

The influence of head lice (*Pediculus humanus capitis*) infestation to nutritional status and anemia occurrence on female elementary school students

I P Sudayasa^{1*}, A Arimaswati², M Abdullah³, and A R Masumi³

¹Departement of Public Health/Community Medicine, Medical Faculty, Halu Oleo University

² Integrated Laboratory, Medical Faculty, Halu Oleo University

³ Medical Education Study Program, Medical Faculty, Halu Oleo University

*putusudayasa@gmail.com, arimaswati@gmail.com

Abstract. Infestation of head lice is obligate ectoparasite infestation, *Pediculus humanus capitis* in the form of eggs, nymphs, or adult fleas on the skin and hair of head. The disease is quite high especially on school-aged children in Indonesia. This ectoparasite can harm the host it occupies because it can suck blood and may cause anemia in infestations for a long time. This study aimed to determine the influences of head lice infestation (*Pediculus humanus capitis*) to nutritional status and anemia occurrences of schoolgirl grade school in the Abeli Subdistrict coastal area, Kendari City. The research was an observational analytic study using cross sectional approach. The samples were 150 samples that selected by proportional stratified random sampling. Data obtained by measurements of height and weight to find the magnitude of Body Mass Indeks (BMI). The data were gained by using hemoglobin testing system quick check set for anemia assessment and either manually or instrumentally direct for lice assessment. The gained data results were processed by chi square, contingency coefficient, and Prevalence Odds Ratio (POR) statistic test. The result showed, that was no influences of head lice infestation to nutritional status $p\text{-value}=0.470$, ($r=0,204$, $\text{POR}=1,54;95\%$ $\text{CI}=0.616\text{-}3.886$). That was a significant correlation between head lice infestation to anemia occurrence, $p=0.021$ ($r=0.204$, $\text{POR}=2.564; 95\%$ $\text{CI}=1,043\text{-}6302$). The conclusion of this study was head louse infestation has no risk factors to nutritional status. While, head lice (*Pediculus humanus capitis*) infestation correlated as risk factor for anemia on female elementary school students in coastal area.

1. Introduction

Pediculosis capitis is a skin disease caused by the infestation of the parasite *Pediculus humanus capitis*. Head lice infestations in the form of eggs, nymphs, or adult lice on the skin and head hair. The highest incidence in school children aged 5-12 years. [1,2] Head lice infestation is endemic in developing countries and epidemics occur in the western world such as Europe. [3] Prevalence in Southeast Asia such as Malaysia and Thailand are 35% and 23.48% respectively [2,4].

Occurrence Pediculosis of schoolchildren in Indonesia is quite high but often overlooked because it rarely results in serious morbidity and does not cause mortality. This is also due to the School Health Unit program as a place to promote school health to prioritize the early detection of non-communicable diseases compared to infectious diseases. [5] Based on the survey results of prevalence of capitis



pediculosis, in grade IV, V, and VI students in Tanah Datar District Elementary School, West Sumatra, there were 51.92% infested with head lice. [4] The results of research conducted in Selayar, South Sulawesi, were 139 elementary school students, 53.7% infested with *Pediculus humanus capitis* [6].

A similar study in Southeast Sulawesi was carried out by SDN 8 Moramo Utara Kabupaten Konawe Selatan, where out of 49 students there were 85.7% who experienced pediculosis capitis. [4] The geografic condition at Moramo was similiary with Abeli District, so that the incidence of pediculosis can also be found in the region.

Students who are infested with head lice can experience sleep disturbances at night due to itching and frequent scratching of their heads. Quality sleep is very important in maximizing height growth because growth hormone will work optimally while sleeping. Children are in desperate need of adequate and quality sleep because optimal growth depends on adequate sleep. [7] The effects of anemia on school-age children are quite serious. Lack of oxygen supply due to anemia causes children to be lethargic, drowsy and affect learning performance and cognitive function. This is in line with the research of Kusmiyati et al. (2013) which showed that there was a significant relationship ($p = 0.002$) between hemoglobin levels with intellectual intelligence of students at Giwangan State Primary School Yogyakarta [8].

Data on capitis pediculosis have not been recorded at the Kendari Health Office, so the distribution was unknown. The condition of Abeli Subdistrict coastal area, where the maximum air temperature is 32.9°C, at least 23.1°C, and the average humidity is 82.58, it is suitable for breeding *Pediculus humanus capitis* which likes warm air and high humidity. [9] This study aims to determine the relationship of head lice infestation (*Pediculus humanus capitis*) with nutritional status and the incidence of anemia in elementary school students in the Coastal Area of Abeli District, Kendari City.

2. Method

This type of research, analytic observational with cross sectional approach, was carried out in November-December 2017, in elementary schools in the coastal area of Abeli Subdistrict, Kendari City. The study sample was 150 people, which was calculated by the proportional stratified random sampling method. Primary data collection is done by manually examining head lice or by using a tool (comb serit and microscope), as well as examining hemoglobin levels to research respondents. Data analysis using Chi-Square statistical test, contingency coefficient, and Prevalence of Odd Ratio with the help of computer application programs.

3. Result

Characteristics of respondents according to age, class level, head lice infestation, and nutritional status, are listed in Table 1 and the results of their relationship analysis are listed in Table 2. While the characteristics of respondents by age, class level, head lice infestation, and anemia are shown in Table 3, and the results of the analysis of the relationship are listed in Table 4.

Table 1. Distribution of Respondents by Age, Class Level, Head Lice Infestation, and Nutritional Status

No	Respondent Characteristics		n	%	Head Lice Infestation				Nutritional Status			
					Positive		Negative		Abnormal		Normal	
					n	%	n	%	n	%	n	%
1	Age (years)	8-10	97	64,6	82	54,7	15	10	28	18,7	69	46
		11-13	53	35,4	47	31,3	6	4	14	9,3	39	26
2.	Class Level	IV	50	33,3	44	29,3	6	4	17	11,3	33	22
		V	46	30,7	38	25,3	8	5,3	11	7,3	35	23,3
		VI	54	36	47	31,3	7	4,7	14	9,3	40	26,7
Total			150	100	129	(86%)	21	(14%)	42	(28%)	108	(72%)

The data in Table 1 shows that respondents based on the highest age category were at 8-10 years of age and experienced flea infestations of 54.7%, and experienced normal nutrition as much as 69%. Based on the grade level, most respondents were in the sixth grade and experienced a flea infestation of 31.3%, and experienced normal nutrition as much as 40%.

Table 2. Analysis of the Relationship of Head Lice Infestation with Nutritional Status

Head Lice Infestation	Nutritional Status				<i>p-value</i>	POR	95% CI	
	Abnormal		Normal				Lower	Upper
	n	%	n	%				
Positive	38	25,3	91	60,7	0,470	1,547	0,616	3,886
Negative	4	2,7	17	11,3				
Total	42	28	108	72				

The data in Table 2 shows that $p = 0.470$ ($p > 0.05$) with a value of Prevalence Odds Ratio (POR) of 1.547 (95% CI = 0.616-3.888), it can be concluded that the infestation of head lice (*Pediculus humanus capitis*) is not as risk factors for changes in nutritional status of elementary school students in the coastal area of Abeli District.

Table 3. Distribution of Respondent Characteristics on Head Lice Infestation and Anemia Events

Respondent Characteristics	Proportion		Head Lice Infestation				Anemia			
			Positive		Negative		Anemia		Not Anemia	
	n	%	n	%	n	%	n	%	n	%
Age										
8-10 years	97	64,7	82	54,7	15	10	50	33,3	47	31,4
11-13 years	53	35,3	47	31,3	6	4	17	11,3	36	24
Class Levels										
Grade IV	50	33,3	44	29,3	6	4	26	17,3	24	16
Grade V	46	30,7	38	25,4	8	5,3	24	16	22	14,7
Grade VI	54	36	47	31,3	7	4,7	17	11,3	37	24,7
Length of Infestation										
No Infestation	21	14,0	0	0	21	14	4	2,7	17	11,3
≤ 3 tahun	42	28,0	42	28	0	0	20	13,3	22	14,7
> 3 tahun	87	58,0	87	58	0	0	43	28,7	44	29,3
Total	150	100	129	86	21	14	67	44,6	83	55,4

Based on data from table 3, the characteristics of age, which experienced the highest head lice infestation and the highest incidence of anemia were 8-10 years old, 82 students (54.7%) infested with lice and 50 students (33.3%) had anemia. Based on the grade level, the highest head lice infestation was in the sixth grade of elementary school (31.3%) while the highest anemia incidence was in the fourth grade of elementary school which was 26 students (17.3%). Based on the duration of infestation, the group that experienced the highest flea infestation was > 3 years, namely 87 students (58%) as well as the highest anemia incidence of 43 female students (28.7%).

Table 4. Analysis of the Relationship between Head Lice Infestation and Anemia of Elementary School Students

Head Lice Infestation	Anemia				P-Value	r	POR	CI 95%	
	Anemia		Not Anemia					Lower	Upper
	n	%	n	%					
Positive	63	42	66	44	0,021	0,204	2,564	1,043	6,302
Negative	4	2,7	17	11,3					
Total	67	44,7	83	55,3					

Based on the data in Table 4, chi-square analysis obtained $p = 0.021$ with a value of $r = 0.204$, indicating that there was a relationship between head lice infestation and the incidence of anemia in elementary school students in the coastal area of Abeli District with a low level of closeness. Statistical test results of POR (Prevalence odds ratio) were 2.564 (95% CI = 1.043-6.302), indicating that head lice infestation was a significant risk factor for anemia in elementary school students.

4. Discussion

Based on the results of the study obtained data from 150 respondents, the positive 86% head lice infestation and 14% negative infestation lice. Based on the positive group of head lice infestations, as many as 25.3% had abnormal nutritional status and as many as 60.7% had normal nutritional status. Based on the negative group head lice infestation, 2.7% had abnormal nutritional status and as many as 11.3% had normal nutritional status.

The proportion of head lice infestations (*Pediculus humanus capitis*) in elementary school students in the coastal area of Abeli Subdistrict was 86%, due to one of them because the personal hygiene of female students was still not noticed such as using a joint comb, frequent sleeping together, and a rare frequency of shampooing, so the risk of head lice infestations increase. This is in line with the research of Muhajir et al., (2017) in children aged 9-12 years in RW XI of Gampingan Village, Yogyakarta City, where a positive proportion of pediculosis capitis was 86.84% [10].

Analysis of chi-square test obtained a p-value of 0.470, the value of Prevalence Odds Ratio (POR) = 1.547, (95% CI = 0.616-3.888), which indicates that head lice infestation is not a risk factor for changes in nutritional status. Based on the results of data analysis, elementary school students who experienced head lice infestations and had normal nutrition were 60.7%. This can be caused by elementary school students who experienced head lice infestation in this study most of the changes did not occur in their diet so that they did not affect their nutritional status. While the other cause was in this study most of the students did not feel ashamed or inferior at all to head lice infestations, so there were no psychological effects that occurred in the female students, where psychological effects were one of the factors that could affect a person's nutritional status. The results of this study are in line with the research conducted by Karim et al. (2014) in Bangladesh which also showed no relationship between head lice infestations (*Pediculus humanus capitis*) and nutritional status in children [11].

The results of this study found that female students who experienced head lice infestations and experienced abnormal nutritional status of 25.3%, due to sleep disturbances in children due to itching caused by head lice at night. Quality sleep is very important in maximizing height growth because growth hormone will work optimally while sleeping. Release of Growth hormone (GH) during sleep as much as 75%. This GH level affects the child's physical condition because this hormone functions to stimulate bone and tissue growth, as well as regulate the child's body's metabolism. So that if there is a sleep disturbance in a child, the child's growth and development can be disrupted as a result, it can affect the child's nutritional status.

The results of this study, respondents were negative head lice infestations, but had an abnormal nutritional status of 2.7%, due to the food intake of the child and his socioeconomic. According to Fatmasari (2014) the socio-economic conditions of coastal communities are relatively low in welfare, especially in terms of access to education and health services, which affect a person's nutritional status.

[12] Research shows that there are 86% of positive students experiencing head lice. where the ages of 8-10 years are 54.7%. This age group entered into a period of late childhood. Late childhood is the end of childhood that lasts from six years until the individual becomes sexually mature. This period is marked by the expansion of the social environment. Children at this age begin to break away from their families and get closer to others, especially peers in the school and play environment. The school and play environment is needed by a child to know and interact with each other so that children's social behavior can develop [13].

The same thing happened in elementary schools in the coastal area of Abeli District. Teaching staff familiarize students to interact with each other, by forming small groups to do a game. However, according to Seif et al. (2000) a younger person has a low level of knowledge, catching power and mindset because of his life experience. Young children who often interact with their peers will be more easily infested, especially if their peers are also infested with head lice [14].

The source of transmission from head lice can be through passive transmission such as wind blowing that can be obtained when the child interacts. Based on observations at the study site, there were several children who lied sitting together and the distance between seats between students was close together. In addition, most of them walk when they go and go home from school. This situation causes children to be exposed to longer temperatures and humidity in Abeli which had generally suitable for breeding head lice.

This research was in line with the research conducted by Akib, et al (2017) at Public Elementary School 08 North Moramo located in the coastal area, indicating that the highest head lice infestation occurs at a younger age ie 7-9 years. According to him, the highest prevalence of head lice based on age depends on the characteristics of the group being studied because it was related to exposure to risk and resistance to a disease. [4] The younger a person's age, the higher the prevalence of occurrence. Students who experienced anemia as much as 67%, mostly occurred in students who experienced > 3 years head lice infestation, namely 58%. Based on these studies, the longer the head lice infestation, the greater the risk of anemia. Research conducted by Speare and his colleagues tried to measure the amount of blood lost by one flea in one meal. The results found were adult female lice consuming as much as 0.0001579 ml, adult males as much as 0.0000657 ml and nymph as much as 0.0000387 ml. If the assumption of eating lice is three times per day with an average infestation of 30 lice (10 females, 10 males, 10 nymphs) then the average child with active pediculosis will lose blood about 0.008 ml of blood per day [15].

The large number of flea infestations in a long time can cause anemia. Symptoms experienced by someone affected by Pediculosis capitis due to a series of head lice growth processes that stimulate an increase in hypersensitivity mediators. This reaction occurs after 4-6 weeks after the infestation develops. Head lice saliva contains the enzyme hyaluronidase and other glycosaminoglycan materials from the extracellular matrix which serve to expand bite lesions. Other components of head lice saliva are antithrombin, enzyme aphyrase, factor Xa, antithromboxane, antiserotonin, and prostaglandin inhibitors which inhibit vasoconstriction and prevent platelet aggregation to make it easier for lice to suck blood [7].

The results of this study was supported by a case report conducted by Guss, D.A (2011) who conducted a 4-year study of a group of patients who experienced anemia and head lice. The group was then evaluated and no evidence of gastrointestinal blood loss or other alternative explanations for the incidence of anemia were found. [16] Based on the study by Speare et al., 2006, anemia was strongly influenced by the number of fleas and the duration of infestation. According to the theory, the longer infestation of lice, the higher the incidence of anemia [15].

Anemia can be caused by several factors other than head lice infestation. Determinant factors for the incidence of anemia are worm status, breakfast habits, consumption patterns of iron-inhibiting foods, and consumption patterns of food sources of heme. [17] In this study, helminthiasis factors have been controlled so that the assumption causes negative distribution of head lice infestations. Anemia is depend on the habit of breakfast, consumption pattern of iron inhibiting foods, and consumption patterns of heme source foods. Breakfast habits are a risk of nutritional anemia in elementary school children. Students who rarely eat breakfast a week are at risk of having 2.95 times more anemia than those who

often eat breakfast. [17] The results of the Indonesian Nutrition Food Survey on 35,000 primary school children showed 44.6% of children who ate breakfast less than 15% of their needs. This was supported by the study of Tandirerung et al., 2013 that there is a relationship between breakfast and anemia. Children with a pattern of consumption of heme sources such as fish, poultry, and red meat ≤ 3 times / week are at risk to experience anemia by 5.09 compared to children who consume > 3 times / week. [18] Anemia can also occur due to lack of iron intake in food, but it was not appropriate food consumption patterns, inadequate quality and quantity of food. [17] Head lice can cause children to experience sleep disturbances at night due to itching caused mainly by active head lice at night. Sleep disturbances experienced, will cause disruption of the synthesis of red blood cells in the spinal cord tissue. Children with head lice infestations had a higher risk of anemia compared to the others.

5. Conclusion

Infestation of head lice (*Pediculus humanus capitis*) was not a risk factor for changes in the nutritional status of female students. However, head lice infestation had a significant relationship as a risk factor for anemia in elementary school students in the coastal area of Abeli, Kendari City.

Further research would needed to find out more clearly the risk factors that affect head lice infestation and children's nutritional health, especially in coastal areas

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