# Anaemia, STH Infection and Nutrition Status (BMI) are not Correlated with Learning Achievement of Elementary School Students in Rural Areas of Lampung, Indonesia

*By* Betta Kurniawan


| | | | |
|---|---|---|---|
| WORD COUNT | 3498 | TIME SUBMITTED | 27-OCT-2020 09:16AM |
| | | PAPER ID | 64452775 |

# Anaemia, STH Infection and Nutrition Status (BMI) are not Correlated with Learning Achievement of Elementary School Students in Rural Areas of Lampung, Indonesia

**Introduction**

The number of children for whom it is compulsory to attend school is approximately 46 million from a population of 237 million. These children are distributed in primary and middle schools across Indonesia either in city or the rural areas. Physical health and good nutrition are needed in order to enable these children's successful education (Husna et. al., 2020; Irawati et. al., 2017).

Student learning achievement is affected by a number of factors. Some researchers maintain that learning achievement is affected by nutrition (Nadharatunna'im & Afrida, 2014). The nutrition status referred to can be in the form of haemoglobin rate (anaemia) (Saadah & Santoso, 2010), (Heryati & Setiawan, 2014), iodine status (Mutalazimah & Asyanti, 2009), the adequacy level of energy and protein (Sulistyanto & Sulchan, 2010;M et. al., 2012), as well as the adequacy of Eicosapentaenoate Acid (EPA), and Docosahexaenoic Acid (DHA) (Zulaihah & Widajanti, 2006).Meanwhile, another factor outside of student nutrition which can affect learning achievement is teachers' teaching performance, utilisation of learning facilities and motivation (Narwoto & Soeharto, 2013), motivation (Hamdu & Agustina, 2011; Corradini et. al., 2011), and the method of peer tutor learning (Arjanggi & Suprihatin, 2010).

According to Basic Health Research (*Riskesdas*) 2013, the prevalence of anaemia in Indonesia is still high, consisting of 21.7% of Indonesian citizens. . At the Primary and Middle School age group, the prevalence of anaemia is 26.4%, which means that more than a quarter of Indonesian children suffer from blood deficiency or anaemia (Kemenkes, 2013; Kurniawan et. al. 2018; Kurniawan et. al., 2019; Kurniawan et. al. 2020). Anemia can be caused by the lack of availibility of haemoglobin shaper substance, especially iron and animal protein. Lack of iron in the body can be caused by less intake of food or iron which cannot be fully absorbed

in the gastrointestinal tract due to soil transmitted helminth (STH) infection (Pasricha et. al., 2013; Kumar, S., & Pandey, A. K. 2013).

According to WHO, more than 1.5 billion people, or 24% of the world population is infected by STH, which is widespread in tropical and subtropical areas, with the biggest number occurring in sub-Saharan Africa, the US, China and East Asia. More than 270 millions preschool aged children and more than 600 million school age children have been infected with this parasite and require treatment and preventive intervention (WHO, 2014). Severe STH

infection can cause various symptoms including intestine manifestation (diarrhea, stomach ache), general malaise and weakness, cognitive disorder and physical development (CDC (Centre for Disease Control and Prevention, 2015).

Indonesia is a tropical country with high humidity resulting in being a good environment for the breeding of helminths. Preschool and school-age children are included in the STH infection risk group (WHO, 2014). The epidemiology research had been conducted in almost all Indonesian provinces, mainly concerning school aged children, usually acquiring a high number of prevalence (Gnankiné & Bassolé, 2017l; 2017; Kurniawan, & Nurcahyani, 2019). Results for the prevalence of STH infection have been sourced from 10 provinces in 2005, targeting primary school students, varying between 1.37 % and 77.14 %, with the highest prevalence occurring in Banten Province and the lowest in South Kalimantan Province (Depkes, 2005). The causal helminths species consists of *Trichuris trichiura* by 16.52%, *Ascaris lumbricoides* by 12.38 % and the smallest *Ancylostoma duodenale* by 1.38 %(CDC (Centre for Disease Control and Prevention), 2015). This survey result indicates that STH infection generally attacks children due to low body endurance. Factors such as a tropical climate, low awareness of cleanliness, bad sanitation, low socio-economic conditions and overcrowding all have an influence on these results (WHO, 2014).

State Primary School 5 Merak Batin, Natar is located in a rural area. It has the highest number of students compared to other primary schools in South Lampung regency, Indonesia. This large number of primary school students are a risk group, therefore this research attempts to analyse the relationship between anaemia, STH infection and nutrition with the learning achievement of elementary school students in the rural area of Lampung.

## Materials and Methododology

### *Study Site*

This research consists of a cross sectional study where anaemia, worn infestation, obesity and learning achievement variables were measured at a time. Research was conducted in State Primary School 5 Merak Batin, Natar, South Lampung. The research was conducted between July and-September 2015. The research process was started from a field survey, respondent determination and respondent data retrieval which covered respondent characteristics, faeces sampling for stool microscopic examination, data retrieval of respondents' blood haemoglobin, data retrieval of even and odd semester grades during the past year to determine students' level of learning achievement. . Once all data was collected, the research shifted to data processing and analysis.

***Patients Recruited and Sample Collection***

The population of this research consisted of third grade students in State Primary School 5 Merak Batin Natar, South Lampung, Lampung province, Indonesia. This choice was based on the fact that third grade students (compared to first and second grade) had already been able to cooperate whenever being asked for to fill out a questionnaire and understood the requested instruction independently such as taking home faeces bottles to obtain faeces sample, then bringing them to school for collection. Another consideration in taking the third grade (compared to fourth and fifth) was the fact that in that age group, children are more exposed to soil so they are more at risk compared to higher grades. The sixth grade was not selected as it was decided that students in this grade needed to focus on their learning without any interruption.

Primary data consisted of student characteristics, including anthropometric data, Hb rate, and grade data of even and odd semesters during the past year. Primary data was obtained through questionnaires as well as direct measurement of body height using stature metre with 0.1 cm accuracy, while body weight was measured using body scales Krisbow brand with 0.1 kg accuracy. Data for anaemia status was obtained by measuring the haemoglobin rate in blood directly through easy touch. STH infection checkup was detected through students' faeces. The ova detection on faeces was conducted in a Parasitology laboratory at the Medical Faculty of Lampung University using floatation method.

***Inclusion and Exclusion Criteria***

The inclusion criteria comprise of third grade students including boys and girls in State Primary School 5 Merak Batin, Natar, South Lampung, Lampung province, Indonesia, being willing to follow the research structure and returning the *informed consent* (IC) for which was already signed by parents. **Exclusion Criteria** consist of students with diseases affecting nutrition status such as aedema; ; students with body posture problems; those who refuse to get checked (faeces, bloodand had taken anthelmintic medicine during the past 6 months.

***Data Processing and Analysis***

Anthropometry data was processed using WHO Anthro Plus so the Body/Age Mass Index (BMI/age) value was obtained, then categorised according to Health Minister Verdict/Kemenkes (2012) into normal nutrition status (-2 SD<Z<+1 SD), *overweight* nutrition status (+1 SD<Z< +2 SD), and obesity nutrition status (Z>+2 SD). Aanemia status data was obtained by directly measuring the haemoglobin blood rate, then being compared to the standard of The Ministry of Health of the Republic of Indonesia in Basic Health Research (Riskesdas) 2013 which states that anaemia if the haemoglobin in blood <12g/dL (Kemenkes,

2013). Grades of even and odd semester were averaged to grade the subject achievement during the past year then categorised according to The Ministry of National Education. Bivariate relation inter-variables was analysed using Chi Square test (p=5%).

## Results

### *Respondent Characteristics*

The sample number of all respondents consists of 117 students. The age range of respondents was between 7 – 11 years. Most respondents 64 (54.7%) were 8 years of age and 9 years of age 40 (34.2%). The number of boy and girl respondents was almost equal equalling 58 (49.6%) boys and 59 (50.4%) girls. Most fathers' occupations consist of being labourers (68.4%) followed by entrepreneurs (16,2%), while civil servants/state owned enterprises employees/armies/police were only 7.7%. It can be estimated that most of these student's are middle-low class.

**Table 1:** Respondent Characteristics Frequency Distribution

| Respondent Characteristics | Total | Percentage |
|---|---|---|
| **Age (years)** | | |
| 7 | 5 | 4,3 |
| 8 | 64 | 54,7 |
| 9 | 40 | 34,2 |
| 10 | 5 | 4,3 |
| 11 | 3 | 2,6 |
| **Gender** | | |
| Male | 58 | 49.6 |
| Female | 59 | 50.4 |
| **Father's occupation** | | |
| No Father | 3 | 2.6 |
| Civil Servant/State Owned Enterprise Employee | 5 | 4.3 |
| Army/Police | 4 | 3.4 |
| Private employee | 5 | 4.3 |
| Entrepreneur | 19 | 16.2 |
| Labour | 80 | 68.4 |
| Farmer | 1 | 0.9 |
| **Nutrition Status** | | |
| Thin | 18 | 15,4 |
| Normal | 98 | 83,8 |
| Fat | 1 | 0,9 |
| **STH Infection** | | |
| Negative | 60 | 51,3 |
| Positive | 57 | 48,7 |
| **Anaemia Status** | | |
| Aanemic | 47 | 40,2 |
| Not Anaemic | 70 | 59,8 |
| **Learning Achievement** | | |
| Below good | 17 | 14,5 |
| Good | 95 | 81,2 |

From a total of 117 samples, most students had normal nutrition status (83.8%), while thin nutrition status was 15.4% while fat nutrition status 0.9%. Students with positive STH infection consisted of 48.7%, so that almost half of the total number of children in the village were STH infected (Darmasetiawan et. al., 2002). This number was much higher than the prevalence of STH infection in Indonesia which was 28.12 percent (Health Minister

Verdict/Kemenkes, 2015). Therefore, counter measures became necessary. From 117 samples, 47 (40.2 %) had anaemia. Compared to the national prevalence of anaemia prevalence children between 5-12 years old (26.4%,) so prevalence of anemia amongst students in the village was much higher bigger (13.8%). Students' learning achievement was graded based on the average grade over 2 past semester. Most had good average grades (81.2%).

***Relationship between STH Infection and Anaemic Status***

There were 22 (38.6%) STH infected students who had anemia,while amongst did not get STH infected, 25 (41,7%) had anaemia. Table 2 shows p value=0.881, therefore there was no difference on anaemic status between STH and non-STH infected students. . In other words, there was no relationship between anaemic status and STH infection.

**Table 2:** Respondent Distribution According to STH Infection and Anaemic Status

| STH Infection Status | Anaemic | | | | Total | | OR | P value |
|---|---|---|---|---|---|---|---|---|
| | Anaemic | | Not Anaemic | | | | | |
| | n | % | n | % | n | % | | |
| Positive | 22 | 38.6 | 35 | 61.4 | 57 | 100.0 | 0.88 | 0.881 |
| Negative | 25 | 41.7 | 35 | 58.3 | 60 | 100.0 | (0.420-1.845) | |
| Total | 47 | 40.2 | 70 | 59.8 | 117 | 100.0 | | |

***Relationship between STH Infection and Children's Nutrition Status***

There were 10 (17.5%) STH infected students who had thin nutrition status, 47 (82.5%) normal and 0 (0%) fat, while amongst non-infected students there were 8 (13.3%) STH infected students who had thin nutrition status, 51 (85%) normal and 1 (0.9%) fat. A P value=0.520 was attained, so that there was no difference regarding students' nutrition status between the STH infected and non-infected students. Therefore, there was no relationship between STH infection and students' nutrition status. Odd Ratio could not be determined (Table 3).

**Table 3:** Respondent Distribution According to STH Infection and Nutrition Status

| STH Infection Status | Nutrition Status | | | | | | Total | | P value |
|---|---|---|---|---|---|---|---|---|---|
| | Thin | | Normal | | Fat | | | | |
| | n | % | n | % | n | % | N | % | |
| Positive | 10 | 17.5 | 47 | 82.5 | 0 | 0 | 57 | 100 | 0.520 |
| Negative | 8 | 13.3 | 51 | 85.0 | 1 | 1.7 | 60 | 100 | |
| Total | 18 | 15.4 | 98 | 83.8 | 1 | 0.9 | 117 | 100 | |

***Relationship between Children's Nutrition and Anaemic Status***

6 students (33.3%) with thin nutrition status had anaemia, while the remaining 12 (66.7%) did not. Amongst students with normal nutrition status, 41 (41.8%) also had anaemia and the remaining 57 (58.2%) did not have, while there was one student with fat nutrition status who did not have anemia.A P value = 0.567 was obtained so that there was no difference regarding anaemic condition between students with thin, normal and fat nutrition status. It can therefore be concluded that there was no relationship between children's nutrition and anemic status. Odd ratio could not be determined (Table 4).

**Table 4:** Respondent Distribution According to Nutrition and Anaemic Status

| Nutrition Status | Anaemic Status | | | | Total | | P value |
|---|---|---|---|---|---|---|---|
| | Anaemic | | Non-anaemic | | | | |
| | N | % | N | % | n | % | |
| Thin | 6 | 33.3 | 12 | 66.7 | 18 | 100 | 0.567 |
| Normal | 41 | 41.8 | 57 | 58.2 | 98 | 100 | |
| Fat | 0 | 0 | 1 | 100 | 1 | 100 | |
| Total | 47 | 40.2 | 70 | 59.8 | 117 | 100 | |

***Relationship between Children's Nutrition Status and Learning Achievement***

To assess the relationship between nutrition status and learning achievement, nutrition status was first categorised into 3 groups: thin, normal and fat. However, as there was only fat student, there was a cell worth 0 (zero), so nutrition was only categorised into 2 categories: . thin and normal. The student with fat nutrition status was placed into normal nutrition status (Table 5)

**Table 5:** Respondent Distribution According to Nutrition Status and Learning Achievement

| Nutrition Status | Learning Achievement | | | | Total | | OR | P value |
|---|---|---|---|---|---|---|---|---|
| | Lower | | Good | | | | | |
| | n | % | n | % | N | % | | |
| Thin | 2 | 11.1 | 16 | 88.9 | 18 | 100.0 | 0.700 (0.146-3.362) | 0.492 |
| Normal/Fat | 15 | 15.2 | 84 | 84.8 | 99 | 100.0 | | |
| Total | 17 | 14.5 | 100 | 85.5 | 117 | 100.0 | | |

There were 2 (11.1%) students with thin nutrition status who had lower learning achievement, while amongst good nutrition status, there were 15 (15.2%) students who had lower learning achievement and the remaining 84 (84.8%) had high learning achievement. A p value=0,492 was obtained, so there was no difference regarding students' learning achievement between students who had thin nutrition status with those who had good nutrition status. In other words, there was no relationship between nutrition status and students' learning achievement.

***Relationship Between Primary School Students' Anaemia and Learning Achievement***

There were 6 (12.8%) aanemic students who had lower learning achievement, while amongst non-anaemic students, 11 (15.7%) had lower learning achievemen while the rest 59 (84.3%) had good learning achievement. A p value=0.860 was obtained,therefore there was no difference regarding students' learning achievement between students who had anaemia and those who did. Therefore, there was no relationship between anaemic status and students' learning achievement (Table 6).

**Table 6:** Respondent Distribution According to Aanemic Status and Learning Achievement

| Anaemic Status | Learning Achievement | | | | Total | | OR | P value |
|---|---|---|---|---|---|---|---|---|
| | Lower | | Good | | | | | |
| | n | % | n | % | n | % | | |
| Anaemic | 6 | 12.8 | 41 | 87.2 | 47 | 100.0 | 0.785 (0.269-2.292) | 0.860 |
| Non-Anemic | 11 | 15.7 | 59 | 59 | 70 | 100.0 | | |
| Total | 17 | 14.5 | 100 | 100 | 117 | 100.0 | | |

**Discussion**

This research obtained 40.2% anaemic prevalence (haemoglobin <12g/dL) regarding students between 7-11 in the village of Lampung province, Indonesia. This research result was similar to results obtained in Malaysia and Ethiopia where anaemic prevalence for 6-13 year old students in a village in Malaysia was 41% ( Ahmed et. al., 2012), while in Ethiopia its prevalence for students between 6-12 years old was 43.7% (Desalegn et. al., 2014). Anaemic prevalence of children in India between 5-16 years old was higher at 56.5% (Jain & Jain,

2012), while in Serbia, anaemic prevalence for 7-14 year old students was 32% (Djokic et. al., 2010).

Risk factor which can be connected to school-aged children's anaemia include gender, age, dietary habit related to not eating poultry and fish, less consumption and skipping lunch (Djokic et. al., 2010), as well as nutrition status (Shang et. al., 2010), STH infection (Ahmed et. al., 2012), mother's level of education, family earnings (Choi et. al., 2011), malaria infection (Degarege et al., 2010) as well asinfectious diseases such as repeated diarrhea and pneumonia (Pasricha et. al., 2013).

The results obtained indicate that there was no meaningful relationship between anaemic status with STH infection ($p>0.05$) and nutrition status ($p>0.05$) on primary school studentsin a village of Lampung province, Indonesia. The research result was consistent with Ahmed's reasearch in Malaysia where results showed was no meaningful relationship between children's anaemic status with nutrition status and infection on 6-13 year-old children ($p>0,05$) (Ahmed et. al., 2012). This reasearch was agreed with Rahman's research in Bangladesh which showed no meaningful relationship between STH infection with anaemic status on children between 6-16 ($p>0.05$) (Rahman et al., 2013). This research result differed from research conducted in Nigeria on children between 1-15 years which obtained a meaningful relationship between anemia and STH infection ($p<0.001$) (Osazuwa et. al., 2011). The research limitation was that it did not measure the daily intake of iron during research related to iron intake of Indonesian children between 7 to 12 showed that 40.9% of children were lacking in iron consumption based on the Recommended Dietary Allowances (RDA) (Arifin et. al., 2013).

This research showed the prevalence of STH infection on primary school students in the village amounting to 48%. This condition did not vary greatly from STH infection studies conducted by Mardiana on primary school students in Jakarta, which found an STH infection prevalence in North Jakarta of 49,02% (Mardiana & Djarismawati, 2008). This number was higher than the STH infection of Indonesian children which was 28.12% (Octama, 2015). WHO stated that more than 1.5 billion people, or 24% of the world's population were STH infected. The infection was spread throughout tropical and subtropical areas, with the largest numbers occurringed in sub-Saharan Africa, the US, China and East Asia. From the total number, more than 270 million pre-school age children and more than 600 millions school age children were STH infected (WHO, 2016). These results did not differ greatly from research on students in a village in Malaysia, where Ascaris infection was 50.8, Trichuris 1.0, and Hookworm 55.6% (Ahmed et. al., 2012), while in Ethiopia, the prevalence of STH infection in students was higher at 82.4% (Alemu et. al., 2011). Research in Kenya found that 34% of children were STH infected (Odiere et. al., 2011), while in China, the prevalence of STH infection totalled 36.7% (Shang et. al., 2010).

In accordance with the environmental conditions, children in the village had lots of contact with nature such as playing in the ricefield, field, fishing, soccer and where they had contact with the soil as ova incubation. Inappropriate behaviour due to lack of knowledge about hygiene and environmental cleanliness encouraged the increasing prevalence of STH infection in this village. Research results in Tanzania showed that the prevalence of STH infection in the village was higher at 73.7% than the city 48.9% (Knopp et. al., 2010; Debboun, M., & Strickman, D. 2013). A meta-analysis of 39 researches in the world proved that STH infection was related to environment sanitation with an OR = 0.46 to 0.58 (Ziegelbauer et. al., 2012). Another meta-analysis study consisting of 94 research associated STH infection with risk factors such as water pipe usage (refined water), environmenta; sanitation, shoe usage, washing hands before and after eating, availability and use of soap (Strunz et. al., 2014).

This research has discovered a significant relationship between learning achievement with anaemic and nutrition status. It is consistent with Heryati's results which indicate that there was no difference between learning achievement and nutrition status (Heryati & Setiawan, 2014). A different result was obtained from research in Malaysia where there was a meaningful relationship between nutrition status and learning achievement. This research also discovered a meaningful relationship between learning achievement with students' birth weight, parents' level of education education and family earnings (Hamid et. al., 2011). Another research connected learning achievement with the availability of nutrition substances in daily food such as amino acid, choline, zink, iron, omega 3, vitamin A, B and E (Rausch, 2013).

**Conclusion**

This research attained 83.8 % students with normal nutrition status, 15.4% thin and 0.9% fat. It acquired students whose faeces tested positive for STH infection to the amount of 48.7%. The prevalence of anaemia of primary school students in the village was 40.2%. There was no relationship between anemic status with STH infection and learning achievement, STH infection and students' nutrition status andstudents' nutrition status with anaemic status and learning achievement. In order to find the connection between nutrition status and anaemia, it was better to obtain results not only through haemoglobin rate, but also by measuring another parameter related to iron deficiency such as level of serum ferritin, etc. Further research is necessary to measure the dietary and activity habit of primary school students in the village. School authorities and parents are expected to increase their concern about sanitation and students' hygiene due to the prevalence of high STH infestation of primary school students in a village.

**Acknowledgement**

Gratitude is expressed to the Medical Faculty of Lampung University which has funded this research. Our gratitude also goes to the research subjects and the volunteers who have actively participated in this research.

**Abbreviations**

| | |
|---|---|
| STH | : Soil Transmitted Helminth |
| EFA | : Eicosapentaenoate Acid |
| DHA | : Docosahexaenoic Acid |

**Ethical Consideration**

This research protocol had been examined and approved by the Medical Ethical Committee from the Medical Faculty of Lampung University, Indonesia (Number: 1162A/UN26/8/DL/2015). Written *Informed consent* was obtained from students' parents after they read the manuscript explanation before approval.

**Conflict of interest**

I am Reni Zuraida the author of this manuscript and the all of co-author, declare that all of the data in this article does not have a conflict of interest with anyone, either financial or non-financial aspects (political, personal, religious, ideological, academic, intellectual, commercial or any other). This study is part of my doctoral dissertation research. Research funding for this manuscript to be published is derived from a research grand from the Faculty of Medicine, University of Lampung.

# Anaemia, STH Infection and Nutrition Status (BMI) are not Correlated with Learning Achievement of Elementary School Students in Rural Areas of Lampung, Indonesia

ORIGINALITY REPORT

6%

SIMILARITY INDEX

PRIMARY SOURCES

| | | |
|---|---|---|
| 1 | Sri Lestari Ramadhani Nasution, Ali Napiah Nasution, Suhartomi, Sri Wahyuni Nasution. "The Effect of Habits on Wearing Footwear And hand washing after playing on the ground Against Worms in Primary School Al-Wasliyah In Medan Deli", Journal of Physics: Conference Series, 2019<br>Crossref | 59 words — 2% |
| 2 | Jhons Fatriyadi SUWANDI, Widya ASMARA, Hari KUSNANTO, Din SYAFRUDDIN, Supargiyono SUPARGIYONO. "Efficacy of Artemisinin Base Combination Therapy and Genetic Diversity of Plasmodium falciparum from Uncomplicated Ma-laria Falciparum Patient in District of Pesawaran, Province of Lampung, Indonesia", Iranian Journal of Parasitology, 2019<br>Crossref | 34 words — 1% |
| 3 | download.atlantis-press.com<br>Internet | 28 words — 1% |
| 4 | www.medicinescience.org<br>Internet | 17 words — < 1% |
| 5 | innspub.net<br>Internet | 14 words — < 1% |
| 6 | www.ncbi.nlm.nih.gov<br>Internet | 11 words — < 1% |
| 7 | Fátima Cruz, Elisabete Ramos, Carla Lopes, Joana Araújo. "Tracking of food and nutrient intake from | 11 words — < 1% |

adolescence into early adulthood", Nutrition, 2018
Crossref

| | | |
|---|---|---|
| 8 | bmcpublichealth.biomedcentral.com<br>Internet | 8 words — < 1% |
| 9 | dmsjournal.biomedcentral.com<br>Internet | 8 words — < 1% |
| 10 | Adrianus Maku, Ni Ketut Mendri, Aan Devianto. "Hubungan Antara Status Gizi Dengan Prestasi Belajar Anak Sekolah Dasar Di Sdn Ngringin Depok Sleman Yogyakarta", Caring : Jurnal Keperawatan, 2018<br>Crossref | 8 words — < 1% |
| 11 | M.L. Formica, G.V. Ullio Gamboa, L.I. Tártara, J.D. Luna, J.P. Benoit, S.D. Palma. "Triamcinolone acetonide-loaded lipid nanocapsules for ophthalmic applications", International Journal of Pharmaceutics, 2020<br>Crossref | 7 words — < 1% |
| 12 | jurnal.ugm.ac.id<br>Internet | 6 words — < 1% |

| | | | |
|---|---|---|---|
| EXCLUDE QUOTES | OFF | EXCLUDE MATCHES | OFF |
| EXCLUDE BIBLIOGRAPHY | OFF | | |