

The Effect of Video Education on Adolescent Compliance with Iron Tablet Supplementation: A Quasi-Experimental Study

Fredrika Nancy Losu¹, Freike S.N Lumy², Sisca D. Solang³, Anis Novitasari⁴

Department of Midwifery, Poltekkes Kemenkes Manado,

e-mail: losunancy@gmail.com¹, freikelumy@gmail.com², siscasolang@gmail.com³,
anis24002@mail.unpad.ac.id⁴

Abstrak

Anemia defisiensi besi merupakan masalah kesehatan utama di kalangan remaja, namun kepatuhan terhadap suplementasi zat besi masih rendah. Studi ini menilai tingkat kepatuhan remaja dalam mengonsumsi tablet zat besi setelah edukasi berbasis video, dibandingkan dengan metode konvensional. Sebuah studi kuasi-eksperimental dengan desain kelompok kontrol nonequivalent dilakukan di SMP Negeri 13 Manado. Variabel independen adalah edukasi berbasis video, sedangkan variabel dependen adalah kepatuhan terhadap konsumsi tablet zat besi. Partisipan adalah 60 remaja putri yang dipilih melalui purposive sampling berdasarkan kriteria inklusi (berusia 12–15 tahun, didiagnosis anemia, dan bersedia berpartisipasi). Kelompok eksperimen ($n=30$) menerima tablet zat besi mingguan dan intervensi video, sedangkan kelompok kontrol ($n=30$) hanya menerima tablet zat besi. Kepatuhan diukur menggunakan kuesioner yang dilaporkan sendiri, daftar periksa observasi, dan jumlah pil. Data dianalisis menggunakan analisis bivariat. Studi ini menemukan bahwa meskipun suplementasi zat besi secara signifikan meningkatkan kadar hemoglobin pada kelompok intervensi video dan kelompok kontrol ($p=0,0001$), video edukasi tidak meningkatkan tingkat kepatuhan dibandingkan dengan perawatan standar ($p=0,754$). Kelompok eksperimen menunjukkan peningkatan hemoglobin rata-rata sebesar 1,51 g/dL dibandingkan dengan 1,59 g/dL pada kelompok kontrol, menunjukkan efikasi biologis yang sebanding terlepas dari pendekatan edukasi. Studi ini menunjukkan bahwa suplementasi zat besi secara efektif meningkatkan kadar hemoglobin pada remaja, tetapi edukasi berbasis video tidak secara signifikan meningkatkan kepatuhan dibandingkan dengan perawatan standar.

Kata kunci: edukasi video, kuasi-eksperimental, kepatuhan, remaja, tablet zat besi

Abstract

Iron deficiency anemia is a major health concern among adolescents, yet compliance with iron supplementation remains low. This study assessed the level of adolescent compliance in consuming iron tablets after video-based education, compared to conventional methods. A quasi-experimental study with a nonequivalent control group design was conducted at SMP Negeri 13 Manado. The independent variable was video-based education, while the dependent variable was compliance with iron tablet consumption. Participants were 60 adolescent girls selected through purposive sampling based on inclusion criteria (aged 12–15 years, diagnosed with anemia, and willing to participate). The experimental group ($n=30$) received weekly iron tablets and a video intervention, while the control group ($n=30$) received only iron tablets. Compliance was measured using self-reported questionnaires, observation checklists, and pill counts. Data were analyzed using bivariate analysis. This study found that while iron supplementation significantly improved hemoglobin levels in both the video intervention and control groups ($p=0.0001$), the educational video did not enhance compliance rates compared to standard care ($p=0.754$). The experimental group showed a mean hemoglobin increase of 1.51 g/dL versus 1.59 g/dL in controls, suggesting comparable biological efficacy regardless of educational approach. The study demonstrated that iron supplementation effectively increased hemoglobin levels in adolescents, but video-based education did not significantly improve compliance compared to standard care.

Keywords: adolescents, compliance, iron tablets, quasi-experimental, video education

INTRODUCTION

Iron deficiency anemia (IDA) remains a significant global health problem, particularly among adolescents who are vulnerable due to rapid growth, increased iron requirements, and often inadequate dietary intake (Silitonga et al., 2023; Utami et al., 2022). During this critical developmental period, iron deficiency can lead to impaired cognitive function, reduced physical stamina, and decreased academic performance, with long-term consequences for health and productivity (Sari et al., 2019). Despite the well-documented benefits of iron supplementation programs in schools, compliance rates among adolescents remain disappointingly low, ranging from 30% to 60% in various studies (Dubik et al., 2019). The primary barriers to adherence include forgetfulness, lack of awareness about the importance of supplementation, unpleasant side effects such as nausea and constipation, and the absence of immediate noticeable benefits (Feriyanti et al., 2022). Traditional health education approaches, such as leaflets or verbal instructions, have shown limited effectiveness in sustaining adolescent engagement and motivation (Anchang et al., 2021). In recent years, digital interventions, particularly educational videos, have emerged as promising tools for health promotion, offering advantages in accessibility, engagement, and information retention (Karimi et al., 2024). Videos can effectively demonstrate the consequences of iron deficiency, proper consumption techniques, and strategies to manage side effects, potentially improving both knowledge and compliance (Aeni, 2018). However, there is limited evidence on the specific impact of video-based education on iron tablet adherence among adolescents, particularly in school-based supplementation programs (Madestria et al., 2021).

Previous studies have consistently demonstrated low compliance rates (30-60%) among adolescents in iron supplementation programs, with key barriers including forgetfulness, side effects like nausea, and lack of perceived benefits (Rah et al., 2020; Rusdin et al., 2021; Setyaningrum et al., 2023). Systematic reviews highlight that conventional education methods (leaflets/counseling) show limited effectiveness, improving adherence by only 15-20% (Silitonga et al., 2023). Recent trials testing digital interventions (e.g., SMS reminders) reported modest improvements (25-35% compliance), but these approaches fail to address knowledge gaps and motivation (Green et al., 2021). Notably, video-based education has shown promise in improving medication adherence in chronic diseases (diabetes/hypertension) with 40-50% efficacy, but only two identified studies applied this to iron supplementation—both limited by short duration (<4 weeks) and lack of behavioral theory frameworks (Aeni, 2018; Tabrizi et al., 2024). These studies also excluded participants with prior supplement experience, limiting generalizability to real-world school programs where intermittent use is common. The current quasi-experimental study addresses these gaps by implementing a theory-based video intervention (Health Belief Model constructs) to target knowledge and perceptions, extending follow-up to 8 weeks to assess sustained compliance, and including adolescents with varied supplement histories to reflect actual program conditions (Haugan & Eriksson, 2021; Jones, 2024). Crucially, it compares video education against standard practice using objective measures (pill counts + hemoglobin tests), whereas prior research relied solely on self-reports—a significant limitation given adolescents' recall biases (Koy et al., 2023). This design provides robust evidence on whether video interventions can overcome the well-documented adherence challenges in population-level supplementation initiatives. Addressing this gap is crucial for developing more effective interventions that can be scaled up in resource-limited settings where anemia prevalence remains unacceptably high.

This quasi-experimental study aims to assess the effectiveness of video-based education in improving adolescents' compliance with iron supplementation compared to conventional methods, and evaluate the sustainability of intervention effects through objective measures (pill counts and hemoglobin levels). The findings could provide critical evidence for integrating digital education into national supplementation programs, offering school health workers a theory-based (Health Belief Model) tool to address compliance barriers. By demonstrating the cost-effectiveness and scalability of video interventions in resource-limited settings, this study may

inform policy updates to optimize anemia prevention strategies, particularly for hard-to-reach adolescent populations where traditional approaches have underperformed. The research specifically bridges gaps in prior studies by incorporating behavioral theory, extended monitoring, and real-world conditions absent in previous short-term trials.

METHODS

Iron deficiency anemia (IDA) remains a significant global health problem, particularly among adolescents who are vulnerable due to rapid growth, increased iron requirements, and often inadequate dietary intake (Silitonga et al., 2023; Utami et al., 2022). During this critical developmental period, iron deficiency can lead to impaired cognitive function, reduced physical stamina, and decreased academic performance, with long-term consequences for health and productivity (Sari et al., 2019). Despite the well-documented benefits of iron supplementation programs in schools, compliance rates among adolescents remain disappointingly low, ranging from 30% to 60% in various studies (Dubik et al., 2019). The primary barriers to adherence include forgetfulness, lack of awareness about the importance of supplementation, unpleasant side effects such as nausea and constipation, and the absence of immediate noticeable benefits (Feriayanti et al., 2022). Traditional health education approaches, such as leaflets or verbal instructions, have shown limited effectiveness in sustaining adolescent engagement and motivation (Anchang et al., 2021). In recent years, digital interventions, particularly educational videos, have emerged as promising tools for health promotion, offering advantages in accessibility, engagement, and information retention (Karimi et al., 2024). Videos can effectively demonstrate the consequences of iron deficiency, proper consumption techniques, and strategies to manage side effects, potentially improving both knowledge and compliance (Aeni, 2018). However, there is limited evidence on the specific impact of video-based education on iron tablet adherence among adolescents, particularly in school-based supplementation programs (Madestria et al., 2021).

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RESULTS

Analysis Univariate Demographic data

Table 1. Distribution of age and menarche (n=60)

Characteristics	Responden	p ^h	
	t n (%)	(max- min)	
Age			
14 years old	8 (13.3)	(14-15)	1,33
15 years old	52 (86.7)		
Menarche			
10 years old	2 (3.3)	(10-11)	0.89
11 years old	12 (20)		
12 years old	41 (68.3)		
13 years old	5 (8.3)		

p^h adalah p value uji levene

The table reveals that the majority of respondents (86.7%) were 15 years old, with only 13.3% aged 14, indicating a highly homogeneous age distribution (range: 14-15 years). The non-significant Levene's test result ($p = 1.33$) confirms equal variances between age groups. For menarche, most participants (68.3%) experienced their first menstruation at age 12, with a relatively normal distribution across 10-13 years ($p = 0.89$ for homogeneity of variance). The concentration of menarche at age 12 and the predominance of 15-year-olds suggest limited variability in these demographic factors, which may influence the generalizability of findings related to iron supplementation compliance. The homogeneity in age and menarche distribution simplifies the control of confounding variables but also highlights the need for caution when extrapolating results to more diverse adolescent populations.

Analysis Bivariate

The Level of Compliance of Adolescents in Consuming Iron Tablets Before and After Watching Video Media between the experiment group and the control group

Table 2. Chi-Square Test

The Level of Compliance	p*
Before	0,055
After	0,754

p value chi-square*

The chi-square test results reveal distinct patterns in iron tablet compliance between the experimental (video intervention) and control groups. Before the intervention, the near-significant p-value ($p = 0.055$) suggests a marginal difference in baseline compliance, approaching but not reaching statistical significance. This indicates that the groups were largely comparable initially, though slight variations may have existed. Post-intervention, the p-value increases substantially to 0.754, demonstrating no statistically significant difference in compliance between groups after the video intervention. This outcome implies that the video-based education did not yield a measurable improvement in adherence compared to standard methods within this study's framework. The shift from a borderline significant pre-intervention difference ($p = 0.055$) to clear non-significance post-intervention ($p = 0.754$) raises questions about the intervention's effectiveness, suggesting that either the video content, duration, or delivery method may require optimization to produce detectable behavioural changes. These findings highlight the complexity of improving adolescent compliance with iron supplementation and underscore the need for further investigation into alternative strategies or modified interventions.

Table 3: Haemoglobin levels of adolescents consuming iron tablets before and after watching video media between the experimental group and the control group

Hb levels	Mean	p*
Experiment group	1,51	0,0001
Control group	1,59	0.0001
<i>p* value t-test</i>		

The analysis of hemoglobin levels reveals statistically significant improvements in both the experimental (video intervention) and control groups, with p-values of 0.0001 for each group, indicating strong evidence for the effectiveness of iron supplementation regardless of educational approach. The experimental group demonstrated a mean hemoglobin increase of 1.51 g/dL, while the control group showed a slightly higher increase of 1.59 g/dL, suggesting the video intervention did not provide additional hematological benefits beyond standard care in this particular study. The identical significance levels between groups confirm that iron supplementation alone has a robust impact on improving hemoglobin levels among adolescents. The comparable outcomes may imply either that the video intervention requires optimization to demonstrate superior effects, that the biological response to iron supplementation overshadows educational interventions, or that the study duration was insufficient to detect differential impacts. These findings underscore that while iron supplementation effectively raises hemoglobin levels, the additional video-based education component did not significantly enhance this physiological outcome compared to standard distribution methods under the current study conditions, highlighting the need for further investigation into optimal intervention strategies for adolescent iron supplementation programs.

DISCUSSION

The study's findings reveal important insights about adolescent iron supplementation compliance through the lens of health promotion theory. Table 1 established the sample's homogeneity in age (86.7% 15-year-olds) and menarche timing (68.3% at age 12), creating a controlled baseline for intervention testing. Table 2's chi-square results showed no significant compliance difference post-video intervention ($p=0.754$ vs $p=0.055$ pre-intervention), contradicting expectations from Health Belief Model (HBM) principles which posit that perceived benefits (via education) should increase adherence. This suggests the video failed to modify key HBM constructs like perceived susceptibility or barriers effectively. Surprisingly, Table 3 demonstrated significant hemoglobin improvements in both groups ($p=0.0001$), with marginally higher gains in controls (1.59 vs 1.51 g/dL), indicating biological efficacy of iron tablets regardless of education - a phenomenon aligned with Social Cognitive Theory's emphasis on environmental factors (regular tablet provision) over knowledge alone (Hanlon et al., 2018;

Yanuardianto, 2019). The disconnect between compliance (behavior) and hemoglobin (outcome) mirrors limitations of knowledge-attitude-practice models, suggesting that structural supports (e.g., direct supplementation) may outweigh educational interventions for physiological outcomes. These results challenge conventional health promotion approaches by demonstrating that in school-based supplementation programs, ensuring consistent access to iron tablets may be more impactful than educational videos alone, though combining both strategies with stronger behavioral theory application (e.g., addressing specific adolescent barriers through tailored messaging) could yield better results (Ribek et al., 2021). The findings underscore the need for multi-level interventions that address both material provision and psychosocial determinants of health behavior.

This study offers valuable insights by objectively measuring both behavioral compliance (Table 2) and biological outcomes (Table 3), advancing beyond prior studies that relied solely on self-reported adherence. Its quasi-experimental design with a control group strengthens causal inference compared to cross-sectional studies, while the inclusion of hemoglobin data provides physiological validation missing in many educational intervention trials (Khan, 2018). However, limitations include the short 8-week duration, which may not capture long-term compliance patterns, and the homogeneous sample (Table 1) limiting generalizability—a common issue in school-based trials (Shaban et al., 2024). The unexpected null effect of video education on compliance contrasts with previous digital intervention successes (Aeni, 2018), potentially due to differing theoretical frameworks; this study's video may have inadequately addressed Health Belief Model constructs like perceived barriers, whereas effective prior interventions incorporated interactive elements. The hemoglobin findings align with demonstration that direct supplementation drives biological improvement regardless of education method (Helmyati et al., 2023; Wells, 2019). These mixed results highlight the need for longer-term, theory-tailored interventions combining education with structural support, bridging a key gap between behavioral theory and practical implementation in adolescent health programs.

CONCLUSION

This study demonstrates that while iron supplementation significantly improved hemoglobin levels in adolescents regardless of educational intervention, the video-based education failed to enhance compliance compared to standard methods. These findings suggest that biological outcomes may be driven primarily by consistent iron tablet provision rather than health education alone, aligning with Social Cognitive Theory's emphasis on environmental support over knowledge acquisition. However, the lack of behavioral change despite educational efforts indicates potential shortcomings in the video's design, such as insufficient engagement with Health Belief Model constructs (e.g., perceived susceptibility, barriers) or inadequate tailoring to adolescent preferences.

SUGGESTION

Future research should develop more interactive, theory-driven digital interventions (e.g., gamified apps or peer-led videos) to better address psychosocial determinants of compliance; extend study durations to assess long-term adherence and hemoglobin sustainability; incorporate mixed-methods approaches to explore contextual barriers (e.g., side effects, school routines); and test interventions in diverse populations to improve generalizability. Additionally, combining educational strategies with structural supports (e.g., supervised tablet intake or mobile reminders) may bridge the gap between knowledge and behavior. These advancements could optimize adolescent anemia programs, ensuring both biological efficacy and sustained behavioral compliance.

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