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Correlation Levels Of Mercury In The Blood Toward Levels Of Cystatin C Serum Treatment In Two Rural Traditional Gold Kokap Kulon Progo Yogyakarta

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Abstract: *Traditional gold processing by using mercury (Hg) as binder (amalgamation) can be environmental pollutants and mercury poisoning in humans. Mercury is a toxic substance that causes kidney damage. The research objective was to analyze the correlation levels of mercury in the blood to levels of Cystatin C in serum traditional gold processing characteristics of the respondent's age, years of service, nutritional status (BMI) and the use of personal protective equipment (PPE). The research was observational with cross sectional approach. Samples are traditional gold processing (the exposed group) and a total of 11 non-processing of gold (unexposed group) amounted to 11 people. Sampling technique is simple random sampling. Data collected through observation, laboratory tests and a questionnaire and analyzed by descriptive and inferential (multiple linear regressions). These results indicate the levels of mercury in the blood of exposed and unexposed groups between <8 -> 8 mg /l, the mean blood mercury levels exposed group 63.65ug / l and a group not exposed to 25.56 ug/l (exceeding standards 5-10 g/l). Serum cystatin C levels exposed and unexposed groups between <0.53 ->1.01 mg/L, mean serum levels of Cystatin C groups exposed to 1.07 mg/L and the group not exposed to 1.10 mg/L (beyond the standard 0,53 to 1.01 mg/L). The analysis showed no correlation mercury levels in the blood (p=0.012) and nutritional status (BMI) (p=0.017) on the serum levels of Cystatin C. There is no correlation among age, years of service and use of personal protective equipment (PPE) against Cystatin C serum levels. The conclusion from this study is that there is a correlation between blood mercury levels and nutritional status (BMI) on levels of Cystatin C in serum traditional gold processing, suggested the rotation and shift work arrangements as well as the completeness of the use of personal protective equipment (PPE) to reduce mercury exposure processing traditional gold.*

Keywords: Levels of mercury in the blood, serum levels of Cystatin C, a traditional gold processing**.**

1. INTRODUCTION

Heavy metal pollution tends to increase with increasing industrialization process. One of the causes of environmental pollution are heavy metals mercury from the tailings/waste processing are processed in the amalgamation of gold in a traditional gold processing, one of which contained two village Kokap Kulon Progo Yogyakarta (IARC, 2010)

Mercury is used as a medium to bind and purify gold. Mercury-gold amalgam is heated so the mercury evaporates leaving the gold metal from the mixture. As many as 10-30% of mercury used in these activities will be separated or lost to the environment (Widhiyatna, 2005: Alpers, 2006).

Elemental mercury (HgO) is a type of mercury used for the amalgamation process in processing gold. The entrance exposure to elemental mercury into the human body through three channels, namely oral, skin and inhalation. Elemental mercury that enters the body through the oral simply be absorbed as much as <a 0.01%, through the skin almost nothing is absorbed and absorbed through inhalation of 80%. Elemental mercury will be absorbed by the pulmonary alveoli and then transferred into the blood and filtered in the kidney in the form of divalent cations (Hg2 +), most will accumulate in the kidneys and a small portion is eliminated in the urine (ATSDR, 1999; Palar, 2008).

Kidney is the main organ of excretion of fluid that is not used anymore by the body. All the waste in the form of a liquid or solution excreted through the kidneys. Mercury is a toxic substance that causes kidney damage. Kidneys are very sensitive to metal for forming a complex or chelate with ligands organi (Soemirat, 2009).

Currently endogenous marker most often used is serum creatinine. Several factors can affect the accuracy of the use of creatinine for kidney function tests, such as age, gender, height and weight, inflammation, muscle mass, hormonal, race, muscle mass effect on endogenous creatinine production, meat intake, physical activity, the secretion of creatinine in renal tubules, the influence of drugs become a problem analytical method creatinine (Lamb, 2006).

Various shortcomings creatinine makes experts develop research to find a more accurate marker of endogenous measuring glomerular filtration rate (GFR). Some low molecular weight proteins has been studied as a marker of glomerular filtration rate and one of them is Cystatin C in serum were found in different human body fluids. Various studies have reported that the examination of serum cystatin C is better than creatinine as a marker of glomerular filtration rate (Oh MS, 2007).

2. RESEARCH METHODS

This study is observational analytic research and cross sectional research design, because the observation and measurement toward variable conducted shortly.

The population of study is the traditional gold processing in the two village Kokap Kulon Progo Yogyakarta (exposed group) and villagers of Sumberadi Mlati Sleman Yogyakarta (unexposed group) with a number of research samples of

each group of 11 people was obtained from the formula calculation of sample size and retrieval techniques sample simple random sampling.

Primary data were collected through interviews and questionnaires to determine the age, years of service and use of personal protective equipment (PPE), measuring height and weight to determine the nutritional status by calculating the body mass index (BMI), blood sampling for mercury in the blood examination Mercury Analyzer method Cold Vapour and Serum cystatin C investigation by the method of Particle-enhanced Turbidimetric Immunoassay (Petia). Analysis of the data used is multiple linear regressions.

3. RESULTS AND DISCUSSION

Results of research on the correlation of the mercury levels in the blood serum levels of Cystatin C are as follows:

Table 1.1 Distribution of the frequency of respondents by the levels of mercury in the blood

Blood Mercury Levels (µg/l)	Group				Totaly	
	Exposure		Not Exposure		n	%
	n	%	n	%		
≤8	0	0	2	18,18	2	9,09
>8	11	100	9	81,82	20	90,91
Totaly	11	100	11	100	22	100
Mean (SD)	63,65 (23,82)		25,56 (15,11)			

Standard blood mercury exposure is 5-10 mg / l (WHO, 2008) and 8 g / l (MOH, 2008).

Table 1.1 shows that the levels of mercury in the blood of exposed group> 8 mg / l is 100% and <8 g / l is 0% or it can be said mercury levels in the blood exceeds all standards, while mercury levels in the blood group is not exposed to> 8 g / l was 81.82% and <8 g / l was 18.18%. The mean blood mercury levels in the group exposed to 63.65 mg / l and the group not exposed to 25.56 mg / l.

Levels of mercury in the blood of the unexposed group was also exceed the standards allegedly caused by consuming water and food are exposed to mercury comes from pesticides used citizens because most of the residents are farmers. This becomes a limitation of the study and can be used as a reference for future research.

Mercury in agriculture is used as an ingredient in pesticides to kill the fungus that agricultural products can be more durable, inorganic mercury is also used to eradicate plant pests such as apples, tomatoes, potatoes and also used as pest control rice (Hadi, 2013).

Research by Riyatun, et al, 2004 also mention that the high level of use of fertilizers and pesticides melon growers and other agribusiness cause heavy metals mercury residues is also high in the river Bengawan Solo (Riyatun, et al, 2004).

Table 1.2 Distribution of the frequency of respondents by serum levels of Cystatin C

Cystatin C serum Levels (mg/L)	Group				Totaly	
	Exposure		Not Exposure		n	%
	n	%	n	%		
<0,53	0	0,00	0	0,00	0	0,00
0,53-1,01	5	45,45	2	18,18	7	31,82
>1,01	6	54,55	9	81,82	15	68,18
Totaly	11	100	11	100	22	100
Mean (SD)	1,07 (0,15)		1,10 (0,27)			

Standard Serum cystatin C is 0.53 to 1.01 mg / L (Yaswir, 2012; PRAMITA Lab)

Table 1.2 shows that none of the respondents either exposed or unexposed who have serum cystatin C <0.53 or 0%, serum levels of Cystatin C 45.45% from 0.53 to 1.01 exposed group and the unexposed group 18.18% , Serum cystatin C levels> 54.55 1.01 exposed group and the unexposed group 81.82%, while the average serum levels of Cystatin C groups exposed to 1.07 mg / L and the group not exposed to 1.10 mg / L. Serum cystatin C levels unexposed group was also exceeded standards in addition to the high levels of mercury in the blood as well as nutritional status (BMI) that is not normal (Kartawinata Y, et al, 2012; Ridwan, et al, 2013; bashir et al, 2010).

Table 1.3 Correlation mercury levels in the blood to levels of Cystatin C in serum traditional gold processing

Variable	Cystatin C serum	
	β	p
Blood Mercury	0,639	0,012*
Age	0,237	0,254
Work Period	0,095	0,710
Nutritional Status (BMI)	-0,382	0,017*
PPE	-0,416	0,067

Table 1.3 shows that there is a correlation between mercury levels in the blood and nutritional status (BMI) on serum levels of Cystatin C is a correlation to the levels of mercury in the blood serum cystatin C (β = 0.639; p = 0.012), the correlation of nutritional status (BMI) against Cystatin C serum (β = -0.382; p = 0.017).

The analysis showed that there is a correlation to the levels of mercury in the blood serum cystatin C (p = 0.012). This is in line with research conducted by Joeharnani Tresnati, 2013, which describes the change in renal tissue flower stingray (Dasyatis kuhlii) as a result of exposure to heavy metals mercury. Exposure to mercury can cause damage to the kidney proximal tubule microscopically stingray flower, a narrowing and closing the lumen of the proximal tubule in the treatment group compared with the control group (p <0.05). Other kidney damage in the form of hyaline droplet, hypertrophy, hyperplasia, atrophy and necrosis. This is consistent with the theory that mercury excretion processes that take place in the kidney may cause adverse effects to the kidney itself (Palar, 2008).

The analysis also shows that there is a correlation of nutritional status (BMI) on levels of Cystatin C in serum (p = 0.017). This is in line with research Kartawinata Y, et al, 2012, which states that there is a correlation between nutritional status and less of the increased levels of Cystatin C in serum (p = 0.43), the study by Ridwan, et al, 2013, which states that the nutritional status (BMI) associated with serum cystatin C (p=0.012) with the positive direction of the relationship, which means the higher the body mass index the

higher the levels of Cystatin C in serum and research by bashir et al, 2010, which stated that there were significant differences in the levels of Cystatin C between obese group, overweight and control groups both in men and women where Cystatin C levels were higher in obese group than the overweight group and the control group. On obesity based on BMI note that adiposity not only serves as a place for storage triacyglycerol, but able to produce and secrete a number of proteins including Cystatin C which affect various physiological processes.

Kidneys have a higher capacity to bind to chemicals, so the more concentrated chemicals in the kidneys compared to other organs (Mukono, 2010), so although kidney weight is only about 0.5% of the total weight, but the kidneys receive blood 20% - 25% of the cardiac output through the renal artery. The high blood flow to the kidneys is what causes different kinds of drugs, chemicals and heavy metal in the systemic circulation is sent to the kidneys in large numbers. These toxic substances accumulate in the kidneys and cause damage to the kidney itself. Therefore, the mercury that goes into the blood and then excreted through the kidneys will accumulate in chronic kidney that can cause damage to the proximal tubule and increases serum cystatin C. According Palar (2008), high exposure to elemental mercury compound/inorganic mercury can damage the kidneys, namely the occurrence of damage to the renal proximal tubule, being further influence on the high level of exposure and a long time is the occurrence of interstitial fibrosis, sclerosis of vessels and glomerular atrophy.

3. CONCLUSION

Based on the research that has been done, can be summed up as follows:

There is a correlation of mercury levels in the blood and nutritional status (BMI) on serum levels of Cystatin C is a correlation to the levels of mercury in the blood serum cystatin C ($\beta = 0.639$; $p = 0.012$), the correlation of nutritional status (BMI) on serum cystatin C ($\beta = -0.382$; $p = 0.017$).

4. SUGGESTION

Advice can be given namely: the expected realization of traditional gold processing in order to reduce exposure to mercury in the body to regulate the rotation of work, shift work and the use of personal protective equipment complete, expected for further research on the correlation of the mercury levels in the blood serum levels of Cystatin C farmer pesticide users that contain mercury because in this study contained mercury levels in the blood group is not exposed to the majority of whom work in agriculture

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