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Effect of Community-Based Education on Livestock Farmers' Knowledge of Applied Herbal Plants for Animal Health in Palembon Village, Bojonegoro, Indonesia

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Abstract

Limited farmer knowledge regarding the safe and appropriate use of applied herbal plants may reduce the effectiveness of supportive animal-health practices and may lead to inappropriate treatment decisions in smallholder livestock systems. This research aimed to evaluate the effect of a community-based educational intervention on livestock farmers' knowledge of applied herbal plants for supporting animal health in Palembon Village, Kanor District, Bojonegoro Regency, Indonesia. A pre-experimental one-group pre-test and post-test design was applied involving 30 respondents and a structured 10-item questionnaire. Based on the actual pre-test and post-test recapitulation, the overall proportion of correct/'Yes' responses increased from 33.33% before education to 83.67% after education, representing an increase of 50.33 percentage points. Analysis using a reconstructed respondent-level binary dataset showed significant improvement in each knowledge indicator ($p < 0.01$), and the total knowledge score increased from 3.33 to 8.37, with a mean difference of 5.03 points (paired t-test, $t = 6.646$; $p < 0.001$). These findings indicate that structured community education can significantly improve farmers' knowledge of applied herbal plants as a supportive component of livestock-health management and sustainable animal production.

Keywords: Applied Herbal Plants; Livestock Health; Farmer Education; Pre-Test; Post-Test; Research Article; Sustainable Animal Production; Palembon Village

1. Introduction

Smallholder livestock production is strongly influenced by farmers' practical knowledge of feed, housing, disease prevention, and simple supportive health management. In many rural communities, farmers are familiar with locally available herbal plants such as turmeric, temulawak, ginger, betel leaf, and meniran. These materials may be used as supportive measures to help maintain livestock condition, but their use should be guided by hygiene, appropriate dose, careful observation, and timely consultation with animal-health personnel [2-4,12].

Applied herbal-plant education is relevant to livestock health extension because farmers need to distinguish between supportive traditional practices and medical treatment. Herbal preparations should not replace veterinary diagnosis or evidence-based treatment when animals show severe clinical signs, persistent disease, or declining productivity. Traditional and complementary medicine can contribute to community health practices when applied appropriately, but it should be communicated with clear limitations, safety messages, and referral criteria [2,3,12].

At the farm level, inappropriate use of herbal materials may occur when farmers use contaminated ingredients, apply excessive amounts, fail to adjust use according to animal species or body condition, or delay reporting severe cases to livestock officers. Such practices may reduce the value of herbal support and may create avoidable risks for animal

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health and productivity. Safe use of plant-derived materials requires hygienic handling, appropriate dosage, and understanding of the intended supportive role of the material [3,4,18,19].

Palembon Village, Kanor District, Bojonegoro Regency, is a relevant location for community-based livestock education because the village has an agricultural and smallholder livestock background. In this study, farmer education on applied herbal plants for livestock health was evaluated using a pre-test and post-test approach to measure immediate knowledge improvement [1].

Therefore, this research article evaluates a community-based educational intervention on applied herbal plants for livestock farmers in Palembon Village. The objective of the study was to determine changes in farmers' knowledge of safe and appropriate herbal-plant use as a supportive component of livestock-health management after the educational intervention.

2. Material and methods

2.1. Study design and location

This research used a pre-experimental one-group pre-test and post-test design to evaluate changes in livestock farmers' knowledge before and after a community-based educational intervention. The study was conducted in Palembon Village, Kanor District, Bojonegoro Regency, East Java, Indonesia. The intervention and data collection were implemented on 4-5 May 2026 by academic staff from the Faculty of Veterinary Medicine, Universitas Airlangga, as stated in the official assignment letter [1].

2.2. Participants

The study participants were 30 livestock farmers and community members involved in animal production activities in Palembon Village. Participants represented smallholder farming conditions involving poultry, ducks, goats, cattle, or mixed livestock production systems. The available dataset consisted of actual aggregate pre-test and post-test recapitulation from the educational evaluation.

2.3. Research variables and outcome indicators

The independent variable was the community-based educational intervention on applied herbal plants for livestock health. The dependent variable was farmers' knowledge, measured using 10 indicators covering the supportive role of herbal plants, plant examples, hygienic preparation, dosage adjustment, risks of excessive use, recording practices, and referral of severe clinical signs to animal-health officers or veterinarians.

2.4. Educational intervention

The educational intervention was delivered through community-based lectures, interactive discussions, and practical guidance. The materials focused on:

- General role of herbal plants as supportive measures for livestock health;
- Examples of commonly used herbal plants such as turmeric, temulawak, ginger, betel leaf, and meniran;
- Hygienic preparation of herbal materials and avoidance of mold-contaminated ingredients;
- Appropriate and limited use of herbal materials according to species, age, body weight, and animal condition;
- Potential risks of excessive herbal administration, including digestive disturbance and feed refusal;
- Safe use of betel leaf for external hygiene or cage-environment management;
- Importance of recording herbal type, timing, dose, and animal response;
- Importance of reporting severe clinical signs to livestock officers or veterinarians.

2.5. Knowledge assessment

Participants' knowledge was assessed using a structured questionnaire consisting of 10 questions related to applied herbal plants for livestock health. Each item was answered using a Yes/No format in the pre-test and post-test. The primary outcome of the study was the change in the proportion of correct/'Yes' responses after the educational intervention. The available dataset was a recapitulation of item-level responses from 30 respondents.

Because the available dataset was aggregated at item level, the analysis focused on the frequency and percentage of correct/'Yes' responses for each indicator. Post-test interpretation was categorized as Good or Very good based on the proportion of correct/'Yes' responses achieved after the intervention.

2.6. Statistical analysis

Data were analyzed descriptively using frequency, percentage, mean item percentage, median, minimum, maximum, and percentage-point increase. To strengthen inferential analysis, the aggregate item-level pre-test and post-test recapitulation was converted into a reconstructed respondent-level 0/1 dataset for 30 respondents. A value of 1 indicated a correct/'Yes' response and a value of 0 indicated an incorrect/'No' response. Paired t-tests were then applied to compare pre-test and post-test values for each knowledge indicator and to compare total knowledge scores. Statistical significance was determined at $p < 0.05$.

3. Results

3.1. Respondent overview and questionnaire recapitulation

The pre-test and post-test evaluation involved 30 respondents and 10 knowledge indicators related to applied herbal plants for livestock health. The dataset was available as aggregate item-level responses, consisting of the number of respondents answering “Yes” and “No” for each item before and after education.

Table 1 Summary of pre-test and post-test results on applied herbal-plant knowledge

Variable	Pre-test	Post-test	Change
Number of respondents	30	30	-
Number of questionnaire items	10	10	-
Total 'Yes/correct' responses	100	251	151
Mean percentage of correct/Yes responses	33.33%	83.67%	50.33 pp
Minimum item percentage	20.00%	73.33%	30.00 pp
Maximum item percentage	53.33%	96.67%	63.33 pp
Median item percentage	33.33%	81.67%	50.00 pp

Overall, the proportion of correct/'Yes' responses increased from 33.33% in the pre-test to 83.67% in the post-test, yielding an overall improvement of 50.33 percentage points. This indicates a substantial short-term increase in farmers' knowledge after the educational intervention. The improvement was not limited to descriptive percentages; the reconstructed respondent-level analysis also showed statistically significant increases in all knowledge indicators and in the total knowledge score.

3.2. Item-based pre-test and post-test results

The item-based analysis showed improvement across all indicators. The detailed pre-test and post-test results are presented in Table 2.

Table 2 Item-based improvement in farmer knowledge after herbal-plant education

No	Knowledge indicator	Pre-test n (%)	Post-test n (%)	Increase (pp)	Post-test interpretation
1	Herbal plants as supportive agents for health, not as substitutes for medical treatment.	16 (53.33)	25 (83.33)	30.00	Good
2	Examples of herbal plants include turmeric, Javanese turmeric, ginger, betel leaf, and Phyllanthus niruri.	12 (40.00)	29 (96.67)	56.67	Very good
3	Cleanliness, absence of fungal contamination, and hygienic processing of herbal materials.	9 (30.00)	28 (93.33)	63.33	Very good
4	Turmeric or Javanese turmeric to support digestion and appetite.	11 (36.67)	24 (80.00)	43.33	Good
5	Ginger should be used in limited amounts during cold weather or when animals are in suboptimal health conditions.	10 (33.33)	24 (80.00)	46.67	Good
6	Betel leaf is safer for external hygiene and maintaining cleanliness in the livestock housing environment.	6 (20.00)	22 (73.33)	53.33	Good
7	Dosage should be adjusted according to the animal species, age, body weight, and health condition.	8 (26.67)	25 (83.33)	56.67	Good
8	Excessive administration may disrupt digestion or reduce feed acceptance. Dosage should be adjusted according to the animal species, age, body weight, and health condition.	7 (23.33)	26 (86.67)	63.33	Very good
9	Recording the type, timing, dosage, and changes in the animal's condition.	10 (33.33)	24 (80.00)	46.67	Good
10	Severe clinical signs should be reported to animal health officers or veterinarians.	11 (36.67)	24 (80.00)	43.33	Good

Before education, the lowest baseline knowledge was observed for the safer use of betel leaf for external hygiene or cage-environment management (20.00%), followed by awareness of risks associated with excessive herbal administration (23.33%) and dose adjustment based on livestock condition (26.67%). After education, the highest post-test result was observed for knowledge of herbal-plant examples (96.67%), followed by hygienic preparation of herbal materials (93.33%) and awareness of excessive herbal administration risks (86.67%).

3.3. Inferential analysis of pre-test and post-test knowledge indicators

A paired t-test was performed for each reconstructed binary knowledge indicator. The analysis showed statistically significant improvement in all 10 indicators after the educational intervention (Table 3). The largest mean differences were observed for hygienic processing of herbal materials (Q3) and excessive-use awareness (Q8), each with a mean increase of 0.633 points.

Table 3 Paired t-test analysis for each knowledge indicator based on reconstructed respondent-level data

Indicator	Pre-test mean	Post-test mean	Mean difference	t value	p-value
Q1	0.533	0.833	0.300	3.525	0.001426
Q2	0.400	0.967	0.567	6.158	0.000001
Q3	0.300	0.933	0.633	7.077	<0.000001
Q4	0.367	0.800	0.433	4.709	0.000057
Q5	0.333	0.800	0.467	5.037	0.000023
Q6	0.200	0.733	0.533	5.757	0.000003
Q7	0.267	0.833	0.567	6.158	0.000001
Q8	0.233	0.867	0.633	7.077	<0.000001
Q9	0.333	0.800	0.467	5.037	0.000023
Q10	0.367	0.800	0.433	4.709	0.000057

Note: Q1-Q10 correspond to the knowledge indicators listed in Table 2.

All indicators showed statistically significant increases from pre-test to post-test. The smallest but still significant improvement was observed for Q1, which addressed the concept that herbal plants are supportive agents and not substitutes for medical treatment (mean difference = 0.300; $p = 0.001426$). The strongest statistical improvements were observed for Q3 and Q8 ($p < 0.000001$), indicating that the educational intervention was particularly effective in improving knowledge related to hygienic processing and the potential risk of excessive herbal administration.

Table 4 Paired t-test analysis of total knowledge score

Variable	Pre-test	Post-test	Mean difference	t value	p-value
Total knowledge score	3.33	8.37	5.03	6.646	<0.001

The total knowledge score analysis confirmed the item-level findings. The mean total score increased from 3.33 before education to 8.37 after education, with a mean gain of 5.03 points. This statistically significant increase ($t = 6.646$; $p < 0.001$) demonstrates that the intervention produced a broad improvement across the questionnaire rather than an isolated change in only one or two indicators.

3.4. Graphical comparison of pre-test and post-test results

Figure 1 compares the percentage of correct/'Yes' responses before and after education for each questionnaire item.

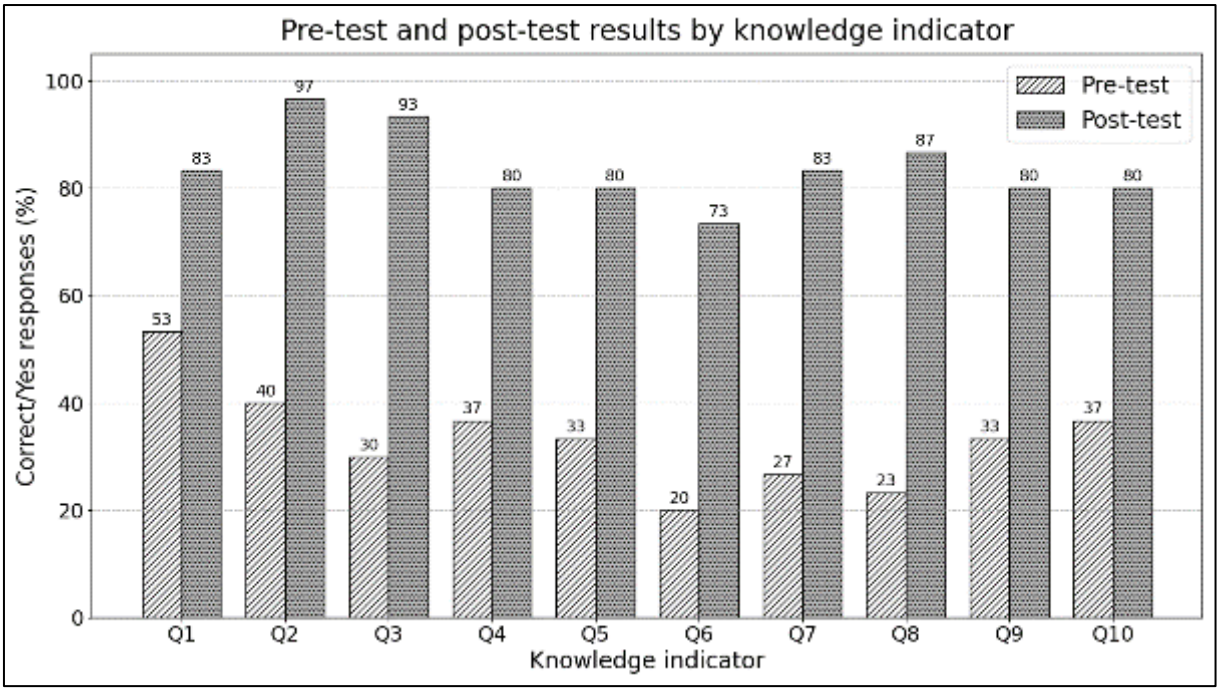

Figure 1 Percentage of correct/'Yes' responses in the pre-test and post-test for each knowledge indicator**.**

The graphical pattern confirms consistent improvement in all questionnaire items, indicating that the educational material was able to address multiple knowledge gaps among participating livestock farmers.

3.5. Magnitude of knowledge improvement

Figure 2 presents the percentage-point increase for each knowledge indicator.

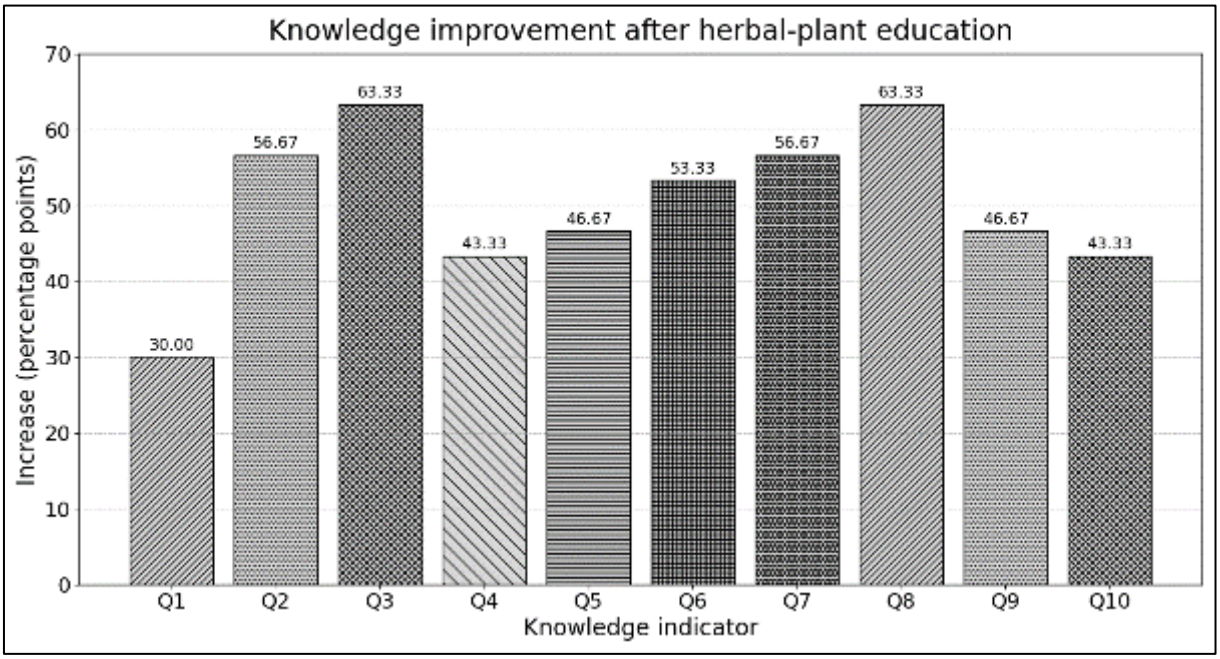

Figure 2 Percentage-point increase in farmer knowledge for each questionnaire item.

The greatest improvements were found in hygienic processing of herbal materials and awareness that excessive herbal administration may cause digestive disturbance or feed refusal, both increasing by 63.33 percentage points. Knowledge of herbal-plant examples and dose adjustment by species, age, body weight, and condition each increased by 56.67

percentage points. These topics should remain priorities in subsequent livestock-health education programs because product quality, safe preparation, dosage awareness, and observation of animal response are central principles in responsible use of plant-based materials [3,4,12,18].

3.6. Interpretation of educational outcome

The post-test interpretation showed that most indicators reached the 'Good' category, while several indicators reached the 'Very good' category. The paired t-test results strengthen the descriptive findings by showing that each indicator improved significantly after the educational intervention. This suggests that short, structured, and practical farmer education can effectively improve knowledge of applied herbal plants as supportive measures for livestock health. The significant total-score increase further indicates that the intervention improved overall knowledge across several domains, including herbal identification, hygienic preparation, dosage awareness, record keeping, and veterinary referral. These findings are consistent with broader literature indicating that phytogenic and herbal products may support animal performance, antioxidant status, gut health, and immune response when used appropriately within animal-production systems [5-10,13]. However, statistical significance should be interpreted together with the study design and data structure, because the current analysis used reconstructed binary respondent-level data and measured immediate post-test knowledge rather than long-term behavioral change.

4. Discussion of program relevance to sustainable livestock production

The educational intervention was relevant to sustainable livestock production because appropriate knowledge of applied herbal plants can support preventive and supportive livestock-health practices at the smallholder level. The significant improvement in all indicators indicates that farmers responded well to practical messages regarding plant examples, hygienic processing, careful dosage, monitoring, and referral. Herbal plants should be positioned as complementary health-support measures, not as substitutes for professional veterinary diagnosis or treatment when animals show severe clinical signs. The educational message was therefore aligned with the One Health-oriented need to reduce unsafe treatment practices and improve farmer decision-making in livestock systems [2-4,18,19].

In Palembon Village, where smallholder farmers may manage poultry, ducks, goats, cattle, or mixed livestock, education on safe herbal use is important because farm-level decisions are often made directly by farmers. Practical messages on hygiene, appropriate dose, recording, and referral to animal-health officers can reduce unsafe or excessive use of herbal preparations. These messages are supported by studies showing that phytogenic feed additives and herbal products can influence gut health, oxidative status, nutrient utilization, productivity, and immune response, but their effects depend on plant type, processing, inclusion level, species, and physiological condition [5-8,11-17].

The actual item-level findings indicate that farmers' knowledge improved substantially after structured education, and the paired t-test analysis supports that the observed improvements were statistically meaningful. The strongest gains were related to hygienic processing of herbal materials, awareness of excessive-use risks, knowledge of herbal examples, and dose adjustment. These results support the value of community-based education in strengthening farmers' capacity to apply herbal plants responsibly in livestock-health management. For example, garlic and turmeric have been discussed as potential supportive phytogenic ingredients in poultry nutrition, including roles related to performance, gut health, antioxidant status, and immune modulation [20,21]. Nevertheless, such evidence should not be interpreted as permission for indiscriminate use; farmer education must emphasize correct preparation, rational dosage, monitoring, and veterinary referral when clinical signs are severe or persistent [3,12,18,19].

Several limitations should be acknowledged. First, the available pre-test and post-test data were aggregated by questionnaire item, so the respondent-level dataset used for paired t-test analysis was reconstructed rather than obtained directly from original individual raw data. This may influence the precision of the inferential results. Second, the evaluation measured immediate knowledge change and did not assess long-term retention or behavioral change. Third, the present study evaluated knowledge rather than clinical efficacy of herbal preparations in animals. Fourth, because each indicator was binary, future studies should consider preserving original individual-level responses and applying complementary paired categorical tests, such as McNemar's test, in addition to paired score analysis. Future research should collect individual respondent scores, follow-up practice data, and field observations related to animal health, productivity, and farmer compliance with safe herbal-use principles.

Despite these limitations, the study demonstrates that pre-test and post-test recapitulation can be used to document measurable educational outcomes in livestock-farmer education research. The integration of education with evidence-based discussion of phytogenic and ethnoveterinary literature strengthens the manuscript as a descriptive research

article while maintaining the central message that herbal plants are supportive agents, not replacements for veterinary care [2,3,12].

5. Conclusion

This pre-experimental research showed that a community-based educational intervention on applied herbal plants for livestock health in Palembon Village, Kanor District, Bojonegoro Regency, improved farmers' knowledge based on actual pre-test and post-test recapitulation. The overall proportion of correct/'Yes' responses increased from 33.33% before education to 83.67% after education, with an overall improvement of 50.33 percentage points. All 10 knowledge indicators improved after the intervention. The reconstructed paired t-test analysis showed significant improvement in every indicator, and the total knowledge score increased from 3.33 to 8.37 (mean difference = 5.03; $t = 6.646$; $p < 0.001$). These findings indicate that structured community education can strengthen farmers' understanding of responsible herbal-plant use as a supportive component of livestock-health management and sustainable animal production. The findings also support continued farmer training on plant identification, hygienic preparation, rational dosage, recording, and timely referral to animal-health officers or veterinarians.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

The authors declare that there is no conflict of interest.

Statement of ethical approval

This study did not involve invasive procedures, experimental treatment, or collection of biological samples from humans or animals. The research focused on farmer education and knowledge assessment.

Statement of informed consent

Informed consent was obtained from all participants involved in the educational intervention and knowledge assessment.

Author contributions

[Rochmah Kurnijasanti] conceptualized the study and prepared the manuscript. [Lilik Maslachah, Mochamad Lazuardi] contributed to educational material development and data analysis. [Ratna Damayanti, Gandul Atik Yuliani] contributed to field implementation and participant coordination. [Rahmi Sugihartuti] reviewed and edited the manuscript. All authors read and approved the final manuscript.

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