Ascertaining changes in thyroid hormones metabolism in white adipose tissue by radiometric enzyme assays

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INTRODUCTION
Thyroid hormones (TH) play important roles in the development and function of both, brown (BAT) and white adipose tissue (WAT). However, data about local transformations of TH in WAT are still scarce [1].

With the aid of our newly developed radiometric enzyme assays [2], we measured changes in activities of the key enzymes of TH metabolism, the liver-formed iodothyronines deiodinases (DIs) in several depots of WAT, and also in BAT and liver of mice, maintained under the conditions that promoted either adipose tissue hypertrophy (fed restriction) or involution (after mild caloric restriction) [3].

Deiodinase of type 1 (D1) performs both, outer-ring 5′-monodeiodination and inner-ring 5-deiodination, converting prohormone thyroxine (T4) either into biologically most active hormone 3,3′,5′-triodothyronine (T3) or inactive 3,3′,5′-triodothyronine (reverse T3), respectively. On the contrary, deiodinase of type 2 (D2) catalyzes specific 5′-deiodination, and deiodinase of type 3 (D3) specific 5-deiodination. Consequently, D3 inactivates both T4 (producing rT3) and T3 (converting it into metabolite 3,3′,5′-triodothyronine (rT3). We have proven that D3 is also responsible for biologically inactive rT3 production in adipose tissue [4].

RESULTS

Fig. 1 Weight of epididymal and dorsolumbar fat depots in mice fed for two weeks HF- or LF-diet

Fig. 2 Obesity in the mice induced by HF-diet feeding for eight weeks

Table 1 Mice growth characteristics and plasma levels of thyroid hormones in the course of obeseogenic treatment (HF) and after caloric restriction (HF-CR). Data are means ± S.E.M. for two (n=18) and eight weeks (n=7-9) of obeseogenic treatment and for five weeks of caloric restriction (n=11-12); *p < 0.05 for the effect of diet.

Table 2 Changes in specific enzyme activity of D1 in mice adipose tissue depots and liver in the course of obeseogenic treatment (HF) and after caloric restriction (HF-CR). Data are means ± S.E.M. for two (n=18) and eight weeks (n=7-9) of obeseogenic treatment and for five weeks of caloric restriction (n=11-12); *p < 0.05 for the effect of diet.

Fig. 3 Radiometric enzyme assay for D3: radiochromatogram of separated labeled product (T3*) and non-radioactive iodide (I−) from unconsumed substrate (T3)

CONCLUSIONS
HF-diet feeding of mice resulted in a significantly higher weight of both epididymal-visceral and dorsolumbar-subcutaneous fat depots.

Development of HF-diet-induced obesity in the mice was associated with stimulation of thyroid hormones metabolism and enhancement of D1 and D3 activities in WAT. However, D1 or D3 acti-vities in BAT did not change.

Caloric restriction caused opposite changes in the metabolism of TH – this treatment decreased D1 activity in WAT, but not in the liver.

The elaborated methods for radiometric determination of D1, D2 and D3 deiodinase activities proved to be extremely sensitive and rapid, and, at the same time, reliable.

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