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	THE DIFFERENCES ON SALIVARY CORTISOL LEVE CHILDREN BEFORE AND AFTER PSYCHOLOGIC	ELS IN PUBERTY CAL STRESS
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ABSTRACT buckground: Contison is a sitess individue sected a by hypothalamic'r initial y-initial (III A) which affects psychological health conditions and can be measured through salivary examination. Psychological stress can increase salivary cortisol levels. **Objective:** To understand the difference of salivary cortisol levels in pubertal children before and after psychological stress. **Methods:** A quasi-experimental intervention study was conducted at Pencawan junior high school, Medan, North Sumatera, in July – December2019. Subjects were students aged 12-14 years. Psychological stress intervention was given by conducting mathematics test. Saliva was collected before and after intervention. **Results:** 16 subjects consist of 8 male students and 8 female students. This study obtained that there was a significant difference in salivary cortisol levels before and after the subject is given a psychological stress (P=0.005, CI 95%). **Conclusion:** Stress can affect salivary cortisol levels. There was a difference in salivary cortisol levels before and after psychological stress in pubertal children

KEYWORDS : psychologicalstress, salivary cortisol, puberty

INTRODUCTION

Puberty is a complex collection of neuroendocrine processes that occur between childhood and adulthood to produce internal and external physical changes into primary and secondary characteristics for sexual reproduction. Puberty is initiated by reactivation of the Hypothalamic-Pituitary-Gonadal (HPG) axis.1 Stress is a non-specific and comprehensive response to all factors that threaten the body's compensatory ability to maintain homeostasis.2A study in India found that 16% of puberty-aged children experience stress and 17% experience anxiety.³

The cortisol hormone is a stress hormone secreted by Hypothalamic-Pituitary-Adrenal (HPA) which affects physical and psychological health conditions. Some conditions caused by elevated cortisol levels are immune system suppression, insomnia, mood swing, depression, and hypotension.4Psychological stress affects the activity of the HPA axis which results in increased release of cortisol.5Cortisol concentration in saliva is not affected by the amount of secretion velocity or dynamics of secretion and can be used to give a picture of the value of free cortisol in serum. Salivary cortisol is taken in a noninvasive procedure sothat it does not cause stress and is stable at room temperature.⁶

A study conducted in Germany to assess the increase in cortisol in psychological stress in adolescents using a stressor in the form of a wechsler intelligence scale for children IV (WISC IV). This research found that psychological stress can significantly increase cortisol.7 WISC IV consists of verbal and mathematical problems that can increase stress levels.6 In another study conducted in Canada assessed the increase in cortisol in psychological stress in elementary school children by using a stressor in the form of a math test. This study found that mathematics tests can increase cortisol levels in primary school children.⁸

At present there are no studies that assess the effect of psychological stress on salivary cortisol levels in puberty children in Indonesia, especially in Medan.Therefore, the main objective of this study is todetermine the whether there is any difference in salivary cortisol levels in puberty children before and after given psychological stress.

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METHODS

Study Design

A diagnostic study with quasi experimental design was conducted in july until October 2019at Pencawan junior high school, Medan, North Sumatera. The inclusion criteria was students aged 12-14 years who have experienced puberty, with middle socioeconomic level, not orphans and parents with sedentary work.Exclusion criteria was students taking corticosteroid drugs, getting chemotherapy or radiotherapy, suffering inflammation of the oral cavity (gingivitis, stomatitis, caries) and clinical conditions that affect the activity of the HPA axis. This study was approved by the Health Research Ethics Committee of the Faculty of Medicine, University of Sumatra Utara.

All students who fulfilled the inclusion criteria were enrolled in this study after given consent. We interviewed bothparent and student to obtain demographic data.Student's stature was measured using microtoise. Sexual maturation were evaluate according to Tanner sexual stage by pediatric resident, and on male students testicular volume were measured by using orchidometer. Saliva was collected at 08.00 am, previously students had been instructed not to eat, drink, or brush their teeth at least one hour. Students were asked to rinse their mouth with water and then passive drooling methods used to collect approximately 1 ml of saliva. Furthermore, students were asked to complete the questions from math exam at 09.00 pm. After finished, saliva was collected in the same way as before. All saliva samples were stored in an ice box with temperature 2-80C until processed in the laboratory. Salivary cortisol examination was performed using enzyme-linked immunoassay kit DRG® Salivary cortisol (SLV-2930).

RESULTS

There are 16 students who fulfilled the inclusion criteria. From 16 students aged 12-14 years consist of 8 boys (50)% and 8 $\,$

girls (50%), we found that median students age was 13 (minmax12-14) years.Table 1 shows the demographic characteristics of students, including mean weight, height, and stage of puberty.

The Wilcoxon signed rank test showed significant differences before and after the intervention (p < 0.05). Tabel 2 shows that psychological stress affects cortisol levels measured through saliva.

Tabel 1 Demographic characteristics of subjects

Characteristics	Subject
	(n = 16)
Gender, n (%)	
boys	8 (50)
Girls	8 (50)
Father occupation, n (%)	
Entrepreneur	12 (75)
Private employee	0 (0)
Farmer	3 (19)
Government employee	0 (0)
Reporter	1 (6)
Mother occupation, n (%)	
Entrepreneur	3 (19)
House wife	10 (63)
farmer	2 (12)
Nurse	1 (6)
Stage Puberty, n (%)	
Tanner II	14 (88)
Tanner III	2 (12)
Age (years) median (min-max)	13 (12-14)
Weight(kg) median (min-max)	43,5 (30-152)
Height(cm) median (min-maks)	146 (133-158)

Tabel 2 Difference levelcortisol before and after intervention

Variabel	Intervention (n=16)		
	median (min-max)	р	
Pre	0,32(0,11-0,98)	0,005	
Post	0,77(0,45-2,49)		

*Wilcoxon test

DISCUSSION

Puberty is a complex biological process that occurs in the transition in childhood and adulthood which takes place in several stages and is influenced by various factors such as genetic, nutritional, environmental and socioeconomic. This factor is responsible for the onset of puberty and subsequent development towards complete maturity.9 Psychological stress has been known to cause the activation of the HPA system.1

Cortisol is the main glucocorticoid that plays an important role in body health, keeping blood sugar and blood pressure normal.22 Increased cortisol secretion occurs in response to stressful conditions.2Salivary cortisol concentrations describe free cortisol in the body. Salivary cortisol is used as a psychoneuroendocrinological examination because it is noninvasive, painless and easy to do to obtain a sample.¹¹

The most commonly used method is saliva removal through cotton swabs (Salivette®) and passive drooling in sterile pots. Passive drooling method is one of the recommended methods because it is cheap and can be done to measure almost all analytes. The advantage of this method is that it can provide pure samples, large sample volumes, and is easy to do.¹

Based on this study found significant differences between salivary cortisol levels before and after psychological stress in puberty children in the form of mathematical tests, namely an increase in salivary cortisol levels in both boys and girls. This is consistent with theories about the relationship of hormonal adaptation responses to stress conditions. The release of cortisol into the bloodstream is the result of a cascade that begins in the hypothalamus. Specifically, corticotropin releasing hormone (CRH) is synthesized and released by the hypothalamic paraventricular (PVN) nucleus into the portal blood circulation. When CRH reaches the anterior pituitary gland, it stimulates the secretion of adrenocorticotropic hormone (ACTH). ACTH enters the systemic blood circulation, and stimulates the adrenal cortex to synthesize and excrete glucocorticoids, with cortisol being the main glucocorticoid in humans.13,14 Exposure to psychological stress reactivates the activity of the HPA axis, which results in increased cortisol secretion to maintain homeostasis. This increase in cortisol secretion is controlled by negative feedback mechanisms that detect elevated cortisol levels by receptors located in several brain regions such as the hippocampus, hypothalamus and pituitary gland.14

Previous studies in Canada found that mathematics tests can increase cortisol levels in primary school children. The study also compared children who could do mathematics with children who could not do mathematics. This study found cortisol levels in children who could not do math higher than children who could do math.8

There are some limitations of this study. The limited number of samples and only done in one school resulted in the results of this study still could not be applied, so it needs to be done more extensive research involving many schools and a larger number of samples so the results can represent the general population.There was no division of sample groups that did not like mathematics with those who liked mathematics.

In conclusion, psychological stress can affect cortisol levels as measured through saliva in puberty children.

REFERENCES

- Herting MM, Sowell ER. (2017), "Puberty and structural brain development in 1. humans." Front Neuroendocrinology, 44, 122-37.
- Sherwood L. (2014), "The peripheral endocrine glands. In: Sherwood L, 2. editors. Human physiology from cells to system. 7th editions." United States: Cengage Learning. p. 700-9. Nair BK, Elizabeth KE. (2016), "Prevalence of stress, anxiety, and its correlates
- 3. among adolescents in Kannur district, Kerala." Int J Health Sci Res, 6:225-8.
- Kandhalu P.(2013), "Effects of cortisol on physical and psychological aspects of the body and effetive ways by which one can reduce stress." Berkeley Scientific Journal, 18, 14-6.
- Wegner M, Koedijker JM, Budde H. (2014), "The effect of acute exercise and 5. psychosocial stress on fine motor skills and testosterone concentration in the saliva of high school students." PloS ONE, 9:1-7.
- Zhang Q, Dou J, Gu W, Yang G, dan Lu J.(2013), "Reassessing the reliability of 6. the salivary cortisol assay for the diagnosis of Cushing syndrome." J Int Med Res, 41,1387-94.
- Wegner M, Muller-Alcazar A, Jager A. (2014), "Psychosocial stress but not 7. exercise increases cortisol and reduce state anxiety levels in school classes results from a stressor applicable in large group settings." CNS NeurolDisord Drug Targets Science Publisher, 13:1015-20.
- Mcquarrie MAM, Siegel LS, Perry NE, Weinberg J. (2014), "Reactivity to stress 8. and the cognitive components of math disability in grade 1 children." J learn disabil, 47,349-65
- Pulungan AB, (2018) "Pertumbuhan di masaPubertas, In: Batubara J, Tridjaja B, Pulungan AB, editors. Buku ajar endokrinologianak. 2nd edition." Jakarta: IDAI, 92-130.
- Zankert S, Bellingrath S, Wust S, Kudielka BM. (2018), "HPA axis responses to psychological challenge linking stress and disease: what do we know on sources of intra and interindividual variability?."].psyneun,1-9
- Cay M, Ucar C, Senol D, Cevirgen F, Ozbag D, Altay Z, et al. (2018), "Effect of 11. increase in cortisol level due to stress in healthy young individual on dynamic and static balance score." North ClinIstanb, 5:295-301
- Salimetrics. (2013), "Saliva collection and handling advice. , Available from: 12. http://hormone.mc.vanderbilt.edu/Saliva_Collection_Handbook.pdf Tsigos C, Kyrou I, Kassi E, Chrousos GP (2000), "Stress, Endocrine Physiology,
- 13. and Pathophysiology. (Updated 2016 march 10). In: Feingold KR, Anawalt B, Boyce A, editors." South Dartmouth:MDText.com, 1-46. Lai JCL. (2014), "Psychosocial stress and salivary cortisol in older people: a
- 14. brief review." Journal of aging access, 1-5.