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Bovine platelet-activating factor acetylhydrolase (PAF-AH) activity related to fertility

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Abstract

Plasma platelet-activating factor acetylhydrolase (PAF-AH), the enzyme characterized by the association with plasma lipoproteins, degrades platelet-activating factor (PAF) as well as PAF-like oxidatively fragmented phospholipids produced during oxidative stress. Apart from pro-inflammatory properties, PAF is also related to reproductive processes and successful fertility. In order to get a better insight into the involvement of PAF-AH in the fertility of cows, the aim of the study was to determine the PAF-AH activity as well as the C-reactive protein, cholesterol and high density lipoprotein-cholesterol (HDL-C) in the serum of dairy cows throughout the pregnancy and lactation, as well as in infertile cows. The results showed that serum PAF-AH activity changes throughout pregnancy and lactation with a lower level during periparturient period. It is also found higher PAF-AH activity in lactating cows with reproductive disorders compared to high lactating cows without reproductive disorders. Strong correlation between PAF-AH activity and HDL-C concentration indicates that HDL could have considerable influence on PAF-AH activity in bovine plasma. CRP concentration was also lower during transition period suggesting that lactation might stimulate CRP synthesis in bovine. A higher CRP concentration in cows with reproductive disorders compared to fertile cows at the peak of lactation, demonstrates that milk production is not the only factor influencing CRP in

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cows. A significant correlation between PAF-AH activity and CRP level shows that both parameters could be influenced by reproductive status of dairy cows.

Keywords: PAF-AH; Dairy cows; Fertility; CRP

1. Introduction

Platelet-activating factor acetylhydrolase (PAF-AH; E.C. 3.1.1.47) is an anti-inflammatory and anti-oxidative enzyme which is in mammalian plasma associated with low and high density lipoproteins (LDL and HDL) (Stafforini et al., 1999). The enzyme hydrolyzes the acetyl ester at the *sn*-2 position of the platelet-activating factor (PAF) producing acetate and biologically inactive lyso-PAF (1-*O*-alkyl-*sn*-glycero-3-phosphocholine) (Castro Faria Neto et al., 2005). PAF-AH also hydrolyzes PAF-like oxidatively fragmented phospholipids produced during oxidative stress. These compounds have a similar structure to PAF and provoke the same acute phase responses (Stafforini et al., 1997). Therefore, anti-oxidant properties of PAF-AH are involved in the protection against the harmful action of free radicals.

PAF is a bioactive phospholipid synthesized by a variety of mammalian cells. In addition to its first discovered physiological action—the activation of the platelets, PAF also activates polymorphonuclear leukocytes and monocytes, suggesting a pathophysiological action as being a mediator of inflammation and a well established activator of the immune system (Stafforini et al., 1987). On the other hand, the presence and function of PAF in the male and female reproductive systems of several species, including humans and bovines (Soubeyrand et al., 1998) demonstrates that PAF is an important mediator for physiological processes associated with reproduction, such as ovulation, sperm motility, fertilization, implantation, fetal tissue development and the initiation of parturition (Matsubara et al., 1997). Events during ovulation are associated with inflammatory-like changes (Espey, 1994) and PAF may influence this process (Abisoqun et al., 1989). Further, the reproductive tissues also contain PAF-AH (Matsubara et al., 1997). Moreover, in the bovine reproductive system, PAF-AH activity was demonstrated in endometrial cells of cows during early pregnancy (Tiemann et al., 2001). Additionally, it has been found the PAF-AH in the bovine endometrium is structurally identical to human and bovine serum enzyme. PAF-AH activity in the female reproductive system is under steroid control negatively correlating with estrogens (Narahara et al., 1996; OŃeill, 2005). During the last third of pregnancy, the enzyme activity decreases and promptly increases at the time of delivery (Yasuda and Johnson, 1992). To understand better, the potential roles of PAF in the processes of reproduction, it is essential to have information on the variations of PAF-acetylhydrolase during the reproductive cycle and pregnancy.

During transition period in dairy cows, low energy balance could induce metabolic disorders, especially lipid parameters changes, accompanied with subsequent disturbances in reproductive physiology (Butler, 2000; Lucy, 2003). The aim of the study was to determine the PAF-AH activity in the serum of dairy cows throughout the pregnancy and lactation as well as in cows with reproductive disorders. Taking into account the anti-inflammatory properties of PAF-AH, we also examined the C-reactive protein concentration, which is considered as an acute phase protein, in order to investigate the relationship between these two parameters. Total cholesterol and HDL-cholesterol (HDL-C) concentrations were also measured to get information of lipid metabolism changes during transition period and to examine the correlation of PAF-AH activity with total cholesterol and HDL-C concentrations, since PAF-AH is associated with lipoproteins in the blood.