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Plasma Vitamin E, Total Carotenoids and Fatty Acids Profile in Cyclic and Postpartum Anestrus Buffaloes

S. Jayachandran, J. Muralidharan, P. Visha, P. Selvaraj and K. Nanjappan
Dept. of Veterinary Physiology and Biochemistry,
Veterinary College and Research Institute, Orathanadu - 614 625

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Abstract

A study was carried out to assess the plasma level of vitamin E, total carotenoids and fatty acids level during anestrus condition in buffaloes. The results showed that the vitamin E, total carotenoids and unsaturated fatty acids profile in plasma observed in this study did not differ between anestrus and regular cyclic buffaloes.

***Key words**: Anestrus, Buffaloes, Vitamin E, Total carotenoids, Fatty acids*

Introduction

Vitamin E and carotenoids are important antioxidant components of animal diet and their role in animal health and immune function are indispensable (Das *et al*., 2014). The vitamin E, a cellular antioxidant, interacts with selenium-containing glutathione peroxidase to prevent oxidative breakdown of tissue membranes and lipid containing organelles by inhibition and destruction of endogenous peroxides, thus maintaining membrane integrity and reducing oxidative stress (Putnam and Comben, 1987). Vitamin E exerts beneficial effect in improving the postpartum reproductive performance of dairy animals (Anita *et al*., 2004).

Carotenoids function as oxygen scavenger and may also react with other reactive oxygen species (Lindmark-Mansson and Akesson, 2000). Carotenoids also have a positive role in fertility independent of the role of retinol (Hurley and Doane, 1989). Ninety per cent of the circulating carotenoids in bovines are beta-carotene (Yang *et al*., 1992). The specific role of beta-carotene in reproduction came in part from the observation that concentrations of beta-carotene are high in bovine plasma, follicular fluid and corpus luteum (Chew *et al*., 1984).

There has been a great deal of interest in feeding fat to dairy cows in order to increase energy density of the diet to improve reproduction. The cows fed supplemental fat experienced improved energy balance and began to cycle sooner because of enhanced follicular growth and development (Grummer and Carroll, 1991). However, Lucy *et al*. (1992) suggested that it was the fatty acids, and not the additional energy provided by the fatty acids that stimulated ovarian function.

In this context, since there are only scanty reports available in this species, an investigation was carried out to study the plasma level of vitamin E, total carotenoids and fatty acids in postpartum anestrus buffaloes.

Materials and methods

Healthy she buffaloes (43 Nos., in 2nd to 4th parity, did not express estrus signs for more than 5 months post partum) having smooth ovaries with no palpable structures by rectal examination done twice at 10 days interval were confirmed as true anesrus. These animals belonged to small farmers in rural areas of Namakkal, Salem and Karur districts of Tamil Nadu state. The animals were maintained on grazing for 3-4 hours per day and supplemented with mixed ration of paddy straw, dried jowar, greens along with little concentrate feed. The animals had access to drinking water *ad lib*. The animals were routinely being subjected to bathing under tap water/ wallowing in pond water by the owners.

The experimental animals were chosen for hormonal therapy and were divided into four groups namely, group I (10 Nos., CIDR), group II (10 Nos., CIDR + GnRH), group III (13 Nos., Progesterone impregnated intravaginal sponge) and group IV (10 Nos., Progesterone depot injection). Ten numbers of regular cycling buffaloes maintained at similar management and feeding conditions were selected to serve as control (Group V).

Blood samples from true anestrus buffaloes before start of hormonal therapy and regular cycling buffaloes were collected from jugular vein using 16G needle in the heparinized vaccutainer to assess the status of vitamin E, total carotenoids and fatty acids in plasma. Vitamin E level in plasma samples was analysed spectrophotometrically by the modified method of Emmerie and Engel as described by Desai and Machlin (1985). Total carotenoids concentration in the plasma was analysed spectrophotometrically by the method of Knight *et al.* (1994). Fatty acids composition of the blood plasma was estimated by gas chromatograph (CHEMITO, Model CERES 800 plus, India) as per the method of Sukhija and Palmquist (1988).

Results and discussion

The mean vitamin E levels for the groups I to IV were 0.321±0.03, 0.314±0.04, 0.325±0.04 and 0.310±0.02 mg/dl respectively. The vitamin E level in regular cyclic buffaloes was 0.319±0.04 mg/dl (Table 1). From the results it was observed that vitamin E level did not differ significantly between anestrus buffaloes and regular cyclic animals.

Table 1: Mean (±SE) Vitamin E and total carotenoids levels in anestrus and regular cyclic buffaloes

	Group I (CIDR)	Group II (CIDR + GnRH)	Group III (Progesterone sponge)	Group IV (Progesterone depot injection)	Group V (Regular cyclic)
Vitamin E (mg/dl)	0.321 ± 0.03	0.314 ± 0.04	0.325 ± 0.04	0.310 ± 0.02	0.319 ± 0.04
Total carotenoids (µg/ml)	1.42 ± 0.13	1.26 ± 0.08	1.62 ± 0.11	1.49 ± 0.12	1.56 ± 0.11

The results of this study are in agreement with the findings of Chandolia and Verma (1987) who reported that blood vitamin E levels did not show variation between anestrus and cyclic buffaloes. Roberts (1971) also reported that vitamin E deficiency did not affect the estrous cycle or ovarian function.

On the contrary, Kahlon and Singh (2003) reported that plasma vitamin E level of anestrus buffalo heifer was significantly lower than normal cyclic buffaloes. Vitamin E and selenium showed synergistic effect in their antioxidant action and reproductive performance in dairy cows (Kim *et al.,* 1997) and supplementation of vitamin E with adequate plane of nutrition increased fertility in bovines (Segerson *et al.*, 1977).

The mean total carotenoids level for the anestrus buffaloes of groups I to IV were 1.42 ± 0.13, 1.26 ± 0.08, 1.62 ± 0.11 and 1.49 ± 0.12 µg/ml respectively and these levels did not differ significantly between anestrus buffaloes and regular cyclic animals (1.56±0.11 µg/ml) (Table 1).

The results of this study did not find any association between total carotenoids and ovarian activity in buffaloes. Similarly, Marcek *et al.* (1985) and Wang *et al.* (1988) could not find any positive reproductive response to beta-carotene supplementation in dairy cattle which might possibly be due to seasonal or initial beta-carotene status (Weiss, 1998).

However, Hurley and Doane (1989) and Chew *et al.* (1984) stated that carotenoids had a positive role in fertility. O'Fauon, and Chew (1984) suggested that beta-carotene is an integral part of the bovine corpus luteal microsomal membrane, where it may play a role in membrane integrity.

The plasma levels of omega-6 fatty acids were 13.02, 13.35, 13.90 and 12.57, and omega-3 fatty acids were 5.80, 4.33, 5.57 and 4.68 per cent for the groups I to IV respectively compared to 14.38 (omega-6) and 7.62 (omega-3) per cent in regular cyclic animals (Table 2). The results revealed that fatty acids profile did not differ between anestrus and regular cyclic buffaloes.

Table 2: **Mean (±SE) plasma fatty acids composition (wt %) in anestrus and regular cyclic buffaloes**

	Group I (CIDR)	Group II (CIDR + GnRH)	Group III (Progesterone sponge)	Group IV (Progesterone depot injection)	Group V (Regular cyclic)
$C_{14:0}$	3.20 ±0.21	2.33 ±0.18	2.73 ±0.20	3.30 ±0.20	3.07 ±0.11
$C_{16:0}$	26.42 ±0.80	28.42 ±1.06	28.52 ±1.13	29.70 ±0.55	27.60 ±0.86
$C_{16:1}$	2.53 ±0.22	3.35 ±0.18	2.25 ±0.22	2.13 ±0.15	1.77 ±0.20
$C_{18:0}$	22.18 ±0.70	22.25 ±1.30	22.07 ±0.83	23.30 ±1.21	20.47 ±0.97

$C_{18:1}$	26.85 ±0.97	25.98 ±1.30	24.97 ±0.68	24.35 ±0.75	25.10 ±0.81
$C_{18:2}$	13.02 ±0.77	13.35 ±0.64	13.90 ±0.74	12.57 ±0.99	14.38 ±0.83
$C_{18:3}$ ALA	1.90 ±0.28	2.18 ±0.31	2.00 ±0.29	1.85 ±0.14	2.97 ±0.21
$C_{20:5\ n\text{-}3}$ EPA	3.20 ±0.26	1.45 ±0.31	2.77 ±0.25	2.33 ±0.39	3.70 ±0.20
$C_{22:6\ n\text{-}3}$ DHA	0.70 ±0.16	0.70 ±0.06	0.80 ±0.12	0.50 ±0.14	0.95 ±0.11
SFA	51.80	53.00	53.32	56.30	51.14
MUFA	29.38	29.33	27.22	26.48	26.87
Omega6	13.02	13.35	13.90	12.57	14.38
Omega3	5.80	4.33	5.57	4.68	7.62

Saturated fatty acids (SFA) – $C_{14:0}$; $C_{16:0}$; $C_{18:0}$; monounsaturated fatty acids (MUFA) - $C_{16:1}$; $C_{18:1}$

Omega-6 fatty acid - $C_{18:2}$ Omega-3 fatty acids – Alpha-linolenic acid, Eicosapentaenoic acid, Docosahexaenoic acid

The presence of higher concentration of long chain fatty acids in regular cyclic as well as anestrus buffaloes indicated that these animals might have been provided with sufficient green fodder/ grazing or concentrate feed as long chain fatty acids are mostly derived from diet escaping rumen biohydrogenation or consumption of abundant green fodder.

Staples and Thatcher (2006) observed that specific unsaturated fatty acids, when able to bypass rumen alterations and absorbed from the small intestine, could improve reproductive performance by directly targeting reproductive tissues or by indirect effects mediated via the endocrine system.

Zachut *et al.* (2008) stated that dietary unsaturated fatty acids increased the size of follicles and elevated steroid hormones in preovulatory follicles, which may be beneficial to consequent ovarian function.

It could be inferred that the level of vitamin E, total carotenoids and unsaturated fatty acids in plasma observed in this study may not have much influence on anestrus condition in buffaloes. It also suggested that further studies with large number of animals to support the findings in buffaloes are needed.

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