

Exposure Mosquito Coil and FT₄ Serum Level in Pregnant Women

Eko Ardiansyah¹, Sulistiyani Sulistiyani², Onny Setiani²

¹ Department of Environmental Health, Faculty of Public Health, University of Diponegoro, Semarang, Indonesia

² Department of Environmental Health, Faculty of Public Health, University of Diponegoro, Semarang, Indonesia
email : ekoardiansyahkesmas@gmail.com

Abstract

Free Thyroxine (FT₄) level is one of the parameters that can be used in the diagnosis of thyroid function disorder. Thyroid function disorder can cause the pregnancy problems both for fetus development and birth result. This result aimed to evaluate the level of FT₄ serum in pregnant women exposed to mosquito coils. This research was a cross-sectional analytic study conducted in the coastal area of Brebes district. Respondents consisted of 40 pregnant women, 20 respondents pregnant women exposed to mosquito coils and 20 pregnant women not exposed to mosquito coils within the second and third trimester of pregnancy. Statistical analysis was performed using SPSS 21.0. Mean (SD) level of FT₄ serum on all respondents was 13.86 pmol/L. Pregnant women exposed to mosquito coils had an average FT₄ level of 15.70 pmol/L while the pregnant women not exposed to mosquito coils had FT₄ levels of 12.02 pmol/L. From the statistical analysis, there was a difference in the average of FT₄ levels between respondents who involved and not involved in farming. There was a significant difference on a mean of FT₄ level between pregnant women who exposed to mosquito coils and not exposed to mosquito coils.

Keywords: The Function of Thyroid; FT₄ Level; Pregnant Women; Mosquito Coils

I. INTRODUCTION

Thyroid function disorder in pregnancy has been associated with the various pregnancy problems such as abortion, pre-eclampsia, preterm labor, low birth weight, even death.(1) According to the report of Basic Health Research (Riskesdas) 2013, around 0.4% or approximately 706.757 people from all Indonesian population aged ≥15 years experienced thyroid function disorder and around 17.04% or about 120.447 people are from Central Java Province.(2) Thyroid function disorder in Brebes District about 46.2% in women of childbearing age.(3) In general, factors that causing thyroid function are nutritional status, food intake, gender, age, smoking habit, genetic factor, area condition, use of certain drugs and alcohol consumption, also the chemical's exposure such as mosquito coils.(4)

Mosquito coils use synthetic pyrethroids such as organophosphates and malathion. These compounds can affect the liver system, thyroid, nervous system, immune system, and endocrine system. Exposure to mosquito coils has been shown to have an adverse health effect. The behavior of a person who uses mosquito coils at night in a closed environment with cancer, disorders of the endocrine system, and immunological disorders.(5)

Several studies found that mosquito coils exposure associated with thyroid function disorder, such as exposure to DDT, amitrole, and carbamate can trigger mumps, decrease the total level of Tri-iodothyronine (T₃), thyroxine (T₄), free T₄, and increase the levels of free Tri-iodothyronine (FT₃) and thyroid stimulating hormone.(6).The diagnosis enforcement of thyroid function disorder on pregnant women should notice to physiological changes occurred during pregnancy, especially during the first trimester of pregnancy, the research was focused on the second and third trimester of pregnancy. Physiological changes in pregnant women can occur like the increase of estrogen hormone, plasma volume and TBG concentration in the plasma. The increasing of TBG can increase the levels of thyroxine which occur until the end of the first half of pregnancy.(7)

The thyroid function examination can be conducted by examining thyroxine hormone levels which generally recommended as a standard examination for the diagnosis of thyroid function disorder, primarily held in the free form of thyroxine hormone or called free thyroxine hormone (FT₄). The analysis of free thyroxine hormone levels is more accurate in detecting thyroid function as it is not affected by the binding level of proteins which can be influenced by many factors such as diseases, genetics, and medicine. (8). The research regarding the effects of mosquito coils and thyroid function with the parameter of FT₄ level on pregnant women still rarely conducted. Therefore, it needs further studies to observe the FT₄ level of pregnant women exposed to mosquito coils.

II. MATERIALS AND METHODS

This Research using a cross-sectional research design. This research was a joint research Faculty of Public Health Diponegoro University and has been approved by the ethics commission of medical faculty at Diponegoro University. Research subjects were 40 pregnant women. The number of subjects determined by the judgment of the researcher and considering the availability cost. The inclusion criteria of the subjects were aged 18-35 years, pregnant women on the second trimester, had normal weight, never prescribed high doses of iodine capsules during pregnancy, not smoking, not consuming alcohol, caffeine, had no family history of thyroid disease, and not suffering from serious illness. The inclusion criteria of respondents including received radiation exposure on the neck and head from medical treatment, experiencing pregnancy complications, and ever consuming drugs which causing thyroid function disorder.

The variable measured for all subjects including mosquito coils exposure and FT₄ level. The mosquito coils exposure variables measured using a structured questionnaire while the FT₄ level measured by the Electrochemiluminescence immunoassay method "ECLIA" (unit pmol/L). Data collection officers were Master students of Environmental Health Postgraduate Program of Diponegoro University who have trained before. The Cito Clinic Laboratory examined the blood sampling and FT₄ parameters. the reference value of FT₄ levels determined by Cito laboratory is 9.0 - 20.0 pmol / L. Before the research, an explanation was made to all prospective research subjects about the research procedure then subject who was willing to be involved was asked to sign the informed consent form. The collected data then processed using SPSS 21.

III. RESULT

Table 1. Characteristics of subjects

Characteristics	Total (n=40)	Exposed to mosquito coils (n=20)	Not exposed to mosquito coils (n=20)
Age			
- 18-25	27.5	17.5	10.0
- 25-30	57.5	25.2	32.5
- 30-35	15.0	7.5	7.5
Education			
- Not attending school	7.5	2.5	5.0
- Elementary school	22.5	15.0	7.5
- Junior high school	57.5	27.5	30.0
- Senior high school	12.5	5.0	7.5
Occupation			
- Housewife	57.5	17.5	40.0
- Entrepreneur	12.5	10.0	2.5
- Private employee	7.5	7.5	0.0
- Farmer	22.5	15.0	7.5

Table 1 shows the proportion of subjects by age, education level and occupation. In this study, almost half of the subjects were housewives, and more than half had junior high school. Mean (SD) level of FT₄ serum on all respondents was 13.86 pmol/L. Respondents who exposed to mosquito coils had Mean (SD) FT₄ serum level of 15.70 pmol/L while the not exposed to mosquito coils FT₄ levels of 12.02 pmol/L.

Table 2. FT₄ level on Pregnant Women

Category	n	Min	Max	Mean	P
Exposed to mosquito coils	20	14.06	18.55	15.70	0.000
Not Exposed to mosquito coils	20	9.66	15.10	12.02	

From the Independent-Samples t-Test showed that level of the sig. F was 1.402 means that Ho accepted which means that both population variants were identical (Equal Variance assumed). Because sig F was Equal Variance assumed then the t-test using Equal Variance assumed. The t value of Equal Variance assumed was 0.244 with Sig. (2-tailed) was 0.000 or less than 0.05 so there was a mean difference of FT₄ level in pregnant women who exposed or not exposed to mosquito coils.

IV. DISCUSSION

This result aimed to determine the level of FT₄ serum in pregnant women exposed to mosquito coils and not exposed to mosquito coils. A total of 40 subjects aged 18-35 years old. The subjects were selected according to

predefined inclusion criteria. In this study, it was known that all respondents have FT₄ level within reasonable limits. However, there was a tendency of respondents who exposed to mosquito coils had the FT₄ level lower than respondents who are not exposed to mosquito coils. The respondents exposed to mosquito coils had an average FT₄ level of 15.70 pmol/L while the respondents who not exposed to mosquito coils had the FT₄ level of 12.02 pmol/L.

Research on mice found a disturbance of thyroid function due to peretroid exposure is a compound contained in the mosquito coils.(9) Some findings proved that chemicals such as mosquito coils inhibit the TPO (thyroid peroxidase) formation, changed the ability of the follicle to produce T₄ and T₃, even in environments with adequate protein and iodide content.(10)

The mechanism of chemical materials including mosquito coils can disrupt the thyroid metabolism through (1) inhibition of iodide retention on thyroid cell membrane through blockage of sodium-Iodide importer; (2) inhibition of the tiroperoksidase synthesis; (3) binding protein transthyretin transport in the bloodstream; (4) change the catabolism of the liver phase 2 by interfering the work of the enzyme glucuronic transferase, and sulfotransferase T₃ and T₄; (5) alters the metabolism of T₄ which arranged by deiodinase; and (6) changes in hormone transportation crosses the cell membrane and changes the cell receptor (TSH receptor).(10)

V. CONCLUSION

In this research, there was a significant difference in the average levels of FT₄ on pregnant women who exposed to mosquito coils and not exposed to mosquito coils even the standards of FT₄ on pregnant women involved in farming still in reasonable limits. However, the tendency of FT₄ levels in pregnant women who exposed to mosquito coils was upper than that who not exposed to mosquito coils.

VI. ACKNOWLEDGMENTS

Thanks to: Lecturers team at the Faculty of Public Health Diponegoro University who has allowed authors to participate in the research, Cito Laboratory Officers, all health workers in Brebes District, all the research subjects, and the entire research team.

References

1. Saraladevi R, Kumari TN, Shreen B, Rani VU. Prevalence of Thyroid Disorder in Pregnancy and Pregnancy Outcome IAIM. 2016;3(3):1-11.
2. Riset Kesehatan Dasar 2013, (2013).
3. Suhartono, Dharminto. Keracunan Pestisida dan Hipotiroidisme pada Wanita Usia Subur di Daerah Pertanian. Kesmas: National Public Health Journal. 2010 2010-04-01:217-22.
4. Knudsen N, Laurberg P, Perrild H, Bulow I, Ovesen L, Jorgensen T. Risk Factors For Goiter and Thyroid Nodules. Thyroid. 2002;12(10):879-88.
5. Raju S, Raman, Sridevi N. Study of Safety of Mosquito Repellants IOSR-JDMS. 2015;14(1): 42-5
6. Brucker-Davis F. Effects Of Environmental Synthetic Chemicals On Thyroid Function. Thyroid. 1998;8(9):827-56.
7. Qin YY. Trimester and Method Specific Reference Interval for Thyroid Test In Pregnant Chinese Women:Methodology, Euthyroid Definition of Reference Intervals. Clinical Endocrinology. 2011;74:262-9.
8. Yeasmin S, Hossain AA, Yeasmin T, Amin MR. Study of Serum FT₃, FT₄ and TSH Levels in Pregnant Women. Medicine Today 2016;27(2):1-4.
9. Zhang J, Hisada A, Yoshinaga J, Shiraishi H, Shimodaira K, Okai T, et al. Exposure to pyrethroids insecticides and serum levels of thyroid-related measures in pregnant women. Environmental research. 2013;127:16-21.
10. Lyn Patrick N. Thyroid Disruption: Mechanisms and Clinical Implications in Human Health. Alternative Medicine Review 2009;14:326-46.