Indian Journal of Animal Sciences **78** (3): 247–250, March 2008

Serum enzymatic profile of buffaloes during gestation, lactation and peripartum period

B A TALVELKAR[1], R R PATIL[2], S D INGOLE[3] and S V BHARUCHA[4]

Maharashtra Animal and Fishery Sciences University, Nagpur, Maharashtra 400 016 India

Received: 10 March 2007; Accepted: 4 September 2007

ABSTRACT

Gestation and lactation bring about variations in body metabolism, which are reflected through alterations in serum enzyme levels. The alterations in enzyme levels occur in the body around parturition also. Mehsana buffaloes (72) were grouped as early gestation, mid gestation, late gestation, early lactation, mid lactation and late lactation, and during peripartum period (54) were grouped as – 4 wk,–3 wk,–2 wk,–1 wk prepartum, on the day of parturition (0), + 1 wk, + 2 wk, + 3 wk, + 4 wk postpartum. SGOT, SGPT, AKP, LDH and ChE were estimated. SGPT was lowest in late gestation and LDH was highest in mid gestation. Decrease of SGOT level from mid gestation to late gestation might be due to uterine and hormonal changes affecting metabolism. SGOT, SGPT and LDH increased from early gestation to mid gestation and the levels were higher when compared with the levels of early postpartum period. Decreasing trends of AKP and ChE were observed with advancement of pregnancy. SGOT and SGPT were lowest in late lactation stage. SGOT was significantly higher in early lactation than that in late gestation group. SGPT increased from early lactation to mid lactation and then decreased in late lactation. AKP decreased with progress of lactation. Slow reduction of AKP while slow increase in LDH was observed from early to late lactation. SGOT, AKP and ChE decreased on the '0' day and then increased while SGPT and LDH indicated continued increase from–1wk to + 1wk. AKP was higher during gestation than on the '0'day. This increase could be attributed to the higher concentrations of circulating estrogen and hepatic lipidosis. The parathyroid over activity might play some part in higher AKP activity during pregnancy, which is related to maternal mobilization of Ca from the skeleton. A reduction of AKP on the day of parturition may be ascribed to the withdrawal effect of progesterone and estrogen.

Key words: Buffaloes, Gestation, Lactation, Peripartum period, Serum enzymes

The biochemical changes taking place during different phases of reproduction have been attributed to the changes in the activities of certain enzymes. Gestation brings about certain variations in the body metabolism which might be reflected through the alterations in the plasma enzyme levels. Lactation represents a physiological stress which is reflected on animal's biological systems. Milk production requires a continuous supply of metabolites and hormones to the mammary glands and thus certain changes in serum enzymes are expected. Hence it was decided to study enzyme profile during gestation and lactation.

Pregnancy and lactation have a great impact on the intensity of metabolism and on metabolic parameters in the blood. Alterations in enzymatic and biochemical indices occur in the body around the time of parturition. Hence it was decided to investigate enzyme profile during peripartum period.

Present address: [1]Emeritus Scientist, [2]Senior Research Fellow, [3]Associate Professor, [4]Technical Officer to Dean, Department of Physiology and Biochemistry, Bombay Veterinary College, Parel, Mumbai 400 012.

MATERIALS AND METHODS

Mehsana buffaloes (C126) between 6–10 years of age and 2–5 lactations were selected from private dairy farms in Ulhasnagar, Dist–Thane. The average maximum, minimum temperatures and the relative humidity were 34.1°C, 22.6°C and 60.3% respectively. The animals were healthy, which was judged by their overall body condition, temperature and external examination. The animals were maintained under standard management and nutritional conditions i.e. they were given appropriate nutrition as per the ICAR standards (1985) and were kept in clean and ventilated environment. Seventy-two animals were placed in 6 groups of 12 animals each as early gestation (30–90 days), mid gestation (91–180 days), late gestation (181 days onwards), early lactation (0–90 days), mid lactation (91–180 days) and late lactation (181 days onwards). Animals (54) were placed in 9 groups of 6 animals each as –4 wk,–3 wk,–2 wk,–1 wk prepartum, on the day of parturition (0), + 1 wk, + 2 wk, + 3 wk, + 4 wk postpartum. The enzyme profile, viz. serum glutamic oxaloacetic transaminase (SGOT), serum glutamic pyruvic transaminase (SGPT), alkaline phosphatase (AKP), lactate dehydrogenase (LDH) and cholinesterase (ChE) were estimated on fully automatic autoanalyzer for SGOT, SGPT, LDH and ChE (Recommended methods for the determination of four enzymes in blood, 1974 and Dietz 1977) and AKP (Tietz 1995). The enzymes were estimated immediately after the collection of sera from the blood samples. The data were analyzed according to Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

The values of serum enzymes (Table 2) were at par with those of Grasso *et al.* (2004). There was significant ($P<0.05$) variation in levels of SGPT and LDH during gestation. The changes in SGPT could be due to changes in progesterone and estrogen levels during pregnancy (Boots *et al.* 1969). Decrease in SGOT level from mid gestation to late gestation might be due to uterine and hormonal changes affecting metabolism which alter transaminase activity. SGPT was lowest in late gestation and LDH was highest in mid gestation. SGPT was higher in gestation than lactation. Increased SGPT during gestation may probably be because of origin of this enzyme from either placenta or uterine muscle (Singh *et al.* 1992). LDH was higher in mid-gestation, thereafter it decreased in late gestation. AKP decreased with progress of gestation. Overall mean AKP was higher in gestation than lactation like studies of Pathak and Janakiraman (1983) and Singha *et al.* (1988). AKP activity increased in early gestation. Increased AKP and LDH during gestation may be due to liberation of enzymes of placenta during pregnancy and the uterine events related to pregnancy (Visha *et al.* 2002). The increased AKP in the early gestation later on declined throughout the pregnancy. Decrease in AKP with advancement of pregnancy was due to transportation of AKP from mother's blood to foetus (Sharma and Luktuke 1981). AKP in foetus increases with advancement of pregnancy. This increased enzymatic activity in foetus may be related to high osteoblastic activity accompanying by corresponding reduction of phosphatase activity in mother's blood (Singh *et al.* 1992). A reduction of AKP on the day of parturition may be attributed to the withdrawal effect for progesterone and estrogen. ChE decreased with progress of gestation. The results of ChE are in conformity with the earlier reports of Venkataraman *et al.* (1990) and Ingole *et al.* (1999) who also found decreased ChE with progress of gestation. The reduction in ChE can be attributed to myometrial blocking effect induced by progesterone, haemodilution, altered hepatic function and anti ChE activity of estrogen (Venkataraman *et al.* 1990).

There was significant ($P<0.05$) variation in SGOT and SGPT during lactation. Both were lowest in late lactation. SGOT, SGPT and LDH increased from early gestation to mid gestation, and the values were higher than that in early lactation. The results are similar to those of Ingole *et al.* (1999) and Yildiz *et al.* (2005). SGOT, SGPT, AKP and ChE were higher in early lactation than late gestation periods, the reason might be the increased metabolic activity of lactating animals (Pourouchottamane *et al.* 2005). Kampl *et al.* (1993) noted increase in SGOT, SGPT activities with increase in milk production in cattle. In the present studies also higher SGOT and SGPT values are recorded in early and mid lactation than late lactation. AKP decreased with progress of lactation. Slow reduction in AKP while slow increase in LDH was observed from early to late lactation.

There was nonsignificant variation in SGPT, AKP, LDH and ChE levels in all 9 groups during peripartum period. SGOT, SGPT and AKP level was lower on the day of calving than its average value in prepartum period. This finding is in agreement with Hafez *et al.* (1983) and Lone *et al.* (2002) who observed higher values of SGOT and AKP in pregnant buffaloes a week preceding calving. SGPT activity was lower a week preceding calving when compared with '0' day (Table 2). SGPT increased gradually after calving with increasing milk production. This finding is in accordance

Table 1. Enzyme profile in buffaloes during gestation and lactation

Group	SGOT (U/L)	SGPT (U/L)	AKP (U/L)	LDH (U/L)	ChE (U/L)
EG	153.40 ± 6.09	66.54^{ab} ± 4.54	200.45 ± 40.23	1338.50^{b} ± 97.11	237.82 ± 25.21
MG	173.69 ± 14.84	67.02^{a} ± 4.05	175.84 ± 20.97	1768.33^{a} ± 128.37	227.75 ± 27.30
LG	144.28 ± 7.85	50.42^{c} ± 4.64	121.68 ± 16.83	1247.22^{b} ± 105.92	215.74 ± 18.31
Mean ± SE, during gestation	157.12 ± 9.59	61.32 ± 4.41	165.98 ± 26.01	1451.35 ± 110.47	227.10 ± 23.60
EL	171.73^{ab} ± 11.94	60.42^{ab} ± 5.07	148.53 ± 11.89	1237.85 ± 88.57	218.68 ± 21.48
ML	179.29^{a} ± 8.89	62.10^{a} ± 5.13	141.85 ± 20.06	1354.37 ± 74.46	231.43 ± 26.32
LL	141.73^{c} ± 6.52	45.73^{c} ± 3.86	111.30 ± 13.77	1363.70 ± 172.44	217.03 ± 14.18
Mean ± SE, during lactation	164.25 ± 9.11	56.08 ± 4.68	133.89 ± 15.24	1318.60 ± 111.82	222.38 ± 20.66

Those means having at least one common superscript within same column (between groups) do not differ significantly.

Table 2. Enzyme profile in buffaloes during peripartum period

Group	SGOT (U/L)	SGPT (U/L)	AKP (U/L)	LDH (U/L)	ChE (U/L)
- 4 wk	190.50 ± 27.48	53.98 ± 13.44	126.33 ± 20.76	1304.66 ± 106.34	253.05 ± 30.98
- 3 wk	179.75 ± 14.45	71.83 ± 10.24	178.82 ± 25.98	1307.83 ± 84.66	330.88 ± 75.03
- 2 wk	127.77 ± 7.79	46.78 ± 4.82	212.05 ± 43.96	1187.93 ± 90.15	211.07 ± 23.36
- 1 wk	147.87 ± 18.33	39.26 ± 4.19	208.47 ± 49.19	1110.80 ± 42.96	233.05 ± 40.00
Mean ± SE, during prepartum period	161.47 ± 17.01	52.96 ± 8.17	181.41 ± 34.97	1227.80 ± 81.02	257.01 ± 42.34
0 day	127.65 ± 5.55	43.25 ± 4.30	150.58 ± 21.32	1280.33 ± 99.65	217.40 ± 44.21
+ 1 wk	162.13 ± 34.82	63.41 ± 17.48	213.38 ± 37.82	1515.16 ± 319.22	235.85 ± 25.80
+ 2 wk	187.92 ± 21.84	43.98 ± 4.21	237.62 ± 61.36	1588.16 ± 156.47	328.35 ± 62.17
+ 3 wk	235.38 ± 48.79	71.61 ± 8.20	125.20 ± 19.72	1529 ± 110.80	234.38 ± 46.91
+ 4 wk	163.20 ± 22.17	51.40 ± 4.14	145.28 ± 17.81	1130.70 ± 102.45	237.87 ± 39.12
Mean ± SE, during Postpartum period	187.15 ± 31.90	57.60 ± 8.50	180.36 ± 34.17	1440.76 ± 172.23	259.11 ± 43.5

with Kampl *et al.* (1993) who observed gradual increase of SGOT and SGPT after parturition with increasing milk production. However, SGOT was higher 4 wk prepartum than on the day of parturition. This result is in synchronus with that of Lone *et al.* (2002).

A higher AKP during gestation could be due to higher concentration of circulating estrogen and hepatic lipidosis. Parathyroid overactivity might play some part in the higher values of AKP activity during pregnancy, which is related to maternal mobilization of Ca from bones to provide material for mineralization of skeleton of growing foetus (Singh *et al.* 1992). A reduction of AKP on the day of parturition may be ascribed to the withdrawal effect of progesterone and estrogen.

LDH level was lower a week preceding calving when compared with '0' day. LDH activity was higher in the first week postpartum. Higher LDH activity in mammary parenchyma is required during initiation of lactation (Visha *et al.* 2002). Therefore LDH level was increased after parturition.

ChE activity was higher (Table 2) a week preceding calving when compared with '0' day. On the day of calving ChE level was lower and after calving it showed rise in + 1 wk postpartum period.

ACKNOWLEDGEMENTS

This study is a part of the work of Emeritus Scientist's Scheme entitled " Studies on Haematological and Enzyme Profile in Buffalo (*Bubalus bubalis*) and their Influence on Milk Production and Reproductive Efficiency", financed by the Indian Council of Agricultural Research, New Delhi. We are extremely thankful to Dr S K Bhere and Dr L D Pawar for excellent dairy farm facilities. We are grateful to the Dean, Bombay Veterinary College, for the help rendered during the research work.

REFERENCES

Boots L R, Crist W L, Davis D R, Brum E W and Ludwick T M. 1969. Effect of age, body weight, stage of gestation and sex on plasma glutamic oxaloacetic and glutamic pyruvic transaminase activities in immature Holstein cattle. *Journal of Dairy Science* **52**: 211–15.

Dietz A. A. 1977. Selected Methods of Clinical Chemistry. Vol 8, p. 41. Amer. Assn. for Clinical Chemistry, Washington, D. C.

Grasso F, Terzano G M, Rosa G D, Tripaldi C and Napolitano F. 2004. Influence of housing conditions and calving distances on blood metabolites in water buffalo cows. *Italian Journal of Animal Science* **3**: 275–82.

Hafez A M, Ibrahim H, Gomaa A, Farrag A A and Salem I A. 1983. Enzymatic and haematological studies on buffaloes at periparturient periods. *Assiut Veterinary Medical Journal* **11**: 21, 173–75.

ICAR. 1985. Nutrients Requirement for Livestock and Poultry. pp. 5–7. ICAR Publi. New Delhi.

Ingole S D, Talvelkar B A, Deshmukh B T and Nagvekar A S. 1999. Serum enzyme profile during gestation and early lactation in Gir and Crossbred cows. *Indian Journal of Animal Science* **69** (7): 479–81.

Kampl B, Martincic T, Alegro A, Catinelli M and Susnjic M. 1993. Profile of selected biochemical parameters in dairy cows and their influence on milk production and reproductive efficiency II Activity of transaminases (AST and ALT) and calcium and inorganic phosphorus levels in blood. *Dairy Science Abstract* **55**: 2013.

Lone A G, Singh C and Singha P S. 2002. Changes in some biochemical constituents of blood before and after parturition in Murrah buffaloes. *Saras Journal of Livestock and Poultry Production* **18**: 54–58.

Pathak M M and Janakiraman K. 1983. Blood serum profile in pregnant buffalo (Surti) during different stages of pregnancy. *Indian Journal of Animal Reproduction* **4**: 98.

Pourouchottamane R, Chatterjee A, Sheikh I U, Sarkar M and Gogoi D. 2005. Blood biochemical constituents of female yaks in different physiological status. *Indian Veterinary Journal* **82**: 1108–09.

Sharma S S and Luktuke S N. 1981. Ascorbic acid, Cholesterol and alkaline phosphatase variation in buffalo and faetal blood serum during pregnancy. *Indian Journal of Animal Sciences* **34** (2): 226–28.

Singh R, Setia M S and Singha S P S. 1992. Plasma enzyme levels during pregnancy in buffalo (*Bubalus bubalis*). *Buffalo Journal* **3**: 287–91.

Singha S P S, Singh A, Singh R, Bhullar M S and Setia M S. 1988. Plasma enzymes during different stages of lactation in buffaloes. Abstract II. *World Buffalo Congress*. December 1988.

Snedecor G W and Cochran W G. 1994. *Statistical Methods*. 9th edn. Affiliated East-West press, Iowa state University Press.

Tietz N W. 1995. Clinical Guide to Laboratory Tests. 3rd edn. AACC.

Venkataraman B V, Iyer G Y, Narayanan R and Joseph T. 1990. Erythrocyte and Plasma cholinesterase activity in normal pregnancy. *Indian Journal of Physiology and Pharmacology* **34** (1): 26–28.

Visha P, Leela V and Vishwanathan S. 2002. Serum alkaline phosphatase and lactate dehydrogenase activity during pregnancy and parturition in goats. *Indian Veterinary Journal* **79**: 77–78.

Yildiz H, Balikci E and Kaygusuzoglu E. 2005. Investigation of important biochemical and enzymatic parameters during pregnancy and postpartum stages in cows. F.U. Saghlc Bil. Dergisi **19**: 2