

LOCALIZATION AND ACTIVITY OF TISSUE LIPOPROTEIN LIPASE IN FELINE PROSTATE GLAND

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Summary

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Tissue lipoprotein lipase (LPL) activity has been studied in prostate glands of 7 adult male European shorthair cats on cryostat cross sections by the Tween technique. The highest activity was observed at the luminal surface of the glandular epithelium, its apical parts, as well as in the lumen of glandular tubules of prostate body. A moderate intensity of LPL expression was found out in the basal parts of parenchymal epithelial cells. The enzyme was slightly expressed in the stroma of the gland, whereas no LPL activity was detected in the glandular capsule. The results provided evidence for a predilection in tissue LPL localization in epithelial components of the glands, as well as for higher enzyme activity in the luminal part of the epithelium, thus presuming a role of LPL in the lipid metabolism of glandular parenchyma, in the production and excretion of lipid products into the tubuloalveolar lumen.

Key words: cat, lipoprotein lipase, prostate gland

INTRODUCTION

Although tissue lipoprotein lipase (LPL) plays an important role in the metabolism of lipids, the localization of its enzyme activity in mammalian genital organs is scarcely studied.

In bulls, LPL is expressed in testes, the heart, kidneys, adrenal glands and the spleen (Elkattawy *et al.*, 2009). The enzyme activity in testes confirms the role of LPL in spermatogenesis. Furthermore, LPL catalyzes the distribution of triglycerides in adipose tissue and muscles.

According to Hausman & Thomas (2005) LPL activity in pigs is expressed after completion of the embryonic differentiations of adipocytes. The enzyme activity is induced or reduced in the diffe-

rent parts of the renal adipose capsule.

The information about the localization of LPL activity in prostate gland refers mainly to men. Nomura (2001) provided evidence that the body fat index and LPL activity correlated positively to the development of prostate carcinoma, whereas Kim *et al.* (2008) established that the inhibition of LPL expression in prostate could induce a malignant transformation of the gland.

Alvarez *et al.* (2007) have shown that cadmium, involved in the prostatic carcinogenesis in men, did not have an effect on LPL activity in rat prostate whereas it influenced negatively the other lipogenic enzymes in the gland.

The insufficient data about the expression of tissue LPL in mammalian prostate gland and the lack of data referring to feline prostate motivated the present investigation of LPL localization for determination of the role of this enzyme in the lipid metabolism of the parenchyma and the adipose transformation of feline prostate gland. The study aimed also to establish the sites in normal feline prostate where the activity of this hydrolase was observed.

MATERIALS AND METHODS

The experiment was carried out under strict observance of the Ordinance No 15/03.02.2006 on the minimum requirements for the protection and welfare of laboratory animals and the requirements to the establishments for their use, rearing and/or delivery.

The prostate glands of 7 sexually mature, clinically healthy male European shorthair cats at the age of 12–18 months, weighing 2.8 to 4 kg were investigated. The animals were obtained from a licensed animal breeder and were euthanized with intravenous injection of 200 mg Thiopental (Biochemie, Austria) into the cephalic vein.

The material for the study was obtained immediately after the euthanasia and processed by the Tween technique of Gomori. After opening of abdominal and pelvic cavities, prostate glands were carefully removed.

Pieces of the prostate (1 cm³) were frozen in a cryostat at –20 °C. Cross sections of 5–7 µm were fixed in 10% neutral formalin, washed with distilled water, placed in incubation medium and put in a thermostat for 24 h at 37 °C. Then the cross sections were washed with distilled water and treated with 1% lead nitrate in a

thermostat at 56 °C for 10 min. The specimens were then treated with 1% yellow ammonium sulfide till the appearance of lead sulfide clusters of dark brown granules (Pearse, 1962).

The localization of tissue LPL expression was determined by light microscopy (Primo Star (Zeiss, Germany), and results were recorded with a digital camera Prog Res CT3 (Germany).

The intensity of the reaction was assessed semi-quantitatively using the score system of Atanassova (2000): 0 – lack of enzyme activity; + – weak enzyme activity; ++ – medium enzyme activity and +++ – strong enzyme activity.

RESULTS

In all studied animals, the LPL activity was mainly localized in prostatic epithelial cells. The enzyme expression predominated in apical parts and the tubuloalveolar lumen, contrasting to basal parts of prostatic parenchymal cells, where LPL was poorly expressed (Fig. 1 and 2).

In the capsule of the gland, no LPL activity was detected, whereas in the glandular stroma expression of this enzyme was observed relatively rarely (Fig. 3).

The activity of LPL was equal in studied cats. The highest intensity (+++) of tissue LPL was observed at the luminal surface of the glandular epithelium, its apical parts, as well as in the lumen of glandular tubules of prostate body. A moderate intensity (++) of LPL expression was found out in the basal parts of parenchymal epithelial cells, but the enzyme was poorly expressed (+) in the stroma of the gland.

No LPL activity was detected in the glandular capsule.

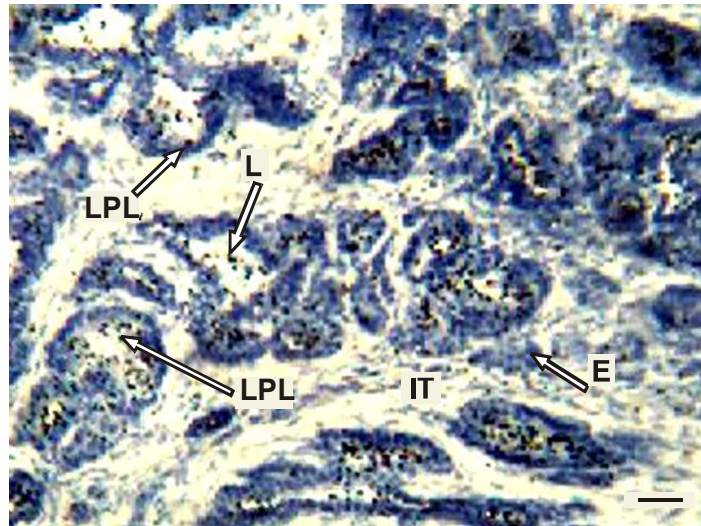


Fig. 1. Feline prostate gland. Lipoprotein lipase (LPL) expression in epithelial cells (E); L – tubuloalveolar lumen, IT –interstitium. Gomori staining, bar = 60 μ m.

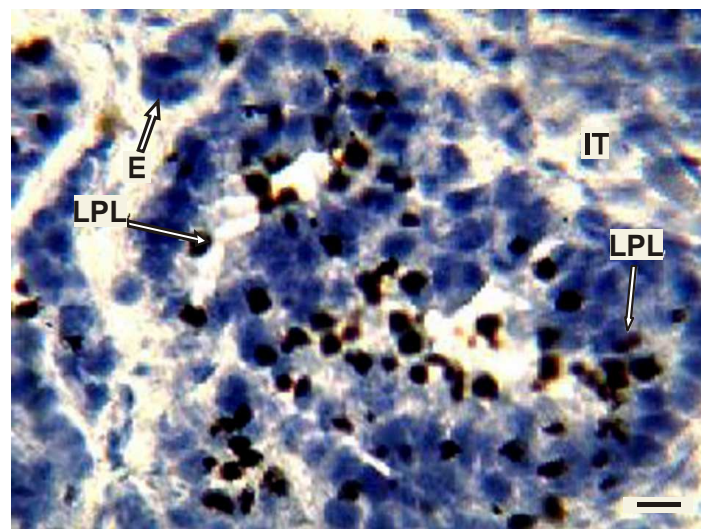


Fig. 2. Feline prostate gland. Lipoprotein lipase (LPL) expression in basal and apical parts of the glandular epithelium (E); IT – interstitium. Gomori staining, bar = 20 μ m.

DISCUSSION

The predilectional localization of tissue LPL activity in epithelial cells of feline prostate and its high degree of expression

allowed us to suggest that this enzyme was important for the lipid metabolism of glandular parenchyma, the production and excretion of lipid products in tubuloalveolar glandular lumen. These results corres-

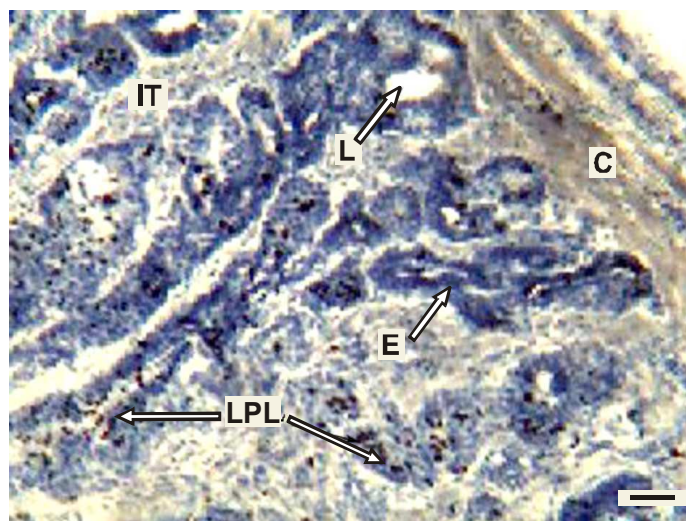


Fig. 3. Feline prostate gland area with a part of the capsule. Lipoprotein lipase (LPL) expression in epithelial cells (E); C – glandular capsule, L – glandular lumen, IT – interstitium. Gomori staining, bar = 30 μ m.

pond to the view of Eckel (1989) about the role of LPL in the metabolism of lipoproteins, the distribution of lipids and the energy metabolism regulation in men.

The considerable extent of LPL presence in feline prostate gland also supports the findings of Elkattawy *et al.* (2009) about a possible role of this enzyme in farm animals' spermatogenesis. As per our results, it could be assumed that LPL expression was probably essential for prostatic fluid production.

The localization of prostate LPL expression corresponds to data reported by Peinado-Onsurbe *et al.* (1993) about the activity of this enzyme in castrated mice and the androgen-dependence of LPL expression. Therefore, LPL expression in prostate (an androgen-dependent gland) must be influenced by testosterone as well.

Our data confirm the opinion that LPL expression in rat prostate was constant,

i.e. unchanged in the different glandular parts (Alvarez *et al.*, 2007).

Similarly to Zaidi *et al.* (2006) who studied the activity of tissue LPL and its role in mammary secretion in rodents, we suppose that the activity of this enzyme was important for secretory functions of feline prostate gland.

It could be also assumed, as did Kim *et al.* (2008) with presuming a role for LPL in human prostatic carcinogenesis, that LPL could play a similar role in the development of malignant prostatic lesions in cats. Also, the relationship of LPL activity and body adipose index in male cats could be related to the development of prostate neoplasms, as shown by Nomura (2001) in men.

In conclusions, the present results could serve as enzyme histochemical data in the differentiation of normal feline prostate from glands having suffered pathological or adipose transformations.

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