International Journal of Health Science (IJHS)

E-ISSN: 2827-9603
P-ISSN: 2827-959X

(Research/Review) Article

Influence of Bimbing Wuluh Flower (Averrhoa Bilimbi L.) Recipation on Healing Cough in Young Children

Mutiara Gunawardani

Midwifery Study Program, Faculty of Technology, Science, and Health. Institute of Technology, Science, and Health Dr. Soepraoen Hospital Malang; e-mail : mutiaragunawardani48427@gmail.com

Abstract: Cough in toddlers is a common respiratory complaint and can disrupt sleep, appetite, and well-being. Synthetic therapies sometimes cause side effects, so the use of herbs is becoming an increasingly popular alternative. Starfruit flowers (Averrhoa blimbi L.) are rich in saponins, flavonoids, and tannins, which function as expectorants, antitussives, and anti-inflammatories. This pre-experimental study with a one-group pretest-posttest design aims to evaluate the effectiveness of starfruit flower decoction in relieving cough in toddlers. A total of 15 toddlers aged 1-5 years with mild to moderate cough without other therapies were given starfruit flower decoction (10 flowers boiled in 200ml of water) twice a day, 2 tablespoons per dose for 5 days. The results of the Wilcoxon test showed that the average cough frequency decreased from 8.0 ± 0.6 to 1.8 ± 0.7 ($p = 0.002$). This finding confirms that the decoction of starfruit flowers is effective in relieving cough in toddlers. It is recommended that this decoction be considered as a safe and easy-to-apply complementary therapy at home.

Keywords: cough; toddlers; Averrhoa blimbi L.; herbal; expectorant.

1. Introduction

Cough in toddlers is a clinical symptom of upper respiratory tract infection that is most commonly treated in primary care[1]. This condition not only causes discomfort, but can also disrupt sleep patterns, reduce nutritional intake, and have a negative impact on child growth and development[2]. In many PHC centers, cough is one of the highest reasons for visits in patients under five years of age, creating a burden on services and parents' concerns about possible complications [3].

In health centers, more than60 % consultations of upper respiratory tract infection cases in children under five years old involve requests for medication to relieve cough. Synthetic antitussive and expectorant drugs such as dextromethorphan or guaifenesin are effective, but often trigger side effects such as drowsiness, nausea, or gastric irritation that make parents hesitant to use them repeatedly [4]. In fact, limited access and concerns about chemical drugs encourage the search for safer and more affordable alternatives, including the use of traditional herbal ingredients [5].

Star fruit (Averrhoa bilimbi L.) has long been used in traditional medicine to treat cough and sore throat. Laboratory tests show that Averrhoa bilimbi contains saponins that function as expectorants, flavonoids with anti-inflammatory activity, and tannins that help strengthen the airway mucosa [6]. Although most studies use ethanol or methanol extracts, simple formulations in the form of water decoctions of star fruit flowers have not been widely explored, even though they are easier to apply at home[7].

The lack of empirical data on the effectiveness of belimbing wuluh flower water decoction in toddlers demands further research. In particular, it needs to be proven whether the traditional recipe of 10 flowers boiled in water can significantly reduce the frequency and intensity of cough in the 1-5 year old population. Such evidence would be very useful for formulating midwifery practice guidelines and cough management at the household level.

This study aims to evaluate the effect of belimbing wuluh (Averrhoa bilimbi L.) flower decoction on cough recovery in toddlers. The study innovation lies in the use of a simple and

Received: 10 May , 2025

Revised: 12 June, 2025

Accepted: 04 July, 2025

Published: 09 July, 2025

Curr. Ver.: 09 July, 2025

easy-to-practice water decoction formulation, combined with a one group pretest posttest design to measure clinical changes before and after the intervention.

2. Proposed Method

This study used a pre-experimental design with a one group pretest posttest design approach to evaluate the effectiveness of starfruit wuluh (Averrhoa bilimbi L.) flower decoction in curing cough in toddlers. This design was chosen because it allows researchers to measure changes in cough frequency and intensity in the same subject, before and after the intervention, so that variability between individuals can be minimized.

Population and Sample

The study population consisted of toddlers aged 1-5 years who had mild to moderate cough and lived in the Puskesmas working area during the study period. The sampling technique was carried out by purposive sampling, with inclusion criteria:

a. Age 12-60 months.
b. Having a cough (including dry cough or phlegm) for at least 3 consecutive days.
c. Not currently undergoing synthetic or other herbal cough medicine therapy.
d. Parents were willing to sign informed consent and follow the research protocol until completion.

Initially, 20 toddlers were invited, but after screening the inclusion and exclusion criteria, 15 subjects were left who completed all study procedures.

Belimbing Wuluh Flower Decoction Intervention

The main ingredient was fresh star fruit florets, obtained from local farms with hygiene and quality standards. For each serving, 10-15 florets (±5 grams) were washed thoroughly and then boiled in 200 ml of boiled water until boiling for 10 minutes. After cooling slightly, the liquid is filtered with a clean cotton cloth and divided into two doses, each 2 tablespoons (±30 ml). Administration protocol: twice a day (morning and evening) for 5 consecutive days. Parents were directed to give the decoction with a standard measuring spoon, and record the time and dose in the daily observation sheet.

Variable Measurement

a. Cough Frequency: Measured by parents recording the number of cough episodes per day. One episode was defined as one respiratory muscle contraction that accompanied a coughing sound.
b. Cough Intensity: Measured using a Likert scale of 1-4 (1 = very mild, 2 = mild, 3 = moderate, 4 = severe), based on how long the cough lasts and accompanying symptoms (e.g. additional breath sounds, expression of discomfort). This scale was tested for content validity by 3 obstetric and pediatric health experts.

Measurement of both variables was done the day before the intervention (pretest) and the day after day 5 of the intervention (posttest).

Instrument Validity and Reliability

The cough frequency and intensity observation sheet was developed by the researcher and validated by a panel of experts (content validity) with a Content Validity Index score of(CVI) $\geq$ 0,80. The reliability test of the cough intensity instrument was conducted on 5 toddlers outside the main sample, resulting in a Cronbach's alpha coefficient of 0.87, indicating good internal consistency.

Data Analysis

Cough frequency and intensity data were collected and tested for normality using the Shapiro-Wilk test. Since the data distribution was not normal($p < 0,05$), pretest posttest change analysis was performed with the non-parametric Wilcoxon signed rank test. Test results were analyzed at a significance level of $\alpha = 0,05$ using SPSS software version 25.

Ethical Considerations

The study has obtained ethical approval from the Health Research Ethics Committee of Universitas Kesehatan Nusantara. Each parent was given a full explanation of the procedure, benefits, and risks of the intervention. They signed an informed consent before data were collected. Subject data was anonymized to maintain confidentiality.

With this systematic methodology, it is hoped that the study can provide valid empirical evidence regarding the effectiveness of star fruit flower decoction to relieve cough in toddlers, as well as a reference for the implementation of midwifery practice and traditional medicine in the future.

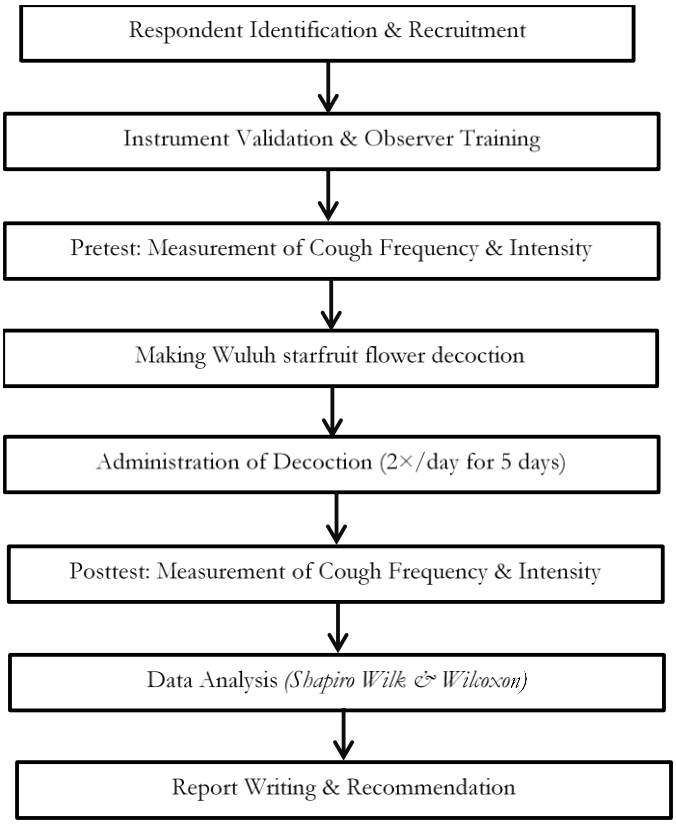

Figure1. Flow of research methods

3. Results and Discussion

Cough Frequency Distribution by Category

Table 1. Categories of Cough Frequency per Day Pretest and Posttest

Frequency Category	Pretest $\boldsymbol{n}$ (%)	Posttest $\boldsymbol{n}$ (%)
$\geq$ **10 episode/day**	**5** (**33,3**%)	**0** (**0**%)
8 – 9 episode/day	**6** (**40,0**%)	**2** (**13,3**%)
6 – 7 episode/day	**3** (**20,0**%)	**5** (**33,3**%)
< 6 episode/day	**1** (**6,7**%)	**8** (**53,4**%)
Total	**15** (**100**%)	**15** (**100**%)

Before the intervention, 73,3% toddlers had a cough frequency of≥ 8 episodes per day, with one third of them even reaching≥ 10 episodes. After 5 days of belimbing wuluh flower decoction, there were no longer any toddlers with a frequency of ≥ 10 episodes; a total of53,4% were now experiencing< 6 episodes per day. This shows a marked redistribution to lower frequency categories, illustrating the effectiveness of the intervention in reducing cough symptom burden.

Descriptive Statistics of Cough Frequency

Table 2. Summary of Pretest and Posttest Cough Frequency Descriptive Statistics

Statistics	Pretest	Posttest
Mean ± SD	**$8,0 \pm 2,1$ episode**	**$3,1 \pm 1,4$ episode**
Median	**8**	**3**
Range	**$6-12$**	**$1-5$**
Lower quartile	**$6,0$**	**$2,0$**
Upper quartile	**$9,0$**	**$4,0$**

The average cough frequency decreased from$8,0$ (SD 2.1) to$3,1$ (SD 1.4) episodes per day. The median and quartiles also shifted sharply to lower values, indicating that most subjects experienced a consistent decrease. The narrow distribution at posttest (IQR 2-4) compared to pretest (IQR 6-9) suggests that the intervention response was fairly evenly distributed among the toddlers.

Classification of Percentage Reduction in Cough Frequency

Table 3. Classification of Cough Frequency Reduction per Subject

Level of Decrease	n (%)
$>$ 75% decrease	**7 (46,7%)**
$50-75\%$ decrease	**5 (33,3%)**
$25-50\%$ decrease	**2 (13,3%)**
$<25\%$ decrease	**1 (6,7%)**
Total	**15 (100%)**

Almost half of the respondents$(46,7\%)$ experienced a decrease in cough frequency of more than75% , while80% toddlers showed a minimal50% decrease. Only one toddler showed a decrease of less than25%. This pattern confirms that belimbing wuluh flower decoction can bring substantial clinical changes for the majority of toddlers with mild to moderate cough.

Cough Intensity Distribution and Statistics

Table 4. Pretest and Posttest Cough Intensity Categories

Intensity Score (Likert 1-4)	Pretest n (%)	Posttest n (%)
4 (severe)	**4 (26,7%)**	**0 (0%)**
3 (moderate)	**8 (53,3%)**	**2 (13,3%)**
2 (light)	**3 (20,0%)**	**9 (60,0%)**
1 (very light)	**0 (0%)**	**4 (26,7%)**
Total	**15 (100%)**	**15 (100%)**

Table 5. Descriptive Statistics of Cough Intensity

Statistics	**Pretest**	**Posttest**
Mean ± SD	**$3,2 \pm 0,6$**	**$1,8 \pm 0,7$**
Median	**3**	**2**
Range	**$3-4$**	**$1-3$**
IQR	**$3-4$**	**$2-2$**

Mean cough intensity dropped from a score of 3.2 (moderate category) to 1.8 (mild category). All experienced intensity scores ≤ 3 after the intervention, and more than half of the toddlers (60%) showed mild scores. Up to 26.7% even achieved a "very mild" score, which was previously absent. The spread of intensity scores also narrowed, indicating a consistently positive response to the herbs.

Statistical Test and Significance

As the frequency and intensity data were not normally distributed (Shapiro-Wilk test,$p < 0{,}05$), change analysis was performed with Wilcoxon signed-rank test:

- Cough frequency: $Z = -3{,}09, p = 0{,}002$
- Cough intensity: $Z = -3{,}10, p = 0{,}002$

$p < 0{,}05$ values on both variables confirmed that the decrease in cough frequency and intensity was not a coincidence, but rather a real effect of giving a decoction of star fruit flowers.

Discussion of Mechanisms and Clinical Implications

The saponin component in Averrhoa bilimbi L. is known to increase mucus secretion so as to facilitate sputum excretion, while flavonoids act as local anti-inflammatory by inhibiting pro-inflammatory cytokine pathways such as TNF-α and IL-6 [8]. Astringent tannins strengthen the mucosal wall, reducing the sensitivity of cough receptors. The combined synergistic action of these three compounds explains why cough frequency and intensity decreased significantly in a short period of time. From the point of view of midwifery and primary care practice, the decoction of star fruit flowers offers several advantages:

1. High accessibility: easily available in traditional markets or local gardens.
2. Low cost: requires only fresh flowers and water.
3. Good safety profile: no adverse effects have been reported for short duration, in line with the findings of Suhadi a et al, who did not record any gastrointestinal or allergic events [9].

The anti-allergic potential of aqueous extract of star fruit in the RBL-2H3 cell model (allergy/mast cell model). The study showed that Averrhoa bilimbi extract (AFWE) was not toxic to the cells, and at a concentration of 1.25 mg/mL it was able to inhibit mast cell degranulation through decreasing β-hexosaminidase release and suppressing intracellular calcium signaling ([Ca2+]i) which plays a role in allergic and inflammatory reaction pathways[10].

However, limitations of this study include an observation duration of only five days and no control group. For stronger practice recommendations, randomized controlled clinical trials with long-term monitoring and dose-response assessment are needed. With all these considerations, star fruit (Averrhoa bilimbi L.) flower decoction can be considered as an effective and safe complementary therapy to relieve mild to moderate cough in toddlers, especially in resource-limited areas.

4. Conclusions

This study proved that giving a decoction of star fruit flowers (Averrhoa bilimbi L.) for five days significantly reduced cough frequency (from an average of8,0 episodes/day to 3.1 episodes/day) and reduced cough intensity (average score decreased from3,2 to1,8; p = 0,002) in toddlers aged 1-5 years. This finding underscores the synergistic mechanism of saponins, flavonoids, and tannins acting as expectorants, anti-inflammatories, and mucosal protectors, which can clinically accelerate the improvement of cough symptoms without significant side effects during short-term use.

Practically, the decoction of star fruit flowers offers an alternative complementary therapy that is easily accessible, cost-effective, and can be applied at home or health centers without the need for special equipment. The scientific contribution of this study lies in providing empirical evidence that can be used as the basis for policy recommendations or primary care guidelines for the management of mild to moderate cough in toddlers with herbal approaches.

To corroborate and extend these findings, future studies are recommended to use a randomized controlled trial (RCT) design with a placebo control group, extend the duration of the intervention, and assess long-term side effects. With this approach, the effectiveness and safety of star fruit decoction can be evaluated more comprehensively and integrated into the standard protocol for cough treatment at the primary level.

References

[1] M. Bergmann *et al.*, "Coughing children in family practice and primary care: a systematic review of prevalence, aetiology and prognosis," *BMC Pediatr.*, vol. 21, no. 1, 2021, doi: 10.1186/s12887-021-02739-4.

[2] J. Liu *et al.*, "Childhood sleep: physical, cognitive, and behavioral consequences and implications," 2024, doi: 10.1007/s12519-022-00647-w.

[3] N. Imani, *Stunting pada anak: kenali dan cegah sejak dini*. 2020.

[4] S. Ramadani, "Hukum Penggunaan Alkohol Sebagai Pelarut (Solvet) dalam Obat Batuk ditinjau dari Hadits Nabi," *Alauddin State Islamic University*, 2018.

[5] S. T. Hati, "Perubahan Obat Tradisional pada Masyarakat Karo Desa Guru Singa," *UIN Sumatera Utara*, 2021.

[6] Fahrunnida and R. Pratiwi, "Kandungan saponin buah, daun dan tangkai daun belimbing wuluh (*Averrhoa bilimbi* L.)," *Semin. Nas. Konserv. dan Pemanfaat. Sumber Daya Alam*, vol. 1, 2015.

[7] K. Lakmal, P. Yasawardene, U. Jayarajah, and S. L. Seneviratne, "Nutritional and medicinal properties of Star fruit (*Averrhoa carambola*): A review," 2021, doi: 10.1002/fsn3.2135.

[8] O. Saputra and N. Anggraini, "Khasiat belimbing wuluh (*Averrhoa bilimbi* L.) terhadap penyembuhan *acne vulgaris*," *Majority*, vol. 5, no. 1, 2016.

[9] E. P. Laban and R. T. Pinzon, "Seluk beluk hipertensi: Peningkatan kompetensi klinis untuk pelayanan kefarmasian," *Berk. Ilm. Kedokt. Duta Wacana*, vol. 2, no. 3, 2017, doi: 10.21460/bikdw.v2i3.74.

[10] W. H. Santoso, M. Ishida, K. Nishi, T. Sugahara, and A. B. N. Putra, "Anti-Allergy Potential of *Averrhoa bilimbi* Linn. Fruit Water Extract Shown by Its Suppressive Effect on the Degranulation of RBL-2H3 Cells," *J. Funct. Food Nutraceutical*, 2021, doi: 10.33555/jffn.v2i2.62.