

## Anemia Prevalence and Program Development to Support Caregivers' Potential in Anemia Prevention among Children Aged 6 - 24 Months<sup>†</sup>

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### Abstract

The purpose of this study was to investigate the prevalence of anemia in children aged 6 - 24 months and develop a potential caregivers support program based on the caregivers' knowledge of anemia and iron syrup supplement, as well as their caring behavior. Participants included 80 dyads of caregivers and children aged 6 - 24 months who received care at the Sa-nguan and Saka Health Promoting Hospitals. The researchers collected data by using an anemia evaluation form, a form of knowledge about anemia and iron supplement, and the caring behavior of children aged 6 - 11 and 12 - 24 months. Data analyses were descriptive statistics in terms of percentage, mean, and standard deviation. House's concept of social support was used as a theoretical based of to develop the program to support caregivers' potential. The program had an IOC of 0.90 from the 5 senior experts who assessed its quality for content validity. The CVI for the form assessing knowledge about anemia and iron supplement syrup was 0.70 and 0.90, respectively. The CVI was 0.80 when evaluating care behavior to support proper food consumption in children, including 6 - 11 and 12 - 24 months. The CVI of the iron syrup supplement evaluation was 0.90. Its reliability score was 0.70.

This result revealed that 11.4 % of the children had anemia, a hematocrit count of less than 33 % (range = 30 - 40, M = 34.89, SD = 1.97). According to the caregivers' potential assessment, the average scores for knowledge about anemia were 12.96 (SD = 1.86), and knowledge about iron syrup supplements was 9.24 (SD = 2.32). The average scores of care behaviors concerning children's consumption of food and medicine among 31 caregivers of 6 - 11 months old children were 16.19 (SD = 3.08), 49 caregivers of 12 - 24 months were 29.56 (SD = 5.94), and the average scores of care behaviors concerning children's consumption of medicine were 33.78 (SD = 11.06).

The program lasted for 12 weeks. It included group activities such as 1) providing knowledge about anemia for caregivers, 2) health education, handbooks, and VDO clip, and teaching them to record in the handbook. The handbook includes information on anemia prevention, a food and iron supplement intake diary, and more. 3) a social media' Line group' of caregivers in each village to share experiences and information about caregiving, and 4) follow up with home visits and phone calls from village health volunteers. Content experts have validated the program to ensure it can implement with the participants. Furthermore, the researcher could provide a guideline for caregivers to follow at home and provide good services in a child health clinic where caregivers have the potential for giving a diet based on a child's age and giving an iron supplement to follow up on anemia prevention in children continuously.

**Keywords:** Caregivers' potential, Food consumption, Iron supplement, Anemia prevention, Children

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## Introduction

Anemia is a worldwide disease that disproportionately affects children, identified in 39.8 % of children under 5 years (World Health Organization, 2019). Anemia in children causes the mortality of 1.8 million people according to a study of 12,000 children aged 28 days to 5 years from 6 African countries (Scott et al., 2014). Children under 5 years are at risk for anemia, especially infants and children under 2 years. Anemia affects up to 60.2 % of children aged 6 months to 5 years in Africa and 49.9 % of children in Southeast Asia (World Health Organization, 2017; World Health Organization Regional Office for Africa, 2020). In China, infants aged 6 - 12 months and 2 years were found to have 51.2 and 24 % of anemia, respectively (Wang et al., 2019). Anemia is a significant public health issue in developing countries, including Thailand, where anemia in pre-school children increased from 25.2 % in 2011 to 29 % in 2016 (World Health Organization, 2016). Based on the Anemia screening, it affected 26.61 % of children aged 6 to 12 months (Nakhon Si Thammarat Provincial Public Health, 2020). Statistics on anemia among children aged 6 months to 1 year in Nakhon Si Thammarat province tend to rise from 19.88 to 25.95 % in 2015 and 2020, respectively (Nakhon Si Thammarat Provincial Public Health, 2020; Nakhon Si Thammarat Provincial Health Office, 2015).

Moreover, anemia in the 11<sup>th</sup> health district was found in 24.66 % of Thai children aged 6 - 12 months. In the Tha Sala district, anemia affects 53.42 % of children aged 6 to 12 months (Nakhon Si Thammarat Provincial Public Health, 2020). Overall, the prevalence of Anemia in Thai children is rising. However, the trend is down in developed countries due to a diagnostic system, treatment method, and development of a community-coordinated public health service system (World Health Organization, 2015). Furthermore, nutritional support combined with dietary iron supplementation can reduce the prevalence of anemia from 45 to 25 % (Vázquez et al., 2019).

Anemia has a direct impact on both the body and mind of children. It causes an increase in heart rate, increased infection rate, fatigue, slow growth rate (Ministry of Public Health, 2014; Chaparro & Suchdev, 2019), and decreased enzyme activities which are essential for neurotransmitters leading to abnormal central nervous system (Pivina et al., 2019). In terms of mind and social development, this resulted in slower mental and social development, which could lead to poor academic performance and possibly decreased functional performance in the future (Suryanarayana et al., 2016), and the development of learning ability and impaired movement (World Health Organization, 2019). Regarding emotional development, the children were aggressive, had less patience than normal children, and were moody, anxious, and jumpy (Fuglestad et al., 2013). Anemia in children impacts more than just the individual's quality of life. Families must pay for medical care due to frequent illnesses. When sick children reach adulthood, chronic diseases cost a lot of money in medical care. Inefficiency at work affects the country's economy (Ministry of Public Health, 2014), which is a severe issue in developing countries (World Health Organization, 2017; Zavaleta & Astete-Robilliard, 2017).

There were 3 main factors related to anemia in children. The first factor is the children. Young children have an increased need for iron, which increases the likelihood of anemia, particularly in children between the ages of 1 and 2 years when the brain develops and grows rapidly (Clark et al., 2017). Some refuse to take the iron supplement because of its side effects e.g., dizziness, vomiting (Autthavee & Phongphetdit, 2018). Children who have poor eating habits and ate less than or equal to 1 to 3 servings of meat and animal products per week were 2.2 times more likely to develop iron-deficiency anemia than children who consumed an iron-rich diet on a regular basis (Kaewpawong, et al. 2018). Moreover, children fed plain fresh milk were 2.05 times more likely to have normal hemoglobin than those not fed plain milk or who had been breastfeeding since birth. Children who were not breastfeeding had 1.77 times the chance of having normal hemoglobin. The second factor is parents. Some parents lack knowledge and understanding of food preparation for anemia prevention (Prachuttake et al., 2019). Consistent with a study of low-educational-level mothers with an increased risk of having anemia in children (Wirth et al., 2016). Furthermore, anemia was primarily found in children who were not properly raised, and there was a lack of support for proper consumption, e.g., delay in appropriate feeding according to age. Breastfeeding for more than 6 months instead of supplementation contributed to anemia (Wang et al., 2019). Some parents were unaware of the significance of providing iron supplements to

their children because they believed their children were not ill (Autthavee & Phongphetdit, 2018); improper care behavior leads to insufficient iron intake from the diet, resulting in an increase in anemia in children (Chokviriyakorn, 2017). The third factor is policy. The Ministry of Public Health intended to reduce the prevalence of anemia in children by providing iron supplement syrup with 12.5 mg of iron once a week. However, it was insufficiently comprehensive and continuous. Failure to provide complimentary food to 6-month-old infants may contribute to iron deficiency anemia in children (Aphikulchatkit, 2020). During the preschool period, children go through many changes; their physical development and maturity, growth rate, and personality influence their food preferences, the amount they eat, and how they eat. Parents help their offspring to shape their feeding attitudes and behaviors; the goal of good nutrition is to help the child to grow physically, mentally, and intellectually, mature psychologically and socially, and form healthy eating habits (Borbor et al., 2014). The role of preschoolers' mothers is vital in preventing anemia in affected societies. Studies show that maternal level of education and nutritional practices contribute to anemia in preschool children (Saaty et al., 2015). More maternal education is positively associated with food consumption which improves the bioavailability of iron and reduces the risk of IDA. Children of mothers with a low educational level are more likely to develop anemia than those whose mothers are better educated (Kishawi et al., 2015). As practice nurses, we recognized the importance of researching the situation of anemia in children, the potential of caregivers, and caregivers' program development. According to research on the problems and causes of anemia in children, caregivers lack knowledge and skills in caring for children to prevent anemia. Therefore, a high-quality mother and child service system should be developed. In this research, we modified House's social support concept for the primary caregiver to receive attention, concern, generosity, and a sense of self-worth to care for the child and avoid anemia; it consists of 4 types of support: Emotional, feeling, caring, loving, committed, empathetic (emotional support), providing assistance with items or services, as well as help (instrumental support), giving information (informational support), including guidance consulting and the aspect of reflection or self-assessment (appraisal support), such as feedback, agreement or certification to ensure. Obtaining comprehensive, relevant, and accurate information will lead to developing policy and practical prevention guidelines and measures at the community organization level and in the family.

### **The objective of this study**

- 1) To investigate the prevalence of anemia in children aged 6 to 24 months who clinic visits at a sub-district health-promoting hospital.
- 2) To investigate the potential of primary caregivers in terms of knowledge of anemia and iron syrup supplement and the behavior of caring for children to receive supplementary food and iron syrup supplement.
- 3) To develop a program to support primary caregivers' ability to prevent anemia in children aged 6 to 24 months.

## **Materials and methods**

### **Methods**

This is a descriptive survey study. Participants were recruited from the sub-district health-promoting hospital. G\*power 3.1.9.4 was used to analyze and calculate the power analysis. A recent study about the developed program for promoting oral-health care of pre-school children by their parents in the child development center, Phon Thong sub-district, Pho Tak district, Nong Khai province (Botmart & Duangsong, 2012) showed a correlation with our study. Hence, we calculated the Effect size of the behavioral care value by G\*power, equal to 0.6. Meanwhile, the power analysis value was adjusted from the least acceptable criteria (equivalent to 0.80), with an  $\alpha$ -value at  $p < 0.05$  (Polit & Hungler, 1999) and a one-tailed test. The calculated result elevated 2: Experimental and control groups, with sample sizes equal to 36 participants in each group. Notably, we increase the sample size by 10 % (equal to 4 participants) to prevent an error or participant attrition. Therefore, 40 participants in each group were assigned, with a total of 80 participants, including children's caregivers and children aged 6 to 24 months.

The sample group was obtained by investigating caregivers' potential for preventing anemia in children aged 6 to 24 months. The children's objectives were recipients from the service healthy-checking clinic, sub-district health-promoting hospital, Tha Sala district; since the Tha Sala district has children with anemia as a fifth-ranked in Nakhon Si Thammarat province. We sampled 2 sub-districts by sampling without a replacement method. Sa Kaeo and Tha Khuen sub-districts were the correspondings sampled. Each sampled sub-district had a health-promoting hospital: Ban Sanguan and Ban Sakha sub-district health-promoting hospitals, respectively, for Sa Kaeo and Tha Khuen sub-district.

Additionally, each sub-district had a similar countryside environment. After sampling, Ban Sanguan and Ban Sakha sub-district health-promoting hospitals were sampled as the experimental and control groups, respectively. Then we performed the simple random sampling method to test children aged 6 to 24 months from HCD online lists. Firstly, all children that meet the criteria were listed. Then children's lists were assigned to each sample group that belonged to their corresponded sub-district. Finally, 80 participants were sampled from 2 sub-districts by the simple random sampling method.

The inclusion criteria for sampled group assignment were as follows: Children were the service recipients from the healthy children's clinic, sub-district health-promoting hospital, Tha Sala district, Nakhon Si Thammarat province. Those children were required to receive iron syrup supplement without surgery, hemorrhage accident within 3 months, medical conditions including heart, kidney, autoimmune, Thalassemia, and Leukemia diseases, and parents without Thalassemia or carrier for Thalassemia record. Caregivers need to take care of children consistently. Their reading ability, writing ability, and permission for this research participation were required. The training decrees were terminated because caregivers were changed to those who never participated in the training or sample group participants requested for cessation.

### **Research instruments**

1) Information inquiry form: The researcher developed this form, including information on the child's general characteristics and the caregiver in the family.

2) The potential of caregivers' assessment form:

- General understanding of anemia assessment form: 16 questionnaires (total score of 16) contained 14 positive and 2 negative questions.

- Knowledge of iron supplement syrup assessment form (total score 11). There were 9 positive questions and 2 negative questions.

- The dietary care behavior assessment form for children aged 1 to 2 years with a 4-point scale (total score of 44).

- The iron supplement care behavior assessment form with a 5-point scale estimate (total score of 65).

This experiment was carried out on a group of caregivers similar to the sample group of 20. The confidence value of the primary caregiver potential assessment was 0.79.

3) Anemia assessment form: The hematocrit was determined using a quality-inspected hematocrit centrifuge.

4) Program development to support caregivers' potential in anemia prevention among children aged 6 to 24 months. The researcher developed this program based on House's social support concept, including a review of relevant research. Five senior experts reviewed this developed program to be consistent with the objectives. Our program mainly focuses on educating caregivers' potential. The program was designed as 12 weekly activities. The main activities were: 1) educating caregiver's potential and knowledge for Anemia assessment, which activates communication, exchanging, and discussion of their knowledge and experience. 2) Proving them with the handbook and iron supplement syrup and nutrition logbook, accompanied with caregivers' training and practice for preventing Anemia in children. 3) Create a Line group for their communication and good relationship, and 4) follow up by house visit or telephoning from the nurses or village health volunteers. Each week's activities were as follows: Week 1 - assess caregivers' potential, evaluate children's anemia, provide handbooks, divide caregivers into groups and create a Line group for them to keep in touch during the program and to build

a good relationship between caregivers and village health volunteers; Week 2 - divide caregivers into groups and create a Line group for them to keep in touch during the program and to build a good relationship. Week 2 - provide knowledge and exchange knowledge, problems, and experience in the care of children to prevent anemia in groups of ten; Weeks 3 and 4 - the researcher and village health volunteers monitor each caregiver's practice to support continuous training. Week 5: Hold an activity where caregivers and village health volunteers can share and analyze their experiences, problems, obstacles, and solutions using the Line application. Weeks 6 and 7 - hold an activity requiring caregivers to share their menu with the Line group once a day during dinner time and their weekly iron supplement intake log. The village health volunteers then choose 1 caregiver with proper and correct caretaking behavior to serve as the village's role model. Weeks 8 and 9 - the researcher updates the knowledge and information and asks if the caregivers have any problems they would like to share in the Line group. Village health volunteers visit caregivers' homes to monitor their practice of providing food supplements and iron supplement syrup. Weeks 10 and 11 - evaluate caregivers' practices regarding providing food supplements and iron supplement syrup, assess village health volunteers' confidence in preventing anemia in their children, and caregivers submit a reflection of their child-caretaking practice. Furthermore, week 12 - Take a test to assess knowledge and behavior in anemia prevention in children, health evaluation, and hematocrit evaluation in children.

Data analysis: Descriptive statistics were used to analyze the general information, potential of primary caregivers, and Anemia assessment such as frequencies, percentage, mean and standard deviation. Program development to support caregivers' potential in anemia prevention among children aged 6 months to 2 years was evaluated and analyzed by senior experts using IOC (Item-Objective Congruence).

The Institutional review board approved this study of Walailak University, Certification number WU-EC-21-133-01, Approved on 25 June 2021.

## Result and discussion

Health status information of children's objectives, 80 % of them passed the weight, height, and nutrition criteria; 75 % of them had an appropriate weight compared to their height. By objective examination, we found that 11.4 % (Range = 30 - 40, M = 34.89, SD = 1.97) of children had pale conjunctivitis with a ratio of 22.5 %, which meets the criteria for Anemia from WHO and the Ministry of Public Health (less than 33 %) (**Table 2**). Meanwhile, all children with mild pale anemia were described in **Table 3**.

By evaluating of caregivers' potential, we found that those caregivers had the appropriate knowledge about anemia and iron supplement intake, with the average evaluated point of 12.96 points (SD = 1.85) from 16 points and 9.24 points (SD = 2.33) from 11 points, respectively (**Table 4**). Those evaluated points were ranked as the medium knowledge; consequently, irregular iron supplement intake was observed. Interestingly, our results corresponded with the previous study, which found that developing the appropriate Anemia knowledge and potential of caregivers could reduce the ratio of iron deficiency-related anemia by 4.8 % in infant children in the age ranges of 6 - 12 months ill (Autthavee & Phongphetdit, 2018). Moreover, we evaluated 31 and 49 mothers with children in 6 - 11 months and 1 - 2 years, respectively. The appropriate habit for medicine and nutrition of those mothers were evaluated. The evaluated points were 16.19 from 20 points (SD = 3.08), 29.56 from 44 points (SD = 5.94), and 33.78 from 65 points (SD = 11.06), respectively. Those results demonstrated a medium rank (**Table 5**). We found that 28.7 % of those mothers continuously nurture their children with iron supplement syrup. Otherwise, 30.1 % of those mothers showed non-continuously or completely not nurturing their children with the iron supplement intake. Iron deficiency in children, especially with age less than 2-years-old, was well-studied to impact children's physical activities, immunity, and brain development in pre-school children, eventually, learning ability and potential loss or mortality (Schreir, 2018; Chaparro & Suchdev, 2019; Pivina, 2019). Therefore, Ministry of Public Health (2014) demonstrated that iron supplement intake was recommended for Thai children aged from 6 months to 5 years to prevent anemia.

Recent studies recommended iron supplementation (Aphikulchatkit, 2020; Wongla, 2015) or appropriated nutrition management (Brito et al., 2013; Shija et al., 2019) as the 1 method to treat anemia for school-aged child (Moonpanane, 2013; Sa-nguanphong & Tongsawang, 2021; Saengthong et al., 2020). However, no study integrates all methods, including iron supplementation, appropriate nutrition management, and education of children's caregivers for preventing anemia in children in the age range of 6 to 24 months. Indeed, children within that age range were supposed to be screened for anemia, iron supplement intake, or appropriate nutrition management for Anemia prevention (Ministry of Public Health, 2014). Hence, this present study develops a program for anemia prevention in children aged 6 to 24 months.

As a result, our program obtained IOC = 0.9 from qualification by 5 senior experts, which demonstrated that our program fulfills an objective. This developed program perchange adapted to be the guideline for caregivers to consistency monitoring and prevent anemia in children, with regards to developing caregivers' potential in terms of appropriate nutritional management and iron supplement syrup for children.

**Table 1** Number and percentage of general data of caregivers and children aged 6 to 24 months.

Data	Total (n = 80)	
	Number of samples	Percentage
Caregivers' detail		
Age	(Min = 16, Max = 67, Mean = 32.42, SD = 12.01)	
Father	4.0	5.0
Mother	61.0	76.3
Grandparents	15.0	18.8
Educational level		
Non-educated/ primary education	18.0	22.6
Secondary education	36.0	45
Diploma	6.0	7.5
Bachelor's degree or higher	20.0	25.1
Occupation		
Housewife	39.0	48.8
Farming	5.0	6.3
Self-employed	19.0	23.8
State enterprise employee/ Government employee	2.0	2.5
Employee	15.0	18.8
Income per month (THB)	(Min = 1000, Max = 6000, Mean = 13468.75 SD = 9366.43)	
Income sufficiency		
Sufficient	55.0	68.8
Insufficient	25.0	31.3
Number of a family members		

Data	Total (n = 80)	
	Number of samples	Percentage
1 - 3	14.0	17.5
4 - 6	55.0	68.8
7 - 9	11.0	13.8
Primary food caregiver		
Father	2.0	2.5
Mother	52.0	65.0
Parents (both father and mother)	13.0	16.3
Grandparents	13.0	16.3
Primary medical caregiver		
Father	1.0	1.3
Mother	53.0	66.3
Parents	12.0	15
Grandparents	14.0	17.5
Children' details		
Sex		
Female	45.0	56.3
Male	35	43.8
Age	(Min = 6, Max = 24, Mean = 12.90, SD = 4.80)	
Birth weight	(Min = 2420, Max = 4200, Mean = 3167.62, SD = 419.59)	
Mode of delivery		
Normal labor	39.0	48.8
Cesarean section	41.0	51.2

**Table 2** Number and percentage of health and nutritional status for children aged 6 to 24 months.

Health and Nutritional status	Total (n = 80)	
	Number of samples	Percentage
Weight-by-age		
High	6.0	7.5
Relatively high	9.0	11.3
Standard	64.0	80
Relatively low	1.0	1.3
Height-by-age		

Health and Nutritional status	Total (n = 80)	
	Number of samples	Percentage
High	9.0	11.3
Relatively high	4.0	5.0
Standard	64.0	80.0
Shorter than standard	3.0	3.8
Weight by Height		
Extreme obesity	8.0	10.0
Obese	8.0	10.0
Overweight	1.0	1.3
Normal weight	60.0	75.0
Underweight	1.0	1.3
Severely underweight	2.0	2.5
Shortness	3.0	3.8
Physical examination in the diagnosis of anemia		
Conjunctiva	18.0	22.5
Palm	4.0	5.0
Face/skin color	0	0
Lips	1.0	1.3
Tongue	2.0	2.5

**Table 3** Mean and standard deviation of hematocrit level in sample group (n = 80).

Sample group (n = 80)	Hematocrit level	
	Number of samples	Percentage
Hematocrit	( Range = 30 - 40, M = 34.89, SD = 1.97 )	
Hematocrit < 33 %	9	11.4
Hematocrit > 33%	71	88.6

**Table 4** Caregivers' average knowledge, understanding of anemia, and iron supplement intake.

Knowledge	Caregivers (n = 80)	
	Mean	SD
1) General understanding of Anemia	12.96	1.85
2) Knowledge about iron supplement syrup for children	9.24	2.33



**Table 5** Food and medication care behaviors on average.

Behaviors	Caregiver (n= 80)	
	Mean	SD
Consumption behaviors (based on age group)		
Children aged 6 - 11 months	16.19	3.08
Children aged 1 - 2 years	29.56	5.95
Consumption of iron supplements	33.78	11.06

## Conclusions

This present study administers the importance of developing caregivers' potential by integrating Anemia knowledge and appropriate nutrition and medication management habits for children. Furthermore, we developed the program to educate caregivers' potential, ability, and knowledge for Anemia prevention. Consequently, obtaining relevant and fruitful data that credible conforms to creating the policies and operating Anemia preventive measurements and guidelines for local families and communities.

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