The erythrocyte membrane lipidome profile in healthy dogs and changes in dogs with diabetes mellitus

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Analysis of erythrocyte membrane lipidome represents a powerful diagnostic tool for assessing the quantity and quality of fatty acids and for the follow-up of the membrane fatty acid remodeling that is associated with different physiological and pathological conditions. Several studies have shown modification of the fatty acids but also of the phospholipid content of cell membranes in human diabetic patients and in animal model of diabetes, however, a systematic study of the membrane fatty acids of dogs to evaluate membrane homeostasis has not yet been established. The aims of the present study were to evaluate 1) the erythrocytes membrane lipidomic profile in healthy dogs (HD, n=24) and 2) changes in membrane lipidome of dogs with newly diagnosed diabetes mellitus (DM, n=6).

Erythrocyte membranes were isolated from EDTA-treated blood samples from dogs and a cluster of 10 saturated [SFA (palmitic; stearic)], mono-unsaturated [MUFA (palmitoleic; oleic; vaccenic)] and polyunsaturated [PUFA (linoleic; dihomo-gamma-linolenic; arachidonic; EPA; DHA)] fatty acids was determined by Gas-Chromatography. Relevant lipid parameters (SFA/MUFA, SFA/PUFA, ω6/ω3, PUFA balance, unsaturation and peroxidation indexes) were calculated.

Healthy dogs, aged from 2 to 98 months (median 38.5) 10 were males (1/10 neutered) and 14 females (4/14 sterilized), while DM dogs, aged from 96 to 158 months (median 120) 2 were males and 4 females (2/4 sterilized).

Among the fatty acids, the ω3 (median 1.75%) showed the wider variability in HD (minimum 0.5-maximum 6.8). No significant differences were observed regarding the age. The EPA levels in intact females were significant lower (P<0.01) compared to sterilized subjects and intact males. Palmitic and arachidonic acids showed less SD variability (<12% and <6%, respectively) in medium body size dogs (10-20 Kg) compared to small (<10 kg and large>20 Kg) dogs (27-40% and 27-14%, respectively).

In comparison to the HD, DM dogs showed increased concentrations of MUFAs (P<0.05), specifically, palmitoleic (P<0.0001) and oleic (P<0.05) acids showed higher levels, while no differences were observed for vaccenic acid. The EPA concentrations in DM dogs were higher (P<0.01) as compared to the HD.

Potential study limitations were the sample size and the lack of data in geriatric healthy dogs.

The present data suggest a variability of ω3 expression in erythrocytes membranes of healthy dogs, probably due to the individual dietary variations. Furthermore, these preliminary results suggest the involvement of the SFA-MUFA pathway in canine diabetes mellitus, involving

higher palmitic-palmitoleic and palmitic-oleic transformations and an accelerated delta-9 desaturase enzymatic activity.