

Sensitivity and Specificity of NaCl and ZnSO₄ Solution Flotation Method for Examination of Worm Eggssoil Transmitted Helminths (STH)

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ABSTRACT

Nematode-class intestina lhelminth infection, which is transmitted by soil that has been contaminated with worm eggs is a worm infection Soil-Transmitted Helminths (STH). Worm infection can be detected by checking the stool. Currently, in a clinical publication or epidemiological surveys, the most widely used technique in the diagnosis of parasites is the flotation method. This research will be conducted with the sensitivity and specificity of the flotation method with NaCl and ZnSO₄ solutions with the gold standard used, the Kato-Katzmethod. Stool examination conducted aims to see whether the flotation method with ZnSO₄ solution is more sensitive for an analysis of STH worm eggs that will be found compared to using a solution of NaCl containing a solution used in the field. The purpose of this study is to examine the sensitivity and specificity of the

NaCl and ZnSO₄ solution flotation methods to the examination of Earthworm Transmitted Helminths (STH) and also use the Naot solution flotation efficiency method which is lower than the ZnSO₄ solution flotation method. The sample used is a sample from elementary student collected at the Health Analyst Parasitology Laboratory usingthe NaCl and ZnSO₄ solution flotation method. The results of this study indicate the sensitivity of the NaCl solution flotation method of 52.38%, specificity 94.44%, positive predictive value 84.61%, and negative predictive value 77.27% and ZnSO₄ solution 71.42%. While the specificity of the flotation method is NaCl solution and ZnSO₄ solution is 94.44%. The flotation method of ZnSO₄ solution was 71.42%, specificity was 94.44%, positive predictive value was 88.23%, negative predictive value was 85.00%. This research discusses the method of flotation sensitivity ofNaCl solution is lower when compared to the flotation method of ZnSO₄ solution.

Keywords: Sensitivity, Specificity, FlotationMethod.

INTRODUCTION

Nematode class intestinal helminth infection, which is transmitted by soil intermediaries that have been contaminated with worm eggs is a worm infection Soil-Transmitted Helminths (STH)¹.Worm infection can be detected by stool examination. At present, in the scope of clinical and epidemiological surveys, the most widely used technique in the diagnosis of parasites is the flotation method². Float solutions used include glucose, ZnSO₄, MgSO₄, and saturated NaCl^{3,4}. The advantage of this flotation method is that the results of the preparation are cleaner so that it is more comfortable to identify and easier and more practical in the process⁵. ZnSO₄ solution has a higher specific gravity compared to egg specific gravity according to the principle of the flotation method in the examination of worm eggs. The excess of ZnSO₄ solution can be used on fresh and durable specimens⁶.Worm egg examination can be done in a relatively short time if the solution used has a high specific gravity. This is because eggs will be raised more quickly on the surface of the solution⁷.

Research on the sensitivity and specificity test of the Kato-Katzmethod has been conducted before⁸, but studies that discuss the sensitivity and specificity of the flotation method for NaCl and ZnSO₄ solutions to the STH worm egg examination have never been conducted. Therefore, in this study, worm eggs will be examined regarding the sensitivity and specificity of the flotation method with ZnSO₄ and NaCl solutions. It is expected that

with the variation of the ZnSO₄ solution in the flotation method in addition to using a standard solution of saturated NaCl, can provide better results on examination of Soil-Transmitted Helminths which are observed microscopically so as to support the diagnosis of the patient's worms correctly.

This study tested the sensitivity and specificity of the flotation method with NaCl and ZnSO₄ solutions with the gold standard used, the Kato-Katzmethod. Stool examination conducted aims to see whether the flotation method with ZnSO₄ solution is more sensitive for the examination of STH worm eggs that will be found compared to using NaCl solution which is a solution that is often used in the field.

RESEARCH METHOD

This type of research is analytic observational research. The design used was a cross-sectional study where the dependent variable data were the sensitivity and specificity test of the flotation method of NaCl and ZnSO₄ solutions and the independent variables of NaCl and ZnSO₄ solutions collected at the same time. Measurements were made in this study only once without any repetition or replication, using flotation methods with NaCl and ZnSO₄ solution. Based on the sample size formula, a minimum sample of 53 samples was obtained⁹, but in this study, the samples examined were 57 samples from 60 students, because the other 3 samples are not possible to be examined by two methods. The sample selection technique

is by quota sampling by taking the number of samples as determined by researchers. The collected samples were examined using the NaCl and ZnSO₄ solution flotation method and the kato-katz method as the gold standard in the Parasitology Laboratory of Health Polytechnic Yogyakarta.

Data displayed on the univariate analysis included the percentage of positive and negative results of the examination using the flotation method of each solution, namely NaCl and ZnSO₄ while the data obtained from the examination of worm eggs using the NaCl and ZnSO₄ solution flotation methods were tested by diagnosing data using a 2x2 table of diagnostic tests and measuring sensitivity, specificity, positive predictive value (NPP) and negative predictive value (NPN) compared with the gold standard of the kato-katz method.

RESULT AND DISCUSSION

The following table will present a data related to the results of the examination of flotation eggs and the kato-katz (gold standard) method.

The observations of samples examined using the NaCl, and ZnSO₄ solution flotation method and the kato-katz method can be seen in Figure 1.

Table 1: Result of Feces Examination Using Three Method

Method	Positive%	Negative%
Kato-Katz	36.84	63.16
Flotation (NaCl Solution)	22.80	77.19
Flotation (ZnSO ₄ Solution)	29.82	70.17

Figure 1: Positive Observation Results of Worm Eggs in the Kato Katz Method

Positive sample (Hookworm)



Positive sample (*Ascaris lumbricoides*)

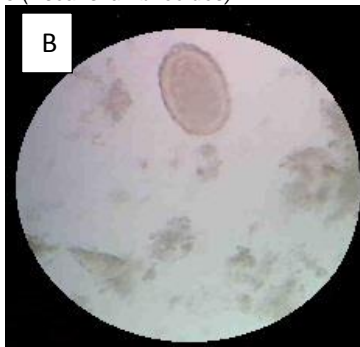


Figure 2: Positive Observation Results of Hookworm Eggs in the Flotation Method

Positive sample (Hookworm) with NaCl solution



Positive sample (Hookworm) with ZnSO₄ solution

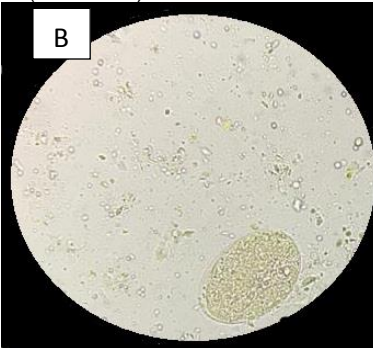
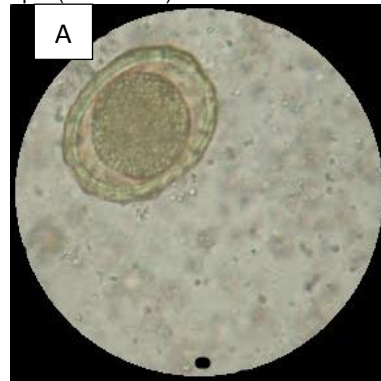


Figure 3: Positive Observation Results of *Ascaris lumbricoides* Eggs in the Flotation Method

Positive sample (Hookworm) with NaCl solution



Positive sample (Hookworm) with ZnSO₄ solution

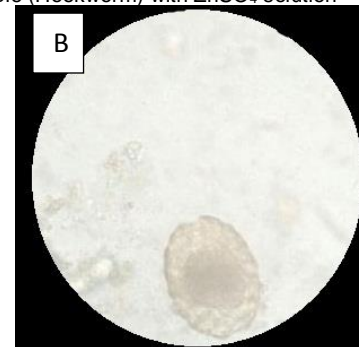


Table 2: Diagnostic Test of Result Examination (Gold Standard Metode Kato-Katz)
Flotation (NaCl Solution)

Result	Positive	Negative	Total
Positive	11	2	13
Negative	10	34	44
Total	21	36	57

$$\text{Sensitivity} = \frac{11}{21} \times 100\% = 52.38\%$$

$$\text{Specificity} = \frac{34}{36} \times 100\% = 94.44\%$$

$$\text{Positive Predictive Value} = \frac{11}{13} \times 100\% = 84.61\%$$

$$\text{Negative Predictive Value} = \frac{34}{44} \times 100\% = 77.27\%$$

Table 3: Diagnostic Test of Result Examination (Gold Standard Metode Kato-Katz)
Flotation (NaCl Solution)

Result	Positive	Negative	Total
Positive	15	2	17
Negative	6	34	40
Total	21	36	57

$$\text{Sensitivity} = \frac{15}{21} \times 100\% = 71.42\%$$

$$\text{Specificity} = \frac{34}{36} \times 100\% = 94.44\%$$

$$\text{Positive Predictive Value} = \frac{15}{17} \times 100\% = 88.23\%$$

$$\text{Negative Predictive Value} = \frac{34}{40} \times 100\% = 85.00\%$$

Stool examination aims to determine the presence or absence of infective worm eggs or larvae by tracking and recognizing the stage of parasites found¹⁰. Flotation examination is an examination based on the specific gravity of worm eggs with certain chemicals¹¹. The flotation method uses a solution of saturated salt or saturated sugar as a solution to float eggs². Hygiene is a person that must be considered; inadequate hygiene is one factor in the high number of helminthiasis¹⁰.

Examination of worm eggs by using the flotation method in Figure 2b of the field of view of the preparation on the microscop looks brighter this can happen because hemiscroscope's diaphragm arrangement is too conspicuous so that it causes the egg wall to look in different. Examination of the flotation method has the advantage that the examined specimens show a brighter and more precise visual field, as shown in pictures no. 2a and 2b when compared to the kato-katz (gold standard) method. Figure 1a and 1b are shown. This is because the flotation method uses centrifugation to separate impurities and debris in the sample so that only the worm eggs are raised on the tube surface. However, in this study, the kato-katz method as a gold standard found more positive results even though the number of samples used was less than the flotation method. This can occur because the flotation method of the sample tube which has been centrifuged with a sloping centrifuge position so that there is movement during removal which causes the egg to sink to the bottom of the tube, but needs to be revisited because the kato-katz method has gone through a lot of research. Previous studies have shown that the kato-katz method has a high sensitivity for detecting wormeggs⁸. In this study the examination of worm eggs using the kato-katz method as a gold standard there are two samples that show negative results but with the flotation method found the presence of worm eggs, this can occur because when taking faeces that have been homogenized the possibility of eggs not being considered.

Flotation examination with NaCl solution showed positive results for 13 wormeggs. Whereas by using ZnSO₄, positive results were obtained more than the NaCl solution, which was 17 samples. This is because the ZnSO₄ flotation solution has a higher specific gravity compared to the specific gravity of NaCl solution, in accordance with the theory of the use of the solution type in the flotation method which has a relatively high specific gravity supports the diagnosis stage to find different parasites simultaneously. High specific gravity buoyancy solutions are needed to lift the worm eggs up to the surface¹². NaCl and ZnSO₄ solution, which is a salt solution that has a denser density than fresh water. Eggs and oocysts are less dense (lighter) than stool flotation solutions, as a result, worm eggs float on their surfaces. Stool debris or debris is denser (heavier) than stool flotation solution¹³.

Factors that influence the examination of the flotation method are the time for the eggs to rise above the surface. Because the faster the flotation time, the eggs that will float have not been completely lifted, but the longer the flotation time the egg will allow the eggs will return to the bottom of the tube. This can be overcome by adjusting the optimal time, the NaCl solution takes 60 minutes, and the ZnSO₄ solution for 45 minutes using a timer¹⁴.

The sensitivity calculation results are shown in table 2 with the sensitivity of the NaCl solution flotation method of 52.38%, specificity value of 94.44%, NPP of 84.61% and NPN 77.27%. Whereas the flotation method of ZnSO₄ solution table 3 shows the sensitivity value of 71.42%, the specificity value of 94.44%, NPP 88.23% and NPN 85.00%. Based on these data, the flotation method with NaCl solution sensitivity value is lower than the sensitivity value of the flotation method with ZnSO₄ solution while the specificity value of the flotation method of each solution obtained the same value that is equal to 94.44%. In epidemiology, it is said that examinations that have a low sensitivity value will increase some number of "false negatives" where the error of the test results shows negative, but the facts that occur are positive whereas if the specificity value is low it will produce a lot of "false positives" where the error of the test results shows positive but actually negative¹⁵.

Based on the above data, the flotation method of ZnSO₄ solution has a higher sensitivity value than NaCl solution. Types of worm eggs that are found in many studies by checking the flotation of NaCl solution and ZnSO₄ solution are hookworm. This is consistent with the theory that the ZnSO₄ solution flotation method is effective in finding hookworms and Giardial ambliacysts⁶. Previous studies have shown that the ZnSO₄ solution flotation method is more effective for detecting worm egg types of Trichiuristrichiura and Enterobius vermicularis is compared to the centrifugation sedimentation method¹⁶. While other previous studies regarding the NaCl larvae flotation method, NaCl solution was found in worm eggs, especially Ascaris lumbricoides, compared to ZnSO₄ solution⁵.

CONCLUSION

The sensitivity of the NaCl solution flotation method is lower when compared to the ZnSO₄ solution flotation method.

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