The Impact of Antenatal *Coping Skill Training* (ACST) towards Cortisol and IgG Serum Level among Pregnant Women

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ABSTRACT

Introduction: Stress coping skill is beneficial to make better outcomes of pregnancy and childbirth. The purpose of this study was to examine the impact of antenatal coping skill training on Cortisol and IgG levels. **Method:** This study used a randomized pre-test post-test control group design in which the ages of primigravida (24-34 weeks) in Semarang City Public Health Center were selected randomly. The mothers were randomly assigned to be an experiment group (N=31) and a control group (N=31). There were two pregnant women who dropped out because of giving birth. The experiment group was given the standard antenatal education and antenatal coping skill training while the control group was given the standard antenatal education only. The data collection was conducted in 4 weeks. Cortisol and IgG serum level were taken at the first week before the intervention and fourth week after the intervention. Cortisol and IgG serum level were measured by using ELISA method. The data analysis employed dependent sample t-test and independent sample t-test. **Results:** There was a significant change over Cortisol serum level for the intervention group ($p<.01$), but not in the control group. However, there was a significant change in the decrease of IgG serum level in the control group ($p<.01$). **Conclusion:** Antenatal coping skill training is predominantly effective to reduce Cortisol and enhance IgG serum levels. Thus, it is important for pregnant women to join antenatal psychoeducational training.

Keywords: *coping skill, cortisol, IgG serum, primigravida*

During pregnancy, women are more susceptible to experience stress than during postpartum.[1] The mother has a chance to increase stress following period of pregnancy.[2] These stress conditions can produce cortisol which suppresses the immune system that is immunoglobulin G (IgG). The IgG is an immunoglobulin produced by plasma cells derived from mature B lymphocyte proliferation. When the immune system is depressed then pregnant women are susceptible to be infected.[3] Pregnant women who experience stress and possess a lack of coping resource during pregnancy are more likely to encounter at least one pregnancy complication namely preterm birth (PTB) or shorter gestation and low birth weight (LBW).[4,5] According to Riskesdas (2013), LBW birth rate in Indonesia is still quite high, that is 10.2%.[6] Stress that occurs early in pregnancy will also cause the onset of hypertension in pregnancy and preeclampsia in the future because of excessive stimulation of the autonom nervous system.[2] While the psychological condition of the mother during pregnancy affects the output of labor and postpartum, mothers who have psychological problems during pregnancy tend to have problems in the output of labor and postpartum.[7] Thus, it is immediately clear that stress during pregnancy will affect a golden period in the first 1,000 days of life namely 370 days of gestation period and 730 days after birth which happens up to two years of life.

Antenatal education (AE) is one of the efforts to prevent problems and complications during pregnancy in pregnant women, in which an increased knowledge and a good preparation for childbirth are the main concerns. However, conventional AE is focused on delivering knowledge rather than preparing pregnant women for strengthening and identifying the sources of coping and self-confidence to face the delivery. There is also a mismatch of AE implementation in which the material is presented with the

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information needed by mother as expectant parents.[8,9] The adaptability of the mother during pregnancy is strongly associated with the mother's coping skills that distinguish the effects of psychological and physiological stress.[10] stress coping skill is the mother's ability to cope with and adapt to stress. Stress coping skill during pregnancy is meant to influence better outcome of pregnancy and childbirth, so that it can minimize or prevent the negative effects of emotional, behavioral, cognitive, and physiological responses to stress. Coping skills serve to select and implement appropriate efforts to cope with stress. In addition, it poses as an important resource bastion of pregnant women and children over the effects of the potential dangerous exposure of pregnancy stress.[11] Based on the aforesaid background, it is imperative to examine the impact of antenatal coping skills training (ACST) on the cortisol and IgG serum level in pregnant women. In addition to the urgency of the examination of the impact of antenatal coping skills training, there has been no research on antenatal coping skills training to pregnant women, so that it is justifiable to conduct the research to disclose the impact of antenatal coping skill training (ACST) on the cortisol and IgG serum level in pregnant women.

MATERIALS AND METHODS

Participants and Procedure

This study was a randomized study with pre-test post-test control group design. The Experiment aimed to examine any changes over Cortisol and IgG serum level from the intervention of ACST. The study was conducted at sixth Public Health Centers (PHC) of Semarang City, in which 37 health centers in Semarang City were chosen randomly. There were three PHCs as a control group and three PHCs as an experiment group. Six PHCs were randomly chosen to be three PHC control group and Each PHC held one standard of AE or ACST with 10 – 11 pregnant women for each PHC. The subjects in this study were 62 pregnant women *primigravida* who encountered the end of second trimester and early third trimester of pregnancy (24-34 weeks). In addition, the subjects also experienced normal pregnancy which possessed the productive age ranging from 20 up to 35 years old. Furthermore, the subjects were also demanded to possess exclusion criterion namely no history of psychological problems. In addition, the subjects must not come from single parent families. Subjects were coming from each health center over six PHCs were contacted and informed to participate in this study voluntarily. Subjects who met the criteria and were approved to participate were randomly chosen as the experiment group (N=31) and the control group (N=31). During the study there were two mothers from the control group who dropped out at the third week because of giving birth. Thus, at the end of the study, there were 60 subjects. Each PHC applied one AE class which consisted of 10 – 11 pregnant mothers. Control group was given AE standard that is developed by Health Ministry program provided in PHC. Intervention of ACST in the experiment group was done by giving AE standard and ACST that were given in the same session of antenatal education classes.

Measures/Instruments

Tools and materials in this study were the AE module package and the antenatal coping skill training (ACST). AE module has been standardized as an AE guideline in Indonesia issued by the Ministry of Health. ACST module was developed through literature reviews of stress coping skills. ACST module was also reviewed and validated by a psychologist. It was also validated through several stages of testing and refinement. At each meeting, there is a tool in the module consists of post-test knowledge, and evaluation of the ACST that have been used to revise the module.

The stress coping skills module consists of three parts. The first material contains material regarding stress, which is elaborated based on the definition of stress, sources of stress, factors that affect stress, psychological and physiological reactions to stress, stress on health, and stress in pregnant women as well as sources to support pregnant women. The second material discusses coping skills in pregnant women including problem-focused coping and emotion-focused coping. The material of the third meeting discusses about the principle of intervention coping, types of intervention coping, and the coping skills practice.

There were two kinds of books employed for the study that is facilitator's book and participants' book. Facilitator's book contains a guidance of delivering the materials and the goals while participant's book contains goals for each session, materials and exercise

at home and during AE class. The length of time for each meeting of the AE standard group was 120 minutes and the group of ACST was 190 minutes.

Interventions at each PHC were carried out by six trained midwives who have been certified as AE facilitators by the government. Each midwife held one class in each PHC. Three facilitators who held experiment group was also trained by certified psychologist to deliver the ACTS. Three midwives were given certified ACTS training. In other side, three midwives also delivered ACTS classes as a trial before implementing ACTS module.

The level of cortisol and IgG serum was measured by using ELISA method. Subjects were measured two times in the form of Cortisol and IgG serum level with venous blood sample. The venous blood sample was taken from the subjects at 09.00 – 10.00 a.m. Cortisol and IgG serum level (pretest) were measured at the time of the first contact (week one) with a gestational age of 24 weeks - 34 weeks before AE and ACST intervention. Posttest Cortisol and IgG serum level were measured at week four after intervention.

Ethics

Ethical clearance was proved by ethical committee of medical faculty of Diponegoro University and Kariadi Hospital number 767/EC/FK-RSDK/2016. All participants that involved in this study were given informed consent to participate in this study voluntarily.

Statistics

Bivariate analysis using a dependent t test was done to determine the differences of Cortisol and IgG serum level before and after the treatment within group, and the independent t test was done to determine the difference between control and treatment groups,[12] which the *p* value < .05 showed significant differences. T-test were employed because the values were normally distributed, which the p value >0.05.

RESULTS

Cotisol serum Level

The study results clearly revealed that the experimental group which received ACST encountered sharper decrease in cortisol levels (-47.132) compared to the control group who received AE (-14.247). Cortisol levels were measured by ELISA with normal levels of 50-230 ng / ml. Changes of serum cortisol levels before and after the intervention are shown in the Table 1 and Figure 1 below.

In the experimental group, the difference in cortisol levels before and after the ACST were analyzed by using paired samples t-test which resulted in a value of p <.01. The findings showed that there were significant differences between the mean of cortisol levels before (314.83) and after (267.70) at experimental group. The mean of cortisol changes levels amounted to -47.132 with standard deviations of 85.92.

In the control group, cortisol levels before and after the AE were analyzed by using paired samples t-test and found *p* value = 0.461. Underlying the aforesaid result, it can be concluded that there was no difference in cortisol levels in the control group before and after AE was being given despite the change in the average levels of cortisol amounted to -14.247 with a standard deviation of 102.65.

Conversely, different test results of mean change (delta) in cortisol levels between the two groups showed that there was no significant difference in cortisol levels (Δ=-47.132 and Δ = -14.274); p <0.181) in the experimental group who received the ACST and the control group that received AE.

IgG serum Level

The findings of this study demonstrated that the experimental group who received ACST posed significant increase in mean of IgG (.654) compared with the control group who received AE. In contrast, the control group experienced a mean decrease in IgG levels (-1.563).

IgG serum levels were measured by ELISA with a normal level of 4.4 - 21.3 mg / ml. The changes of IgG serum levels before and after treatment are shown in Table 2 and Figure 2 below.

In the experimental group, differences in levels of IgG serum before and after the intervention of ACST are tested using a paired sample t-test and p value = 0.234. By looking at the study result, it is immediately clear that there was no difference in the levels of IgG before and after the intervention of ACST. Evidence to this is the fact that the mean levels of IgG before (9.33) and after

intervention of ACST (9.98) was changed at 0.654 with standard deviations of 3.054.

In the control group, the level of IgG before and after being given AE was tested by using paired sample t-test. The results showed that the value of p <.01 indicates that there was significant difference between the mean IgG levels before and after being given AE. The mean levels of IgG before (9.94) and after (8.38) being given AE was changed at -1.563 to 2.193 of standard deviations.

Furthermore, differences between the mean changes in the two groups were tested by using independent sample t-test. Different test results showed differences in the mean change in IgG levels significantly (Δ=.654 and Δ = -1.563); p <0.01) in the experimental group and the control group.

The mean change in IgG in the experimental group who received ACST amounted to 0.654 with standard deviations of 3.054. The experimental group had experienced an increase of IgG levels. In contrary, the mean changes in levels of IgG in the control group that received AE was -1.563 and the standard deviation of 2.193. Considering the aforesaid facts, it can be stated that the control group experienced decreasing levels of IgG.

Table 1. Cortisol serum level in pre and post intervention within and between group

Cortisol	Group		
	ACST (n=31) mean±SD	AE (n=29) mean±SD	*p*§
Pre	314.83 ± 126.87	290.47 ± 84.91	.389
Post	267.70 ± 96.37	276.21 ± 84.91	.761
p¥	.005	.461	
Δ Cortisol	-47.132± 85.92	-14.247± 102.65	.183

¥ pre vs post: *paired t-test*

§ *Independent t-test*

Tabel 2 IgG serum Level at pre and post intervention between group

IgG serum Level	Group		
	ACST (n=31) mean±SD	AE (n=29) mean±SD	p
Pre	9.33 ± 2.64	9.94 ± 2.95	.355
Post	9.98 ± 3.62	8.38 ± 2.55	.051
p¥	.243	.001	
Δ IgG	.654± 3.054	-1.563± 2.193	.002§

¥ pre vs post; *paired t-test*

§ *Independent t-test*

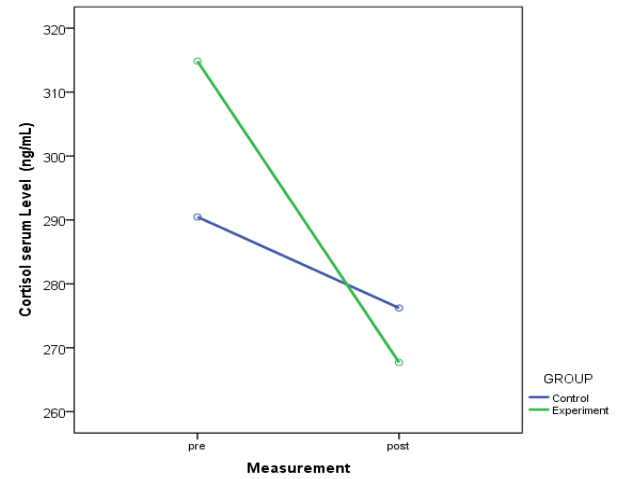

Figure 1. Cortisol serum level pre and post intervention between groups

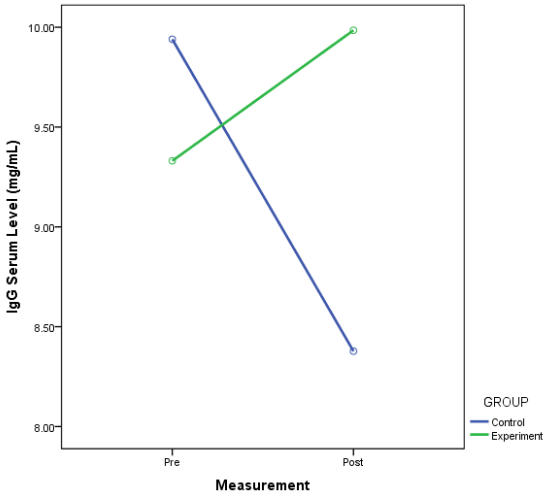

Figure 2. Pre and Post IgG serum Levels Between groups

DISCUSSION

The study that was aimed to examine whether ACTS is more influential to decrease cortisol levels compared to AE is clearly proven as the study result showed the differences in changes significantly in cortisol levels before and after being given the ACST than the pregnant women who was given AE only. Both groups equally encountered the decreased cortisol levels. However, the decreased cortisol levels in the experimental group who were given intervention ACST is greater than the control group who were given AE.

In pregnancy there is an increase of cortisol 2- 3 times of normal adult levels of cortisol that is 50-230 ng / ml. Cortisol levels in pregnant women are influenced by the role of the HPA axis in response to stress and corticotrophin releasing hormone (CRH) which regulate the dispensing of adrenocorticotropic releasing hormone (ACTH) from the pituitary. In addition, is the Cortisol levels also influenced by the feedback from synthesis and expenditure of cortisol. The role of the estrogen and progesterone hormones, especially in pregnancy, also poses significant contribution in increasing cortisol level during pregnancy. Estrogen contributes to decrease cortisol excretion in urine and decrease cortisol ties with transcortin. Progesterone also contributes to decrease cortisol bound by transcortin through the

mechanism of bonding with transcortin competition where transcortin has a higher affinity for binding to progesterone compared to Cortisol, so that the amount of free cortisol will increase. Another factor affecting the level of Cortisol is the adrenal glands of the fetus, of which 0.5% fetal body weight at 20 weeks increases up to 20 times of the weight of adrenal adults and the adrenal glands will return to normal after the birth.[13,14]

On the other hand, Cortisol plays a major role in helping lung maturity of the infants during pregnancy. The cortisol level will rise in gestational age of 34-36 weeks. However, high levels of cortisol show important predictor of preterm pregnancy or preterm pregnancies. One of the reasons for the increased levels of cortisol is a perceived stress which then triggers the beginning of delivery process.[15,16]

It can be stated that intervention of ACST is proven to reduce stress levels for the pregnant mothers who then leads to a significant contribution to decrease cortisol levels in pregnant women. The decreased stress levels will lead to activate the HPA axis response and neuroendocrine system which are affecting cortisol production. Intervention of ACST presented materials which contain knowledge about pregnancy, childbirth, postpartum and newborn care, as well as other relevant materials deal with coping skills to stress during pregnancy. Pregnant mother who was given those materials may become a provision for the mothers to find out more about the development of labor until the time of parturition and figure out how to cope with stress during pregnancy. Maternal knowledge which was acquired through ACST supplied mothers to learn more about the condition of pregnancy and what needs to be prepared at the time of pregnancy and afterward. The readiness of mother after finding out about the condition of pregnancy, childbirth and postpartum and newborn care affect the psychological condition; reduce stress, and impact on the levels of cortisol.

The decreased cortisol in the experimental group who received ACST was greater than the control group who was only given AE course. This fact proves that the material which was presented and drilled through the ACST has significant impact for the mother to lower the stress levels. This fact is acceptable because the ACST material trains the mother to possess an ability or skill of interventions coping. The mastery of the types of coping are trained to the pregnant women in the experimental group which was aimed to make the mother to be able to change the source of stress and to challenge and restore homeostasis in pregnant woman's body. In such circumstances the mother is able to change the state of stress into eustress that actually benefits mothers to achieve satisfaction and well-being of pregnant women.[17]

The findings of the study were in line with the research over the interventions performed on pregnant women through psychoeducation intervention and cognitive-behavioral intervention in which the interventions were given 8 times with 90 minutes for the length of time for each meeting. The study showed that pregnant women who received the intervention encountered a decrease in cortisol levels after the intervention but there was no difference in a change of cortisol after 3 months postpartum.[18] Increased levels of cortisol-induced stress in pregnancy affects the risk of premature birth, and BBLR.[19,20] An increased cortisol during pregnancy also poses as a strong predictor of the outcomes in infants which discloses that the babies born will have a low Apgar score values, and affect the development of children.[21,22]

The study aimed to examine whether ACST is more beneficial to increase in IgG serum levels compared to AE was clearly proven. The results showed that an increase in IgG serum levels were greater in the experimental group which received the intervention ACST compared with a control group who was given AE. The experimental group experienced an increase in IgG serum levels, in contrast to the control group which experienced a decline in the average levels of IgG serum. The decreased IgG serum levels

in pregnancy are common, not only IgG, but also other types of immunoglobulin like IgA and IgM serum level. During pregnancy, the mother experiences a suppression of the immune system in order to receive and retain the conceptus for avoiding rejection from the body. The decreased level of immunology in the body is maintained until the age of pregnancy. In such circumstances, pregnant women are more susceptible to massive infection exposure.[23] The factors that influence IgG serum levels in the body beside of pregnancy is nutrition and the presence of massive infection.[3]

The other condition that affects the levels of immunoglobulin or immune system is the psychological condition. One of the most paramount psychological conditions which affect the levels of immunoglobulin or immune system is maternal stress. Maternal stress will stimulate the increase of cortisol levels through the mechanism of the HPA axis. Increased levels of cortisol are resulted from stress condition of the pregnant women which then affects the immune suppression that is immunoglobulin G (IgG). The IgG is an immunoglobulin produced by plasma cells derived from mature B lymphocyte proliferation. Cortisol in the blood stream will suppress the immune system by suppressing the lymphocyte B cells that do not produce immunoglobulin.[3] IgG antibodies pose a predominant role as the bastion of a mother in combatting either viral infection or bacterial infection. The mothers who have lower levels of IgG are then more vulnerable to viral and bacterial infections. It also affects the health of the mother and baby during pregnancy because the IgG antibody is the only antibody that can go across the placenta in pregnant women and protect the fetus from an excessive infection exposure.[24]

The ACST intervention through emotion focused coping (EFC) and problem focused coping (PFC) trainings in pregnant women allow the mothers to change the stress into eustress. Those trainings also allow mothers to master the ability to suppress the symptoms of stress. Furthermore, the trainings give major impacts to maximize the immune function through the mechanism of cytokines circulation and suppression of the inflammation response.[25] It is advantageous for mothers to improve one immune system especially IgG which has significant role in protecting the mother and infant from the exposure of viral and bacterial infections. This is consistent with the findings that pregnant women who received ACST have elevated levels of serum IgG, while pregnant women who did not receive ACST pose decreased IgG, although they possess maternal serum IgG levels within normal limits ranging from 4.4 -21.3 mg / dl.

CONCLUSION

Compared to AE, ACST is more beneficial and influential to decrease Cortisol levels. The decrease of the cortisol levels in the experimental group after the intervention of ACST is sharper than the decrease of the Cortisol levels in the control group after being given AE.

Compared to AE, ACST is more influential to increase IgG levels. The experimental group experienced an increased IgG levels after the administration of ACST while the control group encountered decreased levels of IgG after being given AE.

ACKNOWLEDGEMENTS

Many thanks are dedicated to the significant and predominant contributions given by the health centers. In addition, the gratitude is also dedicated to the midwives as facilitators and pregnant women who involved in this research.

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