |                    |                     |                     | SE    |
|--------------------------|--------------|---------------------|--------------------|---------------------|---------------------|-------|
|                          |              | T0                  | T1                 | T2                  | T3                  |       |
| Total protein (g/dl)     | LP           | 8.11 <sup>ab</sup>  | 7.82 <sup>b</sup>  | 8.65 <sup>a</sup>   | 8.34 <sup>ab</sup>  | 0.35  |
|                          | PP           | 8.90 <sup>ab</sup>  | 8.19 <sup>b</sup>  | 9.56 <sup>a</sup>   | 9.22 <sup>ab</sup>  | 0.41  |
| Albumin (g/dl)           | LP           | 3.82                | 3.75               | 3.33                | 3.45                | 0.28  |
|                          | PP           | 4.10                | 4.65               | 4.28                | 4.39                | 0.34  |
| Globulin (g/dl)          | LP           | 4.26 <sup>b</sup>   | 4.12 <sup>b</sup>  | 5.32 <sup>a</sup>   | 4.89 <sup>ab</sup>  | 0.38  |
|                          | PP           | 4.02 <sup>b</sup>   | 3.62 <sup>b</sup>  | 5.34 <sup>a</sup>   | 4.85 <sup>ab</sup>  | 0.42  |
| Albumin / Globulin ratio | LP           | 0.89                | 0.91               | 0.63                | 0.71                | 0.15  |
|                          | PP           | 0.85                | 1.28               | 0.80                | 0.91                | 0.25  |
| Glucose (mg/dl)          | LP           | 48.5 <sup>ab</sup>  | 51.8 <sup>a</sup>  | 46.8 <sup>ab</sup>  | 44.9 <sup>b</sup>   | 6.30  |
|                          | PP           | 47.6 <sup>b</sup>   | 58.5 <sup>a</sup>  | 50.2 <sup>ab</sup>  | 49.3 <sup>b</sup>   | 6.91  |
| Total lipids (mg/dl)     | LP           | 355.2 <sup>ab</sup> | 399.5 <sup>a</sup> | 365.8 <sup>ab</sup> | 338.2 <sup>b</sup>  | 35.54 |
|                          | PP           | 391.2 <sup>b</sup>  | 486.3 <sup>a</sup> | 435.7 <sup>b</sup>  | 412.4 <sup>b</sup>  | 48.32 |
| AST (U / L)              | LP           | 42.73               | 47.4               | 49.5                | 46.2                | 2.14  |
|                          | PP           | 45.55 <sup>b</sup>  | 49.7 <sup>ab</sup> | 54.6 <sup>a</sup>   | 50.8 <sup>ab</sup>  | 3.25  |
| Creatinine (mg/dl)       | LP           | 2.48                | 3.25               | 2.80                | 2.52                | 0.18  |
|                          | PP           | 1.75                | 2.55               | 2.34                | 2.18                | 0.25  |
| Calcium (mg/dl)          | LP           | 10.82 <sup>ab</sup> | 10.14 <sup>b</sup> | 11.57 <sup>a</sup>  | 11.51 <sup>a</sup>  | 0.65  |
|                          | PP           | 10.96 <sup>ab</sup> | 10.85 <sup>b</sup> | 12.24 <sup>a</sup>  | 11.62 <sup>ab</sup> | 0.87  |
| Phosphorus (mg/dl)       | LP           | 9.32 <sup>ab</sup>  | 9.72 <sup>a</sup>  | 8.84 <sup>ab</sup>  | 8.24 <sup>b</sup>   | 0.76  |
|                          | PP           | 8.22                | 8.88               | 8.52                | 8.06                | 0.84  |

Means bearing different superscripts in the same row are significantly different ( $P < 0.05$ ).

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### معدل الأداء للجاموس العشار المعامل بفيتامينات أ<sup>3</sup>هـ خلال موسم الصيف

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تم تقسيم ٢٨ جاموسة في مرحلة الحمل المتقدم الى أربعة مجاميع متساوية حيث خضعت لمدة شهر قبل الولادة ولمدة شهرين بعد الولادة لأحد أربع معاملات كما يلي: الأولى مجموعة مقارنة (م) بدون معاملة) والمجموعة الثانية (م١) غنيت على نبات الأذرة بالكيزان المقطع لأحلال جزء من العلف المركز (٢٠% مادة جافة). المجموعة الثالثة (م٢) تم حقنها بفيتامينات أ<sup>3</sup>هـ والمجموعة الرابعة (م٣) تناولت فيتامينات أ<sup>3</sup>هـ مضافة للعلقة. كل حيوان في المجموعة م٢ تناول ٧ مل جرعة أسبوعية من فيتامينات أ<sup>3</sup>هـ بالحقن أحتوت على ٨٠٠,٠٠٠ وحدة دولية/مل فيتامين أ<sup>3</sup>هـ ، ٤٠,٠٠٠ وحدة دولية/مل من فيتامين ٣د ، ٤٠ مجم/مل فيتامين هـ بينما كل حيوان في المجموعة م٣ تناول ١٠ مل جرعة أسبوعية من فيتامينات أ<sup>3</sup>هـ المضافة للعلقة أحتوت على ٥٠,٠٠٠ وحدة دولية/مل فيتامين أ<sup>3</sup>هـ ، ٥٠,٠٠٠ وحدة دولية/مل من فيتامين ٣د ، ٤٠ مجم/مل فيتامين هـ. تحليل الأجسام المناعية بالسرسوب دلت على أن الفروق بين المعاملات فسي محتوى السرسوب من Ig M غير معنوي. ومحتوى السرسوب من Ig A, Ig G كان أعلى نسبياً (مستوى ٠.٠٥) في المجموعة التي حقنت بفيتامينات أ<sup>3</sup>هـ مقارنة بباقي المجاميع بينما مجموعة المقارنة م أحتوت على أقل تركيز من هذين المكونين (مستوى ٠.٠٥).

الفترة بين الولادتين لأنثى الجاموس بالمجموعة م٢ كانت الأقل (مستوى ٠.٠٥) بين المجاميع بسبب قصر فترة عودة الرحم لحالته الطبيعية والفترة المفتوحة للتلقيح. المجموعة م٢ حققت أعلى وزن للعجول عند ميلادها وطاقمها مقارنة بباقي المجاميع ولكن معدل النمو النسبي لعجول جميع المعاملات كان متماثلاً. إنتاج اللبن الكلي للمجموعة م١ كان أعلى (مستوى ٠.٠٥) عن بقية المجاميع. إضافة فيتامينات أ<sup>3</sup>هـ لكلا المجموعتين م٢، م٣ لم يكن مؤثراً فسي زيادة محصول اللبن عن مجموعة المقارنة. متوسط تركيزات بروتينات الدم الكلية والجلوبيولين والكالسيوم والنشاط الناقل لمجموعة الأيمن في المجموعة م٢ كان معنوياً أعلى (مستوى ٠.٠٥) من باقي المجموعات. تميزت المجموعة م١ بارتفاع مستوى جلوكوز الدم والدهون الكلية والفوسفور. تركيز جلوبيولين الدم بالمجموعات م٢، م٣ كانت أقل (مستوى ٠.٠٥) من تلك المجموعات المعاملة بفيتامينات أ<sup>3</sup>هـ خلال الفترة قبل وبعد الولادة.