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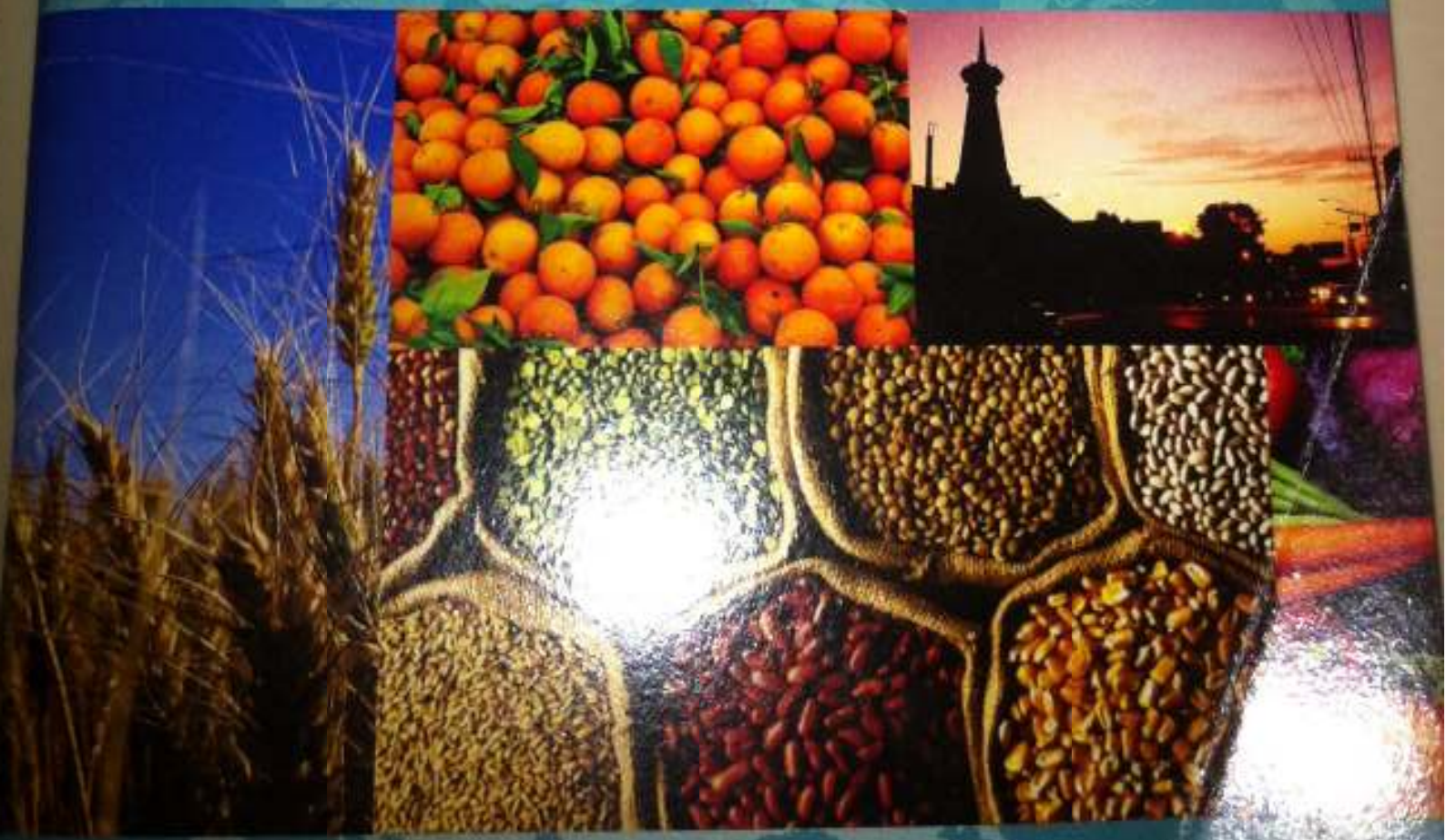

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PREVALENCE AND DETERMINANTS OF ANAEMIA AMONG UNDER-FIVE CHILDREN IN MUNTIGUNUNG, KARANGASEM REGENCY, BALI-INDONESIA

Ni Wayan Septarini

ABSTRACT

The optimal development of infants and young children are significant for their future. One of the most common nutritional issues countenanced by this stage of age in developing countries is anaemia. This research aimed to find out the prevalence of anaemia among children under the age of five in Muntigunung Village and its determinants.

This study is part of cross-sectional general health survey conducted in 2009 in Muntigunung Village with the total survey sample was 275 households who had at least one child under-five years old. The samples were under-five children. Haemocue was used to test the haemoglobin status (anaemia) in the samples. The information regarding determinants of anaemia obtained from their mothers using questionnaire. The sampling technique was systematic random sampling.

The prevalence of anaemia among under-five children in this population was 86.4%. This prevalence was across the village as a whole irrespective of the location of residence, the child□s gender, and the parents□ occupational status.Older children were at greater risk of anaemia (p= 0.006). Children whose mothers were anaemic were 2.3 times more likely to be anaemic compared to those mothers who were not anaemic (p=0.034).

The prevalence of anaemia among under-five children in this population is high. Age of the children and mother□s anaemia status were the predictors.Immediate and effective strategies need to be implemented to reduce the degree of anaemia regardless of the child□s location of residence, gender and parents□ occupationalstatus. Iron supplementation can be the best choice to increase the haemoglobin level.

Keywords: anaemia, under-five children, Bali, Indonesia

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Prevalence and Determinants of Anaemia among Under-five Children in Muntigunung, Karangasem Regency, Bali-Indonesia

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Abstract

The optimal development of infants and young children are significant for their future. One of the most common nutritional issues countenanced by this stage of age in developing countries is anaemia. This research aimed to find out the prevalence of anaemia among children under the age of five in Muntigunung Village and its determinants.

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The prevalence of anaemia among under-five children in this population is high. Age of the children and mother's anaemia status were the predictors. Immediate and effective strategies need to be implemented to reduce the degree of anaemia regardless of the child's location of residence, gender and parents' occupational status. Iron supplementation can be the best choice to increase the haemoglobin level.

Keywords: anaemia, under-five children, Bali, Indonesia

1.0 Background

The optimal growth and development of infants and young children are critical for their future development (Sguassero, de Onis, & Carroli, 2005). Poor nutritional status is a significant contributing factor that compromises optimal growth and development. One of the most common nutritional issues faced by infants and young children in developing countries including Indonesia is iron-deficiency anaemia (Black, Morris, & Bryce, 2003).

Black et al(2008) reported that more than 50% of under-five children in rural Indonesia were anaemic. Each of the 33 provinces across Indonesia have reported diverse prevalence anaemia in under-five children (Health Department Republic of Indonesia, 2008b). Therefore the average prevalence across the country masks the severity of these conditions in some areas. To reduce the prevalence it is the areas of greatest need that need to be addressed. One of these provinces is Bali, the focus of this research and a popular tourist destination. Howard et al (2007) noted that there was a lack information about the prevalence and determinants of nutrition problems especially in the rural and more remote areas in Bali Province.

Muntigunung village is located in a rural-remote area in North-eastern part of the island of Bali, Indonesia. It is a part of Karangasem Regency, one of nine local governments divisions in Bali. The village is located in a mountainous area covering 28 km^2 at an altitude between 200 and 800 metres above sea level. The population of this village is approximately 5,000 people from approximately 1000 families divided into 34 groups based on their location. Twelve of these groups are not reachable by road and for the purpose of this study have been classified as a "difficult to reach area".

According to Statistics Bali (2006) nearly 64% of the 1,154 families who live in Muntigunung are considered to be poor (Statistics Bali, 2011). In contrast, the overall number of poor people in Karangasem regency was 6.37% in 2009 (Statistics Bali, 2011). Poverty is linked to poor nutritional status among other socio-economic determinants (Best et al., 2008a). This study aimed to find out the prevalence of anaemia nad its determinants among underfive children in Muntigunung Village.

2.0 Literature Review

2.1 Prevalence of Anaemia

Anaemia (iron deficiency) in clinical terms is an insufficient mass of RBCs circulating in the blood. The estimated anaemia worldwide is 24.8% which account for one-quarter of the world's population (McLean, Cogswell, Egli, Wojdyla, & de Benoist, 2009). From that estimation, 47.4% occurs in pre-school age children or approximately about 293 million children affected by this problem. The greatest number affected by anaemia is in Southeast Asia where 115.3 million preschool-age children (65.5%) are affected (World Health Organization, 2008). In public health terms, anaemia is defined as a haemoglobin concentration below the WHO thresholds (World Health Organization; Centers for Disease Control and Prevention, 2007). Anaemia is one of the biggest public health issues that effects several groups in the population. Children, women and pregnant women are the most vulnerable groups who are at greatest risk of anaemia. The prevalence of anaemia is an important health indicator, which can provide information about the severity of iron deficiency within a country or region and can focus strategies for specific populations groups can be targeted to overcome the problem. Using the prevalence rates of anaemia, WHO (2001, 2008) classified countries by the degree of public health problem (see Table 2.1).

Table 2.1 Classification of anaemia as a problem of public health significance

Prevalence of anaemia (%)	Category of public health significance
≤4.9	No public health problem
5.0-19.9	Mild public health problem
20.0-39.9	Moderate public health problem
≥40.0	Severe public health problem

(World Health Organization, 2001, 2008)

There are six haemoglobin thresholds or cut of points are used by WHO (2008) to define anaemia based age, gender and geographical location. The thresholds relevant to Bali are presented Table 2.2. There is no threshold used to define anaemia for infants aged less than 6 months. Normal haemoglobin (Haemoglobin) levels vary with age, gender, smoking status, altitude, and physiological status including pregnancy.

Table 2.2 Haemoglobin thresholds used to define anaemia in different subpopulations, at sea level

Age or gender groups	Haemoglobin thresholds (g/L)
Children (0.5-4.99 years)	110
Children (5.00-11.99 years)	115
Children (12.00-14.99 years)	120
Men (≥15 years)	130
Women - Non-pregnant - Pregnant	 120 110

Source: adapted from WHO (2008).

2.2 Factors Contributing to Anaemia

Iron deficiency anaemia (IDA) and anaemia are often used synonymously since it is generally assumed that half of the cases of anaemia is due to iron deficiency (World Health Organization, 2008). The primary cause of anaemia is iron deficiency in the diet but it is a seldom the only cause. More often it coexists with a number of other causes, such as haemoglobinophaties, infections including malaria, tuberculosis, parasitic infections, and other nutritional deficiencies including vitamin A and B12, copper, riboflavin, and folate(World Health Organization, 2008). According to WHO (2008), anaemia is an indicator of both poor health and poor nutrition which give many adverse effects for population including the increased risk of maternal and child mortality. Moreover, anaemia especially IDA leads to negative consequences on cognitive and physical development particularly when it occurs among children. In its severe form, it is also associated with weakness, fatigue, dizziness, and drowsiness.

Several determinants have been found to have an association with anaemia in this region including: nutritional deficiencies, infections, haemoglobinophaties, socioeconomic factors, parental factors and other factors such as age, gender, family size and geographical region(Ickowitz, 2012; Radcliff, 2012).

2.2.1 Nutritional deficiencies

Even though anaemia is well known as iron deficiency disorder, other nutritional deficiencies besides iron can contribute and/or caused anaemia. Several studies have identified that iron deficiency anaemia is influenced by being: underweight, wasted or thin; stunted (Agho et al., 2008; Howard et al., 2007; Kemmer et al., 2003; Semba et al., 2010; Thurlow et al., 2005): vitamin A deficiency (Khan et al., 2010; Soekarjo et al., 2001): vitamin C deficiency (Tengco et al., 2008): and low serum selenium (Van Nhien

et al., 2008). Vitamin A deficiency couldpotentially contribute to the anaemia due to chronic inflammation because of the role these two micronutrients play in maintaining immunity to infectious diseases. The other possible mechanism to explain this associationis that the lack of vitamin A decreases the levelof transferrin and consequently diminishes the transportof iron(Aini et al., 2007). Diarrheal disease is more commonamong children with vitamin A deficiency, and this micronutrientdeficiency is common in Indonesia (Howard et al., 2007)

2.2.2 Haemoglobinopathies

Two studies revealed the relationship between anaemia and two inheritedhaemoglobinopathies (thalassemia and sickle-cell anaemia)(Anderson et al., 2008; Thurlow et al., 2005).Approximately 5% of the world's population are carriers of this potential pathological haemoglobin gene (World Health Organization, 2006a). There was no sufficient data about the prevalence of haemoglobinopathies in Bali and Indonesia. However, the prevalence of carriers β-thalassemia in Indonesia is from 0-9% (Wahidiyat, 2012).

2.2.3 Infections

Several infectious diseases have a known association with the prevalence of anaemia worldwide. Parasitic infections include intestinal infections (trichuriasis, schistosomiasis, and hookworm infections) (Aini et al., 2007; Le, Brouwer, Verhoef, Nguyen, & Kok, 2007; Leenstra et al., 2006;Olson et al., 2009). Leenstra(2006) found that children with high-intensity infection had a greater risk of iron deficiencyanaemia (adjusted prevalence odds ratio: 6.6; 95% CI: 2.9, 14.7). Children suffering from diarrheal diseases that occurred in the previous two week had a lower haemoglobin concentration compared to children who did not suffer from diarrhoea(Agho et al., 2008; Howard et al., 2007).

2.2.4 Socio-economic factors

Low socioeconomic factors have an association with increased risk in being anaemic. Soekarjo et al (2001) stated that Indonesian children who had a higher socioeconomic status had a lower chance of being anaemic. A similar result was found in rural Peninsular Malaysia that the prevalence of IDA was significantly higher in schoolchildren who came from families with

a low household income (Al-Mekhlafi et al., 2008). Low socioeconomic status was also found to be a predictor of anaemia in Philippines together with schistosomiasis and hookworm infections (Olson et al., 2009). In contrast with these three studies, a cross sectional study in Timor-Leste found that children from richest and middleclass households had a significant lower average Haemoglobin concentration compared to those who from the poorest households (117g/L vs 120g/L, $p<0.001$). The possible explanation was children from lower socioeconomic status households were from a rural area while those from the richest and middle-class were mostly from the low land urban region where malaria is common, thus linking anaemia with malaria (Agho et al., 2008). Socio-economic factors alone but in combination with others play an important role in causation of poor health outcomes.

2.2.5 Parental factors

In South-East Asian countries, children's especially infants' haemoglobin level were associated with their mothers' haemoglobin level as a result of breast feeding(Agho et al., 2008; de Pee et al., 2002;Dijkhuizen, Wieringa, West, Muherdiyantiningsih, & Muhilal, 2001). Parents educational level were associated with Haemoglobin level of the children (Agho et al., 2008; Al-Mekhlafi et al., 2008; de Pee et al., 2002; Howard et al., 2007; Kemmer et al., 2003; Semba et al., 2010; Tengco et al., 2008). Agho et al (2008) found that children of mothers with some secondary or more education had a lower mean Haemoglobin concentration than children of mothers with lower educational status due to poor breastfeeding practices amongst the more privileged groups in Timor-Leste. A working mother was found to be a risk factor for anaemia among their children in aMalaysian study (OR=2.2; 95% CI=1.1-4.1) (Aini et al., 2007)

2.2.6 Other determinants

The other determinants found to be significant predictors of anaemia included: age of the child, gender, and low-birth-weight. Younger age seem to be a predictor of anaemia in several studies (Agho et al., 2008; Howard et al., 2007; Kemmer et al., 2003;Thurlow et al., 2005). Research in Indonesia and Burma found that male children had a higher chance of being anaemic than girls (Howard et al., 2007; Kemmer et al., 2003; Semba et al., 2010;Soekarjo et al., 2001). However, in

Malaysia the prevalence of IDA was significantly higher in females than males (Al-Mekhlafi et al., 2008). Other studies in Indonesia determined that parental factors including social economic status, parents' educational status, mothers' working status, fathers' smoking status and mothers haemoglobin level influenced the nutritional status and haemoglobin level of their under-five children (Agho et al., 2008; Best et al., 2008b; de Pee et al., 2002; Howard et al., 2007; Tengco et al., 2008; Toyama et al., 2001)

3.0 Methodology

This study is part of data obtained from a general health survey conducted in 2009 in Muntigunung Village

3.1 Sample size

The minimum sample size required was determined to be 200 households, based on sample calculation using indicators such as illness in Indonesia during one month (p=15%), precision (d=5%), reliability (1- α) = 95%, and non-response rate (f=5%) (WHO Regional Office for South East Asia, 2007)

3.2 Population and sample

All households who had at least one under-five child in Muntigunung Village were eligible to be included in the study. The sampling frame was constructed by obtaining a list of households [1,154 from the 35 clusters within the Muntigunung Village] from the head of the village. Using this list, households with children under-five were identified and then randomly selected based on their location within the village to include a total sample of 300 households with ratio 2:1 for difficult versus easy to reach locations.

Initially a systematic random sampling was applied across the village; however, in the more difficult to reach areas it was found that the list of families was inaccurate. A further complication was a number of families were not living in Muntigunung at the time of the survey as they tend to return to the village only for times of traditional ceremonies. For these reasons all families in the difficult to reach areas were included in the sample. For those families in the easier to reach locations, when the family was not available at the first visit, a second visit was made and if still unavailable, the next household that met the inclusion criteria was substituted for the missing household until there were no more households that had a child under-five in the

hard to reach area. After exhausting the possible households in the difficult to access areas, households that were located in the easy to access areas were substituted for the missing households. The final sample had a ratio of 1:1 in terms of where the family lived within the village. The total survey sample was 278 household (144 in difficult area and 134 in easily assessable area) had at least one child under-five years. However, three of children who did not age and gender recorded were excluded from the analysis. Therefore, the total of 275 children were included in the analysis.

3.3 Data collection

The data was collected by interviewing the mothers of children under 5 years using a structured interview guide conducted by one of 10 trained interviewers. A finger prick blood tests is used to measure of anaemia. The survey was conducted over 2 months (November to December 2009).

3.4 Data Analysis

The IBM SPSS Statistics 20 (Griffith, 2010), was used to analyse the demographic data of characteristics for the under-five children and their mothers. The IBM SPSS Statistics 20 (Griffith, 2010) was also used to analyse the prevalence of anaemia among the under-five children, the chi-square test was used to compare the nutritional determinants of anaemia. Logistic regression model was also used to obtain adjusted Odd Ratio (OR) for independent variables that found to be significant determinants of anaemia from chi-square test. The independent sample t-test was used to compare haemoglobin level between male and female children. Scatter diagram and Pearson's correlation coefficient was used to analyse the correlation between mother's and child's haemoglobin level. The statistic significant level was set at $p<0.05$.

3.5 Ethics

Before conducting the interview, all respondents were informed in Balinese that the collected data was used for the research purposes. They were also informed that their participation to the survey was voluntary and there was no negative consequence for those who decided to not participate in the study. They had the right to withdraw from the study at any time for any reason and to skip any questions that they did not wish to respond to. All information obtained was treated confidentially and individuals could not be identified after the interview. This study was approved by The Kerti Praja

Foundation Institutional Review Board which registered in the office for Human Research Protection/DHHS, USA number IRB00002136 (The Ethical Clearance Appendix B). This research project also has been approved by Curtin University Ethics Committee (Appendix B).

4.0 Results

4.1 Demographic Characteristics

The demographic characteristic of the under-five children and their mothers are presented in the Table 4.1. Half of the households (55.4%) had only one child under-five. The majority of families had more than four members (65.5%). The overwhelming majority of the mothers had never been to school (83.5%). Even though the majority of beggars in Denpasar City claimed that they are from Muntigunung Village based on this study, many of the mothers and fathers were working, either as a farmer or in other types of work such as industry or in public sector (29.5% and 37.5% respectively). Few households used iodine salt (2.6%).

4.2 Prevalence and Determinants of Anaemia

The WHO standard threshold for determining if a child is anaemic is 110 gram/litre (World Health Organization; Centers for Disease Control and Prevention, 2007). Anaemia in women in this case is defined as having haemoglobin concentration less than 120 gram/litre for non-pregnant women (World Health Organization, 2008).

Haemoglobin measurements were taken for n=251 (91%) children and n=272 (99%) of the mothers. The mean of haemoglobin concentration among the under-five children in this sample was 9.26 mg/dl (M=9.25, SD= 1.453) with a minimum value of 5.24 mg/dl and a maximum of 14.24 mg/dl. Table 4.10 using the WHO haemoglobin thresholds to define anaemia shows the levels of anaemia among under-five children (World Health Organization; Centers for Disease Control and Prevention, 2007). It can be seen that anaemia among the under-five children in this group was high regardless of where they lived and gender. Further Table 4.10 shows that there was a high prevalence (61%) of anaemia among the mothers these under-five children regardless their residences. The independent sample t-test shows that the mean haemoglobin level in the easy to reach areas was significantly lower when compared to children in difficult to reach area (9.0302 vs. 9.4680; p =0.016).

Table 4.11 shows the chi-square comparison between haemoglobin statuses and the socio=economic determinants identified in the literature. Mother's haemoglobin status was found to be significantly associated with the child's haemoglobin status ($p<0.05$). The child's age was found to be a statistically significant factor for anaemia among children ($p=0.006$). The younger the child, the greater the likelihood of the child will be anaemic. The correlation between the mother's and child's haemoglobin concentration was statistically significant ($r = 0.151$; $p =0.017$) (Figure 4.3). The other determinants including the gender of the children, location of residence, number of under-five children in one family, mother's educational status, mother's and father's occupational status, and children's height for age status found to not be statistically influence the children's haemoglobin status in this community.

Logistic regression analysis was used to examine the determinants of malnutrition and anaemia among under-five children in Muntigunung Village. After controlling for the child's age, children whose mothers' were categorised as anaemic were 2.3 times more likely to be anaemic than children of mothers were not anaemic (adjusted OR = 2.3; p= 0.034; 95% CI: 1.066 - 4.991). Overall, the age of the child played a statistically important role in determining anaemia among these children (overall p = 0.019). The reference category was children age less than six months. Compared to the reference category, the second category (children age 6-17 months old) were significantly less likely to be anaemic (adjusted OR= 0.186; p= 0.040; 95% CI: 0.037-0.929). However, children age 18-29 months old when compared to the reference category while less likely to be anaemic it was not significant (adjusted OR= 0.160 ; p= 0.093; 95%CI: 0.019-1.357). In contrast children in 30-41 and in 42-59 months age categories when compared to the reference category, were more likely to be anaemic, however, these results were statistically not significant (adjusted OR = 1.184; p= 0.744; 95%CI: 0.429-3.262 and adjusted OR = 1.830; p=0.254; 95%CI: 0.648-5.166 respectively).

Table 4.10 Children and Mother's Haemoglobin status based on location of residence

Cat	Frequency (%)				Total (%)	
	Easy area		Difficult area			
	Child's	Mother's	Child's	Mother's	Child's	Mother's
Anaemic	106 (42.2 %)	75 (27.6 %)	111 (44.2 %)	91 (33.5 %)	217 (86.4 %)	166 (61.0 %)
Normal	13 (5.2 %)	56 (20.6 %)	21(8.4%)	50 (18.4 %)	34 (13.6 %)	106 (39%)
Total	119	131	132	141	251	272

Table 4.1.1 Multivariate logistic regression model of anaemia among under-five children in Muntigunung Village

Variable	Adjusted OR	95% CI	p(value)
Mother's Haemoglobin status	2.306	1.066-4.991	**0.034***
Child's age			**0.019***
Child's age (6-17)	0.186	0.037-0.929	**0.040***
Child's age (18-29)	0.160	0.019-1.357	0.093
Child's age (30-41)	1.184	0.429-3.262	0.744
Child's age (42-53)	1.830	0.648-5.166	0.254

***significant at α=0.05**

5.0 Discussion

The optimal growth and development of infants and young children are critical for their future development (Sguassero et al., 2005). Poor nutritional status is a significant contributing factor that compromises optimal growth and development.

Based on standard of normal haemoglobin level of ≥ 11mg/dl, the number of anaemic children was extremely high at 86.4%. This figure is much higher than the prevalence of anaemia in Southeast Asian countries of 65.5% (World Health Organization, 2008). This figure also made this population categorised to have severe public problem since the prevalence of anaemia was ≥ 40% (World Health Organization, 2001, 2008). The average of haemoglobin level among the under-five children in this sample was 9.26 mg/dl Anaemia is symptom of under nutrition within a population and is linked to a number of co-morbidities that can lead to mortality. Older children, children in 30-41 and 42-59 age group were more likely to be anaemic compared to children less than 6 months old and while this finding was not statistically significant, its importance considering the other findings regarding the prevalence of stunting and wasting should not be disregarded. The age of the child has been found to be an important variable in respect to anaemia in other studies in South

East Asia countries by de Pee et al (2002) and Dijkhuizen et al (2001).

Mother's haemoglobin status was also found to be significantly associated with anaemia among under-five children in this community. Children who have anaemic mothers were 2.3 times more likely to be anaemic compared to children whose mothers were not anaemic. This finding while similar to previous research findings in South East Asia countries (de Pee et al., 2002; Dijkhuizen et al., 2001), but it differs from previous research, which found that mothers' haemoglobin level were more related to their child's haemoglobin level when they were less than 6 months old, before the weaning period (de Pee et al., 2002). This study found a relationship between haemoglobin levels of mothers and their older children (more than six months old) contributing to the higher the proportion of anaemia within this community. This result is likely related to their actual diet reflecting a lack of iron in the family's diet thus mother and child sharing this nutritional deficit.

5.1 Limitations of the study

- This was a cross sectional study and as such it cannot test the cause-effect relationship between variables.
- Children in this population do not have birth certificates and most of their mothers are illiterate (never been to school) thus the age of the children was not based on a specific date of birth but based on the age provided by their mothers and it is likely that some misclassification has occurred. For the sake of the analysis as mentioned in the methodology chapter, the age that obtained from the field were classified into specific age groups. Children who recorded as zero years old were classified as <6 months old group. Therefore age was an estimate and therefore there is the possibility of misclassification. This may have therefore underestimated the prevalence of stunting, underweight and anaemia in this community by age. The misclassification especially might happened in younger age group, those who classified as <6 months old, 6-17 months old, 18-29 months old, and 30-41 months old

could be originally one group higher than it should be. Therefore, those who found stunted, underweight, and anaemic based on this categorisation might even more severe stunted, underweight and anaemic if they originally (supposed) in higher group.

6.0 Conclusion and Recommendation

6.1 Conclusion

Based on the results of this study, it can be concluded that the prevalence anaemia among under-five children in this at risk population is higher than the local Bali community and Indonesian national figures at 86.4%. The prevalence was across the village as a whole irrespective of the location of residence, the child's gender, and the parents' occupational status.

The prevalence of anaemia in this community is a significant concern. Children whose mothers were anaemic were 2.3 times more likely to be anaemic compared to those mothers who were not anaemic. The age of the child and the mother's anaemia status was significant contributing for children under-five. Younger children (define here >6 months) were more likely to be anaemic. Children age between two and less than five years old were more likely to be anaemic. Since there were a high prevalence of anaemia among children and their mothers' (86.4% and 61.5% respectively), lack of iron in diet and lack of availability of food that high in iron might be related to this phenomenon.

6.2 Recommendation

Since the prevalence of anaemia among under-five children in this population were found high compared to province and national figures, some recommendation that can be considered such as:

1. Immediate and effective strategies need to be implemented to reduce the degree of malnutrition regardless of the child's location of residence, gender and parents' working status.
2. Since the prevalence of anaemia among under-five children and their mother were very high in this community, iron supplementation can be another best choice to increase the haemoglobin level, since normal haemoglobin level is very crucial for cognitive and physical development of children which can affect their future (de Pee et al., 2002). This supplementation program can also be integrated with giving information to

the families about high iron food such as pumpkin, tomatoes, and sunflower seed which that can be grown in family backyard and liver which can obtain from chicken (Muthayya et al., 2012; Save The Children, 2009)

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Prevalence and Determinants of Anaemia among Under-five Children in Muntigunung Village, Bali-Indonesia

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Muntigunung

BACKGROUND

- Muntigunung → known as "beggars" village
- → 1.154 families with 5.319 (July 2008) → divided into 35 groups called "Kelompok" (14 to 84 families). → 12 Kelompoks are remote

- The optimal growth and development of infants and young children are critical for their future development
- Normal haemoglobin level is very crucial for cognitive and physical development of children which can affect their future (de Pee et al., 2002).

Table haemoglobin thresholds used to define anaemia in different subpopulations, at sea level

Groups	Haemoglobin thresholds (g/L)
Children (0.5-4.99 years)	110
Children (5.00-11.99 years)	115
Children (12.00-14.99 years)	120
Men (≥15 years)	130
Women	
Non-pregnant	120
Pregnant	110

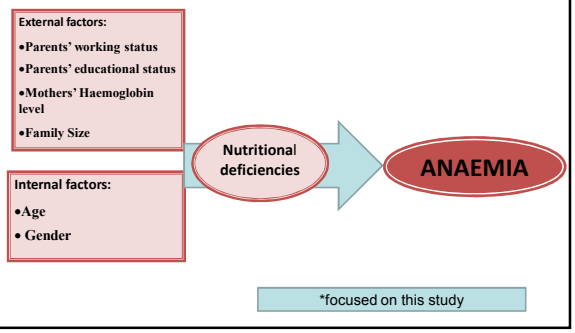
Source: adapted from WHO (2008).

Table classification of anaemia as a problem of public health significance

Prevalence of anaemia (%)	Category of public health significance
≤4.9	No public health problem
5.0-19.9	Mild public health problem
20.0-39.9	Moderate public health problem
≥40.0	Severe public health problem

Source: World Health Organization, 2001, 2008

Determinants of Anaemia among Under-five Children



Aim and Objectives

- **Aim:**
  - To assess the prevalence and determinants of anaemia in children under the age of five

- **Objectives:**
  - **Describe the prevalence of anaemia among under-five children**
  - **Identify the determinants of anaemia among under-five children in Muntigunung village**

METHODS

- **CROSS SECTIONAL SURVEY IN LATE 2009.**
- **Population and sample**
  - Population ⟶ 1.154 households
  - Sample ⟶ 300 households ➔ 275 children
- **Sample collection methodology:**
  - *Systematic random sampling* method
- **Instrument and data collection:**
  - Interviews, hemoglobin measurement using Haemocue

RESULTS

- DEMOGRAPHIC CHARACTERISTICS

Characteristics	Category	Frequency	Percentage (%)
1. Children age (months old) (n=275) [estimate]	<6	72	26.2
	6-17	32	11.6
	18-29	65	23.6
	30-41	53	19.3
	42-53	53	19.3
2. Gender or Sex of the children (n=275)	Male	128	46.5
	Female	147	53.5
3. Number of under-five children in one household (n=275)	1	151	54.9
	2	115	41.8
	3	9	3.3
4. Number of member in one family	Up to 4	95	34.5
	More than 4	180	65.5

- DEMOGRAPHIC CHARACTERISTICS

Characteristics	Category	Frequency	Percentage (%)
5. Mother's occupation (n=275)	Not working	68	24.7
	Farmers	81	29.5
	Others	126	45.8
6. Father's occupation (n=264)	Not working	14	5.1
	Farmers	99	37.5
	Others	151	57.2
7. Location of residence (n=275)	Easy	133	48.4
	Difficult	142	51.6
8. Mother's education level (n= 275)	Never been to school	229	83.3
	Some Elementary School	20	7.3
	Elementary School	20	7.3
	Junior High School	3	1.1
	Senior High School	3	1.1

The Prevalence of Anaemia

Category	Frequency (%)				Total (%)	
	Easy area		Difficult area			
	Child's	Mother's	Child's	Mother's	Child's	Mother's
Anaemic	106 (42.2%)	75 (27.6%)	111 (44.2%)	91 (33.5%)	217 (86.4%)	166 (61.0%)
Normal	13 (5.2%)	56 (20.6%)	21(8.4%)	50 (18.4%)	34 (13.6%)	106 (39%)
Total	119	131	132	141	251	272

The Determinants of Anaemia

	Haemoglobin status of under-five children		p(value)
Determinants	Anaemic (%)	Normal (%)	
Children age (mo) (n=251)			
<6	60 (96.8%)	2 (3.2%)	
6-17	30 (96.8%)	1 (3.2%)	**p= 0.006***
18-29	49 (81.7)	11 (18.3%)	
30-41	35 (76.1%)	11 (23.9%)	
42-53	42 (84.0%)	8 (16.0%)	
Children sex /gender (n=251)			p = 0.350
Male	99 (84.6%)	18 (15.4%)	
Female	117(88.6%)	15 (11.4%)	

The Determinants of Anaemia

	Haemoglobin status of under-five children		p(value)
Determinants	Anaemic (%)	Normal (%)	
Location of residence (n=251)			p = 0.249
Difficult	111 (84.1%)	21 (15.9%)	
Easy	106 (89.1%)	13 (10.9%)	
Mother's Haemoglobin status (n=249)			**p = 0.049***
Anaemia	139 (89.7%)	16 (10.3%)	
Normal	76 (80.9%)	18 (19.1%)	

The Determinants of Anaemia

	Haemoglobin status of under-five children		p(value)
Determinants	Anaemic (%)	Normal (%)	
Number of under-five children in one household (n=251)			p = 0.577
1	123 (85.4%)	21 (14.6%)	
More than 1	94 (87.9%)	13 (12.1%)	
Mother's education status (n=251)			
Never been to school	182 (85.4%)	31 (14.6%)	p = 0.269
Have ever been to school	35 (92.1%)	3 (7.9%)	

The Determinants of Anaemia

	Haemoglobin status of under-five children		p(value)
Determinants	Anaemic (%)	Normal (%)	
Mother's working status (n=240)			p = 0.316
Working	170 (87.6%)	24 (12.4%)	
Not working	47 (82.5%)	10 (17.5%)	
Father's working status (n=242)			p= 0.904
Working	198 (86.8%)	30 (13.2%)	
Not working	12 (85.7%)	2 (14.3%)	

Multivariate logistic regression model of anaemia among under-five children in Muntigunung Village

Variable	Adjusted OR	95% CI	p(value)
Mother's Haemoglobin status	2.306	1.066-4.991	**0.034***
Child's age			**0.019***
Child's age (6-17)	0.186	0.037-0.929	**0.040***
Child's age (18-29)	0.16	0.019-1.357	0.093
Child's age (30-41)	1.184	0.429-3.262	0.744
Child's age (42-53)	1.83	0.648-5.166	0.254

CONCLUSION

- **The prevalence of anaemia among under-five children in this population 86.4%**
- **Children whose mothers were anaemic were 2.3 times more likely to be anaemic compared to those mothers who were not anaemic.**
- **Younger children (define here >6 months) were more likely to be anaemic. Children age between two and less than five years old were more likely to be anaemic.**

RECOMMENDATION

- **Immediate and effective strategies need to be implemented to reduce the degree of malnutrition regardless of the child's location of residence, gender and parents' working status.**

RECOMMENDATION

- **Iron supplementation can be the best option to increase the haemoglobin level**
- **Integrated with giving information to the families about high iron food such as pumpkin, tomatoes, and sunflower seed which that can be grown in family backyard and liver which can obtain from chicken (Muthayya et al., 2012; Save The Children, 2009)**

LIVELIHOOD PROGRAM