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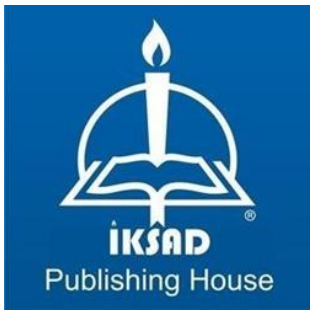




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ÖZET

Saanen keçisi en yüksek süt üreten keçi ırklarından biridir ve diğer keçi ırklarından daha yüksek üreme verimine sahiptir. Bu çalışmanın amacı, Saanen süt keçilerinin periparturient döneminde paraoksonaz-1 (PON1) aktivitesi ile lipid mobilizasyonu arasındaki ilişkiyi araştırmaktır. Çalışma için on beş Saanen keçisi (2-3 yaş) seçildi. Her keçiden doğumdan sonraki -21, -14, -7, 0, 7, 14 ve 21. günlerde kan örnekleri toplandı. Kan esterleşmemiş yağ asitleri (NEFA), β-hidroksibütirik asit (BHBA), trigliseritler (TG), toplam kolesterol (CHOL), Düşük yoğunluklu lipoprotein (LDL), yüksek yoğunluklu lipoprotein (HDL) ve çok düşük yoğunluklu lipoprotein (VLDL) ve Paraoksonaz-1 aktivitesi (PON1) seviyeleri ölçüldü. Trigliserit konsantrasyonları doğumdan 21. güne kadar, doğumdan önce elde edilen değerlere kıyasla önemli ölçüde ($P<0.001$) azalmıştır. Serum HDL konsantrasyonları -21, -14 ve -7. günlerde, 14. ve 7. günlerdeki değerlere kıyasla önemli ölçüde düşüktü ($P<0.001$). Serum VLDL konsantrasyonları doğumdan önce elde edilen değerlere kıyasla doğumdan prepartum 21. güne kadar önemli ölçüde artmıştır ($P<0.001$). Serum LDL seviyeleri -21 ve -14. günlerde +7 ve +14. günlerdeki değerlere kıyasla anlamlı derecede yüksekti ($P<0.001$). Serum BHBA düzeyleri -21. günde -14, -7, +7 ve +14. günlerdeki değerlere kıyasla anlamlı derecede yüksektir ($P<0,001$). Serum NEFA seviyeleri -21. günlerde -14. ve doğum günlerine kıyasla önemli ölçüde daha düşüktür. PON-1 ve CHOL seviyeleri arasında istatistiksel bir fark bulunmamıştır. Sonuç olarak, istatistiksel bir farklılık olmamasına rağmen, doğum öncesi Saanen keçilerinde PON-1 seviyelerinde önemli değişiklikler meydana gelmiştir ve PON-1, doğum öncesi keçilerde metabolik ve inflamatuar

ilişkili ve/veya bozukluklar için biyobelirteç olarak kullanılabilir. PON-1'in oksidatif stresin bir belirteci olarak kullanılabilirliğini daha iyi anlamak ve bu bulguları doğrulamak için daha fazla çalışma yapılması kanaatindeyiz.

Anahtar Kelimeler: Keçi, Lipoproteinler, Esterleşmemiş yağ asitleri, Paraoksonaz-1 aktivitesi.

RELATIONSHIP BETWEEN PARAOXONASE-1 ACTIVITY AND LIPID MOBILISATION IN PERIPARTURIENT SAANEN GOATS

ABSTRACT
Saanen goat is one of the highest milk-producing goat breeds and is greater than the other breeds of goats, has a high reproductive yield. The aim of this study was to investigate the relationship between paraoxonase-1 (PON1) activity and lipid mobilisation in periparturient period of Saanen dairy goats. Fifteen Saanen goats (aged 2-3) were selected for the study. Blood samples were collected from each goat on days -21, -14, -7, 0, 7, 14 and 21 relative to parturition. Blood non-esterified fatty acids (NEFA), β-hydroxybutyric acid (BHBA), triglycerides (TG), total cholesterol (CHOL), Low-density lipoprotein (LDL), high-density lipoprotein (HDL) and very lowdensity lipoprotein (VLDL) and Paraoxonase-1 activity (PON1) levels were measured. Triglyceride concentrations decreased significantly ($P<0.001$) from parturition until day 21 as compare to the values obtained before parturition. Serum HDL concentrations were significantly lower values on days -21, -14 and -7 ($P<0.001$) compared to values on days 14 and 7. Serum VLDL concentrations increased significantly from parturition until day prepartum 21 as compare to the values obtained before parturition ($P<0.001$). Serum LDL levels were significantly higher on day -21 and -14 compared to values on days +7 and +14 ($P<0.001$). Serum BHBA levels significantly higher on days -21 compared to values on days -14, -7,+7 and +14 ($P<0.001$). Serum NEFA levels significantly lower on days -21 compared on days -14 and parturition. PON-1 and CHOL levels were no statistical difference. In conclusion, although there was no statistical differences, significant changes in levels of PON-1 were occurred in periparturient Saanen goats and PON-1 may be used as biomarker for metabolic and inflammatory-related and or disorders in periparturient goats. Further study should be conducted for better understanding the determine the availability of PON-1 as a marker of oxidative stress and to confirm these findings.
Keywords: Goat, Lipoproteins, Non-esterified fatty acids, Paraoxonase-1 activity.

INTRODUCTION

The periparturient period from late pregnancy to early lactation in dairy goats is a critical period associated with physiological and metabolic adaptations to support fetal growth and milk production (Goff and Horst, 1997). The periparturient period is characterised by elevated circulating ketone bodies and negative energy balance (NEB). During early lactation, goats mobilise body fat reserves from adipose tissue, resulting in increased concentrations of non-esterified fatty acids (NEFA) in the blood (Drackley et al., 2001). PON1 plays an important physiological role in lipid metabolism through hydrolysis of oxidised lipids in the form of lipid hydroperoxides formed on lipoproteins such as High density lipoprotein (HDL) and Low density lipoprotein (LDL) and within this ability it is considered as an antioxidative/anti-inflammatory component of HDL. Thus, it provides protection against the development of oxidative stress, but the precise mechanism by which PON1 reverses and prevents liver damage by exogenous antioxidants PON1 enzyme protects LDL, the bad cholesterol, from oxidation and neutralises radicals including hydrogen peroxide with its antioxidant properties (Arslan et al., 2012).

The aim of this study was to investigate the relationship between Paraoxonase-1 Activity and lipid mobilisation in healthy goats in different stages of the reproductive and lactation cycle.

MATERIALS AND METHODS

Saanen goats (n=15) with an expected parturition date within the next 7 days were selected for the study. Blood samples were taken by puncturing vena jugularis three, two and one weeks before parturition, on the parturition day, and 7, 14 and 21 days after parturition. Animals which parturition more than 2 days earlier or later were not included in the study. After the samples were precipitated, they were centrifuged at 3000 r.p.m. 5 min. The serum obtained was frozen at –20 ºC until examined.

Serum total cholesterol (CHOL), triglycerides (TG), high-density lipoprotein (HDL), low-density lipoprotein (LDL), very low density lipoprotein (VLDL) were measured using autoanalyzer. Non- esterified fatty acids (NEFA) (Goat NEFA ELISA kit), β-hydroxybutirate (BHBA) (Goat BHBA ELISA kit) and Paraoxonase-1 (PON 1) (Goat Paraoxonase assay fully automated kit) were measured using ELISA.

Descriptive statistics were calculated for each variable. SPSS 14.01 package programme was used for statistical analysis. $P<0.05$ was used in all statistical evaluations.

RESULT AND DISCUSSION

Triglyceride concentrations decreased significantly (P<0.001) from parturition until day 21 as compare to the values obtained before parturition. Serum HDL concentrations were significantly lower values on days -21, -14 and -7 (P<0.001) compare to values on days 14 and 7. Serum VLDL concentrations increased significantly from parturition until day prepartum 21 as compare to the values obtained before parturition (P<0.001) (Figure 1). Serum LDL levels were significantly higher on day -21 and -14 compare to values on days +7 and+14 (P<0.001). Serum BHBA levels significantly higher on days -21 compare to values on days -14, - 7,+7 and +14 (P<0.001). And BHBA levels significantly lower on days -14 compare to values on days +21. Serum NEFA levels significantly lower on days -21 compare on days -14 and parturition. NEFA levels similar significantly higher on parturition compare to values on days -14, and parturition significantly higher compare on days +7 and +14 (P<0.001).PON-1 and CHOL levels were no no statistical difference. All results were presented in Table 1.

Table 1: Mean values (± SEM) of metabolic parameters, lipid metabolism and PON1 activity in Saanen goats during the preparturient period.

Weeks	PON-1	CHOL	TG	VLDL	LDL	HDL	BHBA	NEFA
-21	90,14 ± 13,95	94 ± 3,63	32,6 ± 3,42 ^{a}	6,52 ± 0,68 ^{a}	32,53 ± 2,55 ^{ab}	51,8 ± 2,4 ^{ab}	0,45 ± 0,05 ^{ac}	0,33 ± 0,05 ^{b}
-14	86,62 ± 15,61	91 ± 3,78	33,8 ± 3,29 ^{a}	6,76 ± 0,66 ^{a}	33,8 ± 2,94 ^{ab}	52,6 ± 2,06^{ab}	0,17 ± 0,03 ^{b}	0,19 ± 0,02 ^{c}
-7	91,82 ± 15,15	88,27 ± 3,06	40,6 ± 3,94 ^{a}	8,12 ± 0,79 ^{a}	29,13 ± 2,23 ^{abc}	50,53 ± 1,42^{a}	0,15 ± 0,04 ^{b}	0,29 ± 0,06^{bc}
0	106 ± 17,18	82,53 ± 3,02	9,67 ± 0,65 ^{b}	1,93 ± 0,13 ^{b}	22,27 ± 1,55 ^{ac}	53,93 ± 2,7^{abc}	0,4 ± 0,07 ^{abc}	0,59 ± 0,07 ^{a}
7	100,95 ± 17,75	89,6 ± 3,11	14,93 ± 1,35 ^{c}	2,99 ± 0,27 ^{c}	30,47 ± 1,71 ^{b}	56,4 ± 1,7^{abc}	0,18 ± 0,03 ^{b}	0,29 ± 0,05^{bc}
14	97,59 ± 14,59	88,27 ± 3,86	12,67 ± 1,02 ^{bc}	2,53 ± 0,2 ^{bc}	24,6 ± 1,75 ^{c}	58,2 ± 2,5^{bc}	0,27 ± 0,05 ^{ab}	0,27 ± 0,07^{bc}
21	103,74 ± 17,46	92,07 ± 3,84	14,8 ± 1,08 ^{c}	2,96 ± 0,22 ^{c}	27,27 ± 1,55 ^{abc}	63,47 ± 2,59^{c}	0,61 ± 0,07 ^{c}	0,17 ± 0,03^{abc}
P-value (Time)	0,513	0,094	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001
Linear	*0,372*	*0,547*	*<0,001*	*<0,001*	*0,003*	*0,001*	*0,049*	*0,47*
Quadratic	*0,546*	*0,051*	*0,109*	*0,108*	*0,06*	*0,014*	*<0,001*	*<0,001*
Cubic	*0,673*	*0,916*	*<0,001*	*<0,001*	*0,271*	*0,936*	*0,814*	*0,065*

* P<0.001;$^{a,b,c,:}$ The different superscript letters in the same column indicate significant difference statistically (p<0.001)

(-21; Preparum 21, -14; Prepartum 14, -7; Preparum 7, 0: Parturition, +7; Postpartum 7, +14; Postpartum 14, +21; Postpartum 21)

The Maximum levels of TG on day 7 prepartum was detected. Triglyceride concentrations significantly declined at parturition and remained at lower values until day 21 of lactation. Changes in this factor were inconsistent in the lactation period. Decreased triglyceride concentration in the weeks of gestation are similar to those in cows (Seifi et al., 2007). As highlighted in the data on cattle, higher eserum triglyceride concentrations in the prepartum period may be due to lower matabolism due toy he lactating stage (Marcos et al., 1990) or due ton o triglyceride uptake by mamary gland form ilk fat synthesis (Grummer, 1993).

High-density lipoproteins (HDLs) have long been known to be antiatherogenic (D.J. Gordon, B.M. Rifkind 1989) and their protective role has been partly attributed to related enzymes (Navab et al, 1996), of which paraoxonase 1 (PON1) - an esterase synthesised and stored mainly by the liver and with a broad substrate specificity (Primo-Parmo et al, 1996) PON1 limits the accumulation of lipid oxidation products in low-density lipoproteins (LDL) and HDL (Aviram et al., 1998).

In present study, although there was no statistical difference, serum PON1 activity increased at parturition and decreased on prepartum.

NEB, BHBA or NEFA can be monitored and tested in dairy cattle. NEB is a threshold state and goats are only affected when BHBA and/or NEFA concentrations are increased. BHBA is one

of the important energy status indicators during the periparturient period (Sadjadian et al., 2013). According to the results of our study, BHBA concentrations were highest on postpartum day 21 (Figure 1). This situation is similar to other studies, which is a result of the increase in NEFA during labour (Vanholder et al., 2005, Bıonaz et al., 2007). Blood concentrations of 0.8 to 1.6 mmol/L of BHBA are predictive of NEB in sheep (Navarre and Pugh, 2002). In the present study, no value was found for NEB.

In conclusion, this study demonstrates the relationship of PON1 with lipid metabolism as well as the role of PON1 in immunity-related disorders in periparturient goats. Although there was no statistical difference, significant changes in PON-1 levels occurred in periparturient Saanen goats and PON-1 can be used as a biomarker for metabolic and inflammatory-related disorders in periparturient goats. Further studies should be conducted to better understand the utility of PON-1 as a marker of oxidative stress and to confirm these findings.

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