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Original Research

Short-Term Anemia Knowledge Changes After School-Based Education Among Eighth-Grade Girls in Bekasi

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ABSTRACT

Introduction: Adolescent anemia prevention requires awareness of iron nutrition and supplementation, but immediate knowledge gains should not be conflated with behavior or anemia reduction.

Objective: To compare anemia-knowledge scores before and after a single school-based health education session among eighth-grade girls in Bekasi.

Method: This one-group pretest–posttest study included 36 girls selected through reported proportionate stratified random sampling. Participants completed the same 20-item true/false questionnaire before and after an approximately 60-minute lecture supported by slides. Paired scores were compared using the Wilcoxon signed-rank test.

Result: Median score increased from 13 (IQR 3) to 16 (IQR 1); 35 students improved, none declined and one remained unchanged. Wilcoxon Z was −5.189 ($p<0.001$); the approximate standardized statistic was $|r|\approx0.88$ using 35 nonzero pairs.

Conclusion: Knowledge scores were higher shortly after education, but the uncontrolled design, repeated questionnaire and absent behavioral or hematologic outcomes prevent causal or clinical-effectiveness claims.

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INTRODUCTION

Anemia is a relevant adolescent-health problem because iron requirements increase during growth and menstruation. The Indonesian Health Survey 2023 reported an anemia estimate of 15.5% for the adolescent age group represented in the national survey; interpretation requires attention to the survey population and case definition (1). Evidence linking iron status to academic and cognitive outcomes is heterogeneous, so educational consequences should not be assumed for the participants in this study (2). Health promotion in schools may support awareness of nutritious diets and iron supplementation, but knowledge alone does not establish hemoglobin improvement, dietary change, or iron-tablet adherence (3-5,17,21,22).

Previous Indonesian studies have reported increased anemia-related knowledge after lectures or structured education in adolescent populations (6-9,19,20). International school-based evidence also supports the feasibility of context-adapted education: a seven-week mixed-methods study in Karnataka delivered repeated, teacher-supported sessions combining lectures, role-play and demonstrations, and reported changes in knowledge (10). Qualitative research highlights that adolescents' understanding is influenced by peer and school environments, and that awareness does not necessarily translate into preventive practice (11). These findings distinguish short-term cognitive outcomes from behavioral and clinical outcomes.

A preliminary assessment at MTs Plus Roudhotul Muhibbin, Bekasi, suggested incomplete understanding of anemia prevention among eighth-grade girls, alongside reported concerns about dietary choices and iron-tablet use. These observations provided the local implementation rationale for evaluating a feasible single-session educational activity. They did not constitute baseline measurement of anemia prevalence, supplement adherence, or nutritional status in the present sample.

The scientific gap is not the absence of a study at this school alone: existing educational reports vary substantially in the population, mode and intensity of delivery, assessment timing, and outcomes measured (6-12). Less is established about the immediate distribution of paired knowledge-score changes after a single lecture supported by visual materials among girls in a faith-based junior-secondary school. This study contributes a transparent, site-specific description of that immediate pretest-posttest change, including score distributions, individual directions of change, and explicit limits on causal and behavioral inference. The educational format itself is not claimed to be novel, nor can this design demonstrate sustained knowledge retention or anemia prevention.

The objective was to describe and compare anemia-knowledge scores immediately before and after one school-based education session among eighth-grade girls at MTs Plus Roudhotul Muhibbin, Bekasi.

METHOD

A quantitative, pre-experimental, one-group pretest-posttest design was used to examine within-participant differences in knowledge scores around a single education session. This design can identify a short-term change but cannot estimate the causal effect of education because it lacks an unexposed comparison group. Potential alternative explanations include test familiarity, background exposure,

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and other time-related factors; the short observation interval limits evidence about sustained learning.

The source population comprised 115 eighth-grade girls at MTs Plus Roudhotul Muhibbin. Thirty-six participants were selected using the reported proportionate stratified random-sampling approach: 7 from class VIII A, 10 from VIII B, 9 from VIII C, and 10 from VIII D. The source manuscript describes an initial paired-measures sample-size estimate of 32 at alpha 0.05, power 80%, and assumed standardized effect 0.5, increased to 36 for anticipated nonresponse. Because the final analysis used a Wilcoxon test, this parametric planning assumption is not evidence of achieved nonparametric power. The actual sampling frame, random-number procedure, nonresponse and any replacement procedure must be confirmed from study records before publication. Study sequence: eligible school population (N=115) → proportional class allocation → enrolled paired sample (n=36) → pretest → one education session → posttest → paired analysis.

Eligible participants were enrolled eighth-grade girls who were present for both assessments, agreed to take part and had parental or guardian permission. The manuscript reports one approximately 60-minute lecturer-led session supported by PowerPoint slides and an educational session plan, covering anemia definition, causes, clinical manifestations, consequences, diet-related prevention and iron supplementation. The session included information delivery and discussion. Educator qualifications, teaching fidelity, setting and group size, attendance verification, and exact posttest delay were not provided in the available research record and require author confirmation. The single combined package was evaluated; this design cannot isolate the effect of PowerPoint from the lecture, discussion, or testing sequence.

Anemia-related knowledge was assessed using the same 20-item true/false questionnaire at both measurements (correct=1; incorrect=0; range 0–20). Prespecified categories reported by the authors were poor (0–11), adequate (12–15), and good (16–20), corresponding to ≤55%, 56–75%, and ≥76% of the total score. These cut-offs are descriptive classifications, not evidence of clinically meaningful literacy thresholds; their original source and validation should be documented by the authors. The questionnaire's original development or adaptation source, content-validity process and item-level psychometric results should likewise be supplied for reproducibility.

The original pilot study reportedly involved 30 respondents. The manuscript states that 20 item-total Pearson correlations exceeded r=0.361 and that Cronbach's alpha was 0.724. These figures are reproduced from the source report and have not been independently recalculated. Their interpretation is limited by the pilot size and missing item-level coefficients. For dichotomous items, KR-20 or equivalent internal-consistency evidence, content validity and an independent pilot-sample description would improve appraisal of this instrument; these analyses must not be reported as having been conducted without the underlying output.

The study sequence comprised an individual knowledge pretest, a single approximately 60-minute lecture and discussion using PowerPoint, and a subsequent posttest using the identical questionnaire. The precise elapsed time from education to posttest is not specified in the supplied documentation. Consequently, results should be interpreted as early post-session performance, potentially

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influenced by immediate recall and familiarity with the repeated items, rather than as demonstrated long-term retention.

Data were reported as analyzed using IBM SPSS version 30. Descriptive outputs comprised frequencies, percentages, medians, interquartile ranges and score ranges. The Wilcoxon signed-rank test compared paired pretest-posttest scores (two-sided alpha=0.05), which is suitable for ordinal or non-normally distributed paired differences. However, the Shapiro-Wilk normality test on paired differences and the underlying signed-rank output were not supplied; a specific normality-test result therefore cannot be asserted. The reported Z was −5.189 ($p<0.001$). An approximate standardized rank-test effect size using $|Z|/\sqrt{36}$ is r=0.865 (or r=0.877 using 35 nonzero pairs); the denominator must be specified and verified against the software convention. The primary report contains 35 positive, zero negative and one tied pair; paired-change median/CI cannot be recovered from marginal medians alone. Ethical approval was obtained from Komite Etik Penelitian Univeritas ‘Aisyiyah Surakarta (Approval No. 0098/VI/AUEC/2026). Written informed consent was obtained from parents or legal guardians, and assent was obtained from all adolescent participants before data collection. Participation was voluntary, and all responses were handled confidentially using participant identification codes. Only the research team had access to the study data.

RESULTS

All 36 participants had recorded paired knowledge scores. Outcomes presented below are descriptive comparisons of the observed sample and should not be interpreted as changes in hemoglobin concentration or anemia prevalence.

Table 1. Distribution of Knowledge Scores Before and After Health Education

Statistics	Pretest	Posttest
n	36	36
Median	13	16
IQR	3	1
Minimum	10	13
Maximum	15	17

In the 36 paired observations, median scores were 13 (IQR=3; range 10–15) before the session and 16 (IQR=1; range 13–17) afterwards. The decrease in the posttest IQR describes less dispersion in these marginal scores; it does not constitute a formal test of variance or establish the distribution of each person's change. Paired-change summary statistics and their uncertainty require the individual paired data.

Table 2. Distribution of Knowledge Levels Before and After Health Education

Knowledge Level	Pretest n (%)	Posttest n (%)
Poor	9 (25.0)	0 (0.0)
Adequate	27 (75.0)	12 (33.3)
Good	0 (0.0)	24 (66.7)
Total	36 (100)	36 (100)

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Using the stated scoring thresholds (poor 0–11; adequate 12–15; good 16–20), the pretest comprised 9 girls with poor knowledge (25.0%) and 27 with adequate knowledge (75.0%). At posttest, 12 girls were adequate (33.3%) and 24 were good (66.7%), with none in the poor category. The category shift describes knowledge classification immediately after the session; it does not measure health behavior.

The signed-rank counts indicated 35 positive changes, no negative changes, and one tie among 36 students.

Table 3. Distribution of Changes in Knowledge Scores Based on the Wilcoxon Test

Category	N
Negative Ranks (Posttest < Pretest)	0
Positive Ranks (Posttest > Pretest)	35
Ties (Posttest = Pretest)	1
Total	36

Thirty-five participants scored higher on the posttest; one had an unchanged score and none had a lower score. These signs alone do not quantify the median individual gain or establish the intervention's effect independently of repeated testing.

Table 4. Results of the Wilcoxon Signed-Rank Test

Variable	N	Z	p-value
Paired knowledge scores (posttest versus pretest)	36	-5.189	<0.001

The reported Wilcoxon signed-rank statistic was $Z=-5.189$, $p<0.001$, indicating that the paired differences were unlikely to be centered at zero under the test's null assumptions. The sign of Z depends on the software's subtraction/ranking convention, so its negative direction must not be interpreted as deteriorating knowledge. An approximate magnitude is $|r|\approx0.88$ using nonzero pairs ($n=35$; $|Z|/\sqrt{35}$); this describes the standardized paired-score contrast, not a causally identified educational effect or clinically meaningful improvement.

DISCUSSION

The core observation was a short-term upward shift in measured knowledge: the median increased from 13 to 16 of 20, 35 of 36 participants had positive signed ranks, and the distribution shifted toward the study-defined good category. The rank-based test ($Z=-5.189$; $p<0.001$) supports a within-sample difference, while a large standardized Z-based contrast is sensitive to the design and scoring convention. Because the same questions were repeated shortly after one teaching session, retention, independent application of concepts, and changes in actual anemia-prevention behavior cannot be established.

The narrower posttest interquartile range (3 to 1) may reflect convergence of observed scores but is also compatible with restricted score range after teaching or repeated exposure to test items. With 20 binary items, a score of 16 indicates 80% correct responses but does not independently establish competence in selecting an iron-rich diet or adhering to tablets. The marginal median difference ($16-13=3$)

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is not necessarily the median of individual paired differences, which requires patient-level calculations.

A plausible educational explanation is that an organized, age-relevant session helped participants encode and retrieve information on anemia, iron-rich foods, symptoms and the purpose of iron tablets. In health-literacy terms, however, remembering facts represents an initial step rather than verified appraisal, decision-making or performance. Social learning, opportunity for repeated practice and access to supplements may influence translation to action, but these mechanisms were not measured and should be treated as hypotheses rather than results [7,10,11,15,23].

The observed short-term knowledge change is directionally consistent with education studies by Mesi and colleagues [8] and by Nahak and colleagues using lectures plus leaflets [9]. A stronger school implementation contrast is the seven-week, teacher-supported mixed-methods intervention described by Salam et al. [7], which incorporated repeated sessions and practice [7]. Such differences in exposure, setting and measurement prevent direct comparison of effect size, long-term persistence or relative efficacy. A systematic review of nutrition education has also reported variability across studies and clinical outcomes [12], underscoring the need to distinguish immediate questionnaire performance from hematologic benefit.

PowerPoint served as a visual aid within a combined, approximately 60-minute lecture-and-discussion activity, not as an independently allocated treatment. Thus, no separate benefit of slides can be estimated. Other educational work has evaluated audiovisual, peer and mobile formats [13-15,24]; those modalities have different intensity and implementation features, and their findings are not interchangeable with the current single-session study. For school-health practice, brief education may be useful as an introductory learning activity, preferably coupled with reinforcement and monitoring of actual iron-supplement behaviors.

The 35 positive ranks suggest widespread improvement on the repeated questionnaire, while one unchanged score confirms that responses were not uniform. Student attention, baseline information and exposure outside class may explain variation, but those factors were not measured. Importantly, the observed pattern of increased scores does not establish improved dietary intake, iron-tablet adherence or hemoglobin status. Research on nutrition and iron interventions demonstrates why these distinct endpoints should be evaluated separately [2,16-18,25].

The one-group design leaves testing effects, familiarity with the questionnaire and short-term contextual factors as viable alternative explanations. Random selection of students within classes, even if verified, does not create a counterfactual control group. Without measurements at later time points or behavioral and biological endpoints, claims should be limited to short-term within-group knowledge-score differences. A controlled study with prospectively specified follow-up and a validated tool is necessary to estimate a durable intervention effect.

LIMITATIONS

This study has limited internal validity because it used one group, pretest and posttest administrations of the same 20-item questionnaire, and a short assessment interval. Repeated testing may improve familiarity independently of

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learning, and unmeasured influences cannot be excluded. The original data supplied do not include the paired change-score distribution or information sufficient to quantify uncertainty around the median individual change.

The intervention comprised a single session and a posttest administered afterwards, with the exact interval not documented in the available manuscript. Accordingly, longer-term recall, retention and application were not established. Detailed educator qualifications, treatment fidelity, participant attendance and delivery setting also require confirmation before the intervention can be fully replicated.

The sample of 36 eighth-grade girls from one school represents a narrow population. Although proportionate sampling by class is described, the actual within-class random selection procedure and response/replacement records should be verified; consequently, generalizability beyond this institution is limited.

Only knowledge was measured. No hemoglobin or ferritin testing, anemia diagnosis, iron-supplement adherence, dietary-intake measurement or behavioral follow-up was undertaken in the outcomes reported here. Thus, no clinical improvement or reduction in anemia risk may be inferred from these results.

The questionnaire was administered as a self-reported true/false test. Respondents could recognize correct options or remember pretest items. The available record reports alpha=0.724 from 30 pilot participants, but does not provide full content-validity documentation, item-level analysis, or the basis for the knowledge cut-offs.

Subsequent studies should compare an educational intervention with a relevant control condition, pre-register the analysis, report recruitment and loss to follow-up, assess questionnaire validity, and present paired effect estimates with uncertainty. Repeated assessments at several weeks or months and direct measures of iron-tablet adherence, dietary practice and hemoglobin would test whether knowledge changes persist or translate into health-related outcomes.

CONCLUSION

Among 36 eighth-grade girls at MTs Plus Roudhotul Muhibbin, the observed median anemia-knowledge score increased from 13 to 16 of 20 after a single school-based education session. Thirty-five students had higher posttest scores, one score was unchanged, and the within-group Wilcoxon comparison was significant ($Z=-5.189$; $p<0.001$). These findings establish a short-term difference in repeated questionnaire scores only. Because the study had no control group and no measures of adherence or anemia status, they do not demonstrate a causal educational benefit or reduced anemia prevalence.

The descriptive findings may inform refinement of school-based teaching materials and evaluation procedures. Verification of the full sampling, instrument-development and implementation record is needed before final publication. Longer follow-up and controlled designs are required to assess retention and consequences for preventive behavior and clinical anemia outcomes.

AUTHOR CONTRIBUTIONS

MSL contributed to conceptualization, methodology, investigation, formal analysis, and writing of the original draft. EY contributed to data curation, validation, supervision, and critical revision of the manuscript. All authors reviewed

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and approved the final manuscript and agreed to be accountable for its scientific integrity.

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CONFLICT OF INTEREST
The authors declare that they have no conflicts of interest that could influence the study design, data collection, analysis, interpretation, or conclusions reported in this manuscript.

STATEMENT ON THE USE OF GENERATIVE AI AND AI-POWERED TECHNOLOGIES IN THE WRITING PROCESS
The authors disclose that AI tools, including ChatGPT, Grammarly, and DeepL, were used solely for language refinement, grammatical correction, and structural editing during the manuscript preparation process. The intellectual content, research design, data interpretation, and conclusions were developed and written independently by the listed contributors.

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