

LOCAL WISDOM OF JEMBER COMMUNITY IN REDUCING CYANOGENIC LEVELS TO LOWER URINE THIOCYANATE LEVELS

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INTRODUCTION

Disorders caused by iodine deficiency remains a global health problem in the world with a prevalence of 30.6% in 2007 (De Benoist et al., 2003; De Benoist et al., 2008). The causing factors are not only limited to iodine deficiency. Instead, other factors of IDD are goitrogenic substances; one of them is thiocyanate resulted from cyanide detoxification. The work mechanism of thiocyanate disrupts thyroid function by inhibiting the uptake of the iodine and interferes with the thyroid peroxidase (TPO) activities (Gaitan, 1990; Taurog, 1970; Van Etten, 1969; Stoewsand, 1995; Virion et al., 1980 cit Chandra & Ray, 2001; Chandra et al., 2004; Delange, 2000; Erdogan, 2003; Gibbs, 2006; Sinebeeh, 2007; Semba & Delange, 2008). In addition, small amount of cyanide is always available in many kinds of plants commonly consumed by community. Goitrogenik source foods are easily accessible by the community because the prices are cheap or they can be self-planted (Nio, 1989; Chandra et al., 2004).

Some studies mention that most of the goitrogenic substances do not cause clinical effects except they are going along with iodine deficiency. Therefore, the consumption of goitrogenic substances becomes etiologic agent in an endemic area (Zimmermann et al., 2008). Jember is one of regencies in East Java which experiences an increase in TGR from 21.94% in 2003 to 23.57% in 2007. Most of its districts are included in the category of endemic goiter area (Jember regency Health Department, 2007). The results of previous studies made by the researchers show that goitrogenic substance as a causative factor of IDD in Jember, through one of the indicators of urinary iodine levels, is included in the category of normal and tend to be high. In addition, urinary thiocyanate levels goiter group are higher than those in non-goiter group (Ningtyias, 2006; Ningtyias et al., 2007; Ningtyias et al., 2008). Consumption pattern of goitrogenic source food in Jember of at least 3-5 times per week with an average consumption of 505 µg per day is a risk factor of IDD in Jember (Megawati, 2007; Ningtyias et al., 2008). The existence of these substances will

disrupt the process of the formation of thyroid hormones; therefore, it needs to be eliminated, or the levels are reduced, so that the food ingredients containing goitrogenic substances are safe for consumption. This study used local wisdom to solve problems of nutrition, that is, one of the habits of people in Jember to boil vegetables for fresh vegetables for overcoming nutritional problem of IDD because the boiling process can reduce cyanogenic levels up to 93% (Murdiana, 2001). By the decrease in cyanogenic levels, it is expected that goitrogenic substance intake into the body will decrease indicated by the decreasing biomarkers of goitrogenic substance of urinary thiocyanate levels.

RESEARCH METHOD

This research was conducted in District of Arjasa, an endemic goiter area ranked second in Jember Regency. District of Arjasa is also the area with the equal composition of Javanese and Madurese ethnicities, whic are the two largest ethnicities forming local wisdom in Jember. The experiment was conducted in March-May, 2013.

The population was housewives in District of Arjasa. The inclusion criteria included: the housewives who provided their own food for their families. 196 people were randomly chosen from the sample frame in the form of RW (the second smallest Neighborhood Group) in District of Arjasa. By randomization, 98 people were selected in each of control and treatment groups.

Respondents were invited to the meeting for delivery of material. For the pre-test, before treatment was measured respondents urine thiocyanate levels. Furthermore, by the single-blind, treatment was given in the form of counseling on IDD, goitrogenic substances and demonstration on processing techniques of goitrogenic source foods in treatment group. As a placebo, control group was given materials on PUGS (general guidelines for balanced nutrition). Furthermore, with leaflets, respondents were asked to apply the materials for a month. In the range of a month, measurements were undertaken three times on the changes in the

processing techniques of goitrogenic source food. In the fourth week, the respondents were invited back for urinary thiocyanate level post-test.

The materials on processing techniques of goitrogenic source food were derived from preliminary studies that showed that boiling was the best way to reduce cyanide levels in foodstuffs. Decreased level of cyanide in foodstuffs containing goitrogenic substances by boiling was up to 95.5%. The second position was occupied by blanching. Boiling is the term used by Jember community for the processing method of blanching i.e. the processing of vegetables by putting them in a little boiling water for 1-5 minutes depending on the type of vegetable and immediately draining water if the vegetables are considered to have been well-done. Usually, this type of processing is carried out for vegetables as well-done vegetables accompanying peanut sauce or chili paste.

Data analysis was performed by comparing the condition before and after the treatments. Besides, comparability was made between the two groups (treatment and control) by seeing the difference in decline in the situation before treatment compared to after treatment. The statistical test used in this analysis was t-test and paired t-test with a significance level of 95%. T-test was used to see the difference of two independent samples in a large number by ratio data scale. All statistical tests analysis in this study used Spss statistics 17.

RESULT

Urinary thiocyanate levels after treatment in both groups increased, i.e. 0.12 µg/l (mean difference = -0.12; 95% CI: -0.28;0.04) in the treatment group and 0.25 µg/l (mean difference = -0.25; 95% CI: -0.47;-0.04) in the control group. The higher increase occurred in the control group (mean difference = 0.13; 95% CI:-0.13;0.40). There were differences in average levels of thiocyanate after treatments between the two groups (mean difference = 0.29; 95% CI:0.06;0.51) (p = 0.01) and only the increase in the control group was significantly different seen by paired t test (mean difference = -0.25;95%CI:-0.47;-0.04) (p = 0.02).

The results of paired t-test of urine thiocyanate levels showed that only urinary thiocyanate levels in control group was significantly different. Although the level increased in the treatment group, there was no significant difference between the condition before and after treatments. The increased urinary thiocyanate levels in the control group were higher than those in the treatment group..

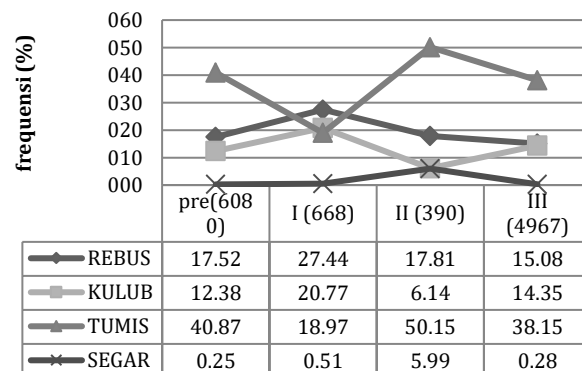
Table 1. Data Characteristics of Research Subjects (n = 98 per group)

Variables	Treatment	Control	Mean difference (95% CI)	p
	n = 98	n = 98		
<i>Mean (SD) Urine thiocyanate levels (µg/l)</i>				
Before	1.23 (0.87)	1.38 (0.68)	0.15(-0.07; 0.37)	0.17
After	1.35 (0.68)	1.63 (0.87)	0.29 (0.06;0.51)	0.01*
Difference (Δ)	0.12 (0.81)	0.25 (1.07)	0.13(-0.13; 0.40)	0.33
<i>Mean difference (95% CI)</i>	-0.12 (-0.28;0.04)	-0.25 (-0.47;-0.04)		
P	0.14	0.02**		

*) significant by t-test **) significant by paired t-test

There were better changes in the processing techniques in the treatment group. An increase in the frequency of processing method by boiling in the third week measurements after a drastic decline had previously occurred. In addition, there was a decline in the consumption of goitrogenic source food in a fresh/raw state, whereas in the control group there was not much change in processing technique of goitrogenic source food during the research. What needs attention is the increase in consumption of goitrogenic source food in fresh/raw state in control group, whereas the highest cyanide content is in the raw food ingredients. The frequency change on processing technique of goitrogenic source food can be seen in Figures 1 and 2.

Changes in processing techniques commonly done in treatment group



Rebus=boiling (angka yang berkoma (,) diganti titik (.)
Kulub=blanching; Tumis=Stir-frying; Segar=fresh

Figure 1. Changes in processing techniques in treatment group

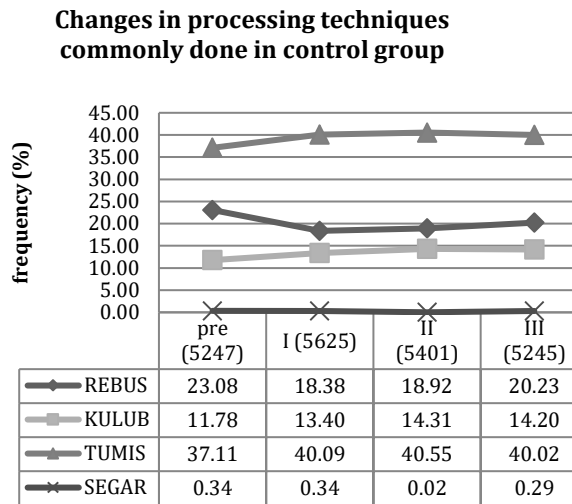


Figure 2. Changes in processing techniques in control group

DISCUSSION

All urinary thiocyanate levels in both groups after treatment increased. In the pre-test conditions, urinary thiocyanate levels in the control group were higher than those the treatment group, as well as in the post-test conditions. Increased urinary thiocyanate levels in the control group were also higher than those in the treatment group. Paired t-test results showed that the increased levels of urinary thiocyanate in the treatment group had no difference, meaning that there was no difference between before and after treatments, whereas in the control group the increased levels were significantly different, which means that there were differences in the conditions before and after treatment in the control group. In addition, urinary thiocyanate levels after treatment between the two groups were significantly different. It related to the increase in consumption of goitrogenic source food in the group control group. This can be seen from the frequency of the processing method of goitrogenic source food very week which was higher in the control group compared to the treatment group.

However, an increase in urinary thiocyanate levels in both groups requires deeper explanation. This was partly because of the influence of season. Data collection in May, 2013 coincided with the rainy season, which affected the cyanide content in foodstuffs. This is in line with the theory that poison content in each variety of cassava is not constant and can change. This is due to several factors, among others: climate, soil conditions, fertilization technique and cultivation method (Winarno, 2002). Many things affect the cyanide content in foodstuffs, including age and the use of fertilizers. Young plants contain more cyanide than older plants and the use of fertilizers such as nitrate

fertilizer can raise the levels of cyanide in plants (Son, 2003).

Another factor affecting the increase in urinary thiocyanate levels, in addition to an increase in cyanide content in foodstuffs, is age. Urinary thiocyanate concentration continues to increase until the age of 14; then, it decreases in men and increases in women up to the age of 39 (Brodoux, et al., 1982). In this study, the majority of respondents were in the age range under 39 years and more numerous in the treatment group (85.71% vs. 82.65%).

In addition to playing a role in the synthesis and metabolism of thyroid hormones, protein also plays a role in controlling the metabolism of cyanide; hence, the adequacy of protein in endemic goiter area is very beneficial to its role in reducing the prevalence of goiter (Muhillal, 2002). Methionin in the body forms cysteine and cystin. Cysteine has a role in forming sulfurtransferase enzymes that neutralize cyanide into thiocyanate and pirufat acid, while cystin has a direct ability to neutralize cyanide to form thyocyanopyrufat acid which is excreted in the urine. Protein deficiency causes much buildup of cyanide in the body that has not been neutralized because it inhibits the formation of cysteine as the creator of sulfurtransferase enzyme that neutralizes cyanide into thiocyanate and pyruvic acid. Perhaps, the respondents in the research location were deficient in protein but eventually returned to normal, so that the urinary thiocyanate as a result of cyanide detoxification increased by the help of sulfurtransferase enzymes.

Other possible causes of the increase in urinary thiocyanate were other sources of entrance of thiocyanate into the body. Thiocyanate in the body is not only derived from the cyanide detoxification but can also come from cigarette smoke. The content of nitrates in water and food, thiocyanate of food or cigarette smoke has the same mechanism in affecting the thyroid gland (Bravemann, et al., 2005; Tonacchera, et al., 2004, Wyngaarden, et al., 1953) cit Steinmaus, et al., 2007. Although not as active smokers, usually the women will be victims because of being passive smokers from their husbands who smoke. In Indonesia, approximately 65.6 million women and 43 million children are exposed to cigarette smoke or being passive smokers. Many Indonesian citizens exposed to cigarette smoke since 91.8% of smokers smoke at home (Sutrisno, et al., 2013).

The lower levels of urinary thiocyanate in the treatment group compared with those the control group are a sign of success of the intervention. Treatment group preferred the recommended processing methods, that is, boiling and blanching to be applied in daily life. In the second measurement,

the frequency of good processing to reduce levels of cyanide ingredients had once decreased. This might be due to boredom. Boredom can be overcome by refreshing the materials; besides, it can also switch to other processing methods such as stir-frying, but the vegetables should not contain goitrogenic substances.

Knowledge gained through the counseling equipped with demonstrations on appropriate processing methods to reduce the cyanogenic levels in foodstuffs that contain goitrogenic substances became an important domain for the formation of the respondents' actions. Moreover, knowledge could form certain beliefs, so that a person behaved in accordance with his beliefs. Simons-Morton, et al. (1995) mention that behavioral changes based on knowledge will be more lasting than those without knowledge base, so it is expected that this behavior will be steady and sustainable even though the research has been completed, and the purpose of this study, to set up a solution to overcome the problem of IDD in Jember through local wisdom-based education/counseling on nutrition for Jember community, will be achieved.

CONCLUSION

An increase in urinary thiocyanate levels occurred in both groups after the treatment. Only the increase in the control group was significantly different.

That levels of urinary thiocyanate in treatment group were lower than those in the control group is a sign of the success of the intervention. Knowledge was underlying behavioral changes that occurred. Changes in behavior based on knowledge will be more lasting.

The increased urinary thiocyanate is caused by the increased levels of cyanide in foodstuffs due to the influence of climate, other sources of thiocyanate into the body i.e. cigarette smoke, and also the factors of protein adequacy and age.

RECOMMENDATIONS

It is necessary to carry out a nutrition education on the proper way to process goitrogenic source foods that are safe for consumption i.e. blanching and boiling; also on other factors of IDD in addition to iodine deficiency, including cigarette smoke, goitrogenic factors and protein deficiency.

The combined use of media in education such as leaflets, flipcharts and samples of artificial and real objects can improve the effectiveness of counseling

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