

Studies on receptors and actions of steroid hormones in adipose tissue

Implications for fat distribution

Steen Bønløkke Pedersen

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Official opponents: Jens Sandahl Christiansen, Henning Beck-Nielsen, and Jørgen Vinten.

Correspondence: Steen B. Pedersen, Department of Endocrinology and Metabolism, Aarhus Sygehus THG, 8000 Aarhus C, Denmark.
E-mail: amtssp@hotmail.com

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ABSTRACT

Adipose tissue distribution is different between women and men. Therefore, we have investigated the expression of steroid receptors in human adipose tissue and report that receptors for glucocorticoid androgen and estrogen are present in human adipose tissue. Furthermore, we discovered regional differences in expression pattern, indicating that steroid hormones might affect the different adipose tissue depots differently.

Glucocorticoids promote accumulation of adipose tissue in the intra-abdominal depot. Accordingly, we found four fold higher glucocorticoid receptor number in this depot compared to the subcutaneous depot. In contrast we were unable to detect progesterone receptors in human adipose tissue. Ligand binding assays revealed that progesterone acts as a glucocorticoid receptor antagonist and studies in rodents showed that progesterone treatment could block the effects of glucocorticoids in adipose tissue. These results suggest that progesterone in pre-menopausal women might protect against cortisol-induced intra-abdominal fat accumulation. Thus, men and post-menopausal women who have low progesterone level might experience the full-blown cortisol effect on intra-abdominal fat accumulation and therefore tend to accumulate a larger proportion of their fat intra-abdominally.

Our studies have shown that human adipose tissue contains as many testosterone receptors as the prostate, indicating that testosterone probably affects adipose tissue directly via binding to the receptor. However, the precise metabolic pathways by which testosterone affects adipose tissue accumulation are not fully revealed.

Estrogen is known to promote the female fat distribution and we demonstrate that human adipose tissue contain both the estrogen receptor subtype α as well as the subtype β . Estrogen increases the number of the adrenergic receptor subtype α 2A (which posses antilipolytic activity) in adipocytes from the subcutaneous depot. In contrast estrogen did not influence the adrenergic receptor in adipose tissue from the intra-abdominal depot. Thus, estrogen seems to increase the amount of subcutaneous adipose tissue by blunting the lipolytic response in this depot via up-regulating the antilipolytic adrenergic receptor α 2A.

Our data supports the notion that adipose tissue accumulation is controlled by steroid hormones. Moreover, the individual fat depots seems to be controlled individually, indicating that it might be possible selectively to slow down intra-abdominal fat accumulation and thus promote a more healthy fat distribution.