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Leptin and Cortisol: Relationships with Metabolic Syndrome in Male and Female Teachers

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ABSTRACT

Background : Increasing prevalence of metabolic syndrome causes the need for prevention of risk factors and markers, some of them are the role of leptin and cortisol. The aim of this study was to investigate the relationship between leptin and cortisol levels as risk factors of metabolic syndrome among men and women in the teacher group.

Method: A cross sectional study was performed with 86 teachers (16 men and 70 women). Characteristic sample, Anthropometry, Lipid profile, fasting blood glucose, blood pressure, cortisol and leptin were measured for all samples.

Results: Leptin levels are higher in women than in men (30.64±15.50 vs 7.87±6.02; p=0.005). While cortisol levels are higher in men than in women (12.09±4.94 vs 8.64±4.15; p<0.001). Age, stress levels, leptin and cortisol showed a significant association with metabolic syndrome. Leptin correlates significantly with High Density Lipoprotein/ HDL levels (r=0.391) for all samples. In men, leptin is significantly correlated with triglycerides/ TG (r=0.529) and systolic blood pressure (r=0.510), whereas in women, leptin correlates with abdominal circumference (r=0.479). Cortisol was significantly correlated with Fasting Blood Glucose/ FBG (r = 0.30) in all samples. In men cortisol was significantly correlated with Body mass index/ BMI) (r = 0.612 while in women it was significantly correlated with FBG (r = 0.328).

Conclusions: Leptin levels are higher in women than in men, but cortisol is higher in men than in women. In men, triglyceride levels and systolic blood pressure correlate with an increase in leptin, whereas in women is the abdominal circumference. In men, BMI correlates with cortisol and in women fasting blood glucose levels.

Keyword: *markers, metabolic syndrome, leptin, cortisol*

INTRODUCTION

Non-communicable diseases (NCD) cause the death of 40 million people each year, equivalent to 70% of deaths globally. The highest causes of death were vascular disease, chronic lung cancer, diabetes, and other NCD (44,25%; 22%; 9,75%; 4%; and 20%)[1]. Of this amount, 85% are in developing countries, one of which is Indonesia.

One of the main risk factors for NCD is metabolic syndrome[2]. The main parameters are blood glucose level, abdominal circumference, blood pressure, HDL levels, and triglyceride levels[3]. Several markers were then developed to detect an increased risk of metabolic syndrome including cortisol and leptin[4,5].

The hormone cortisol is a hormone that is associated with stress, not only in negative conditions, but also

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in a comfortable and happy condition[6]. Chronic stress is associated with hypercortisolemia and long-term sympathetic nervous system (SNS) activation that results in fat accumulation, especially in the abdomen[7]. Excess fat in the abdomen is one of the parameters of the metabolic syndrome. Identifying risk factors for cortisol is important for stress management as an effort to prevent metabolic syndrome.

Leptin is commonly known as the obese gene. People who are obese have high leptin levels. Leptin is identified as a regulator in regulating body weight. Errors in transportation can cause leptin resistance and cause obesity[8]. A literature review shows that of several markers available, leptin is an appropriate biomarker to identify metabolic syndrome[9].

Research on metabolic syndrome in Indonesia is still very limited. The results of the analysis of the Riskesdas data 2007 conducted by Nurhaedar Jafar showed that the prevalence of metabolic syndrome was 5.2% which increased along with the increasing prevalence of obesity[10]. Research on leptin and cortisol as a marker of metabolic syndrome has never been done before in Indonesia. This study aims to determine the relationship between differences in levels of leptin and cortisol in men and women, the influence of risk factors on metabolic syndrome and risk factors that correlate with leptin and cortisol in men and women in the teacher group.

Methode

The study with a cross sectional study design was conducted on a group of teachers in Makassar City. This study involved 12 selected schools and was part of a cohort study, educating teachers as an effort to prevent metabolic syndrome.

The number of samples that can be analyzed for this study is 86 people (16 men and 70 women). Demographic characteristics (age and sex), stress levels were measured using a questionnaire through interviews with respondents. Interview and measurement of anthropometry (weight, height, waist circumference/ WC) was carried out by trained personnel taken from undergraduate nutrition students public health faculty of Hasanuddin University. Blood collection is carried out by the prodia laboratory.

Metabolic syndrome

Metabolic syndrome is defined using criteria from the results of harmonization of several groups in the world. The following are the limits for determining the risk of metabolic syndrome parameters.

HDL levels, risk if <40 mg / dl male and <50 mg / dl female

Triglyceride levels, risk if ≥ 150 mg / dl

Glucose blood sugar levels, risk if fasting blood glucose levels ≥ 100 mg / dl

Blood pressure, risk if ≥ 130/85 mmHg

Abdominal circumference, risk if > 90 cm for men and > 80 cm for women

Blood samples were taken after fasting respondents for 12-14 hours were taken by medical personnel from the Prodia laboratory. HDL examination is carried out by Homogenous Enzymatic Colorimetric Assay method, examination of triglycerides by using enzymatic colorimetric method, whereas fasting blood glucose examination using the Hexokinase method. Blood pressure was measured in the condition of the respondent being seated, and being relaxed using Mercurial Sphygmomanometer.

Leptin and cortisol

Leptin and cortisol were measured using the enzyme immunoassay test method. Reagents used in the Diagnostic Biochem Canada Inc brand, where cortisol uses reagents with Ref can-C-270 and leptin using reagents with Ref: can-L-4260. Leptin and cortisol examinations were carried out at the Hasanuddin University Hospital Laboratory.

RESULT

Characteristics of samples based on sex can be seen in Table 1. The average age of male samples is higher than women (50,81 vs 48,89) but the stress level in women is higher than in men (29,00 vs 27,56). There are differences in anthropometry in men and women ($p<0,001$). There are differences in levels of leptin and cortisol in men and women ($p<0,001$ and $p=0,005$). Fasting blood glucose and triglyceride levels do not show the difference between men and women. However, there are significant differences in HDL levels, systolic blood pressure, diastolic and abdominal girth, where women are better than men.

The relationship between how many risk factors for MetS can be seen in table 2. The risk factors for age and stress are higher in respondents who experience MetS than those who are only at risk (consecutive p=0,010 and p=0,026). All MetS parameters show a meaningful relationship with MetS (p<0,05) as well as levels of the hormone leptin and cortisol. Respondents who have lower levels of leptin are at risk of developing metabolic syndrome (p=0,016) and respondents who have higher cortisol levels are at risk of developing metabolic syndrome (p=0,014). The relationship of MetS risk factors stratified based on sex can be seen in table 3. There were significant differences in age, systolic blood pressure, fasting blood glucose levels, triglyceride levels, HDL levels, between men and women in respondents who experienced metabolic syndrome.

The relationship between leptin and cortisol in several MetS risk factors and MetS parameters can be seen in Table 4. Leptin hormone is significantly associated with HDL levels and abdominal circumference (p <0,05) while cortisol hormone is significantly associated with fasting blood glucose levels (p < 0,001).

Table 1. Characteristics of Samples Based on Sex

	Variable	Men (n=16)	Women (n=70)	P value*
	Age (Mean±SD)	50.81± 3.89	48.89 ± 5.79	0.210
	Stress level (Mean±SD)	27.56±4.77	29.00±8.28	0.506
Anthropometry	weight (Mean±SD)	73.37±6.48	59.69±5.87	<0.001
	height (Mean±SD)	166.20±5.61	153.05±5.51	<0.001
	BMI (Mean±SD)	26.57±1.99	25.49±2.23	0.081
Hormone	Leptin (Mean±SD)	7.87±6.02	30.64±15.50	<0.001
	Cortisol (Mean±SD)	12.09±4.94	8.64±4.15	0.005
MetS parameter	FBG (Mean±SD)	99.81±25.41	94.46±22.95	0.411
	TG (Mean±SD)	176.81±94.95	135.14±67.70	0.113
	HDL (Mean±SD)	42.06±7.51	58.16±10.90	<0.001
	Systole (Mean±SD)	130.00±12.65	119.71±12.74	0.005
	Diastole (Mean±SD)	85.63±6.29	81.00±7.45	0.024
	WC (Mean±SD)	93.42±3.30	86.66±5.06	<0.001

*Sex difference are using T test

Table 2. MetS Risk Factors

	Mets (n=24)	Risk Mets (n=62)	P value
Age	51.21±3.39	48.48±5.99	0.010*
Stress	31.71±12.01	27.58±4.94	0.026*
BMI	26.29±2.21	25.46±2.19	0.122
WC	89.99±5.57	87.11±5.23	0.027*
Systole	130.42±15.17	118,23±10.79	<0.001**
Diastole	84.58±8,84	80.81±6.60	0.034*
FBG	113.58±34.06	88.44±11.99	<0.001**
TG	198.46±84.08	121.39±58.50	<0.001**
HDL	46.08±10.26	58.68±10.90	<0.001**
Leptin	19.46±12.49	29.09±17.50	0.016*
Cortisol	11.17±5.04	8.54±4.07	0.014*

* P < 0,05 ** P < 0,001

Table 3. MetS Risk Factor by Sex

	Mets		**Risk Mets**	
	Male (n=10)	**Female (n=14)**	**Male (n=6)**	**Female (n=56)**
Age	50.40±4.11	51.79±2.77*	51.50±3.73	48.16±6.13
BMI	27.01±1.97	25.77±2.31	25.83±1.99	25.42±2.23
WC	93.62±3.74	87.41±5.29	93.08±2.69	86.47±5.04
Systole	136±11.74*	126.43±16.46*	120.00±6.33	118.04±11.19
Diastole	86.00±6.99	83.57±10.08	85.00±5.48	80.36±6.59
FBG	101.50±31.37	122.21±34.34*	97.00±12.23	87.52±11.69
TG	212.10±103.80*	188.71±69.29*	118.00±31.88	121.75±60.85
HDL	38.80±6.32*	51.29±9.43*	47.50±6.35	59.88±10.64
Leptin	10.09±6.59	26.16±11.42	4.18±2.06	31.76±16.26
Cortisol	12.69±5.52	10.08±4.55	11.08±4.04	8.28±4.01

*P < 0.05

**P < 0,001

Table 4. Correlation Table Between Leptin and Cortisol With MetS Risk Factors and MetS Parameters

	Leptin			Kortisol		
	Men (n=16)	Women (n=70)	Total (n=86)	Men (n=16)	Women (n=70)	Total (n=86)
Stress	-0.263	-0.083	-0.038	0.130	-0.055	-0.051
Spiritual	-0.069	-0.178	-0.198	-0.293	-0.057	-0.063
Age	-0.226	-0.021	-0.099	0.124	-0.059	0.012
FBG	0.172	-0.150	-0.147	0.153	0.328**	0.302*
TG	0.529*	-0.032	-0.095	-0.352	0.027	-0.003
HDL	-0.212	0.180	0.391**	0.074	0.041	-0.120
Sistole	0.510*	-0.008	-0.136	0.007	0.006	0.097
Diastole	-0.078	0.107	-0.053	0.321	-0.089	0.059
WC	-0.074	0.479**	0.074	-0.483	0.014	0.099
BMI	0.420	0.050	0.067	-0.612*	-0.079	-0.083

*P < 0.05

**P < 0,001

DISCUSSION

This study shows the relationship between levels of leptin and cortisol with metabolic syndrome in teachers who are distinguished by sex. Leptin levels are higher in women than in men. In the group that experienced the MetS and risk of MetS, female respondents had higher levels of leptin than men. Leptin hormone levels are associated with obesity. Research conducted in Korea shows that serum leptin is associated with metabolic syndrome, especially in the body mass index[12]. A meta-analysis conducted by Zeng, et al showed that there was a relationship between leptin and an increased risk of heart and stroke[13].

Leptin is a hormone associated with regulating food intake and energy balance[14]. Leptin is closely related to the level of obesity, where obese people also have higher hormone levels than those who do not obese[15]. This

study showed that the average abdominal circumference and BMI of men were higher than women, however, based on the results of the analysis it was seen a positive correlation with the increase in levels of leptin hormone with abdominal circumference in women. The higher the abdominal circumference, the higher the level of leptin hormone. This study is in line with research conducted in Saudi Arabia, where leptin levels are higher in women and are positively correlated with BMI and abdominal circumference[16].

The hormone cortisol shows a significant relationship with the metabolic syndrome, where respondents who experience metabolic syndrome have higher cortisol levels than those at risk. Hormone cortisol is higher in men than in women, as well as in respondents who experience mets and are at risk of MetS, men have higher cortisol levels than women. This is the same as research conducted by Esteghamati, et al in Tehran, which shows high levels of serum cortisol in men compared to women after being justified by age, BMI, and abdominal circumference[17]. High cortisol levels are strongly associated with a person's stress level[7].

The hormone cortisol can be a marker of the metabolic syndrome. One mechanism that shows the relationship between metabolic syndrome and cortisol is hypothalamic-pituary-adrenal (HPA) active in respondents who experience Mets. One of the active activities of HPA is due to sustained levels of stress[4]. One of the factors associated with stress is work[18].

In this study, stress showed a significant relationship with the metabolic syndrome, but did not show a significant relationship with cortisol levels. A meta-analysis was conducted on 29 cross sectional studies by Pan, et al. Which showed that respondents who experienced higher stress had a higher prevalence of metabolic syndrome than those who experienced less stress[19]. Some mechanisms that can show this relationship are obesity[20], the occurrence of inflammation[21] and an increase in oxidative stress in respondents who are obese[22].

CONCLUSION

Leptin levels are higher in women than in men, but cortisol levels are higher in men than in women. Increased parameters of the metabolic syndrome also increase levels of leptin and cortisol, but there are different parameters that increased in men and women. This study strengthens that the hormone leptin and the hormone cortisol are markers for the determination of the metabolic syndrome.

Conflict of Interest: There is no any conflict of interest within this study and publication

Ethical Clearence: Taken from Hasanuddin University Ethics Committee with number: 969/ H4.8.4.5.31 /PP36-KOMETIK / 2017.

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