Time course of incorporation of 1-^{14}C-α-linolenic acid into various rat tissues

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In a previous study we showed that an oral dose of 1-^{14}C-α-linolenic acid is found in skin and fur of guinea pigs 48 hours after dosing (1). The aim of this study was to determine the time course of labeling of various tissues in rats following an intraperitoneal dose of 1-^{14}C-α-linolenic acid. Twenty, 3-wk old, male Sprague-Dawley rats were each given 1.85 mCi of 1-^{14}C-α-linolenic acid (mixed in olive oil) by intraperitoneal injection. Rats were then sacrificed 5, 10, 25, 50 hours after the dose (n = 5 for each time point). The dpm and concentration of omega-3 polyunsaturated fatty acids (PUFA) were determined by scintillation counting and gas liquid chromatography, respectively.

The tissues with the highest specific activity (dpm/mg omega 3) were the liver, spleen, kidney, fur and lung. The fur label declined over time starting from being high at 5 hours, which might indicate possible contamination from the intraperitoneal dose. However, the specific activity stabilized over the next 45 hours which might point to ^{14}C-labelled α-linolenic acid being deposited onto the fur. The maximum specific activity was different between tissues, maximum specific activity was at 10 hours for the liver, epididiymis and heart, while the label did not reach a maximum for the testis, skin (head) and brain areas (cerebellum, basal forbrain and cortex) over the period examined. Analysis by silver nitrate TLC at 25 hours time point showed that the main fractions containing ^{14}C were the 6 double bond fraction for all tissues, except for epididymis and adipose where it was in the 3 double bond fraction, the skin and fur where it was in the 3 and 6 double bond fraction and the carcass where it was in the 3, 5, and 6 double bond fractions. These data are in contrast to the guinea pig where after 48 hours of dosing, almost no ^{14}C from labelled linolenic acid was found in the 5 or 6 double bond fractions.

In this study, different tissues followed a different time course with regard to the uptake and metabolism of the ^{14}C-labelled α-linolenic acid. The finding that the epididymis had a relatively high specific activity is novel and may indicate an important function for this essential nutrient. The labelling of fur support the findings previously reported (1), however it is still possible that the fur could have been contaminated from the intraperitoneal injection site.

Based on the results in this experiment, it is possible to speculate that α-linolenic acid may have a function in relation to fur, perhaps as a secreted lipid from sebaceous glands to protect the fur from damage by water, light or other agents. This speculation is consistent with the use of linoleic acid in dogs to maintain their coats in good condition (2).

1. Fu Z, Sinclair AJ. Novel pathway of metabolism of a-linolenic acid in the guinea pig. Ped Res 2000; 47, 414–417.
2. Lloyd DH. Essential Fatty Acids and Skin Disease. J Small Anim Prac 1989; 30: 207–212.