Ege Tıp Dergisi 43(1): 15 –18, 2004

ALTERATIONS IN SERUM THYROID HORMONES, LIPIDS AND DEHYDROEPIANDROSTERONE SULFATE LEVELS IN THE FASTING AND POSTPRANDIAL STATES

SERUM TİROİD HORMONLARI, LİPİD PARAMETRELERİ VE DEHİDROEPİANDROSTERON SÜLFAT DÜZEYLERİNİN AÇLIK VE TOKLUKLA İLİŞKİSİ

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Key words: dehydroepiandrosterone sulfate, preanalytic error, lipids, postprandial levels, thyroid hormones.
Anahtar sözcükler: preanalitik hata, dehydroepiandrosteron sülfat, tokluk, lipidler, tiroid homonları .

SUMMARY

Biochemical tests are known to be affected by fasting or postprandial state. The aim of the present study is to assess the possible alterations between the fasting and postprandial serum levels of total triiodothyronine (T3), total thyroxine (T4), free T3, free T4, thyroid stimulating hormone (TSH) dehydroepiandrosterone sulfate (DHEA-SO4) and lipids. In 35 healthy cases blood samples were obtained aftera 12-hour-fasting period at 08:00-09:00 hours and postprandial samples after 2 hours at 10:00-11:00 hours. In both groups of samples, serum lipids (total cholesterol, triglyceride, HDL cholesterol, LDL cholesterol, VLDL cholesterol), thyroid hormones and DHEA-SO4 were assayed on the same day. Total cholesterol, triglyceride and HDL cholesterol were analyzed on an automatic analyzer by enzymatic methods, thyroid hormones by cheiluminescence and DHEA-SO4 by radioimmunoassay. Fasting triglyceride, VLDL and DHEA-SO4 values were significantly (p=0.042, p=0.038 and p=0.002, respectively) lower than the postprandial values, while fasting LDL cholesterol and TSH values were found significantly (p=0.027, p=0.002, respectively) higher than the postprandial values. However, no differences were found between the postprandial and fasting values of total T3, total T4, free T3 and free T4. In conclusion, to avoid preanalitical errors especially serum TSH and DHEA-SO4 levels should be assessed on samples obtained after a 12-hour-fasting period.

ÖZET

Örnek alımı sırasında kişinin aç veya tok olmasının değişik biyokimyasal testleri farklı oranlarda etkileyerek preanalitik hatalara neden olduğu bilinmektedir. Çalışmamızda Total T3 (T3), Total T4 (T4), Serbest T3, Serbest T4, TSH, dehidroepiandrosteron sülfat (DHEA-SO4) ve lipid parametrelerinin açlık ve tokluk düzeyleri arasındaki olası değişikliklerin incelenmesi amaçlanmıştır. 35 sağlıklı gönüllüden 12 saatlik açlık sonrası (saat 08:00-09:00 arasında) açlık kan örnekleri ve aynı gün postprandial 2.saatte (saat 10:00-11:00 arasında) tokluk kan örnekleri alınmıştır. Tüm açlık ve tokluk kanlarında serum lipidleri (total kolesterol, trigliserid, HDL kolesterol, LDL kolesterol, VLDL kolesterol), tiroid hormonları ve DHEA-SO4 testleri çalışılmıştır.

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Makalenin geliş tarihi : 16.02.2004 ; kabul tarihi:26.08.2004

Total kolesterol, trigliserid, HDL kolesterol düzeyleri aynı gün otanalizörde enzimatik yöntemle, tiroid testleri kemilüminesans immunassay metoduyla, DHEA-SO4 düzeyleri ise radyoimmunassay ile ölçülmüştür. Açlık trigliserid (p=0.042), VLDL (p=0.038) ve DHEA-SO4 değerlerinde (p=0.002) tokluk değerlerine gore istatistiksel olarak anlamlı düşüklük saptanmıştır. Açlık LDL kolesterol (p=0.027) ve TSH değerlerinde (p=0.002) ise tokluk değerlerine oranla istatistiksel olarak anlamlı yükseklik saptanmıştır. T3, T4, Serbest T3 ve Serbest T4 düzeylerinin açlık ve tokluk değerleri arasında anlamlı bir fark gözlenmemiştir. Bu çalışmada, serum TSH ve DHEA-SO4 düzeylerinde görülen anlamlı değişiklik nedeniyle preanalitik hatadan kaçınmak için örnek alımı sırasında hastaların en az 12 saat aç olması gerektiği sonucuna varılmıştır.

INTRODUCTION

It is known that, a number of biochemical tests are influenced in different manners when samples are obtained during fasting or postprandial status (1, 2). Thus, it seems impossible to avoid the preanalytic errors in the laboratory data. Factors such as the previous composition and varying concentrations of body stores, the accompanying physical activity and fasting interval all play role in the concept of fasting state (3). In the postprandial period some alterations occur in the element concentration of plasma due to food intake (2). In recent studies it have been observed that the meal compositions influence the postprandial response of the pituitary-thyroid axis (4). Although there have been intensive research on the effect of fasting on serum thyroid hormones and the effect of aging on dehydroepiandrosterone sulphate (DHEA-SO4) concentrations there was not clear data about the differences between fasting and postprandial differences on serum thyroid and DHEA-SO4 levels (5,6). Our hospital is the major referral center for a wide region and is the regional center of laboratory investigations. People are referred to the laboratory from out-patient clinics at different times of the day either in fasting or postprandial state. Thus, the objective in the present study is to disclose, if present, any alterations in total triiodothyronine (T3), total thyroxine (T4), free T3, free T4, TSH, DHEA-SO4 levels and lipis in fasting and postprandial states.

MATERIALS AND METHODS

Thirty five healthy cases (13 males and 22 females), aged between 20-45 were included into the study. In the study group none of the cases presented any clinical symptoms of thyroid dysfunction or gave a history of autoimmune thyroid disease or medication. Pregnant women and cases with complaints relating to thyroid functions were excluded. People were asked not to eat except drinking water, after 20:00 hours the previous night. Fasting blood samples were obtained after a 12-hour-fasting period, at 08:00-09:00 hours on the next day. The postprandial samples were obtained two hours postprandial, after having breakfast at 9:00 at 10:00-11:00 hours. In both fasting and postprandial samples serum lipids (total cholesterol, triglyceride, HDL cholesterol and VLDL cholesterol) and thyroid hormones (Total T3, Total T4, Free T4, Free T3 and TSH) and DHEA-SO4 concentrations were assessed. Total cholesterol, triglyceride and HDL cholesterol were assessed on the same day on an automatic analyzer with commercial reagents (Olympus System Reagents, Olympus UK Ltd., Southall Middlesex, Ireland) and the VLDL cholesterol and LDL cholesterol were calculated by Fridewald formula (7). The thyroid parameters were assessed on an enzyme-amplified chemiluminescence assay analyzer (IMMULITE®, Diagnostic Products Corp., Los Angeles, CA, USA) by chemiluminescence immunoassay method and DHEA-SO4 by radioimmunoassay by commercially available kits (Coat a Count, Diagnostic Products Corp., Los Angeles, CA, USA). Informed consent of the volenteers was obtained before the study.The statistical evaluations were done by SPSS software and analyses were formed by independent student t-test . Values below $p<0.05$ were accepted as significant.

RESULTS

The mean age ± S.D. of subjects included in the study (13 males and 22 females) was 30.9 ± 10.8 (range: 20-45) years. The results of fasting and postprandial serum lipids and hormone parameters of 35 study cases are summarized in Table 1. Fasting triglyceride, VLDL and DHEA-SO4 values were found significantly lower than the postprandial values (p=0.042, p=0.038 and p=0.002, respectively), while fasting LDL cholesterol and TSH values were observed to be statistically higher than the postprandial values (p=0.027, p=0.002, respectively). However, no differences were found between the postprandial and fasting values of total T3, total T4, free T3 and free T4 values.

DISCUSSION

In addition to various metabolic and physiologic factors, food intake is known to affect serum levels of thyroid and adrenal androgen hormones (1). While the effect of food intake on blood parameters such as glucose and triglyceride is certain, no answers could be given for its influence on hormone assessments (1-2). In the present study, no significant differences were found between the

fasting and postprandial serum total (p=0.238) and HDL cholesterol levels (p=0.168).

Table 1. Serum fasting and postprandial levels of lipid, thyroid hormones and DHEA-SO_4 parameters at fasting and postprandial state.Values are given as mean ±standard deviation and range levels.NS: non significant, p >0.05.

(n=35)	Fasting state	Postprandial state	p
Total Cholesterol (mg/dL)	174.71±28.24 (133-237)	172.91±28.32 (131-240)	NS
Triglyceride (mg/dL)	110.22±69.45 (37-372)	164.65±109.00 (61-519)	p=0.042
HDL Cholesterol (mg/dL)	46.17±12.23 (21-77)	47.40±12.39 (20-78)	NS
LDL Cholesterol (mg/dL)	105.31±23.62 (69-154)	93.60±25.13 (20-146)	p=0.027
VLDL Cholesterol (mg/dL)	22.25±13.72 (7-74)	33.11±21.76 (12-104)	p=0.038
T_3 (ng/dL)	134.1±37.88 (74.00-235.0)	127.8±30.04 (66.00-201.0)	NS
T_4 (µg/dL)	10.14±2.16 (7.00-16.20)	9.78±2.33 (5.20-10.40)	NS
TSH (µIU/mL)	1.92±1.78 (0.57-11.20)	1.38±0.90 (030-5.48)	p=0.002
FREE T_3 (pg/mL)	2.66±0.81 (1.80-5.50)	2.66±1.22 (1.20-8.50)	NS
FREE T_4 (ng/dL)	1.45±0.18 (1.10-1.90)	1.43±0.21 (1.10-2.00)	NS
$DHEASO_4$ (µg/dL)	213.8±100.2 (49.00-438.0)	243.8±126.3 (85.0-639.0)	p=0.002

Postprandial serum levels of triglycerides and VLDL cholesterol were found significantly higher (p=0.042 and p=0.038, respectively), while postprandial LDL cholesterol levels were significantly lower than the fasting levels (p=0.027). The relationship between serum lipid parameters and thyroid hormones have been investigated intensively (8-13). In some studies it is shown that total and LDL cholesterol are increased in hypothyroidism (8). In another study, it is reported that hyperthyroidism induces a decrease in serum cholesterol; however, no alterations were reported in hypothyroidism and euthyroidism (9). In a population-based study in older women, in women with high TSH, LDL cholesterol is found 13 % higher, HDL cholesterol 12% lower and total cholesterol, although not statistically significant, 8% higher than women with normal TSH levels (13). In the present study, TSH was foundto be high in 2.2% of women with normal serum lipids and in 12% of women with high total cholesterol levels, although this difference was not statistically significant.

To study the influence of fasting on circadian and pulsatile TSH rhythms in healthy subjects, 24 hours after normal feeding and after a 60-hour- fasting period, consecutive TSH assessments were performed in the last 24 hours (14). The TSH levels in the fasting group were found higher than those of the normal feeding group. In the same study, it was concluded that during fasting, although the TSH pulsatile frequency remains in the same pattern, the amplitude would be lower (14).

During fasting, the first variations in TSH are thought to begin around 14:00 to 18:00 hours. After a 10:00-14:00-hour-fasting period, a slight rise in free T4 level is seen, followed by a slight fall in T3 level. In the first 24 hours no alterations in TSH level in fasting could be detected (7). In the present study, after a 10-12 hour- fasting period no alterations were expected. However, in 33 of our 35 study cases postprandial TSH levels were found lower; only two cases were found high. In evaluating such decreases in the TSH level we suggest that the circadian rhythm should be taken into consideration (7, 12).

In the present study, no statistically significant differences were found between fasting and postprandial serum levels of total T3 (p=0.085), total T4 (p=0.055), free T3 (p=0.980) and free T4 (p=0.880). Only the postprandial serum level of TSH was found significantly (p=0.002) lower than the fasting serum level of TSH, nevertheless this decrease was within reference limits. In addition, either in fasting or in the postprandial state, no statistical correlation was found between any lipid fractions and any thyroid hormone parameters.

The most important factors influencing serum DHEA-SO4 levels are age and gender. A significant decrease in DHEA-SO4 level is seen with ageing (15-23). However, enhanced insulin secretion does not alter the circulating level of DHEA-SO4 (15, 23). A positive correlation is seen between DHEA-SO4 and the total cholesterol, triglyceride and the LDL cholesterol; and a negative correlation between DHEA-SO4 and the HDL cholesterol (16, 20). A relation within reference limits is shown between low DHEA-SO4 serum level and increased glucose (18, 19). Although DHEA has a circadian rhythm parallel to cortisol

secretion, due to its long half-life, circulating DHEA-SO4 is not influenced by the circadian rhythm (22). In the present study, the postprandial DHEA-SO4 values showed a statistically significant (p=0.002) increase in relation to fasting values in concordance with the literature (18, 19).

In conclusion, our opinion is that TSH and DHEA-SO4 parameters should be assessed after a 12-hour-fasting period to avoid preanalytical errors.

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