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Comparative profiles of different lipoprotein cholesterol parameters and Growth Hormone during hot humid and winter season in Murrah Buffaloes

Laxmi N. Anand *, B.S. Prakash

DCP, NDRI, Karnal, Haryana 132001, India

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Abstract

Now, it is well known that in bovines HDL-C act as substrate for ovarian steroidogenesis. The restriction of entry of other lipoprotein parameters is due to ovarian blood barrier, which restricts the entry of other lipoproteins, which are bigger in size. In vitro studies have indicated their role in mediating proliferation of cells. Besides gonadotropin, Growth Hormone (GH) is also gaining importance in the field of reproduction. GH receptors have been localized on the ovaries and follicle of bovines. Further it has been suggested that it can be the direct role of the hormone or it can be mediated through IGF-I. It has been assigned various roles in mediating follicle development, ovulation and corpus luteum maintenance. The river buffaloes are capable of breeding throughout the year, but during certain period of time were found to be more favourable than the others. It has been found that, winter season and hot humid season exhibit two extreme conditions of temperature variation; Hot humid season being unfavourable than the winter season because of high humidity and reasonably high temperature. It has been observed that during June to August months, conception rate and exhibition of estrus behaviour is low. This study was undertaken to analyze different lipoprotein cholesterol parameters namely Total cholesterol (TC), High-density lipoprotein cholesterol (HDL-C), Triglycerides (TG) and Low density lipoprotein cholesterol (LDL-C) in the plasma of cyclic Murrah buffaloes throughout the estrous cycle. The mean plasma concentration (μg/ml) of different lipoproteins during hot humid season were TC 592±40, HDL-C 229±42, TG 345±95, LDL-C 285±94.Where as in winter season their concentrations were 1381.0±31.0, 1793.0±110.0, 511.0±21.0, 608.0±94.0 respectively.

The mean±SEM circulatory level of GH was low during HH season than during winter (6±2 ng/ml vs. 17±2 ng/ml). During estrous cycle only one peak of GH was exhibited during hot humid season where as three peaks were exhibited during winter season. It can be concluded that winter season is favourable for maintaining physiological levels of hormones and metabolic parameters, which in turn may increase the reproductive efficiency of bovines. During winter season average temperature was 15±5 °C. During hot humid season average temperature was 34±3 °C. THI was more than 75%.

Keywords: Buffaloes; Estrous cycle; Progesterone; Growth Hormone; Season

1. Introduction

Lipoproteins are macromolecule complexes of protein, phospholipids, cholesterol, cholesterol esters, and triglycerides. The different types of circulatory lipoprotein

* Corresponding author. Tel.: +91 0184 2259075.
E-mail address: dnana44@yahoo.co.in (L.N. Anand).

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cholesterol are total cholesterol (TC), high density lipoprotein cholesterol (HDL-C), low density lipoprotein cholesterol (LDL-C) and triglycerides (TG). HDL-C predominates in the cattle and rat species. Research reports have supported the view that dietary fat intake have profound effect on a variety of ovarian characteristics. It has been observed that responses to heightened dietary fat intake in cows lead to dose dependant increase in the intestinal synthesis of lipoprotein cholesterol. This in turn resulted an increase in the concentration of HDL-C in the follicular fluid. In ruminants the major site for synthesis and regulation is small intestine (Grummer and Carroll, 1988). In addition to steroidogenesis they have been assigned the role of mitogens (Bao et al., 1995). Park and Rfalowski (1983) have studied the effect of dietary fat on lipid metabolism in Holstein heifers. Various research reports are available which show the effect of season and temperature on reproductive performance. (Singh and Lal, 1992; Thatcher, 1973). Now, GH is recognized as a major player in fine tuning of the hypothalamo–gonadotropic axis. Burton et al. (1994), Zachmann (1992) have reported that GH modulates steroidogensis, gametogenesis and gonadal differentiation. Both the factors lipoprotein and GH are having important role in regulating ovarian function (Hull and Harvey, 2000). Somatogenic and gonadotropic axis are closely related during growth and sexual maturation. In pigs it has been observed that there is an increase in ovarian steroid production after administration in vivo. (Bryan et al., 1992) and the same effect was observed in vitro experiments in cattle (Wathes et al., 1995).Further it has been suggested by Hull and Harvey (2000) that the mechanism of action of GH on steroidogenesis is either direct or by potentiating the action of gonadotropins. Xu et al. (1997) have also reported that GH action may be independent or mediated through IGF-I on steroidogenic enzymes. Gong et al. (1993) have shown that increase in the no. of follicles is related to the circulatory plasma IGF-I concentrations. Further work with rat oocytes have shown that higher circulatory levels of GH leads to abnormal embryonic development (Mendoza et al., 1999).Studies with recombinant bovine somatotropin have shown that its administration at first insemination increased pregnancy rates in dairy cattle.(Starbuck et al., 2006). The dynamics of somatotropin specific binding by granulosa cells during maturation of antral follicles differed at dissimilar reproductive states of cows. (Lebedeva et al., 2004).

Seasons have a marked effect on the circulatory level of the biochemical parameters as well as on hormones in the plasma. Though literature is available on circulatory level of lipoproteins in plasma in cattle, there is paucity of information available on the circulatory levels of lipoproteins and Growth Hormone profiles during estrous cycle in buffaloes. In addition seasonal effect on these parameters has not been reported in this species. This study was therefore undertaken to observe the effect of winter and hot-humid season on these two parameters.

2. Materials and methods

Blood samples were collected on alternate days for two months. From, six, non-lactating, multiparous, Murrah buffaloes Samples were centrifuged at 3000 rpm and plasma was stored at −20 °C. Samples were collected in the months of January & February for winter season and in the months of August & September for hot humid season. During winter season average temperature was 15±5 °C. During hot humid season average temperature was 34±3 °C. THI was more than 75%.

In these samples following parameters were estimated; 1.TC 2.HDL-C 3.LDL-C and 4.TG with help of Bayer's autopak enzymatic kits.

Progesterone hormone was assayed by RIA (Prakash and Madan, 1986), Growth Hormone was assayed by EIA (Prakash et al., 2003). Cyclicity of animals was confirmed by Progesterone assay in addition to rectal palpation.

2.1. GH assay

The Growth Hormone was assayed by a highly sensitive enzyme immunoassay by a second antibody technique. For the assay, 100 μl plasma samples were used in duplicate. The lowest detection limit was 1 ng/ml. Intra and inter assay coefficients of variation were found to be 1% and 4% respectively.

2.2. Progesterone assay

Plasma progesterone was estimated in plasma samples directly in duplicates. An amount of 100 μl of plasma sample was taken. Sensitivity of the assay was 4 pg/tube. Fifty percent of the binding was observed at the concentration of 80 pg/tube. The intra and inter assay coefficient of variation were 6.2% and 8% respectively.

2.3. Statistical analysis

The data for plasma hormones and metabolic parameters and days for estrous cycle were analyzed by analysis of variance with respect to season and significance was calculated using *t* test. The Pearsonean correlation coefficient between the parameters was calculated as per Snedecor and Cochran (1980). Statistical software used for data analysis were Microsoft ® office Excel 2003, Systat Version 6.0.1; 1996, SPSS Inc. and graphpad prism ® Version 3.02, 2000.

3. Results

In the normal cyclic animals, the estrous cycle length was of 22±2 days, the peak level was exhibited on 10±