Proceeding
International Seminar 2013

Shangri-La Hotel
Surabaya, Indonesia
July 4th, 2013

International Partnerships Related
to the Development of Technology and Maritime

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INTESTINAL WORM INFECTION AND ANEMIA AMONG CHILDREN AGED 4-6 YEARS IN GISIK CEMANDI, SIDOARJO, INDONESIA: A PUBLIC HEALTH CONCERN IN A COASTAL AREA

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Abstract: Poverty, poor hygiene and sanitation, hot and humid tropical climate, which are common in coastal areas, are favorable to the growth of intestinal parasite. Gisik Cemandi is a coastal village in Sidoarjo Regency, East Java Province, Indonesia. The vast majority of people in Gisik Cemandi Village is accustomed to defecate, urinate, clean kitchen equipment and takes a bath in the river that put them on the high risk of intestinal worm infection. This study aims to determine the association between intestinal worm infection and anemia among children aged 4-6 years in Gisik Cemandi Village. The study was carried out on 48 children aged 4-6 years in Gisik Cemandi Village, with cross sectional design and a cluster random sampling procedure. We used blood samples to detect anemia; faecal, water and soil samples to detect intestinal parasite. The blood samples were analyzed using erythrocyte index and blood smear; while faecal, soil and water samples were analyzed using a concentration-floating method. Around 56.3% do not use any footware, 68.8% do not wash their hand before eating, and 81.2% are used to defecate in the river. Fecal examination showed that 56.2% respondents were infected by intestinal worm, and 45.8% were anemia. The peripheral blood smear showed that 31.3% respondents had hypochromic micrositer anemia and six respondents had hypochromic normositer anemia. A bivariate analysis with Chi square test showed a significant association between intestinal worm infection and anemia among children aged 4-6 years in Gisik Cemandi Village.

BACKGROUND

Intestinal worm infection is one of public health problems in Indonesia, but it is often considered trivial (INE 2010; Ministry of Health of the Republic of Indonesia 2010). The prevalence of intestinal worm infection in Indonesia is ranged between 40% to 60% for all ages, whereas preschool and elementary school children carry the heaviest burden of intestinal worm infection with a prevalence of 60% to 80% (Margono 2001; Margono 2003; Agoes 2007). Poverty, poor hygiene and sanitation, hot and humid tropical climate, which are common in coastal areas, are favorable to the growth of intestinal parasite (Mahmoud 2000a; Mahmoud 2000b; Margono 2003). Intestinal worm infection leads to anemia, stunted growth and development of children, decreases productivity, and leads to low birth weight if the worm infection occurs in pregnant women (Abidin and Hadicjaja 2003; Chwaya and Stolzfus 2003; Cumpton, Torriesse et al. 2003; Hailing, Khine et al. 2003; Kvalsvig 2003; Brooker, Hulse et al. 2006; Aii, Faityy et al. 2011).

Gisik Cemandi Village is a coastal area in Sidoarjo Regency, East Java, where majority of the population work as laborers and fishermen without having their own boats. Their work is very dependent on the season, meaning that they can only sail if the weather is good. The local government policy to perform fecal examinations in preschool and elementary children has not been done; even intestinal worm infection is considered a trivial. The vast majority of people in Gisik Cemandi Village is accustomed
to defecate, urinate, clean kitchen equipment and takes a bath in the river that put them on the high risk of intestinal worm infection (Diarsvitr, Utami et al. 2008). Therefore, this study aims to determine the association between intestinal worm infection and anemia among children aged 4 – 6 years in Gisik Cemandi Village.

METHODS

Study area, design and population
This study was carried out in March-April 2011 on children aged 4-6 years in Gisik Cemandi Village, a coastal area in Sidoarjo Regency, East Java. A cross sectional design and a cluster random sampling procedure based on three neighborhoods of Gisik Cemandi Village were used in the study. Children who took treatment of intestinal worm infection in the previous month were excluded from the study. The final respondents in the study were 48 children, and their parents were asked for an informed consent.

Data collection
Interviews with parents were performed to obtain information about background characteristics of children, breastfeeding, food consumption, clean and healthy behavior, as well as the children’s past and present illnesses. Body weight was measured using standardized procedure to the nearest 100 grams using a scale. Age was calculated from the birth date based on birth certificates.

Blood samples (5 ml) were collected by venipuncture from each child, were put into labelled vials containing ethylenediamine tetra acetic acid (EDTA) and were sent into Fanida laboratory for hemoglobin and blood smear analysis.

For assessment of intestinal parasites infection, two containers containing 10% of formaline and 70% of alcohol for collection of stools were distributed to each mother and mothers were asked to collect and deliver a sample of their child’s feces to the health cadre the next day. In case some children were unable to return a sample, one of the health cadres returned the next day to collect the rest of the samples. Stool, water and soil samples were sent to the Biology laboratory of the Tenth of November Institut of Technology Surabaya for a direct wet mount examination, a floatation test and a concentration test.

DATA ANALYSIS AND DISCUSSION
Of the 48 respondents, 27 (56.2%) were males and 21 (43.8%) were females. The majority (64.6%) of respondents aged five years, while only seven (14.6%) aged six years. Twenty (41.6%), 14 (29.2%), and 14 (29.2%) of respondents were from Gebang, Gebang Klopo and Gisik neighborhoods, respectively. Majority (52.2%) of parents worked as fishermen, while the rest worked as laborers, farmers and traders. Further, 25 (52.1%) of parents had elementary school education, while the rest had secondary school education.

Related to the clean and healthy behavior, only 21 (43.7%) of respondents used to wearing footwear, 15 (31.2%) used to washing hand before eating, and only nine (18.8%) used to defecate at home, while 81.2% of respondents used to defecate in the river or trench.

Adult worm or worm egg were found on 27 (56.2%) of stool samples. They were from *Ascaris* sp, *Strongyloides* sp, *S. Japonicum*, *D. caninum*, *S. mansoni*, *H.*
nana, Ancylostoma sp, Taenia sp, Fasciola sp, and Enterobius vermicularis. The findings were confirmed by soil and water examination.

In addition, anemia (low haemoglobin of less than 11 g/dl) was found on 22 (45.8 %) respondents, in which 15 (68.2%) of their blood smear showed a microcytic hypochromic anemia, and the rest showed normocytic hypochromic anemia. Of the total respondents, eighteen (37.5%) respondents with worm infestation in their stool samples suffered from anemia, four (8.3%) of respondents without worm infestation also suffered from anemia; while nine (18.8%) of respondents with worm infestation did not suffer from anemia. Bivariate analysis using Chi square test showed there was a statistically significant association between worm infestation and anemia (p = 0.003).

Table 1. Worm infestation and anemia

<table>
<thead>
<tr>
<th>Concentration test on stool samples</th>
<th>Haemoglobin test</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Anemia (Hb&lt;11g/dl)</td>
<td>Without anemia</td>
</tr>
<tr>
<td>Negative worm infestation</td>
<td>4 (8.3%)</td>
<td>17 (35.4%)</td>
</tr>
<tr>
<td>Positive worm infestation</td>
<td>18 (37.5%)</td>
<td>9 (18.8%)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>22 (45.8%)</td>
<td>26 (54.2%)</td>
</tr>
</tbody>
</table>

Intestinal worm infection is commonly found among children in coastal areas related to their poor hygiene and sanitation (Refirman 1998; JIIPP Badan Litbang Kesehatan 2001; Crompton, Montresor et al. 2003; Ginting 2005; Ernawati 2006; Agoes 2007), in which majority of the population in Gisik Cemandi Village did not apply clean and healthy behavior. This condition was also related with low education and income level (En and Gan 2011; Mukherjee 2011).

Majority of respondents with worm infestation suffered from a microcytic hypochromic anemia, which was a sign of iron deficiency anemia, even though it needed to be confirmed with further tests, including ferritin, iron concentration and Total Iron Binding Capacity (TIBC) (Clark 2009; Pasricha, Flecknoe-Brown et al. 2010).

Intestinal worm infection may cause malabsorption of nutrients, chronic bleeding due to the attachment of the worm in the intestine, inflammation, and decrease appetite that worsen the anemia (Ngui, Lim et al. 2012).

CONCLUSION

Fifty-six percent of respondents in this study suffered from intestinal worm infection and 45.8% of respondents suffered from anemia, in which 15 (68.2%) of their blood smear showed a microcytic hypochromic anemia. There was a statistically significant association between worm infestation and anemia (p = 0.003) in this study.

The high rates of intestinal worm infection among children in Gisik Cemandi Village may be related to their poor hygiene and sanitation. We strongly suggest that the local public health center provides stool and haemoglobin examination for all children and pregnant women of Gisik Cemandi Village that are at high risk of
contracting the intestinal worm infection. Further, a mass treatment of intestinal worm infection should be given to all population for high prevalence of intestinal worm infestation.

Children are taking a bath in a trench

Stool samples

REFERENCE


INE (2010). "Twenty percent of Indonesian children suffer from worm infestation (20% pemuda Indonesia menderita kecacingan)."


Ministry of Health of the Republic of Indonesia (2010) "Worm disease is still considered trivial (Penyakit kecacingan masih dianggap sepele)."

Mukherjee, N. (2011) "Scaling up rural sanitation. Factors associated with achieving and sustaining open defecation free communities: learning from East Java."


THE CAPACITY OF MUSCIDAETAND CALLIPHORIDAE FAMILY AS MECHANICAL VECTORS OF PARASITE AND BACTERIA WITH DIARRHEA INCIDENT IN COASTAL AND NON COASTAL AREAS IN SIDOARJO

Prawesty Diah Utami
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Abstract: Diarrhea is a common public health problem in developing countries such as Indonesia, which cause high morbidity and mortality. Parasite and bacteria that are attached in Muscid and Calliphoridae flies often transmit diarrhea. This study aims to determine the potency of Muscid and Calliphoridae flies as mechanical vectors of parasites (Entamoeba histolytica and Giardia lamblia) and bacteria (Escherichia coli, Salmonella spp and Shigella spp), which caused diarrhoea in coastal and non coastal areas in Sidoarjo. The study used observational analytic design with cross sectional approach toward 32 group samples of files. The research was carried out in coastal area (Sedati district) and non coastal areas (Waru, Sidoarjo and Balongbendo districts). The files were captured using a fly trap. Parasites and bacteria were identified using a biochemical test (IMVIC) and a microscope. The results showed that Muscid and Calliphoridae flies had a potency to carry pathogenic agent (31,25% parasites and 53,12% bacteria) on their body surface. However, there was not any significant association between the potency of carrying pathogenic agent with diarrhoea incident. This fact might be influenced by several possibilities, such as the death of parasites and bacteria before ingesting a new host, hygiene and healthy living behaviors.

BACKGROUND

Diarrhea is a common public health problem in developing countries such as Indonesia. Diarrhea was ranked second out of ten main diseases in Sidoarjo Regency, East Java (Statistics Sidoarjo 2007). Diarrhea may be caused by infection of parasites, bacteria or virus, in which the transmission of all agent of diseases could be brought by flies (Nmorsi, Ukwandu et al. 2006; Ajero and Nwoke 2007). Flies could act as mechanical vectors for many kinds of pathogenic agents which caused diarrhea, such as enteric bacteria (Salmonella, Shigella, and Escherichia coli (Vasan, Prabhu et al. 2008) and protozoa parasites such as E.histolytica and G.lambila (Nmorsi, Ukwandu et al. 2006). Previous study reported that there was an association between flies population and diarrhea (Emerson, Lindsay et al. 1999; Rudianto and Azizah 2005).

METHODS

The study used observational analytic design with cross sectional approach toward 32 group samples of flies with 10 flies from one family and diarrhoea's data collected from local public health center (Puskesmas). The flies were collected from four traditional markets (Ajero and Nwoke 2007) in four different areas of Sidoarjo Regency using stratified random sampling. Each area represents different characteristic, such as Waru area (industry area), Sedati area (coastal / fishery region), Sidoarjo area (central government region) and Balongbendo area (agriculture region).
The flies were captured in August using a fly trap (White 2006). Each fly was then grouped into four groups based on the family (Muscid and Calliphoridae), which contained 10 flies on each group. 10 group of flies were put in the sterile covered tubes containing 20 ml sterile saline liquid (2 ml saline liquid for each fly), followed by isolating the bacteria and parasites from the fly's body surface (Lamiaa, Marriam et. al. 2007).

Samples for parasite examination were mixed with MIF (a mixture of mertiolat – iodium – formalin) (Neva and Brown 1994). After settled for 24 hours in room temperature, the mixture was processed using concentration and sedimentation method, and prepared for microscopic examination (Garcia and Bruckner 1996; Soheir and Nevine 2008).

Samples for microbiologic examination were planted on a nutrient agar plate using a spread plate count method and incubated for 24 hours. The number of bacterial colonies was counted by colony counter (HACH 2000; Prescott 2002). E.coli, Salmonella and Shigella identification was done using planted samples on Mac Conkey media, SS agar, TSI agar and biochemical testing (Indol, Red methyli, motility, urease, Voges Proskauer and Simon’s citrat) (Prescott 2002; Brooks, Butel et. al. 2004; Hogg 2005).

Diarrhea cases data in an associated month were collected from local public health center of Waru, Sedati, Sidoarjo and Balongbendo subdistricts.

DATA ANALYSIS AND DISCUSSION

Parasitology examination

The result of parasitology examination on 32 groups of fly samples could be seen in the diagram below:

![Diagram 1. Frequency Distribution of Parasites Examination](attachment:diagram.png)

Based on diagram 1, Balongbendo area (agriculture region) had the highest number of parasites than other areas, especially Entamoeba histolytica.
Microbiology examination

![Bar chart showing frequency distribution of bacteria examination.]

Diagram 2. Frequency Distribution of Bacteria Examination

Based on diagram 2, Balongbendo area (agriculture region) showed the highest number of bacteria, followed by Sedati area (coastal/fishery region). *Shigella* sp was found in Balongbendo and Sedati areas, but *Salmonella* sp was not found in all areas.

**Diarrhea incidence**

**Table 1. Incident Diarrhea’s Data in 4 Region:**

<table>
<thead>
<tr>
<th>Region</th>
<th>Population</th>
<th>Number of new diarrhea patients</th>
<th>Diarrhea Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balongbendo</td>
<td>72,273</td>
<td>158</td>
<td>0.2186</td>
</tr>
<tr>
<td>Sedati</td>
<td>81,687</td>
<td>319</td>
<td>0.3905</td>
</tr>
<tr>
<td>Sidoarjo</td>
<td>172,646</td>
<td>88</td>
<td>0.0510</td>
</tr>
<tr>
<td>Waru</td>
<td>199,837</td>
<td>204</td>
<td>0.1021</td>
</tr>
</tbody>
</table>

Based on median value of diarrhea incidence in four areas Sedati and Balongbendo showed a high incidence, while Sidoarjo and Waru showed low incidence of diarrhea.
The association between capacity of Muscid and Calliphorid flies as mechanical vector of parasites and bacteria with incidence of diarrhea

Table 2. Frequency Distribution Parasites and Bacteria Finding in High and Low Incident Diarrhea Region

<table>
<thead>
<tr>
<th>Diarrhea Incident</th>
<th>Total sample</th>
<th>The sample containing the parasite and bacterial causes of diarrhea</th>
<th>n*</th>
<th>%</th>
<th>p=0.457</th>
</tr>
</thead>
<tbody>
<tr>
<td>The high incidence of diarrhea (Balongbendo and Sedati region)</td>
<td>16</td>
<td>12</td>
<td>75.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The low incidence of diarrhea (Waru and Sidoarjo region)</td>
<td>16</td>
<td>9</td>
<td>56.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
<td>21</td>
<td>65.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*: number of flies samples

Statistical analysis did not show a significant association between the capacity of Muscid and Calliphorid flies as mechanical vectors of parasites and bacteria which caused diarrhea (p=0.457).

The findings might be due to:
1. The death of the parasite and bacteria before examination (OSRAS, 2001), considering the lifespan of both fly’s families which was about 30 days (Kaufman et al., 2000; Moon, 2002) were longer than bacteria’s lifespan (less than 20 days) or parasite’s lifespan (less than 10 days), (OSRAS, 2001).
2. The ability of each pathogen agent life could be elongsted or shortened. This ability could be effected by air humidity, temperature and sun exposure (OSRAS, 2001). Samples were collected in August, in which the climate and weather conditions was hot and dried without interspersed rain. This condition caused reduction of air humidity, temperature enhancement and sun exposure continuously. All of these factors caused the death of parasite and bacteria before they were transmitting the disease to human.
3. There were many factors that causing the onset of diarrhea, including virus, other bacteria and other parasites, besides agents pathogenic on this research, so that might be the cause of insignificance relationship (Musher and Musher, 2004).
4. The clean and healthy behavior of the population in the four areas might have influence on the incidence of diarrhea, including washing hand, covering food and drink, storing the cutlery in a closed place, washing fruits/ raw vegetables before eating, closing the existing landfills, etc. If the community had a healthy behavior like the example above, the transmission of pathogenic agent would be failed.
CONCLUSION

Musciidae and Calliphoridae flies could act as mechanical vectors parasites and bacteria that caused diarrhea, however the statistical analysis showed there was not any significant association between the capacity of Muscidae and Calliphoridae flies as mechanic vectors of parasites and bacteria which caused diarrhea in Sidoarjo.

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