HOW DOES ENERGY INTAKE INFLUENCE THE LEVELS OF CERTAIN STEROIDS?

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Introduction

Even though the daily profiles of the main sex hormones are well known, small oscillations in their levels may be connected to food intake have yet to be systematically studied. Glucocorticoids have many various functions in organisms, and they influence the maintenance of the homeostasis. With rhythmic changes of the hormone levels, the hypothalamic-pituitary-adrenal (HPA) axis can ensure tissue and organ-specific reactions of the organism to endogenous and exogenous stimuli (Lightman et al., 2008). According to a study by Stárka et al. (2015), levels of DHEA and its conjugated form androstenedione and T-dehydroandrostenedione (DHEA) decline one to two hours after lunch and dinner. Another recent study has described significant changes of estradiol and SHBG after meal intake (Rácz et al., 2015). The influence of steroid hormones on the food intake is well known. In contrast, however, there are only a few published reports on how the food intake influences levels of steroid hormones.

Objectives

The aim of this study: Analyse the influence of food intake on steroid hormone and melatonin levels.

Methods

The study participated eight women with average age of 25.4 (1.3) years and BW of 21.3 (0.8) kg/m². All of the women were pre-menopausal, they were non-smokers, healthy, and they were not using any medication or hormonal contraceptives. Blood samples were collected during the usual phase (days 1 – 7) of the menstrual cycle. Five days before they had undergone the tests, all of the women followed a standard protocol that did not vary significantly from their normal dietary routines (5 hours of sleep, food intake according to a standardized menu). Before the tests they were informed about the study protocol and they signed an informed consent form. The study was approved by the ethical commission of the Institute of Endocrinology in Prague.

Each woman passed the four different tests during four consecutive menstrual cycles:

1) Control test. An oral glucose tolerance test (GTT) of 75 g of glucose (Dextrose tablet) in 250 ml of unsweetened tea (untransformed)

2) GTT + LP: an intravenous glucose tolerance test – a bolus of 50.55 g of glucose per kg of weight in 20% glucose solution, administered to a peripheral vein.

3) GTT + Intravenous corticotropin (Corticotropin bolus of 80 IU, 5 ml of 5% dextrose injection, 1 hour after the bolus introduction to the bloodstream) and also, before the GTT, a bolus of 75 g of glucose (Dextrose tablet) in 250 ml of unsweetened tea (untransformed)

An intravenous cannula was inserted into the cubital vein ten minutes before the first blood sampling. Sampling was performed for 120 minutes, with the following schedule:

- the first sampling was performed at 7:30 am, after overnight fasting,
- subsequent samples were performed at 8:30, 40, 60, 90, and 120 minutes.

Analytical methods:

Each sample was collected into a plastic tube containing 100 µl of 0.1% EDTA. Plasma was obtained after centrifugation for 6 min at 2000 rpm at 4 ºC, then separated and frozen within half an hour of being drawn from the subject, and stored at -20 ºC until analysis.

Cortisol was measured in serum using ECLIA (electrochemiluminescence immunoassay), kit SE 125 analyzer, Roche. The measuring range of the kit (defined by the lower detection limit and the 99th percentile of the master curve) was 0.02 – 15.9 nmol/l or 0.01 – 40.0 ng/l for plasma, intra- and inter-assay coefficients of variation were 1.5% and 2.2%, respectively.

Brdolav was measured using the enzymatic reference method with hexokinase (Cotesta glucose 400 plus analyzer, Roche). The measuring range of the kit was 1.1 – 11.1 mmol/l (20 – 200 mg/dl), intra- and inter-assay coefficients of variation were 1.7% and 3.0%, respectively. Cortisol was measured using an Roche kit (immunofehrenzyme). The measuring range of the kit was 1.8 – 430 nmol/l (20 – 450 µg/dl), intra- and inter-assay coefficients of variation were 1.5% and 3.0%, respectively.

Results

In order to better elucidate various findings on the influence of food intake on hormone levels, we studied the influence of several stimuli on the course of hormone levels. As stimuli we chose a standard breakfast, oral glucose, intravenous glucose and psyllium (chosen to follow mechanical effects of food on the gastrointestinal tract). The timeline of samplings was focused on monitoring and analysing of acute and small changes of hormone levels after each stimulus. As we expected, the glycemia and C-peptide levels reflected normal values of a healthy population (Figures 1 and 2).

Cortisol

There was a slowing of the physiological decline in cortisol levels after each of the stimuli, excepting psyllium. This slowing was most pronounced after intravenous glucose, lasting even 60 minutes. After oral glucose and intravenous glucose there was a plateau in cortisol levels, but after breakfast there was an increase in cortisol at 40th minute (Figure 3).

DHEA

After the initial decline there was an increase in DHEA after all stimuli. This increase was most pronounced after intravenous glucose, but this increase was delayed compared to the other stimuli (Figure 4).

Testosterone

The course of testosterone levels did not have any significant relationship to any of the individual stimuli (Figure 5).

Conclusions

Despite the fact that we performed the tests in the morning hours, when steroid hormone levels physiologically start to change due to their diurnal rhythm, we still found that food intake influences some of the hormone levels.

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Steroid metabolism action
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