The Impact of WIFA Program on Haemoglobin Concentration of Stunted and Non-Stunted Female Students and Factors Affecting Haemoglobin Concentrationin Cianjur Regency, West Java Province, Indonesia

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Abstract

Background: Stunting is a nutritional problem occurs on adolescents that have risk to develop into anemia. This is known as co-occurrence anemia-stunting (CAS). Stunted adolescents have significantly lower haemoglobin level than non-stunted adolescents. The Weekly Iron Folid Acid Supplementation (WIFA) is one of government programs to resolve stunting problem by preventing anemia and/or CAS. This study aimed to analyze impact ofWIFA supplementation on haemoglobin concentrationfrom stunted and non-stunted female students as well as factors affecting haemoglobin concentration.

Methods: This study applied a cross sectional design. The subjectswere 66 female studentsdivided intostunted group and non-stunted group. Subjects were selected using a simple random sampling technique. The data takenwerebody weight and height, anemia and WIFA knowledge, compliance of WIFA consumption,dietary diversity, andhaemoglobin concentration. Dietary diversity was obtained by 2x24 hours recall by employingWDDS questionnaire. Thedifference and correlation test were used to analyse the data.

Conclusions: There was no significant different haemoglobin concentration of both group and there wereno correlation between affected factors with haemoglobin concentrationwhich could be caused by haemoglobin concentration on normalcategory at the beginning of WIFA program and good quality diet that could promote haemoglobin production.

Keywords: *stunted;anemia; co-occurrence anemia-stunting; WIFA supplementation*

Introduction

Stunting is one of the chronic malnutrition problems in Indonesia that has not been resolved. Z-score height for age of stunted individual is< -2SD.[1]A stunting condition has a negative impact such as suppressing linear growth and causing cognitive development disorders. In the long term, a stunting problem is capable to reduce work capacity, increasing the risk of developing metabolic syndrome and non-communicable diseases in their adulthood.[2]

Indonesia's stunting prevalence rate reaches 30.8%.[3] Among all Indonesia provinces, West Java province also has stunting problems with prevalence rate reaches 29.2% for toddler,stretching out into 29 districts. The Cianjur regency reported a higher stunting prevalence for toddler (35.7%) comparing to its province.[4]

A stunting is not only a nutritional problem for children but also becomes a prolong problem into their adolescents time. Stunted children will tend to grow into stunted adolescents or stunted adults.[5] In Indonesia, for West Java in particular, the prevalence stunting for 13-15 years old reached 33.8%, while the stuntingfor 16-18 years old reached 29.7%.[6]

Anemia is one of many contributing factors to the formation of the stunting generation. Anemic women in their reproductive age are at risk of giving preterm birth, low birth weight (LBW), and small-for-gestational-age (SGA) babies. Moreover, the LBW, preterm birth, and SGA are exposed to 3.2 times higher risk to develop into stunted children.[7]

Apart as a contribution factor to the creation of the stunting generation, anemia also becomes significant risk to happen in stunted individual.[8]The study of Puristasari et al. (2016) stated that stunted adolescents had significantly lower haemoglobin levels than non-stuntedadolescents.[9]The micronutrients deficiency occurred in stunted individuals contributes to low haemoglobin formation.[10] The condition of anemia and stunting incidence that occurs simultaneously is known as co-occurrence anemia-stunting (CAS). Hence,a prevention of anemia or CAS is needed to avoid the birth of children with risk of stunting and anemia.[11]

Weekly Iron-Folic Acid Supplementation (WIFA) is one of the Indonesia government programs to prevent and overcome iron deficiency anemia in order to reduce stunting. The program of improvement and prevention of anemia is considered as one of the modifying factors that have a major effect on the birth of children with a stunting potential.[11] One of the targets of this program is adolescent girl. The dosage contained in one tablet of WIFA is 182mg offerro fumarate and 0.4 mg of folic acid.[12]WIFA is consumed once per week. The expected effect of the WIFA consumption is the improvement of iron status and haemoglobin concentration.[13]

The haemoglobin concentration of WIFA recipients can be affected by several factors such as the anemia and WIFA knowledge, compliance of WIFA consumption, and dietary diversity. Knowledge plays a role in guiding individuals to make various efforts to meet their nutritional needs.[14]Adolescent girls with less knowledge of anemia have 14.4 times higher risk of developing anemia.[15] Compliance is one of the most influential factors in the success of the WIFA program. The WIFAsupplementation can increase haemoglobin concentration when accompanied by compliance with consumption.[16] Dietary diversity is an indicator that can be used to assess dietary adequacy that affects blood formation.[17] An increase in one dietary diversity score can increase haemoglobin levels by 0.714 g/dL.[18]

Researches on the haemoglobin concentration of stunting adolescent girls as recipients of WIFA program which especially conducted in Cianjurregency as one of the areas that has a high prevalence of stunting are still limited. The factors affectinghaemoglobin concentration also need to be explored for evaluation the next implementation of the WIFA program. The aims of this study are to determine the impact WIFA program on stunted and non-stuntedfemale students as well as factor affecting the haemoglobin concentration in Cianjur regency, West Java province, Indonesia.

Materials and Method

This study applied a cross sectional design and was a part of the research of Khomsan et al. (2020) funded by the Neys-van Hoogstraten Foundation, The Netherlands. This study was conducted from June 2019 to June 2020. It has met the requirements the ethical review of the Medical/Health Research Bioethics Commission under acceptance letter of 004/I/2020/ Bioethics Commission from Sultan Agung Islamic University Semarang, Indonesia.

The population target in this study was female students with age ranging from 15-18 years old in Cianjur regency. This study involved 66 samples which divided into two groups;stunted group and non-stunted group. Sampling was carried out by simple random sampling technique in 12 Senior High Schools. The inclusion criteria were female students who recipient the WIFA program, have HAZ < -2SD for stunted group and ≥ -2SD for non-stunted group, haveBMI for age on normal category for both groups, and willing to attend all series of research. Meanwhile, the exclusion criteria were female students who had an infectious disease in the past one year, and taking supplements or drugs with substances that could inhibit or increase iron absorption.

The data collections were included subject identity,anthropometric data (weight and height),

anemia and WIFA knowledge, compliance of WIFA consumption, dietary diversity, and haemoglobin concentration. Anthropometric data were obtained by taking a direct measurement twice by employing a digital scale for weight with accuracy of 0.1 kg and microtoise for height with accuracy of 0.1 cm. Data on level of knowledge and compliance of WIFA consumption were obtained through direct interviews using a questionnaire. Subjects are considered to have knowledge if they are able to choose at least one correct answer in every aspect of the question. Data of food consumption were obtained through 2x24 hours recall interviews on non-consecutive days. Food consumption data was then processed to determine individual food diversity by using the Women's Dietary Diversity Score (WDDS) questionnaire.[19]Haemoglobin concentration was obtained by direct measurement using the Hemocue 301 device. Haemoglobin concentrationwas categorized as anemia (haemoglobin concentration<12 g/dl) and non anemia (haemoglobin concentration ≥ 12 g/dl).[20] All data analyzed by SPSS 23.0 software. The test used in this study are Independent T test and the Mann-Whitney test to determine difference in haemoglobin concentration between groups, as well as the Pearson correlation test and Spearman correlation test to determine the relationship between variables.

Results and Discussion

Characteristics of Research Subjects

Table 1 shows that there were 12.12% had anemia and 9.09% experienced CAS. The conditions of anemia and CAS in adolescents girls require serious handling. Anemia condition in adolescent girls that is not treated properly leads to the potential problems during pregnancy, such as low birth weight (LBW)[21], preterm birth[21], and small-for-gestational-age(SGA)[7]. This condition will be exacerbated in anemicadolescents with stunting problem. Moreover,stunting problems have a transgenerational effect, a stunted woman tends to deliver stunted offspring.[2] Stunted women also have a similar risk of experiencing pregnancy problems as anemic women.[22,23]The poor quality of pregnancy that occurs in anemic and stunted individuals will lead to give birth of children with stunting and anemia problems.[7,10]

Table 1. The Characteristics of Research Subjects

Category	Stunted n(%)	Non-stunted n(%)
Age		
Middle adolescents (14-16 years)	16 (48.48)	24 (72.73)
Late adolescents (17-20 years)	17 (51.52)	9 (27.27)
Anemia status		
Anemia	3 (9.09)	4 (12.12)
Normal	30 (90.91)	29 (87.88)
Haemoglobin concentration (g/dl), mean±SD	13.52±1.21	13.47±1.68

Knowledge about Anemia and WIFA Supplementation

Table 2 shows that subjects of both groups had a knowledge score of ≥60 with the largest percentage in the moderate category.Subjects in the both groups relatively had almost the same answer choices. The eminent cause of anemia that widely known was lack of iron intake (60.61%). Iron deficiency becomes a factor that contributes to the incidence of anemia. However, there are deficiencies of other nutrients that also cause anemia, including folic acid, B12, and protein. Folic acid and B12 play a role in the DNA and haemoglobin synthesis during the RBC formation[23], while protein facilitates the absorption and mobilization of iron, and the synthesis of haemoglobin[24]. The incidence of infections such as worms and malaria are also associated with anemia which worms cause iron loss, and malaria causes metabolic and iron distribution disorder through hemolysis and decreased iron absorption.[25]The anemia effect that extensively recognized is having difficulty in concentrating. The WHO states that anemia that occurs during adolescence can affect physical and cognitive growth, work performance,and reproduction quality.[26]

The subject's knowledge about WIFA was dominated by a score of≥60. Table 3 illustrates side effect that most recognized in both groups was nausea. Subjects in both groups knew about how to reduce side effectsby consuming WIFA tablets after meal. 90.91 % subjects in both groups chose the benefit of consuming WIFA tablets was to preventanemia.

Table 2. Knowledge and Compliance of WIFAof Research Subjects

Subject Knowledge About Anemia			
Aspects		**Stunted n(%)**	**Non-stuntedn(%)**
	Scores of knowlegde about anemia		
1.	Low (score <60)	0 (0.00)	0 (0.00)
2.	Moderate (score 60-80)	18 (54.50)	18 (54.50)
3.	Good (score>80)	15 (45.50)	15 (45.50)
	Causes of anemia		
1.	Blood loss due to menstruation or accidents	19 (57.58)	18 (54.55)
2.	Deficiency iron intake	20 (60.61)	20 (60.61)
3.	Deficiency folic acid intake	5 (15.15)	2 (6.06)
4.	Deficiency vitamin B12 intake	5 (15.15)	4 (12.12)
5.	Infections (worms and malaria)	5 (15.15)	1 (3.03)
6.	Vegetarian	2 (6.06)	1 (3.03)
7.	Deficiency protein intake	7 (21.21)	15 (45.45)
8.	Lack of fruits consumption	10 (30.30)	17 (51.52)
	General signs		
1.	Palecolor of eyes, nails, and palms	18 (54.55)	20 (60.61)
2.	Dizzy	27 (81.82)	28 (84.85)
3.	Weak	19 (57.58)	21 (63.64)
4.	Fatigue	16 (48.48)	15 (45.45)
5.	Lethargic	20 (60.61)	22 (66.67)
	Effects of anemia		

Cont... **Table 2. Knowledge and Compliance of WIFAof Research Subjects**

1.	Decrease academic achievement	12 (36.36)	12 (36.36)
2.	Difficulty concentrating	23 (69.70)	30 (90.91)
3.	Decrease work performance	10 (30.30)	10 (30.30)
4.	Low birth weight offspring	7 (21.21)	9 (27.27)
5.	Susceptibility to infection	2 (6.06)	1 (3.03)
	How to prevent anemia		
1.	Consumption of weekly iron- folic acid supplementation	28 (84.85)	30 (90.91)
2.	Consumption of dark green leafy vegetables	22 (66.67)	24 (72.73)
3.	Consumption of vitamin C rich vegetables and fruits	17 (51.52)	19 (57.58)
4.	Consumption of meat and chicken's liver	14 (42.42)	20 (60.61)
5.	Taking worms medicine once for 6 months	5 (15.15)	1 (3.03)
6.	Getting enough rest	16 (48.48)	18 (54.55)
	Detection of anemia		
	Haemoglobin level	17 (51.52)	15 (45.55)

Table 2. Knowledge and Compliance of WIFA of Research Subjects (Continue)

Knowledge About WIFA Supplementation			
Aspects		**Stunted n(%)**	**Non-stunted n(%)**
Scores of knowlegde about WIFA supplementation			
1.	Low (score <60)	6 (18.20)	7 (21.20)
2.	Moderate (score 60-80)	12 (36.40)	13 (39.40)
3.	Good (score>80)	15 (45.50)	13 (39.40)
Frequency consumption (once a week)		28 (84.85)	31 (93.94)
Duration of taking WIFA supplementation in a year (52 weeks)		20 (60.61)	13 (39.39)
WIFA supplementation content (iron and folic acid)		11 (33.33)	10 (30.30)
Side effect of WIFA consumption			
1.	Nausea	27 (81.82)	24 (72.73)
2.	Difficulty defecating	0 (0.00)	0 (0.00)
3.	Blackish stool	6 (18.18)	6 (18.18)
4.	Rust sensation	4 (12.12)	6 (18.18)
5.	Dizzy	12 (36.36)	20 (60.61)
How to prevent or reduce the side effects			
1.	Consumption WIFA after meal	20 (60.61)	18 (54.55)
2.	Consumption with fruits	7 (21.21)	12 (36.36)
Benefit			
1.	Increase concentration	18 (54.55)	19 (57.58)
2.	Not easy fatigue	17 (51.52)	20 (60.61)
3.	Increase work productivity	9 (27.27)	7 (21.21)

Cont... **Table 2. Knowledge and Compliance of WIFA of Research Subjects (Continue)**

4.	Increase work capacity	5 (15.15)	9 (27.27)
5.	Prevent anemia	30 (90.91)	30 (90.91)
Compliance of WIFA Consumption			
Aspects		Stunted n(%)	Non-stuntedn(%)
Compliance of WIFA consumption			
Not comply		20 (60.60)	12 (36.36)
Comply		13 (39.40)	21 (63.64)
Reason for compliance :			
Asked by the teacher		4 (12.12)	6 (18.18)
Asked by the health center staff		4 (12.12)	1 (3.03)
Prevent anemia		13 (39.39)	14 (42.42)
Reason for not compliance :			
Taste of tablet is bad		9 (27.27)	6 (18.18)
Already feel healthy		1 (3.03)	1 (3.03)
Worrying about side effect (nausea, vomiting, dizzy)		12 (36.36)	7 (21.21)
Worrying about unwanted health problems		0 (0.00)	0 (0.00)
Not attending at school		1 (3.03)	2 (6.06)
Forget		8 (24.24)	7 (21.21)
Reason for not compliance :			
Unnecessary		2 (6.06)	0 (0.00)
Blackish stool		0 (0.00)	1 (3.03)
Family do not allow		0 (0.00)	0 (0.00)

Compliance of WIFA Consumption

Table 2 shows that the subjects in the stunted group was more likely to not comply to consume the WIFA tablets (60.60%) compare to the non-stunted group (36.36%). The most reason subjects obeyed the consumption of WIFA was preventing anemia. This result is similar to a study conducted inEthiopia.[27] The reasons for the subjects not adhering to the consumption of WIFA were worry about side effects (nausea/ vomiting, headache), bad taste of the tablets, and forgetfulness. It also similar to researches conducted in Indonesia and Iran.[28,29] Providing information about side effects, the right time for consumption, its benefits and complications of WIFA consumption needs to be carried out by health personnel through nutritional counselling to improve subject compliance.[30]

Dietary Diversity

Dietary diversity becomes an indicator that strongly correlated with micronutrient adequacy such as vitamin A and heme iron. Table 3 shows that only 27.37% of the stunted group and 30.30% of the non-stunted group had adequate food diversity. Table 4 shows that the food groups with a low percentage of consumption are dark green leafy vegetables, vegetables and fruits rich in vitamin A, milk and its processed products, and organ meat. These food groups are rich in vitamin A content. Vitamin A plays an important role in the formation of RBC through the modulation mechanism of erythropoietin synthesis[25], and acts as cell-mediated immunity, thereby reducing the risk of anemia due to infection[31]. This study shows difference in the consumption of milk and milk products group on the

first and second recall day (p=0.014). This result could be due to a special day that provides these food products which coinciding with the second recall day. The result of this study is similar to a study of Savyet al.(2007) which states that market day is one of the special days that causes changingfood groups consumption. The changing in consumption of food groups had impacted on the increasing score of food diversity.[32]

Table 3. Dietary Diversity of Research Subject

Categorization	Stuntedn (%)	Non- stuntedn (%)
Inadequate (consumption <5 food groups)	24 (72.73)	23 (69.70)
Adequate (consumption ≥ 5 food groups)	9 (27.37)	10 (30.30)
Total score, mean±SD	4.24±1.15	4.27±1.03

Table4. Dietary Diversity Based Food Group

Food group	Recall day -1n (%)	Recall day -2n (%)	p
Strachy staples			
No consumption	0 (0.00)	0 (0.00)	1.0001)
Consumption	66 (100.00)	66 (100.00)	
Dark green leafy vegetables			
No consumption	46 (69.70)	44 (66.67)	0.7101)
Consumption	20 (30.30)	22 (33.33)	
Other vitamin A rich fruits and vegetables			
No consumption	47 (71.21)	56 (84.85)	0.0591)
Consumption	19 (28.79)	10 (15.15)	
Other fruits and vegetables			
No consumption	26 (39.39)	25 (37.87)	0.8591)
Consumption	40 (60.61)	41 (62.12)	
Organ meat/ Offals			
No consumption	58 (87.88)	62 (93.94)	0.2281)
Consumption	8 (12.12)	4 (6.06)	
Meat and fish			
No consumption	17 (25.76)	16 (24.24)	0.0762)
Consumption	49 (74.24)	50 (75.76)	
Eggs			
No consumption	33 (50.00)	29 (43.94)	0.4892)
Consumption	33 (50.00)	37 (56.06)	
Legumes, nuts, and seeds			
No consumption	28 (42.42)	22 (33.33)	0.0852)
Consumption	38 (57.58)	44 (66.67)	
Milk and milk products			
No consumption	63 (95.45)	54 (81.82)	0.0141)
Consumption	3 (4.55)	12 (18.18)	
Total score of food diversity, mean±SD	4.18±1.37	4.33±1.26	0.2992)

[1)]Mann-Whitney test; [2)]Independent T test; p<0,05

Difference Variables Between Stunted and Non-Stunted Groups

Table 5 shows no difference in haemoglobin concentrationof both groups (p=0.887). That is expected to be the effect of WIFA supplementation because there is no literature stating that iron metabolism and haemoglobin production mechanisms differ between both groups. Interventions to improve haemoglobin concentration must be carried out immediately for stunted individuals to prevent low haemoglobin levels and the negative impact on rapid growth process of the adolescent period.[33]

Table 5. Bivariate Analysis

Difference Variables Between Stunted and Non-Stunted Group			
Variables	**Mean**		**p**
	Stunted	**Non stunted**	
Score of knowledge about anemia	86.06±14.56	88.48±11.21	0.4511)
Score of knowledge about WIFA supplementation	74.75±17.24	72.73±17.09	0.6341)
Dietary diversity	4.24±1.15	4.27±1.03	0.9111)
Haemoglobin concentration	13.52±1.21	13.47±1.68	0.8871)
Compliance of WIFA consumption	56.89±37.76	75.25±31.59	0.0361)
Correlation Variables with Haemoglobin concentration			
Variables	r		p
Score of knowledge about anemia	-0.078		0.5342)
Score of knowledge about WIFA supplementation	0.044		0.7272)
Consumption of WIFA	-0.135		0.2793)
Compliance of WIFA consumption	0.068		0.5892)
Dietary diversity	-0.095		0.4472)

[1)]*Independent T test*; [2)]*Pearson Correlation*; [3)] *Spearman Correlation*; p< 0,05

Correlation of Affected Factorsto HaemoglobinConcentration

Table 5 shows that there were no significant correlation all variables with haemoglobin concentration. The intervention research conducted by Allen et al.(2000) states that the absence of a significant variable with haemoglobin concentration can be caused by the level of haemoglobin in a normal category at the beginning of WIFA program and a good quality diet that can support the formation of haemoglobin.[34]The causal relationship cannot be clearly illustrated in this study because of the use of a cross sectional design.

Conclusion

There was no significant difference the haemoglobin

concentrationofboth groups and there were no correlation between affected factors with haemoglobin concentration. The absence of a significant variable with haemoglobin concentration can be caused by the level of haemoglobin in normal category at the beginning of the WIFA program and a good quality diet that is able to support the formation of haemoglobin. As a final remarks, the causal relationship cannot be described clearly because of the use of a cross sectional study design in this study.

Conflict of Interest: *The authors hereby declare that they have no conflict of interest within this research.*

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