Article

The Outcome of a Caregiver Potential Support Program on Anemia Prevention among Children Six Months to Two Years in Thasala District, Nakhon Si Thammarat Province, Thailand

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Abstract: Children under two years old are at risk for anemia because young children have an increased need for iron for their physical growth and brain development. The purpose of this study was designed to evaluate the effects of a caregiver potential support program on anemia prevention in children six months to two years old attending the subdistrict health-promoting hospital in Thasala District, Nakhon Si Thammarat Province. This study was quasi-experimental. The sample included children aged six months to two years old and their caregivers, who were selected by random sampling and allocated to either the experimental or control group, with 40 pairs per group. The experimental group received a potential support program, while the control group received regular care. Both groups were followed for 12 weeks. The instruments used were the potential caregiver assessment, children's anemia assessment, and a program to support the potential of primary caregivers. Descriptive statistics, chi-square, and t-tests were used to analyze the data. The results revealed that 11.4% of the children had anemia, and a hematocrit count of less than 33% (range = 30-40, M = 34.89, SD = 1.97). The mean scores of knowledge about anemia and iron supplementation after using the program in the experimental group and control group were significantly different ($p < 0.001$). The mean scores of knowledge about anemia in the experimental and control group were 15.75, SD = 0.54, and 13.28, SD = 1.43 respectively. The mean scores of knowledge about iron supplementation in the experimental and control group were 10.75, SD = 0.49, and 8.15, SD = 1.54 respectively. It was found that the experimental group had a higher mean score on food care behaviors than the control group for 6-11 months and 1-2 years, with statistical significance. The experimental group also had a higher mean score of care behaviors concerning children's consumption of medicine than the control group (M = 58.20, SD = 4.05; M = 45.78, SD = 9.66, respectively), ($p < 0.001$). The mean score of the hematocrit level for the experimental group was found to be higher than the control group after receiving the program (M = 35.80, SD = 1.55; M = 34.83, SD = 2.14, respectively), ($p < 0.05$). Therefore, healthcare providers should support caregivers' capacity to provide continued care for children to prevent anemia.

Keywords: support caregivers' potential; food consumption; iron supplement; anemia prevention

 doi:10.20944/preprints202303.0150.v1

1. Introduction

The World Health Organization estimated the prevalence of anemia in 2020 and found that 42% were children under the age of 5 years, and it was most common in Africa, followed by Southeast Asia [1]. Infants and children under 2 years are most at risk for anemia. Anemia affects up to 60.2% of children aged 6 months to 5 years in Africa and 49.9% of children in Southeast Asia [2-4]. In China, infants aged 6-12 months and 2 years were found to have 51.2 % and 24% of anemia, respectively [5]. Anemia in children is a significant public health issue worldwide in developing and developed countries, including Thailand, where anemia in preschool children increased from 25.2% in 2011 to 29% in 2016 [6]. In Nakhon Si Thammarat Province, anemia in children aged 6 months to 1 year is 30.44%, a rate higher than the standard of 10% or less, as set by the Ministry of Public Health. If the healthcare provider does not provide treatment in early childhood, it will result in anemia and further affect the child's health [7,8]. However, the trend is down in developed countries due to a diagnostic system, treatment method, nutritional support combined with dietary iron supplementation, and the development of a community-coordinated public health service system [9,10].

Anemia is a condition in which the amount of red blood cells decreases or the hemoglobin level decreases. Hemoglobin is essential to carry oxygen to the tissues, and when there are too few red blood cells or insufficient hemoglobin, the transport of oxygen to the body is reduced. Anemia in children aged 6 months to 2 years can be diagnosed by blood tests, hemoglobin less than 11 gm/dl, or hematocrit level less than 33% [1]. Anemia affects up to 1.8 million children resulting in death [2]. Anemia has impacted an increase in heart rate, an increase in infection rate, an increase in fatigue, a decrease in growth rate [11,12], and a decrease in enzyme activities which are essential for neurotransmitters leading to an abnormal central nervous system[13]. The conditions resulting from mental and social problems could lead to decreased learning ability, decreased quality of life, and impaired activity movement [14,15]. In addition, children could become aggressive, moody, anxious, and jumpy [16]. In the future, caregivers of children would have to pay for their medical care due to frequent and chronic illnesses, which would be a problem in developing countries where adults are working with low potential and efficiency [17].

Anemia in early childhood has been caused by the following main factors. First, young children have an increased need for iron, folate, vitamin B12, and nutrients to help form blood cells, especially children under the age of 2 years where the body and brain grow and develop rapidly [18]. Some children refuse to take an iron supplements because they have side effects such as nausea and vomiting [19]. Children who have unhealthy food consumption habits and eat less than or equal to 1-3 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 regularly [20]. Second, some caregivers lack knowledge and understanding of food preparation for anemia prevention [21]. This is consistent with a study of mothers with a low level of education, who have children with an increased risk of anemia [22]. Breastfeeding for more than 6 months and a delay in appropriate feeding according to age instead of supplementation also contributed to anemia [23]. Some parents were unaware of providing iron

 doi:10.20944/preprints202303.0150.v1

supplements to their children because they believed that their children were normal. They were unaware that, improper care behavior leads to insufficient iron intake from the diet, resulting in an increase in anemia in children [24]. Third, the policy of the Ministry of Public Health is intended to prevent the incidence of anemia in early childhood by screening anemia in children aged 6-12 months, which should be repeated at the age of 3-6 years, and advocating iron supplements by iron supplementation syrup with 12.5 milligrams of iron once a week in all children aged 6-24 months. However, the policy was comprehensively and continuously insufficient, along with being inappropriate in providing complimentary food since children aged 6 months are susceptible to anemia [25]. An important factor in preventing anemia in children aged 6-24 months is taking iron supplements and receiving age-appropriate nutritional supplements [3].

Children in early childhood under 2 years old go through many changes; physical, developmental, and growth rate changes influence their food preferences. Caregivers should help in shaping their children's feeding attitudes and behaviors; the goal of good nutrition is to help the child to grow physically, mentally, and intellectually; mature psychologically; and form healthy eating habits [26]. The role of the mother or caregiver is vital in preventing anemia. Studies have shown that a maternal's level of education and nutritional practices contribute to anemia in preschool children [27]. More education is positively associated with proper food consumption behaviors, which improves the bioavailability of iron and reduces the risk of anemia. Mothers with a low educational level are more likely to development of anemia in their children compared to those whose mothers are better educated [28]. Therefore, parents or caregivers should be learning and increasing their knowledge of nutrition and iron supplementation to prevent anemia.

According to a literature review on the problems and causes of anemia in children, it was found that caregivers lack knowledge and skills in caring for children to prevent anemia, and children do not receive supplementary food according to their age [3, 15, 24]. Based on a review of the literature on anemia prevention and management programs mostly focus on the prevention of anemia through administering iron supplements once a week from 6 months of age, monitoring hematocrit levels at 9-12 months of age, promoting nutritional status alone, monitoring the post-treatment hematocrit changes in infants with iron deficiency, and conducting studies among preschool and school-aged children [10, 25, 29, 30]. In Thailand, the prevention of anemia has not focused on a caregivers' potential support program for anemia prevention, especially through providing iron supplements and promoting nutrition among children aged 6-24 months, who have a high prevalence rate of anemia. Therefore, nurse practitioners should develop a high-quality service for caregivers and children; and they should recognize the importance of studying the situation of anemia in children, the potential of caregivers, and the development of a caregivers' program.

In this study, researchers applied House's social support concept for the caregivers to receive knowledge, consider food consumption behaviors, and develop a sense of potential to care for children and prevent anemia. This consists of four supports: 1) Emotional support (including feeling, caring, loving, committed, and empathetic support),

 doi:10.20944/preprints202303.0150.v1

2) Instrumental support (providing assistance with items or services, as well as help), 3) Informational support (giving information including guidance consulting), and 4) Appraisal support (including the aspect of reflection or self-assessment such as feedback, agreement or certification) [31]. Obtaining comprehensive, relevant, and accurate information for caregivers would lead to the development of practical prevention of anemia in children.

This study aimed to examine the effects of a caregiver potential support program on anemia prevention among children aged 6 months to 2 years old. The research hypothesis was that the mean scores of the caregivers' knowledge and behaviors in anemia prevention in the experimental group would increase after the intervention program. Additionally, the post-intervention mean scores of the caregivers' potential in knowledge and behaviors in anemia prevention in the experimental group would be higher than that of the control group.

2. Materials and Methods

2.1. Study Design

This study's quasi-experimental research consists of two groups with a pre-test and post-test design. The sample included children aged 6 months to 2 years and their caregivers, who were selected by random sampling and allocated to either the experimental or control group, with 40 pairs per group, in Thasala District, Nakhon Si Thammarat Province.

2.2. Measures

The sample size was calculated using the G*Power Version 3.1.9.4 program, as used in the study on the program for promoting oral health care of preschool children by their parents in the child development center of Phon Thong Subdistrict Pho Tak District, Nong Khai Province [32]. The effect size was 0.6. In determining the influence size of the sample, the power analysis value was adjusted from the least acceptable criteria of 0.80, and an effect size of 0.5 was determined, with an α-value at $p < 0.05$ and a one-tailed test [33].

The calculated result elevated two groups: the experimental and control groups, with sample sizes equal to 36 participants in each group. Notably, we increased the sample size by 10% (equal to 4 participants) and additional samples per group to prevent sample shrinkage during the study. Therefore, 40 pairs per group were assigned, with a total of 80 participants, including children's caregivers and children aged 6 to 24 months.

The sample group was selected by investigating caregivers' potential for preventing anemia in children aged 6 to 24 months. The children were recipients of a health service clinic, a subdistrict health-promoting hospital, in Thasala district, Nakhon Si Thammarat Province. We sampled two subdistricts by sampling without a replacement method. Sa Kaeo and Tha Khuen subdistricts were the corresponding samples. Each sampled sub-district had a health-promoting hospital: Ban Sanguan and Ban Sakha subdistrict health-promoting hospitals, respectively.

Additionally, each subdistrict had a similar environment. After sampling, Ban Sanguan and Ban Sakha subdistrict health-promoting hospitals were sampled as the experimental and control groups, respectively. Then, we performed the simple random sampling method

 doi:10.20944/preprints202303.0150.v1

to check children aged 6 to 24 months from the HCD lists in Nakhon Si Thammarat Province. All children that met the criteria were listed. Then, the children lists were assigned to each sample group that belonged to their corresponding subdistrict. Finally, 80 participants were sampled from two subdistricts by simple random sampling.

The inclusion criteria were as follows. Children were the service recipients from the health service clinic, a subdistrict health-promoting hospital, in Thasala District. Those children were also required to receive iron supplement syrup; have no history of surgery, hemorrhage accident within three months, medical conditions (including heart disease, thalassemia, and leukemia), and have parents without thalassemia illness. Caregivers were required to take care of their children consistently and had to possess a good level of reading and writing ability. They also had to be willing to cooperate in the activities and provide consent to participate in the research throughout the program activities. The training was terminated if caregivers never participated during the training or if sample group participants requested cessation.

2.3. Research Instruments

1. Questionnaire on demographic data: The researcher developed this form, including information on the child's general characteristics and the caregiver in the family.

2. An assessment form on the potential of caregivers as follows:

(1) Assessment form on knowledge of anemia: The researchers adapted the knowledge of anemia assessment from the Department of Health [11], consisting of 16 items (total score of 16) containing 14 positives and 2 negative items. The reliability value of the assessment was 0.70.

(2) Assessment form on knowledge of iron supplement syrup: The researchers adapted the knowledge of iron supplement assessment from Bussaba Autthavee & Bampen Phongphetdit [19], consisting of 11 items (total score of 11). There were 10 positive items and 1 negative item. The reliability value of the assessment was 0.80.

(3) Assessment form on dietary care behaviors: The researchers adapted the dietary care behaviors assessment from the Department of Health [11], with a 4-point scale, for children aged 6-12 months consisting of 5 items (total score of 20), and for children 1-2 years consisting of 11 items, (total score of 44). The reliability value of the assessment was 0.70.

(4) Assessment form on iron supplement care behavior: The researchers adapted the iron supplement care behavior assessment from Bussaba Autthavee & Bampen Phongphetdit [19], consisting of 13 items with a 5-point scale estimate (total score of 65). There were 3 positive items and 10 negative items. The assessment form was trialed in a group of 20 similar caregivers. The reliability value of the assessment was 0.70.

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

4. The caregivers' potential support program on anemia prevention among children aged 6-24 months was adapted based on House's social support concept [31], including a review of relevant research. Five senior experts reviewed this developed program to be consistent with the objectives. Our program mainly focused on educating caregivers about their potential. The IOC value equaled 0.90.

 doi:10.20944/preprints202303.0150.v1

The program was designed as 12 weekly activities. It included group activities as follows: 1.1) providing knowledge about anemia for caregivers; 1.2) providing health education, handbooks, and a VDO clip, and teaching them to record in the handbook, which included information on anemia prevention, a food and iron supplement intake diary, and more; 1.3) using Line group of caregivers to share experiences and information about caregiving; and 1.4) following up with home visits and phone calls by the researchers and village health volunteers. Content experts have validated the program to ensure that it can be implemented with the participants. Furthermore, the researchers 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.

2.4. Data Collection

The duration of the program was 12 weeks, which consisted of a preparation period before the data collection process. The researchers met with the sample group to clarify details before the experiment, introduce themselves, and explain the study objectives, as well as the different stages, entailed in the research. More importantly, the researchers explained to the participants their right to accept or decline research participation as well as clarification on confidentiality of information. The participants could stop participating in the research project or withdraw from the study at any time.

The activities were conducted as guided by the manual developed by the researchers. Week 1: Assess caregivers' potential, evaluate children's anemia, provide handbooks, divide caregivers into groups, create a Line group for them to keep in touch during the program, and build a good relationship among caregivers, researchers, and village health volunteers. Week 2: Provide knowledge and exchange knowledge, problems, and experience in the care of children to prevent anemia in groups. Weeks 3 and 4: The researchers 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 food menu and their weekly iron supplement intake with the Line group. Weeks 8 and 9: The researchers provide an update on knowledge and information if the caregivers have some problems they would like to share in the Line group. Village health volunteers visit the caregivers' homes to monitor their practice of providing food supplements and iron supplement syrup. Weeks 10 and 11: Monitor caregivers' practices regarding providing food supplements and iron supplement syrup assess village health volunteers' confidence in preventing anemia, and request caregivers to submit a reflection of their child-caretaking practice. Week 12: Take a test to assess knowledge and behaviors in anemia prevention in children, provide a health evaluation, and provide a hematocrit evaluation for the children.

 doi:10.20944/preprints202303.0150.v1

2.5. Statistical Analysis

This research analyzed the statistics using the SPSS software (Version 24) for Windows™ (IBM Corporation, New York, NY, USA). The statistics employed the following:

1. Descriptive statistics were used to analyze the general information, potential of caregivers, and anemia assessment entailing frequency, percentage, mean, and standard deviation.

2. Statistics were used to compare the differences in children and caregivers' general information among the experimental group and control group using the chi-square and independent t-test. The differences in mean scores suggesting caregivers' potential for preventing anemia in children before and after the program in the experimental and control groups were analyzed using the paired sample t-test. The comparison of the mean scores suggesting caregivers' potential for preventing anemia in children and the hematocrit levels were tested between the experimental group and control group using an independent t-test.

3. Results

The general data of the caregivers consisting of 80 subjects included an average age was 32.42 years (SD = 12.01), with 78.8% parents and 21.2% grandparents. Most of the caregivers had a secondary school/vocational certificate (52.5%). The majority of the occupation was househusband and housewife (48.8%). The caregivers had an adequate income (57.5%), while 42.5% had an inadequate income. Most families had 4-6 members, accounting for 68.8%. Children's food consumption was provided by the parents (83.2%), and 82.5% of caregivers who provided iron supplements for children were also parents. When comparing the differences in the general data of caregivers between the control group and the experimental group, it was found that there was no statistically significant difference ($p > 0.05$), as shown in Table 1.

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Table 1. Comparison of the frequency and percentage of caregivers categorized by general data before enrollment in the program (n = 80).

Data	Total(n=80)		Experimental group (n=40)		Control group (n=40)		*p*-value
	Number	%	Number	%	Number	%	
Age (Min-Max=16-67 years) Mean (S.D.)	32.42 (12.01)		31.35 (9.82)		33.70 (13.89)		0.38[a]
Caregiver status							
Father/mother	63	78.8	31	77.5	32	80	0.78[b]
Grandparents	17	21.2	9	22.5	8	20	
Educational level							
Primary school	18	22.5	7	17.5	10	25	
Secondary school/vocational certificate	42	52.5	21	52.5	21	52.5	0.61[b]
Bachelor's degree or higher	20	25	12	30	9	12.5	
Occupation							
Househusband/housewife	39	48.8	19	47.5	20	50	
Business owner	18	22.5	10	25	8	20	0.86[b]
Others	23	28.7	11	27.5	12	30	
Income adequacy							
Adequate	46	57.5	24	60	22	55	0.82[b]
Inadequate	34	42.5	16	40	18	45	
Number of family members							
1-3	14	17.5	8	20	6	15	0.76[b]
4-6	55	68.8	26	65	29	72.5	
7-9	11	13.8	6	15	5	12.5	
Caregiver's role in food consumption							
Father/mother	67	83.2	35	87.5	32	80	0.36[b]
Grandparents	13	16.3	5	12.5	8	20	
Caregiver's role in iron supplement							
Father/mother	66	82.5	35	87.5	31	77.5	0.23[b]
Grandparents	14	17.5	5	12.5	9	22.5	

[a] t-test, [b] chi-square.

For the general data on the children, it was found that 56.2% of the children in the sample group were female and 43.8% were male. The average children's age was 12.78 months, and the birth weights were in the range of 2,420-4,200 grams. Cesarean section and normal proportions were 51.2% and 48.8%, respectively. Overall, most children's growth was in the normal range, with 80% meeting the weight-for-age criteria, 75% meeting the weight-for-length criteria, and 80% meeting the length-for-age criteria.

When comparing the differences in the children's general information between the control group and experimental group, it was found that there was no statistically significant difference ($p > 0.05$), as shown in Table 2.

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Table 2. Comparison of the frequency and percentage of children aged 6 months to 2 years as classified by the general information before enrollment in the program (n = 80).

Data	Total (n = 80)		Experimental group (n = 40)		Control group (n = 40)		*p*-value
	Number	%	Number	%	Number	%	
Age (Min-Max = 6-24 months) Mean (S.D.)	12.78 (4.75)		12.1 (4.95)		13.45 (4.71)		0.21[a]
Birth weight (Min-Max =2,420- 4,200 gms) Mean (SD)	3,170.75 (416.61)		3,124.90 (414.26)		3,216.60 (419.11)		0.32[a]
Gender							
Female	45	56.20	23	57.50	22	55	0.65[b]
Male	35	43.80	17	42.50	18	45	
Birth							
Normal	39	48.8	16	40	23	57.5	0.11[b]
Cesarean section	41	51.2	24	60	17	42.5	
Growth							
Weight-for-age							
Do not meet the criteria	16	20	10	25	6	15	0.26[b]
Meet the criteria	64	80	30	75	34	85	
Length-for-age							
Do not meet the criteria	16	20	8	20	8	20	0.55[b]
Meet the criteria	64	80	32	80	32	80	
Weight-for-length							
Do not meet the criteria	20	25	11	27.50	9	22.50	0.60[b]
Meet the criteria	60	75	29	72.50	31	77.50	

[a] t-test, [b] chi-square.

A comparison was performed on the difference in mean knowledge scores about anemia and iron supplementation and childcare behaviors of the caregivers between the experimental group and the control group before enrollment in the program. The mean scores of the caregiver's potential for anemia prevention in children between the control group and experimental group, in the cognitive dimension, were as follows: knowledge about anemia (M = 13.20, S.D. = 1.30; M = 12.70, S.D. = 2.24; respectively) and knowledge about iron supplements (M = 8.63, S.D. = 1.58; M = 8.48, S.D. = 1.43; respectively). The dimension of childcare behaviors of the caregivers together with food consumption behaviors in children was as follows: aged 6-11 months (M = 15.46, S.D. = 3.97; M = 16.70, S.D. = 2.15; respectively), aged 1-2 years (M = 29.27, S.D. = 7.07; M = 30.25, S.D. = 3.82; respectively), and iron supplementation behaviors (M = 34.03, S.D. = 13.24; M = 35.28, S.D. = 9.43; respectively). There was no statistically significant difference ($p > 0.05$), as shown in Table 3.

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Table 3. Comparison of the mean score and standard deviation of the caregivers' potential for preventing anemia in children between experimental and control groups before participating in the program (n = 80).

Caregivers' potential	Control group (n = 40)		Experimental group (n = 40)		Mean difference	df	t	p-value
	M	S.D.	M	S.D.				
Cognition								
- Anemia knowledge (total of 16)	13.20	1.30	12.70	2.24	0.5	78	1.21	0.221
- Iron supplements knowledge (total of 11)	8.63	1.58	8.48	1.43	0.15	78	0.44	0.652
Childcare behaviors								
- Food consumption of children aged 6-11 months (total of 20)	15.46	3.97	16.70	2.15	1.23	31	1.16	0.252
- Food consumption of children aged 1-2 years (total of 44)	29.27	7.07	30.25	3.82	0.88	45	0.54	0.583
- Iron supplementation (total of 65)	34.03	13.24	35.28	9.43	1.25	78	0.48	0.624

$p > 0.05$.

A comparison was performed on the mean scores of the cognitive dimension in anemia and iron supplementation knowledge and the dimension of childcare behaviors of the caregivers after enrollment in the program. The mean scores of caregivers' knowledge of anemia and iron supplementation after participating in the potential support program for the experimental group and control group showed that the experimental group had significantly higher mean knowledge scores about anemia than the control group (M = 15.75, S.D. = 0.54; M = 13.28, S.D. = 1.43; respectively), ($p < 0.001$). The mean score of iron supplementation knowledge in the experimental group was significantly higher than the control group (M = 10.75, S.D. = 0.49; M = 8.15, S.D. = 1.54; respectively), ($p < 0.001$). After the caregivers participated in the program, it was determined that the experimental group exhibited statistically significantly higher mean scores for children's food consumption behaviors for both children aged 6-11 months and 1-2 years than the control group (M = 19.45, S.D. = 0.88; M= 15.23, S.D. = 4.08; M = 39.75, S.D. = 1.86; M = 28.15, S.D. = 7.13; respectively), ($p < 0.05$; $p < 0.001$; respectively). For iron supplementation, the experimental group had a statistically significantly higher mean score than the control group (M = 58.20, S.D. = 4.05; M = 45.78, S.D. = 9.66; respectively), ($p < 0.001$), as shown in Table 4.

 doi:10.20944/preprints202303.0150.v1

Table 4. Comparison of the mean score and standard deviation of the caregivers' potential for preventing anemia in children between experimental and control groups after participating in the program (n = 80).

Caregivers' potential	Experimental group (n = 40)		Control group (n = 40)		Mean difference	df	t	*p*-value
	M	S.D.	M	S.D.				
Cognition								
- Anemia knowledge (total of 16)	15.75	0.54	13.28	1.43	2.47	78	10.22	0.000**
- Iron supplements knowledge (total of 11)	10.75	0.49	8.15	1.54	2.60	78	10.14	0.000**
Childcare behaviors								
- Food consumption of children aged 6-11 months (total of 20)	19.45	0.88	15.23	4.08	4.22	31	4.49	0.000*
- Food consumption of children aged 1-2 years (total of 44)	39.75	1.86	28.15	7.13	11.60	45	7.08	0.000**
- Iron supplementation (total of 65)	58.20	4.05	45.78	9.66	12.43	78	7.50	0.000**

**p< 0.001.

When comparing the mean difference in the cognitive dimension in anemia and iron supplementation knowledge in the experimental group, the results found that caregivers had higher mean scores on the assessments of the cognitive and childcare behavior dimensions after participating in the potential support program. The mean score on knowledge of anemia increased after participation (M = 15.75, S.D. = 0.54) compared to before participation (M = 12.70, S.D. = 2.24). After participation, the mean score of iron supplementation knowledge (M = 10.75, S.D. = 0.49) was higher than the score before participation (M = 8.48, S.D. = 1.43). The mean food consumption behavior score of children aged 6-11 months after the experiment (M = 19.45, S.D. = 0.88) increased from before the experiment (M=16.70, S.D.=2.15), while the mean score of children aged 1- 2 years after the experiment (M = 39.75, S.D. = 1.86) showed an increase compared to before the experiment (M = 30.25, S.D. = 3.82). In addition, the mean score on providing iron supplements after the experiment (M = 58.20, S.D. = 4.05) increased from the score before the experiment (M = 35.28, S.D. = 9.43). It was found that there was a statistically significant difference ($p < 0.001$). When comparing the mean difference in the cognitive dimension in anemia and iron supplementation knowledge in the control group, the results showed that the mean score on knowledge about anemia after participating in the program (M = 13.28, S.D. = 1.43) slightly increased from the score before the experiment (M = 13.20, S.D. = 1.30), and the mean score on knowledge about iron supplementation after participating (M = 8.15, S.D. = 1.54) decreased from before the experiment (M = 8.63, S.D. = 1.58). After participating in the program, the mean score of childcare behaviors regarding food consumption for children aged 6-11 months (M = 15.23, S.D. = 4.08) decreased from before the experiment (M = 15.46, S.D. = 3.97), while the mean score for children aged 1-2 years (M = 28.15, S.D. = 7.13) also decreased from before the experiment (M = 29.27, S.D. = 7.07). There was no statistically significant difference ($p > 0.05$). However, it was found that the

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childcare behaviors in iron supplementation after the experiment (M = 45.78, S.D. = 9.66) increased significantly from before the experiment (M = 34.03, S.D. = 13.24), ($p < 0.05$), as shown in Table 5.

Table 5. Comparison of the mean scores on knowledge about anemia and iron supplementation and childcare behaviors of caregivers in the experimental and control group after participating in the program.

Caregivers' potential	Before		After		Mean difference	df	t	*p*-value
	M	S.D.	M	S.D.				
Experimental group (n = 40)								
Cognitive dimension								
Anemia knowledge	12.70	2.24	15.75	0.54	3.05	39	9.90	0.000**
Iron supplements knowledge	8.48	1.43	10.75	0.49	2.27	39	10.44	0.000**
Childcare behaviors dimension								
Food consumption of children aged 6-11 months	16.70	2.15	19.45	0.88	2.75	19	6.71	0.000**
Food consumption of children aged 1-2 years	30.25	3.82	39.75	1.86	9.50	19	12.40	0.000**
Iron supplementation	35.28	9.43	58.20	4.05	22.92	39	11.31	0.000**
Control group (n = 40)								
Cognitive dimension								
Anemia knowledge	13.20	1.30	13.28	1.43	0.08	39	0.41	0.680
Iron supplements knowledge	8.63	1.58	8.15	1.54	-0.47	39	-1.98	0.055
Childcare behavior dimension								
Food consumption of children aged 6-11 months	15.46	3.97	15.23	4.08	-0.23	12	-1.00	0.337
Food consumption of children aged 1-2 years	29.27	7.07	28.15	7.13	-1.22	26	-1.34	0.190
Iron supplementation	34.03	13.24	45.78	9.66	11.75	39	3.78	0.001*

*p<0.05, **p< 0.001.

The range of hematocrit (Hct) level before participating program in children was 30 - 40, (Mean = 34.89, S.D. = 1.97.) The hematocrit level lower than 33% was discovered in 11.4% of the children. When comparing the hematocrit (Hct) level difference between the experimental group and control group after participating in the program, the experimental group's hematocrit (Hct) volume increased by 70% after participation in the program, while the control group's hematocrit (Hct) level increased by 2.5%, with mean values of the experimental group and control group at 35.80 and 34.83, respectively, as shown in Table 6.

 doi:10.20944/preprints202303.0150.v1

Table 6. Numbers, percentages, mean, and standard deviation of the hematocrit (Hct) levels of children in the experimental and control group before and after participation in the program (n = 80).

Hematocrit (Hct)	Frequency (percentage)			M	S.D.
	Decreased	Constant	Increased		
Before					
Total Hematocrit (n=80), (Range = 30 - 40, M = 34.89, SD = 1.97) < 33 %, n = 9; 11.4% > 33%, n =71; 88.6%					
After					
Experimental group	0	12 (30)	28 (70)	35.80	1.56
Control group	11 (27.5)	28 (70)	1 (2.5)	34.83	2.15

The mean and standard deviation of the children's hematocrit (Hct) levels before participating in the program were M = 34.67, S.D. = 1.83 for the experimental group, and M = 35.08, S.D. = 2.10 for the control group. Before participating in the program, there was no statistically significant difference ($p > 0.05$). Comparing the mean values of the children's hematocrit (Hct) levels in the experimental group and control group after participation in the program revealed that the experimental group had a statistically significantly higher mean value than the control group (M = 35.80, S.D. = 1.56; M = 34.83, S.D.=2.15; respectively), ($p < 0.05$), as shown in Table 7.

Table 7. Comparison of the mean differences in the hematocrit levels between the experimental and control group and standard deviation before and after participating in the program (n = 80).

Hematocrit (HCT) volume	Experimental group (n = 40)		Control group (n = 40)		Mean difference	df	t	*p*-value
	M	S.D.	M	S.D.				
Pre-experiment	34.67	1.83	35.08	2.10	1.12	78	0.90	0.36
Post-experiment	35.80	1.56	34.83	2.15	0.97	78	2.33	0.02*

*p < 0.05.

The mean value of the children's hematocrit (Hct) levels was statistically significantly higher in the experimental group after participation in the program (M = 35.80, S.D. = 1.56) compared to before participation (M = 34.67, S.D. = 1.83) ($p < 0.001$). The mean value of the children's hematocrit (Hct) levels in the control group after participating in the program was significantly lower than before the program ($p < 0.01$) (M = 34.83, S.D. = 2.14; M = 35.08, S.D. = 2.10; respectively), ($p < 0.01$), as shown in Table 8.

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Table 8. Comparison of the mean values of the children's hematocrit levels in the experimental and control group and standard deviation before and after participating in the program (n = 80).

Hematocrit levels	Pre		Post		Mean difference	df	t	*p*-value
	M	S.D.	M	S.D.				
Experimental group (n = 40)	34.67	1.83	35.80	1.56	1.12	39	8.06	0.000***
Control group (n = 40)	35.08	2.10	34.83	2.15	-0.25	39	-3.20	0.003**

**$p < 0.01$, ***$p < 0.001$.

4. Discussion

The sample consisted of 80 caregivers of children (aged 16 – 67 years, with an average age of 32.42 years) of children aged 6 months to 2 years. They were related to their children as parents (78.8%) and graduated from high school/ vocational certificate (52.5%), which shows the ability to apply knowledge and understanding to the right and appropriate behaviors. In this study, it was found that mothers with a low level of education caused an increased risk of anemia in their children [22]. Pattana Katong and Pitsanu Aphisamacharayothin found that there was a statistically significant relationship between parental behaviors and preschool children's health care [34]. Increased knowledge would enable the caregiver to provide more effective care for the child to prevent anemia [35]. There were 48.8% who worked as househusbands or housewives and 57.5% who had adequate income. In this study, it was found that children in poor families are more likely to have anemia than children in financially stable families. It can be seen that economic conditions affect anemia in children [36]. Thai rural society is also a related society, so elderly people in families take part in raising children because their parents have to work to support the family. Thus, the family size in the sample group was common. Large family size would affect the amount of income that must be allocated to meet the needs of family members as well as the selection of quality food in child care to prevent anemia [37].

The sample group of children aged 6-24 months had an average age of 12.78 months, which was mostly within the normal growth criteria both in weight and height-for-age at 80% and weight-for-height at 75%. Anemia was discovered in 11.4% of the children. It found that a rate higher than the Ministry of Public Health, not more than 10% [11]. The experimental group's hematocrit (Hct) levels increased by 70% after participation in the program, while the control group's hematocrit (Hct) levels increased by 2.5%. Young children have an increased need for iron, which can increase the likelihood of anemia. Therefore, caregivers must pay special attention to anemia in children between the ages of one and two years because young children have an increased need for iron as the physical, mental, and brain develops and grows rapidly [13, 18].

The caregivers' care behaviors after the experimental anemia prevention potential support program revealed that the mean scores of knowledge and overall care behavior were statistically significantly higher than those before the experiment. Based on House's concept [31], in terms of taking care of food consumption and iron supplementation, it was found that the overall knowledge and care behaviors of the caregivers in the experimental group were found to be

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significantly better than the control group, indicating that the caregiver's potential support program made them realize the importance of preventing anemia. This is consistent with the pre-determined hypothesis. Emotional support made them realize the importance of preventing anemia, accept that they are not facing problems alone; and share how to take care of children's food consumption. It was found that allowing caregivers to express their opinions and make decisions about food consumption issues in their children resulted in behavioral change [38]. Caregivers intended to pay attention to their children's health and had confidence that they would be able to care for children, resulting in better health than before. In terms of informational support, it was found that caregivers who lacked knowledge and opinions and ignored the importance of iron supplements for their children may cause anemia [19, 30]. In terms of instrumental support and assisting with items or services, it was found that the preparation of media for educating caregivers contained content related to health care for children in various aspects. This enhanced the caregivers' confidence in caring for their children. Thus, preparing media to publish knowledge would appropriately improve the understanding of caregivers. This is good social support for parents. In terms of appraisal support, it was found that following up with home visits or telephone calls helped to promote the knowledge and behaviors of caregivers [38, 39].

With a potential caregiver support handbook, lecture materials, and teaching video, caregivers can use what they've learned to practice with their children at home. The worksheet's dates for each activity were followed up on. The researchers called the sample group to ask questions, identify obstacles, and encourage them to participate in activities. A comparison of the mean scores of the potential caregivers in both knowledge and children's care behaviors after participation in the experimental and control groups revealed statistically significant differences. This is consistent with the concept of social support introduced by House (1981), who said that individuals are encouraged to receive informational, material, or emotional support from their sponsor, which could be a person or a group of people. This enables them to develop and adjust their behaviors in the direction desired by the supporter [31].

In the control group of caregivers who did not participate in the program or have not exchanged, learned, or experienced anything, they still received regular advice from nurses. Sometimes the experience of taking care of children was not enough. Thus, no role model can be adapted to suit everyday life. As a result, there was only a slight change in childcare behaviors. It's consistent with some parents being unknown of providing iron supplements to their children because they thought their children were normal, caring behaviors lead to insufficient iron intake from the diet, increasing anemia [24]. Therefore, the mean value of the children's hematocrit (Hct) levels in the control group after participating in the program was significantly lower than before the program ($p < 0.01$).

In addition, the effects of the teaching program on the knowledge and care behaviors of caregivers were investigated. The values of the children's hematocrit (HCT) levels were significantly higher after participation in the potential support program compared to before participation in the program ($p < 0.001$) because caregivers closely received information from health personnel about anemia in children

 doi:10.20944/preprints202303.0150.v1

and nutritional and iron supplementation advice, which can help caregivers understand the causes and build confidence in proper childcare [11]. If caregivers consistently receive accurate nutritional and iron supplementation information, anemia in children can be prevented [20]. When children received iron supplements regularly, their normal hemoglobin levels were 2.69-fold greater than those of children who did not receive iron supplements [21]. Continuous iron supplementation, either alone or in combination with other vitamins and one to three times per week, can increase hemoglobin levels and decrease the risk of iron deficiency anemia [6]. In addition, age-dependent supplementation of foods containing protein and iron (especially meat, liver, blood, eggs, and seafood) daily extended breastfeeding up to 2 years of age and supplemented foods with no more than 2-3 glasses of plain milk per day or no more than 500 cc. of milk. It also supplemented foods by aiding in iron absorption (especially vitamin C), preventing foods from reducing the absorption of iron, and encouraging children to consume enough iron and prevent iron deficiency, thereby reducing the incidence of anemia in children [3, 11].

5. Conclusions

The caregiver's potential support program on anemia prevention among children aged 6 months to 2 years was able to develop caregivers in knowledge about anemia, iron supplementation, and care of food consumption for their children which can be seen by the significant increase in the average score. As a research suggestion, community nurses should support caregivers' capacity to provide continued care for children to prevent anemia and follow up with the caregiver from this study regarding the effects of the program on anemia prevention.

Author Contributions: S.S. prepared the proposal research, reviewed the literature, designed the methodology, executed the study in this research, assisted with the data collection and analyses, and wrote the original draft in preparation for the manuscript. K.K. assisted with preparing the proposal research, designing the conceptualization of the study, executing the study, supervising, and writing and editing the draft and final manuscript. T.E. assisted with the data analyses and supervised the writing of the draft of the manuscript. All authors have read and agreed to the published version of the manuscript.

Funding: Funding for this study was supported and awarded to the first author or the corresponding author from the Excellence Center of Community Health Promotion, Nursing Institute, Walailak University.

Institutional Review Board Statement: All procedures involving human participants that were performed in the studies followed the ethical standards of the Ethical Institutional Consideration. Ethical approval was obtained from the Office of the Human Research Ethics Committee of Walailak University, dated 25 June 2021, No. WUEC-21-133-01.

Informed Consent Statement: Informed written consent was obtained from all parents involved in the study.

Data Availability Statement: The data that supported this study's findings are available from the corresponding author upon reasonable request.

Acknowledgments: We want to express our gratitude to the School of Nursing, Walailak University for its support and advice. We would also like to sincerely thank the healthcare providers, presidents of the Health Promoting Hospitals, and the village health volunteers for their kind and active cooperation.

Statement Conflict of Interest: The authors declare no conflict of interest.

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