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## Nutrition education, hemoglobin levels, and nutrition knowledge of adolescent girls in Banyumas district

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### ABSTRAK

**Latar belakang:** anemia merupakan masalah gizi utama yang ditemukan pada remaja putri. Jejak prevalensinya semakin meningkat. Anemia pada remaja putri yang tidak tertangani akan berlanjut hingga masa kehamilan dan berakibat pada tingginya ibu hamil anemia. Suplementasi tablet besi cukup efektif dalam penanganan masalah anemia namun kurangnya pengetahuan terhadap anemia menurunkan tingkat kepatuhan konsumsi tablet besi sehingga pengetahuan dan sikap remaja memegang peranan penting dalam keberhasilan menurunkan prevalensi anemia.

**Tujuan:** menganalisis efektifitas edukasi gizi terhadap kadar hemoglobin dan skor pengetahuan dalam upaya penanganan anemia gizi remaja putri.

**Metode:** Penelitian menggunakan desain True experimental dengan randomized pretest-posttest control group design. Intervensi menggunakan edukasi gizi di laksanakan sebanyak enam kali selama 1,5 bulan dengan satu kali pertemuan setiap minggu. Jumlah subjek sebanyak 70 orang terdiri dari 31 orang kelompok perlakuan dan 39 orang kelompok kontrol. Uji T berpasangan digunakan untuk menganalisis perbedaan kadar hemoglobin dan skor pengetahuan sebelum dan sesudah pemberian edukasi gizi.

**Hasil :** Hasil analisis statistik menunjukkan terdapat perbedaan rerata kadar hemoglobin pada kelompok perlakuan antara sebelum dan sesudah edukasi gizi dari 12.17 g/dL meningkat menjadi 12.68 g/dL ( $p=0,001$ ). Skor pengetahuan subjek meningkat dari  $16.03 \pm 2.30$  menjadi  $20.09 \pm 2.21$  ( $p=0,000$ ).

**Kesimpulan:** Pemberian edukasi gizi efektif meningkatkan kadar hemoglobin dan skor pengetahuan remaja putri.

**KATA KUNCI:** Remaja putri; kadar hemoglobin; skor pengetahuan; pendidikan gizi

### ABSTRACT

**Background:** Anemia is a major nutritional problem found in adolescent girls. The prevalence trend is increasing. Anemia in untreated adolescent girls will continue until pregnancy and result in anemia of anemic pregnant women. Iron supplementation is quite effective in handling anemia problem but lack of knowledge to anemia decrease compliance level of iron tablet consumption so that knowledge and attitude of adolescent plays an important role in the success of decreasing prevalence of anemia.

**Objectives:** to analyze the effectiveness of nutritional education on hemoglobin level and knowledge score in the effort of anemia treatment in adolescent girls.

**Methods:** This research used true experimental with randomized pretest-posttest control group design. Intervention using nutritional education was conducted in six sessions for 1.5 months once every week. Total participants of this study were 70 people consisted of 31 treatment groups and 39 controls. Paired T test is used to analyze the difference of hemoglobin level and score of knowledge before and after nutrition education.

**Results:** The statistical test showed that there was a difference of mean hemoglobin level in treatment group between before and after nutrient education from 12.17 g / dL increased to 12.68 g / dL ( $p=0,001$ ). The subject knowledge score increased from  $16.03 \pm 2.30$  to  $20.09 \pm 2.21$  ( $p=0,000$ ).

**Conclusions:** Effective nutrition education raises the hemoglobin level and the girls' knowledge score.

**KEYWORDS:** adolescent girls; hemoglobin levels; knowledge scores; nutrition education

## INTRODUCTION

One of nutritional problem in developing country including Indonesia, is anemia, with female adolescents and young pregnant women are most susceptible. The prevalence of anemic female adolescents in Brazil was 30.2% (1). Basic health research (Riskesdas) 2013 found that 22.7% of adolescents in Indonesia suffered with anemia. One research in Bengkulu reported that 43% of female adolescents were anemic (2). Koerniawati, *et al.* 2016 also reported that 45.8% of young pregnant women are anemic (3). Banyumas Public Health Office reported in 2014 that 5.1% of high school teenagers were suffered from anemia (4). However, a research conducted in two high school in Banyumas Regency showed different result with 84.45% female adolescents suffered with anemic(5).

Anemia in female teenagers occur because of protein, iron, and other micronutrients deficiency, worsened by the lack of nutrition-related knowledge that could affect behavior. Balci, *et al.* 2012 reported that 59% of anemic incidences are caused by iron deficiency and 41% are the combination of iron and B12 vitamin deficiency (6). In the urban areas, around 60% of female adolescents and around 76% in the rural areas are lack of protein intake. Statistical analysis result showed a correlation between protein intake and anemic incidence in female adolescents ( $p=0,0008$ ) (4). The lack of animal protein intake combine with sole consumption of staple foods will resulted in lower iron intake (7). Knowledge test conducted in anemic female adolescents showed 39% of them has low result in nutrition-related knowledge (8).

Plausible interventions that could be implemented to lower anemic prevalence in female adolescents are including dietary pattern improvement, food fortification, and iron supplementation (9). Iron supplementation is an effective approach to attenuate anemic problem. However, lack of nutritional knowledge related with anemic could lower the adherence of iron supplementation intake. Thus, adolescents' knowledge and behavior play an important role to ensure the effectiveness of iron deficiency anemia reduction (10,11,12).

Nutritional education has some predominance, including affordable, feasible, has no side effects, and sustainable through knowledge improvement that could impact on behavioral change of food pattern. An experimental study trying to compare nutritional education intervention and iron supplementation program reported that nutrition education group is more effective to improve anemic condition (13).

Some limitations of iron supplementation interventions and presumption of education-based intervention to improve anemic condition in female adolescents trigger authors to conduct present research, aiming to analyze nutritional education effectivity towards hemoglobin level and knowledge scoring test in the efforts to improve anemic in female adolescents.

## MATERIALS AND METHODS

The study design of this research was using *true experimental with randomized pretest-posttest control group design*. The research conducted in two High Schools, which are SMA Negeri 2 and SMA Negeri 4 Banyumas with nutrition-related educational intervention period conducted during March – April 2016. SMA Negeri 2 as the treatment group and SMA Negeri 4 as the control group. The reason behind SMA Negeri 2 as treatment group was according to report from previous study that anaemic presentation of female adolescent in the school aforementioned was 85.45% (5). On the other hand, the reason behind SMA Negeri 4 as control group was based on matching process towards school and student characteristics. Both schools were located in the same urban area, although there were enough distance between those schools to minimize the possibility of respondents to interact with each other. Being as state schools, this was also one of the consideration due to their similarities in school schedule, which is 5 days active.

The subjects of this research are female teenagers aged 15-17 years-old with inclusion criteria are as follows: do not have blood abnormalities, sign agreement to be research subject, not in menstruational period during hemoglobin check, do not regularly taking iron supplementation, do

not ill during data retrieval, and attending nutritional education session at least 5 times.

Minimal subject required are calculated using large sample from two populations formula, with additional 10% of drop out estimation. Sampling method used in this study is simple random sampling, by randomizing from the respondent list that meet the inclusion criteria with the help of the excel software. Randomization was conducted on the responden list of SMA negeri 2 who meet the inclusion criteria, the names that came out were included as members of the treatment group. Randomization on the respondent list of SMA negeri 4 for the names that came out was entered into the control group. Secondary data obtained from schools were student's name list that meet the inclusion criteria, which then were randomised to determine the respondents list. Later in this study, total participants that attended education session for 5 times are 70 subjects, specifically 31 from intervention group and 39 from control group.

The collected data from this study are blood hemoglobin level and knowledge score. Blood hemoglobin level were obtained from venous blood by skilled laboratory officer. The samples were then analysed using Cyanmethemoglobin method. Knowledge scores were collected using standardised knowledge questionnaire, which consist of 25 nutrition and anemic-related questions. Knowledge questionnaire development was started with validity and reliability tests to 30 young adolescents with similar characteristics to the respondent in this study. Pearson correlation test result shows that questions number 1, 2, 5 – 19, 21 – 25 were valid, whereas questions number 3, 4, 20 were invalid. However, invalid questions were

still maintained though with some improvements of redactional sentences to make them more understandable. At the end, all 25 questions were used in this study. The result of reliability analisis were considered as reliabel ( $\alpha$ -cronbach 0,656).

The intervention of this study was nutritional education session that conducted in 6 meetings. Educational materials were delivered to the participants using combination of lectures, presentation, and educational game methods. Baseline information regarding hemoglobin level and knowledge score were collected pre-intervention, followed by nutrition education sessions every weeks for 1.5 months. Post-intervention data were then collected for endline hemoglobin level and knowledge score. This present study was reviewed and approved by the Research Ethics Committee of Faculty of Medicine Universitas Jenderal Soedirman with reference number : 082/KEPK/II/2016.

The data collected from this study were presented in description and statistical analysis using the software package SPSS 17 for Windows. The analysis of baseline and endline data from pre- and post-intervention were calculated using paired t test.

## RESULTS

### Subject characteristics

The respondent characteristics were presented in **Table 1** with 70 female adolsecents were participated in this study. The range of age from subject is categorised as middle adolescence that is 15-17 years-old (14). Most of the participants are 15 years-old (55.7%), while 41.4% are 16 years-old, and only 2.9% of the participants are 17 years-old (**Table 1**).

**Table 1. Subject distribution based on individual characteristic**

Characteristic	Category	Group		Total	%
		Intervention	Control		
Age	15	18	21	39	55.7
	16	12	17	29	41.4
	17	1	1	2	2.9
Anemic status	Not anemic	19	27	46	65.7
	Anemic	12	12	24	34.3

Source: Primary Data, 2016

The results of statistical analysis in **Table 2** showed that there were no significant differences in mean hemoglobin levels and knowledge scores between the intervention and control groups before giving nutritional education ( $p > 0.05$ ). This shows that the characteristics between the intervention group and the controls are not significantly different or homogeneous.

**Table 2. Hemoglobin level and knowledge score subject before education**

Variable	Group		p
	Intervention mean±SD	Control mean±SD	
Hemoglobin	12.17±1.29	12.43±1.36	0.407
Knowledge Score	16.03±2.30	13.84±2.15	0.095

Source: Primary Data, 2016

**The Effect of Nutrition Education towards Hemoglobin Level**

The distribution of hemoglobin levels between pre and post nutrition education presented in **Table 3**. It can be seen from the analytical result that there is a significant reduction in subject with low

hemoglobin level (<12 gr/dl) from 38.7% during pre-education to 22.57% post-education in intervention group. This result is aligned with previous study that reported a reduction of subject with low hemoglobin level (<10 gr/dl) from 35% to 25% after receiving nutrition education (15).

The rates of hemoglobin level in subjects before nutrition education showed 12.17 gr/dL, and the level was elevated after nutrition education to 12.68 gr/dL. However, this trend is inconsistent with previous study that reported nutrition education intervention could not increase subject hemoglobin level (16).

**The Effect of Nutrition Education towards Knowledge Score**

The rates of knowledge score in intervention group were 16.03±2.30, which then increase significantly after nutrition education to 20.09±2.21. The result of different *t* test support this finding that there was significant increase of knowledge score in intervention group before and after nutrition education (**Table 4**). However, different result showed in control group that there was no different

**Table 3. Hemoglobin level distribution before and after education**

Hemoglobin Level	Before		After	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Intervention Group				
<10	3	9.67	3	9.67
10-11.9	9	29.03	4	12.90
>12	19	63.30	24	77.41
Total	31	100	31	100
Control Group				
<10	2	5.12	1	2.56
10-11.9	5	12.82	11	28.20
>12	32	82.05	27	69.23
Total	39	100	39	100

Source: Primary Data, 2016

**Table 4. Result in hemoglobin level and knowledge score before and after education**

Variable	Group	Before (Mean±SD)	After (Mean±SD)	p
Hemoglobin	Intervention	12.17±1.29	12.68±1.22	0,001
	Control	12.43±1.36	12.40±1.09	0,753
Knowledge Score	Intervention	16.03±2.30	20.09±2.21	0,000
	Control	13.84±2.15	13.76±2.07	0,805

Source: Primary Data, 2016

in knowledge score before and after intervention ( $p=0,805$ ).

## DISCUSSION

### Subject Characteristics

The result of this study reported that 34.3% of participants suffered from anemia. Thus, the prevalence of anemic in this study population classified as high. However, this prevalence is considered smaller than previous studies, with one study showed approximately 43% of female adolescents were anemic (45.8%) (17). Additionally, other researchers reported that 45.8% of young pregnant women were anemic (3). However, a different result showed that the prevalence of anemic in female adolescents was relatively small with only 9.7% (18).

### The effect of nutrition education towards hemoglobin level

The subject's different *t* test illustrated that there are significant difference of hemoglobin rates pre and post nutrition education in intervention group ( $p=0,001$ ). Meanwhile, there is no different in hemoglobin rates before and after intervention in control group ( $p=0.753$ ). This condition indicates that nutrition education is an effective approach to increase subjects' hemoglobin rates (**Table 4**).

The findings of this study supported previous results that there were significant elevation in hemoglobin level for 2.89 gr/dL between pre and post intervention of nutrition education combine with iron+vitamin C supplementation (19). Another study also reported similar result that there are significant increase in teenagers' hemoglobin level for 4.6% after nutrition education(13).

### The effect of nutrition education towards knowledge score

This study results were aligned with previous studies that reported significant improvement in subjects' knowledge level from 20% to 90%, which considered as good level, in intervention group after nutrition counselling session. Whereas, there is no significant difference occurred in control group

(15). Previous studies reported that there were larger increase in nutrition knowledge level after vitamin C supplementation and nutrition education in intervention group (17.44 point) compared with supplementation group with no additional nutrition education (19). Other researchers also reported an increase in knowledge score between pre and post intervention in nutrition education group compared with supplementation only group (13). The result of statistical analysis *paired t test* indicated a significant change in nutrition knowledge between pre and post nutrition education intervention ( $p<0,05$ ) (20).

## CONCLUSION AND RECOMMENDATION

The exposure of nutrition education for 6 meetings in 1.5 months towards female adolescents effectively increase blood hemoglobin level and knowledge score in this study. The results of the research can be used as the basis by the health department and education department to conduct nutrition education efforts to adolescent girls.

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