Study of Plasma Hormones and Lipids in Healthy Elderly Thais Compared to Patients with Chronic Diseases : Diabetes Mellitus, Essential Hypertension and Coronary Heart Disease

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Abstract

Simultaneous measurements of serum estradiol, testosterone, cortisol, prolactin, total cholesterol (TC), high density lipoprotein cholesterol (HDLC), low density lipoprotein cholesterol (LDLC) and triglycerides in Thai men and postmenopausal women aged over 50 years were carried out in four groups of subjects: healthy controls, and patients with essential hypertension, non-insulin dependent diabetes mellitus (NIDDM), and coronary heart disease. Hypertriglyceridemia and hypercholesterolemia were found more often in patients with essential hypertension than in patients with other diseases. Low levels of HDLC with high TC/HDLC and LDLC/HDLC ratios occurred more frequently in coronary heart disease patients. Hypertensive men had the highest plasma estradiol levels while men with coronary heart disease had the least testosterone levels compared with men with the other two diseases. Decreased testosterone and/or increased estradiol may have an adverse effect on lipid profiles in elderly men. However, neither the sex hormones, cortisol, nor prolactin, appeared to have any influence on serum lipids and lipoproteins in elderly women. These findings in the Thai population are consistent with those previously reported in other populations.

Key word : Hormones, Lipids, Elderly

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Ischemic heart disease, non-insulin dependent diabetes mellitus (NIDDM), and essential hypertension, are age-dependent diseases. Conditions that frequently occur together, especially in the elderly, are insulin resistance, hyperlipidemia, abdominal obesity and hypertension(1). Human experiments suggest that the insulin resistant state is associated with a decrease in the vasodilatory effect of insulin. The intracellular calcium of vascular smooth muscle is increased, as is sympathetic tone, and there is an enhancement of renal sodium retention(1-3). Glucose tolerance is affected by

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aging due to alterations in insulin sensitivity and secretion of the hormone. Impaired glucose tolerance and diabetes mellitus may be found in nearly 20 per cent of women aged 55 to 65 years[4]. Hypertension and hyperlipidemia in NIDDM is characterized by elevated levels of serum triglycerides, low density lipoprotein cholesterol (LDLC), total cholesterol (TC) and a reduction in high density lipoprotein cholesterol (HDLC) levels. These lipid abnormalities are major risk factors for developing premature atherosclerosis and coronary heart disease[5-7].

The onset of cardiovascular disease occurs 10 years later in women than in men[8] but the ratio of male to female coronary events decreases with age[9]. About 30 per cent of cardiovascular risk is due to changes in lipid and lipoprotein profiles[10]. It has been suggested that the alteration of lipid profiles in the elderly is mediated by sex hormones. Female reproductive cycles cease rather abruptly at around 50 years of age with a reduction of estrogen and progesterone production. In men, however, testosterone gradually declines with age. The menopause impacts significantly on lipid and lipoprotein profiles, and this is associated with a 2-3 times increased incidence of coronary heart disease in postmenopausal women. Approximately two years after the cessation of menstrual periods, serum TC, LDLC and triglyceride concentrations increase significantly. In contrast, HDLC decreases as a consequence of the menopause[11,12]. Plasma cholesterol, LDLC and the ratios of both of these to HDLC were shown to be significantly related to coronary heart disease events[13].

The occurrence of increased atherogenic lipid profiles in postmenopausal women has been attributed to a reduction in estrogen, specifically estradiol, or a consequence of relatively increased androgen concentrations[11,14,15]. In the Framingham study, the increased incidence of ischemic heart disease in women aged 49 years and older occurred in those who had high total cholesterol and reduced HDLC concentrations[16]. A significant decrease in TC/HDLC and LDLC/HDLC ratios, due to increased HDLC concentrations, has been shown to occur after estrogen replacement therapy[17]. Estrogen deficiency in women may be responsible for a decreased secretion of insulin and an alteration of its metabolic clearance rate[4]. Insulin resistance and/or hyperinsulinemia may also raise the testosterone levels in women[15]. However, recent data suggest that changes in endogenous estrogen is not the explanation for the differences observed in HDLC levels between men and women, nor do they explain the increase in coronary heart disease in women around the menopause[18].

In men, androgen has been shown to be directly associated with high HDLC concentrations but controversy remains in regard to the relationship between testosterone and total cholesterol, LDLC or triglyceride concentrations[14,19-21]. Aging men have high circulating levels of estrogen, surpassing those of postmenopausal women, presumably as a result of peripheral conversion of adrenal and testicular androgens. However, no correlation has been found between estradiol and any lipids or lipoproteins in healthy men[22] or in postmenopausal women[6]. Recent findings suggest that low testosterone concentrations in aging men are as important, or indeed more important, than high estrogen levels as a contributing factor to the increased risk of coronary heart disease, diabetes mellitus, abdominal obesity and hypertension[15, 23]. Thus, conflicts remain concerning the interrelationship among sex hormones, lipids and diseases of aging, especially coronary heart disease in men and women. Further investigations are required.

Cortisol is a major stress hormone and is known to produce hyperglycemia and hyperlipidemia in humans. Basal cortisol levels do not change with age but stress-induced cortisol concentrations increase in advanced age[24]. Chronic elevation of cortisol or prolactin is associated with hypogonadism and decreased sex hormone secretion. The objective of the present study was to investigate whether sex hormones such as estradiol and testosterone and the two stress hormones, cortisol and prolactin, have any relationship to dislipidemia in the elderly with essential hypertension, diabetes mellitus, or coronary heart disease. Results were compared to those of healthy subjects in the same age range.

MATERIAL AND METHOD

Subjects

Thai men and women over 50 years of age were studied. The healthy control group included 39 men (CTm) and 60 women (CTf) who had no history of serious illness or taking any medication regularly. All of them had a blood pressure less

than 140/90 mmHg[25] and a fasting plasma glucose less than 115 mg/dl[26]. Patients who were attending clinics or had been admitted to Siriraj Hospital were divided into three groups. The first group of patients comprised 43 diabetic men (DMm) and 60 diabetic women (DMf). This group included the patients who were complicated with hypertension or coronary heart disease or both. The second group, patients with essential hypertension, consisted of 61 men (HTm) and 70 women (HTf). They all had pre-treatment blood pressure above 160/95 mmHg[25] and some of them had developed diabetes mellitus during follow-up. The third group included 99 men (HDm) and 70 women (HDf) with coronary heart disease all of whom were within 1-4 days after developing acute myocardial infarction. Smoking habits, alcohol consumption, weight, height and body mass index (BMI) were recorded in every case.

Method

Fasting plasma samples obtained between 7-9 AM from individual subjects were analysed for estradiol (E_2), testosterone (T), prolactin and cortisol by radioimmunoassay (WHO reagents). Total cholesterol, HDLC and triglycerides were measured by enzymatic colorimetric methods (Boehringer Mannheim Diagnostica). LDLC, TC/HDLC ratios and LDLC/HDLC ratios were calculated. Non-parametric statistics were used for comparison and establishing relationships. Simple as well as multiple regression analysis were performed. Significance defined as a p value less than 0.05.

RESULTS

The characteristics of the studied subjects are shown in Table 1. Among the four groups, the controls, both men and women, had the lowest mean BMI ($p<0.05$). The percentage of smokers

Table 1. Characteristics of studied subjects (mean ± SEM).

	Control		Diabetes Mellitus		Hypertension		Coronary Heart Disease	
	men	women	men	women	men	women	men	women
N	39	60	43	60	61	70	99	70
Age (yr)	67.2 ± 1.4	63.8 ± 0.8	64.4 ± 1.1	62.6 ± 0.7	62.5 ± 0.9	62.1 ± 0.8	62.0 ± 0.9	64.3 ± 1.1
Weight (kg)	60.9 ± 1.2	57.3 ± 0.9	65.8 ± 1.5	58.2 ± 1.2	69.6 ± 1.7	61.0 ± 1.2	61.9 ± 1.2	56.1 ± 1.5
BMI (kg/m^2)	22.8 ± 0.4	23.9 ± 0.4	24.1 ± 0.5	24.9 ± 0.5	25.4 ± 0.6	26.0 ± 0.4	23.6 ± 0.6	25.4 ± 0.4
Smoker (%)*	12.8	0	18.9	1.6	11.1	4.0	25.0	17.5
Alcohol consumer (%)*	23.1	0	32.4	0	22.2	1.3	46.8	6.2

* Only current smoker or alcohol consumer

Table 2. Plasma levels of estradiol (E_2), testosterone (T), prolactin (PRL) and cortisol (C) in different diseases. (mean ± SEM).

	N	E_2 (pmol/L)	T (nmol/L)	E_2/T ratio X 10^{-3}	Prolactin (MU/L)	Cortisol (nmol/L)
CTm	39	146.78 ± 8.47[b]	16.09 ± 1.06[b]	10.84 ± 0.99[b]	176.27 ± 19.45	364.58 ± 18.03
DMm	43	139.85 ± 9.83[3]	12.40 ± 0.86[2] (c)	14.20 ± 1.63[c]	296.88 ± 53.31[4]	456.00 ± 26.33[1]
HTm	61	177.87 ± 8.91[4] (c)	13.36 ± 0.50[c]	14.42 ± 0.89[3] (c)	240.51 ± 34.05	375.96 ± 24.98
HDm	99	150.47 ± 8.38[a]	11.09 ± 0.53[3](c)	25.76 ± 8.53[c]	265.64 ± 25.44[2]	642.03 ± 53.32[2]
Male	**242**	**154.89 ± 4.72[a]**	**12.70 ± 0.36[a]**	**18.44 ± 3.52[a]**	**250.57 ± 16.92**	**494.50 ± 24.27[b]**
CTf	60	84.50 ± 4.62[b]	1.09 ± 0.06[b]	102.03 ± 8.53[b]	191.79 ± 23.63	323.79 ± 14.34
DMf	60	116.84 ± 5.36[1]	1.44 ± 0.09[4] (c)	101.19 ± 9.16[c]	260.65 ± 43.70	429.77 ± 22.44[1]
HTf	70	123.42 ± 8.59[1] (c)	1.40 ± 0.16[c]	121.15 ± 10.45[c]	212.92 ± 21.52	359.74 ± 20.39
HDf	70	113.69 ± 6.50[a]	1.72 ± 0.34[1] (c)	102.36 ± 8.50[c]	335.23 ± 42.73[2]	571.07 ± 56.27[1]
Female	**260**	**110.30 ± 3.43[a]**	**1.42 ± 0.11[a]**	**107.07 ± 4.64[a]**	**253.00 ± 17.70**	**420.18 ± 17.63[b]**

[a] $p < 0.01$, [b] $p < 0.001$, [c] $p < 0.0001$ comparing between sexes
[1] $p < 0.0001$, [2] $p < 0.001$, [3] $p < 0.01$, [4] $p < 0.05$ compared to healthy group of the same sex
CTm = male control; DMm = male diabetes mellitus; HTm = male essential hypertension; HDm = male coronary heart disease;
CTf = female control; DMf = female diabetes mellitus; HTf = female essential hypertension; HDf = female coronary heart disease

who smoked more than 5 cigaretts per day and of those who regularly drank alcohol was higher in the coronary heart disease group than in the healthy control group for both men and women ($p < 0.0001$).

Tables 2 and 3 show plasma levels of hormones and lipids. In the diabetic group, estradiol did not differ between the sexes, but in the other groups men had higher estradiol levels than women (Fig. 1). Aging men had a higher testosterone but lower E_2/T ratio than the women in each group. No sex difference in the plasma concentrations of prolactin and cortisol was detected in any group.

A comparison of blood lipids and lipoproteins between different sexes showed that normal postmenopausal women, diabetic, and hypertensive females had higher HDLC levels than men in the corresponding group (Fig. 2). However, the HDLC levels in patients with coronary heart disease was not significantly different between men or women. Hypertensive men had higher ratios of TC/LDLC and LDLC/HDLC than women with the same disease. Total cholesterol, LDLC and triglycerides were not different between sexes. The mean HDLC value in alcohol drinkers was significantly lower than in those who did not take alcohol ($p<0.05$).

The studied hormones were compared in the different groups (Fig. 1). Healthy men had higher testosterone levels, but lower prolactin and cortisol levels, compared to patients of the corresponding sex with diabetes or coronary heart disease. Hypertensive men had higher mean estradiol and E_2T ratio compared with healthy controls. Diabetic women had higher values of estradiol, testosterone and cortisol than healthy women while hypertensive women only had estradiol level more than female controls. Women with coronary heart disease had higher levels of testosterone, prolactin and cortisol compared with female controls. In comparison to another two diseases, hypertensive men had highest estradiol while hypertensive women had highest E_2T ratio but lowest mean cortisol value was found in both sexes. Lowest mean testosterone value was found in men with coronary heart disease.

A group comparison of lipids and lipoproteins (Fig. 2) revealed that coronary heart patients of either sex had the lowest mean HDLC value with highest TC/HDLC and LDLC/HDLC ratios among the four groups ($p < 0.05$). HDLC was more and these two ratios were less in the healthy group when compared to diabetic and hypertensive patients. Women with coronary heart disease had lower values of total cholesterol and LDLC compared with the female controls. Hypertensive men and women had significantly higher triglyceride values than healthy subjects and than patients with diabetes or coronary heart disease. Higher total cholesterol in hypertensive patients than in the other two diseases was also shown. A lower mean value of total cholesterol was also seen in diabetic women when compared with the control females.

Simple regression between two parameters within each sex showed that BMI decreased with advancing age both in men and women (Table 4 and Table 5). HDLC increased while TC/HDLC and LDLC/HDLC ratios decreased with advancing

Table 3. Plasma lipids and lipoprotein levels in different diseases. (mean ± SEM).

	N	Total cholesterol (mg/dl)	HDLC (mg/dl)	TC/HDLC	LDLC (mg/dl)	LDLC/HDLC	Triglycerides (mg/dl)
CTm	39	248.61 ± 6.29	48.66 ± 1.89(a)	5.35 ± 0.21	166.83 ± 5.93	3.63 ± 0.20	165.66 ± 9.04
DMm	43	238.39 ± 7.35	42.04 ± 1.88(1)(a)	5.95 ± 0.19(4)	158.48 ± 7.79	3.97 ± 0.21(1)	214.51 ± 30.78
HTm	61	252.20 ± 4.92	39.87 ± 1.50(2)(c)	6.67 ± 0.20(2)(b)	165.87 ± 4.55	4.47 ± 0.19(2)(b)	232.34 ± 16.23(3)
HDm	99	231.21 ± 4.67	37.59 ± 1.16(3)	7.28 ± 0.33(1)	162.19 ± 4.06	4.91 ± 0.26(4)	163.67 ± 6.66
Male	**242**	**240.70 ± 2.85(a)**	**40.75 ± 0.79(b)**	**6.14 ± 0.20**	**163.20 ± 2.62**	**4.42 ± 0.13(a)**	**190.87 ± 7.82**
CTf	60	266.82 ± 4.43	55.39 ± 1.67(a)	4.99 ± 0.18	176.77 ± 3.94	3.39 ± 0.13	173.27 ± 9.16
DMf	60	251.86 ± 5.71(4)	46.58 ± 1.46(1)(a)	5.72 ± 0.23(1)	168.89 ± 4.86	3.69 ± 0.14(4)	192.69 ± 15.41
HTf	70	262.42 ± 4.73	47.73 ± 1.32(1)(c)	5.81 ± 0.19(1)(b)	170.13 ± 4.68	3.77 ± 0.16(4)(b)	225.81 ± 11.34(1)
HDf	70	232.10 ± 5.29(1)	35.39 ± 1.47(1)	7.74 ± 0.49(4)	159.55 ± 4.97(3)	5.65 ± 0.55(1)	185.86 ± 9.56
Female	**260**	**253.00 ± 2.66(a)**	**45.95 ± 0.85(b)**	**6.47 ± 0.17**	**168.56 ± 2.36**	**4.16 ± 0.17(a)**	**195.82 ± 5.91**

(a) $p < 0.05$, (b) $p < 0.01$, (c) $p < 0.0001$ compared between sexes
(1) $p < 0.0001$, (2) $p < 0.001$, (3) $p < 0.01$, (4) $p < 0.05$ compared to healthy group of the same sex
HDLC = High density lipoprotein cholesterol; TC = Total cholesterol; LDLC = Low density lipoprotein cholesterol

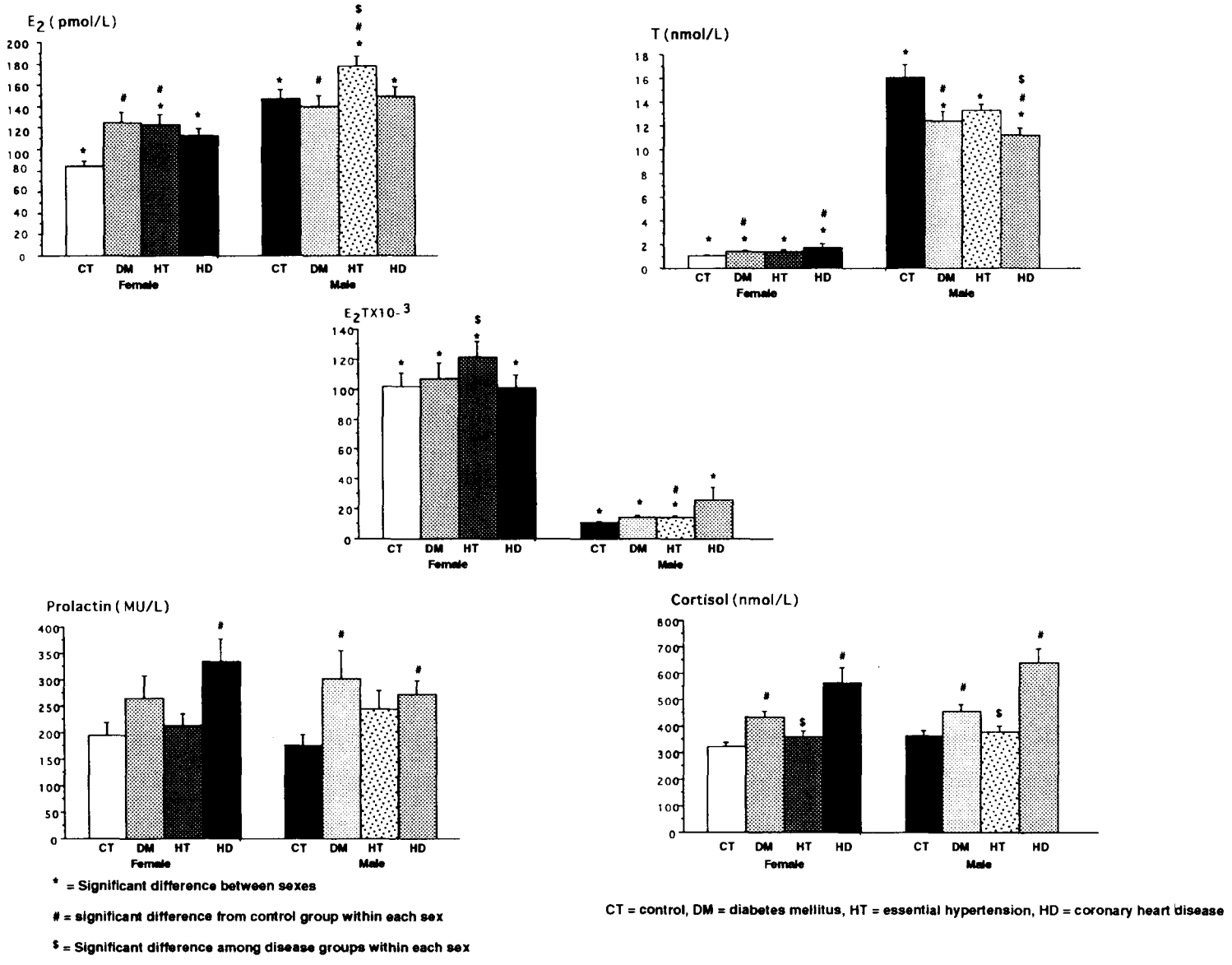
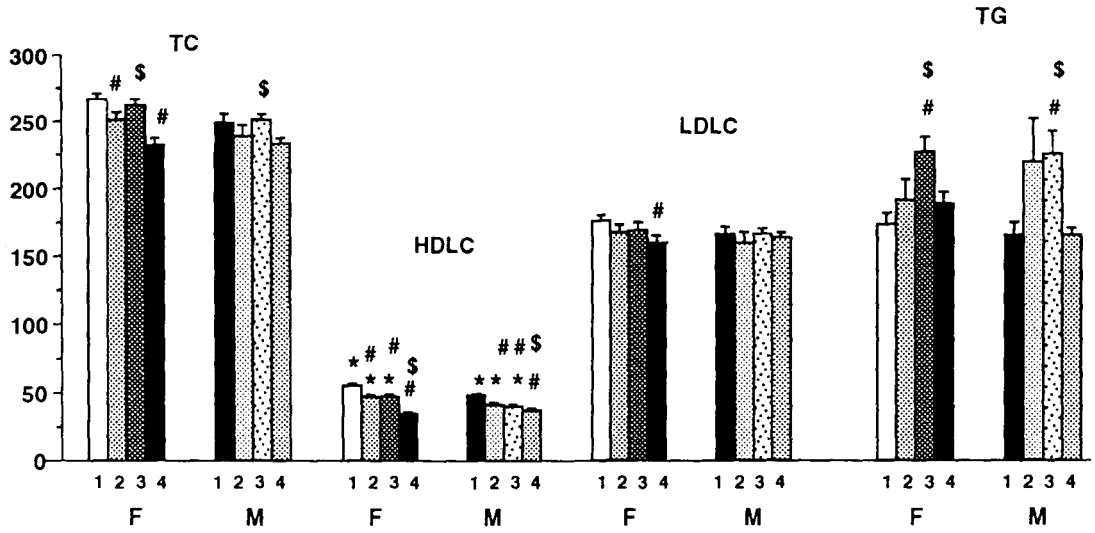
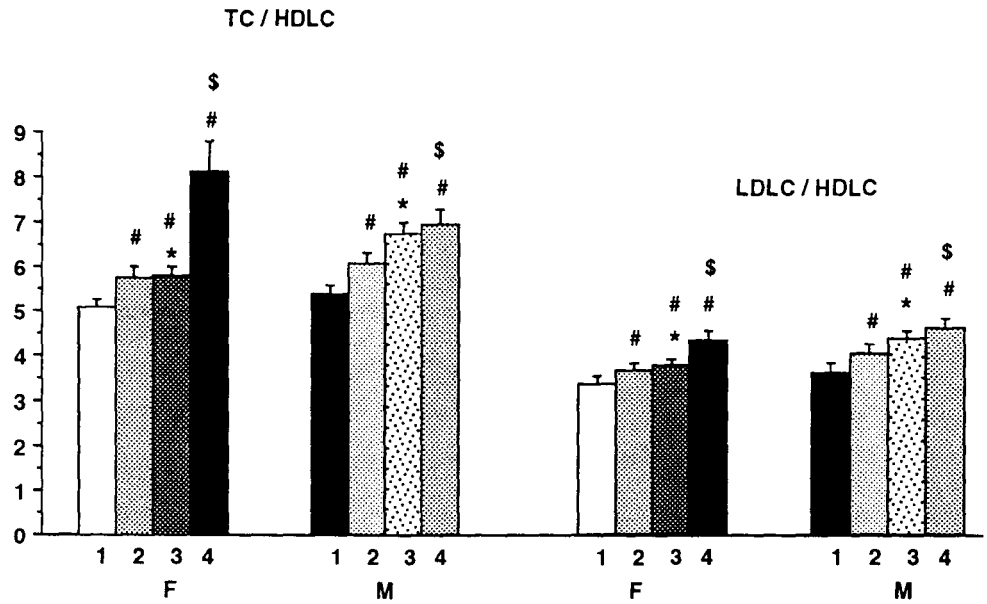


Fig. 1. Studied plasma hormones in four groups of subject.





* = Significant difference between sexes

\# = significant difference from control group within each sex

$ = Significant difference among disease groups within each sex

1 = control, 2 = diabetes mellitus, 3 = essential hypertension, 4 = coronary heart disease

F = Female, M = Male

Fig. 2. Plasma lipids and lipoproteins in four groups of subject.

Table 4. Correlations of plasma hormones, lipids, lipoproteins, age and BMI in aging men (N = 242).

	Age	BMI	TC	HDLC	LDLC	TC/HDLC	LDLC/HDLC	TG
Age		-0.18[b]	0.02	0.17[b]	-0.05	-0.14[a]	-0.13[a]	0.06
BMI		-	0.003	-0.27[c]	0.02	0.16[a]	0.20[b]	0.08
E_2	0.03	0.19[b]	-0.06	-0.03	-0.06	-0.05	0.01	-0.03
T	-0.10	-0.25[c]	0.09	0.24[c]	0.11	-0.09	-0.10	-0.12[a]
E_2/T ratio	0.09	0.30[c]	-0.13[a]	-0.05	-0.10	-0.03	-0.03	-0.05
PRL	0.04	-0.11	-0.06	0.04	-0.05	-0.10	-0.06	-0.01
Cortisol	0.06	-0.07	-0.15[b]	-0.02	-0.09	-0.02	-0.02	-0.11

[a] = $p < 0.05$, [b] = $p < 0.01$, [c] = $p < 0.0001$

Table 5. Correlations of plasma hormones, lipids, lipoproteins, age and BMI in aging women (N = 260).

	Age	BMI	TC	HDLC	LDLC	TC/HDLC	LDLC/HDLC	TG
Age		-0.14[a]	-0.02	0.04	0.02	-0.09	0.03	-0.10
BMI		-	-0.08	-0.20[b]	-0.06	0.06	0.14[a]	0.10
E_2	-0.34[c]	0.09	-0.15[b]	0.03	-0.12[a]	-0.08	-0.09	-0.12[a]
T	-0.10	0.06	-0.07	-0.02	-0.01	-0.03	0.02	-0.13[a]
E_2/T ratio	-0.27[c]	0.02	0.01	0.002	0.007	-0.006	-0.01	0.02
PRL	0.01	0.07	-0.05	-0.002	-0.03	-0.05	-0.01	-0.04
Cortisol	0.03	-0.01	-0.08	-0.16[b]	0.003	0.03	0.15[a]	-0.10

[a] = $p < 0.05$, [b] = $p < 0.01$, [c] = $p < 0.0001$

age in men but not in women. Women had decreased estradiol with increasing age but estradiol did not change with age in men. Significant age related change in testosterone concentrations was not detected either in men or women. Men with a high BMI had a low testosterone but high E_2/T ratio compared to those with a lower BMI. This association of BMI was not found in aging women. Both women and men with a high BMI had low HDLC levels and high LDLC/HDLC ratios while high TC/HDLC ratios with increased BMI were seen only in men. Testosterone correlated positively with plasma HDLC but negatively with triglyceride concentrations in men. An inverse relationship between testosterone and triglycerides was also observed in women. There was a negative correlation between estradiol concentrations and total cholesterol, LDLC and triglycerides in women, as shown by simple regression, whereas in men, a significant relationship between estradiol and lipids or lipoproteins was not observed. A direct association of cortisol with prolactin and LDLC/HDLC ratio, as well as an inverse relationship between cortisol and HDLC, were detected in aging women but not in men. The relationship between total cholesterol and HDLC, LDLC, TC/HDLC ratio, LDLC/HDLC ratio and triglycerides, calculated from all studied subjects (N=502), is tabulated in Table 6.

Multiple regression analysis separately revealed that smoking was associated positively with triglyceride levels in both males and females. HDLC concentrations in men or women were positively related to total cholesterol but negatively to triglycerides, TC/HDLC and LDLC/HDLC ratios. In aging females, neither lipids nor lipoproteins was independently correlated with estradiol, testosterone, prolactin or cortisol. In contrast, total cholesterol, HDLC, LDLC and triglycerides in aging males were significantly correlated to estradiol in the opposite direction to their relationship with testosterone. (Table 7) A low estradiol and high testosterone seem to produce better lipid profiles in aging men.

DISCUSSION

BMI, estradiol, and E_2/T ratios were decreased in postmenopausal women after 50 years of age, whereas, there were no significant changes

Table 6. Association between lipids and lipoproteins in aging men and women (N = 502).

	TC	HDLC	LDLC	TC/HDLC	LDLC/HDLC	TG
TC		0.20[b]	0.88[b]	0.20[b]	0.39[b]	0.26[b]
HDLC			0.03	-0.70[b]	-0.69[b]	-0.25[b]
LDLC				0.31[b]	0.59[b]	-0.08
TC/HDLC					0.94[b]	0.25[b]
LDLC/HDLC						0.11[a]

[a] $p < 0.01$, [b] $p < 0.0001$

Table 7. Multiple regression analysis with estradiol and testosterone as dependent variable in aging men. (N = 242).

Dependent	Variable Independent*	R^2	ß	SE of ß	t	p
Estradiol (E_2)		0.71				
	T		9.74	0.87	11.18	0.0001
	E_2/T ratio		9.66	0.52	18.47	0.0001
	TC		6.79	1.23	5.54	0.0001
	HDLC		-8.72	1.62	-5.40	0.0001
	LDLC		-6.37	1.26	-5.07	0.0001
	TG		-1.23	0.23	-5.73	0.0001
Testosterone (T)		0.63				
	E_2		0.04	0.004	11.16	0.0001
	E_2/T ratio		-0.56	0.04	-13.27	0.0001
	TC		-0.27	0.09	-3.15	0.0002
	HDLC		0.42	0.11	3.74	0.0002
	LDLC		0.26	0.09	2.95	0.004
	TG		0.04	0.02	2.42	0.02

R^2 = squared of correlation coefficient
ß = regression coefficient
SE = standard error
* = data shown only variables with significant relationship

in testosterone, lipid or lipoprotein levels with age. In men, testosterone and estradiol did not alter with age but HDLC was found to be increased, whereas BMI, TC/HDLC and LDLC/HDLC ratios all decreased with advancing age. Our findings are consistent with the findings in a Caucasian population[27]. Relatively higher cholesterol and triglyceride levels in this group of healthy Thais in comparison with other reports may be due to their eating habits and less activity. In 1982, Viseshakul et al reported higher HDLC but lower total cholesterol in Thais aged over 60 in comparison to those under 60 years of age[28]. In addition, a similar finding that there is no significant age-related change in testosterone concentrations in men has been previously reported[29,30]. Prolactin and cortisol did not change with advancing age either in men or women between 50-89 years in the present study. It has been suggested that the reason for unchanged serum cortisol concentrations is that reduced secretion is balanced by a reduced clearance rate of this steroid[31]. Prolactin levels in the elderly remain controversial with reports that plasma concentrations are reduced, unchanged, or even increased[24].

Comparison of hormones and lipids between sexes showed that aging men had higher estradiol as well as testosterone than aging women, although the sex - difference of estradiol was not seen in the diabetic group. These results are in agreement with those reported before[32,33]. Increased aromatization of testicular and adrenal

testosterone in peripheral tissues together with decreased renal excretory function will raise the testosterone level in aging men when compared to postmenopausal women whose ovarian steroid synthesis has completely stopped. Cortisol or prolactin did not differ between men and women in any group of subjects. It is well accepted that adult women of all ages have consistently higher levels of HDLC than adult men[34]. This was indeed the case in the healthy, diabetic and hypertensive groups in our study but a sex difference in HDLC concentrations in coronary heart disease patients was not detected.

In the present study, healthy elderly had a lower BMI than those with disease. Moreover, BMI was associated positively with LDLC/HDLC ratio but negatively with HDLC concentrations both in aging men and women. A direct association between BMI and TC/HDLC was also detected in aging men. These two ratios are atherogenic indices and indicate an increasing risk of coronary heart disease. The results also confirm that atherogenic lipid profiles occur more frequently in obese than non-obese Thais as it has been reported in other populations[19,35-37].

Smoking is one of the primary risk factors for coronary heart disease[34,37]. Lower levels of HDLC and higher levels of total cholesterol, LDLC and triglycerides have been reported among women smokers[11]. The percentage of Thai men or women with coronary heart disease who smoke was higher than in the healthy aging group. A positive association between smoking and plasma triglyceride levels was also observed in this study. High triglyceride levels have been shown to be an independent risk factor for coronary heart disease[7,38] and smaller, denser, more atherogenic LDL particles were produced by high triglyceride concentrations [39]. In addition, smoking has been found to have a strong positive correlation with free testosterone concentrations in women[40] and with estradiol and waist-to-hip ratio in men[41]. We did not observe the relationship between smoking and estradiol or testosterone in either men or women, and this might simply be due to the low percentage of smokers in the population under study. Our data did not confirm that smoking altered sex hormones but it may indeed induce dislipidemia by some other mechanism causing a greater risk of coronary heart disease.

There were more patients who drank alcohol in the coronary heart disease group in this study than in the control group. We also found that HDLC levels in alcohol consumers was less than in those who did not drink alcohol. Our findings are at odds with the inverse association between regular alcohol consumption and risk of ischemic heart disease reported by some researchers[35,42]. However, alcohol was not found to be an independent variable affecting the levels of any of the lipids, lipoproteins or studied diseases in our subjects.

The comparison of hormones with lipids and lipoproteins showed that aging men with hypertension had the highest levels of estradiol and triglycerides among the four groups and also had higher levels of total cholesterol when compared to the diabetic and coronary heart disease groups. Other researchers have reported increased estradiol levels in men in association with a higher incidence of hypertension[22,33,43]. This suggests that increased estradiol in aging men may have some adverse effects, for example hypertriglyceridemia or hypercholesterolemia, and that this might lead to hypertension and coronary heart disease. In addition, there was an inverse relationship between HDLC and triglyceride levels in our study. Hypertensive men had higher ratios of TC/HDLC and LDLC/HDLC than hypertensive women. Increasing estradiol in men had a greater effect on reducing HDLC and increasing total cholesterol compared with its lowering effect on LDLC and triglyceride concentrations (Table 7). Thus, aging men with high plasma estradiol have less HDLC than those with low estradiol concentrations. In contrast to the findings in men, though hypertensive women had highest E_2T ratio, total cholesterol and triglycerides among three diseases, estradiol seems not to relate to lipids and lipoproteins in aging women when all variables were considered at the same time. It is possible that hypertensive men with high estradiol are at more risk of developing coronary heart disease than hypertensive women of similar age. Less mean cortisol level in hypertensive men and women compared to other two diseases may due to the cross-reaction occuring in cortisol assays by some anti-hypertensive drugs such as spironolactone or cyproterone acetate[30].

The lowest HDLC levels and highest ratios of TC/HDLC and LDLC/HDLC were found in the coronary heart disease group. This group had

lower concentrations of total cholesterol and triglycerides, but the same LDLC levels, as the other three groups though insignificant, when compared by sex. This implies that decreasing HDLC and a rise of TC/HDLC and LDLC/HDLC ratios are the most important dislipidemic criteria which indicate coronary heart disease in elderly men or women. Men with coronary heart disease were shown to have decreased serum testosterone concentrations but in women increased free testosterone may be a risk factor for coronary atherosclerosis[15]. Moreover, low testosterone in men and high testosterone in women appear to be associated with increased plasma triglyceride levels, decreased HDLC levels and increased glucose and insulin concentrations [15,22,40]. In the present study, male patients with coronary heart disease had the lowest testosterone levels compared to other male groups. Testosterone correlated positively, and estradiol negatively, with HDLC in male subjects taking other variables into account. This is similar to some previously reported studies[15,19,43-45] but not to others[36,46]. Decreased testosterone, possibly together with increased estradiol and cortisol may have a role in causing dislipidemia in aging men. On the other hand, the role of increased testosterone or decreased estradiol in creating atherogenic lipid profiles in aging women is not backed up by our data. Our results suggest that the alteration of sex hormones does not appear to be an important determinant of lipid and lipoprotein concentrations in women after the menopause.

SUMMARY

Data obtained from elderly Thai men and postmenopausal women provides the following information : (1) Aging men and women with a high BMI tended to have an atherogenic lipid profile. (2) Smoking increases triglyceride concentrations independently of any changes in sex hormone levels in the elderly. (3) Alcohol seems to have no benefit for reducing the risk of coronary heart disease. (4) In aging men and postmenopausal women, decreased HDLC together with increased TC/HDLC and LDLC/HDLC ratios, appears to increase the risk of coronary heart disease. (5) Cortisol or prolactin concentrations are not correlated with lipid or lipoprotein levels in aging men and women. (6) Hypercholesterolemia and hypertriglyceridemia were dominant findings in male patients with essential hypertension compared with men with NIDDM or coronary heart disease. (7) Elderly men with increased plasma estradiol and decreased plasma testosterone concentrations had poor lipid profiles that put them at more risk of developing essential hypertension and coronary heart disease respectively. (8) Estradiol deficiency or an increase in testosterone in postmenopausal women did not appear to have any significant relationship to unsatisfactory changes of plasma lipids or lipoproteins. The increased incidence of coronary heart disease in aging women does not appear to be associated with hormonal changes after the menopause.

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การศึกษาระดับฮอร์โมนและไขมันในผู้สูงอายุปกติชาวไทย เปรียบเทียบกับผู้ป่วยโรคเบาหวาน โรคความดันเลือดสูง และโรคหลอดเลือดหัวใจผิดปกติ

สุพรพิมพ์ เจียสกุล, พ.บ., กวี เจริญลาภ, พ.บ.**, วิเชียร ทองแตง, พ.บ.**, วรรณี นิธิยานันท์, พ.บ.***

ได้ทำการวัดระดับเอสตราดิออล, เทสโทเสตอโรน, คอร์ติซอล, โปรแลคติน, โคเลสเตอรอลรวม, HDLC, LDLC และไตรกลีเซอไรด์ ในชีรัมชายและหญิงวัยหลังหมดประจำเดือนซึ่งอายุมากกว่า 50 ปี โดยแบ่งเป็น 4 กลุ่ม : กลุ่มควบคุมที่มีสุขภาพแข็งแรง, กลุ่มโรคความดันเลือดสูง, โรคเบาหวาน และโรคหลอดเลือดหัวใจผิดปกติ พบว่าผู้ป่วยความดันเลือดสูงมีระดับไตรกลีเซอไรด์และโคเลสเตอรอลรวมสูงมากกว่ากลุ่มอื่น ๆ ผู้ป่วยโรคหลอดเลือดหัวใจผิดปกติมีระดับ HDLC ต่ำ แต่อัตราส่วนระหว่างโคเลสเตอรอลรวม/HDLC และ LDLC/HDLC สูงมากกว่ากลุ่มอื่น ๆ ผู้สูงอายุชายที่มีโรคความดันเลือดสูงมีระดับเอสตราดิออลในเลือดสูงสุด ส่วนผู้ที่มีโรคหลอดเลือดหัวใจผิดปกติมีระดับเทสโทเสตอโรนต่ำสุดเมื่อเทียบกับอีกสองโรค การลดลงของเทสโทเสตอโรนและ/หรือการเพิ่มขึ้นของเอสตราดิออลอาจเป็นสาเหตุทำให้เกิดความผิดปกติของไขมันในเลือดชายสูงอายุ ตรงข้ามในผู้สูงอายุสตรีไม่พบว่าฮอร์โมนและไขมันทุกชนิดที่ศึกษามีความสัมพันธ์อย่างมีนัยสำคัญต่อกัน ผลการศึกษาในผู้สูงอายุชาวไทยครั้งนี้สอดคล้องกับผลที่รายงานไว้ในชนชาติอื่น ๆ

คำสำคัญ : ฮอร์โมน, ไขมัน, วัยสูงอายุ

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