

Improving Health-Related Knowledge Among Older Adults Through Herbal Education and Functional Beverage Training in Mangunrejo Village

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ABSTRACT

Older adults are at increased risk of noncommunicable diseases, including diabetes mellitus (DM) and hypertension, highlighting the need for accessible and practical health education. This community service activity aimed to improve health-related knowledge among older adults regarding DM, hypertension, herbal plants, bioactive compounds, and the appropriate use of natural ingredients through health education and functional beverage training. The activity was conducted as a community service program with quantitative evaluation using a one-group pretest–post-test design among 20 older adults in Mangunrejo Village. The activities included education on DM, hypertension, herbal plants, bioactive compounds, and the appropriate use of herbal ingredients, followed by training in the preparation of infused water using lemon, cucumber, and cinnamon. Participants' knowledge was assessed using a 20-item true/false questionnaire before and after the activity. Data were analyzed using the Wilcoxon signed-rank test at $\alpha = 0.05$. The mean knowledge score increased from 9.85 ± 1.23 (49.25%) in the pretest to 16.15 ± 1.46 (80.75%) in the post-test representing an absolute improvement of 6.30 points or 31.50 percentage points ($p < 0.001$). All participants showed increased post-test scores. These findings indicate an improvement in health-related knowledge following the community service activity. However, the one-group design, limited number of participants, and immediate post-test assessment limit the ability to establish causal effects or determine changes in health-related behavior and long-term outcomes.

Keywords : Functional Beverage, Infused Water, Herbal Plants, Health-Related Knowledge, Older Adults.

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INTRODUCTION

Older adults are at increased risk of noncommunicable diseases, including diabetes mellitus (DM) and hypertension. Aging increases susceptibility to chronic diseases, highlighting the need for promotive and preventive efforts to support healthy aging. Analysis of the 2018 Basic Health Research (Riskesdas) identified type 2 DM as a health problem among older adults in Indonesia (Milita et al., 2021), while hypertension is also prevalent in this population (Aryani et al., 2023). These conditions highlight the importance of providing accessible health education for older adults.

Health education is particularly important in community settings because older adults need to understand health information and apply it appropriately in daily life. Health literacy involves the ability to obtain, understand, and use health information for health-related decision-making. Among older adults with DM, health literacy is associated with illness perception (Setyarini et al., 2024), while health literacy interventions may support health among older adults (Sihombing et al., 2025). Therefore, improving health-related knowledge can serve as an important component of health education for older adults, although knowledge improvement alone does not represent health literacy as a whole.

Based on initial coordination with the village government and Posyandu cadres, health education for older adults was identified as relevant to the community setting, particularly regarding diabetes mellitus, hypertension, and the appropriate use of herbal and natural ingredients. The discussions highlighted the need for accessible information that could help older adults understand common health conditions and the appropriate use of natural ingredients in daily life. This initial community assessment provided the basis for conducting health education and practical training in the preparation of a simple functional beverage.

Herbal plants and natural ingredients are relevant to health education because they contain various bioactive compounds. Lemon (*Citrus limon*) contains vitamin C and other compounds with antioxidant activity (Puspitasari et al., 2019), while cucumber (*Cucumis sativus*) and cinnamon (*Cinnamomum* spp.) contain phytochemicals associated with antioxidant activity (Agustin & Gunawan, 2019; Antasionasti & Jayanto, 2021). However, the presence of bioactive compounds does not directly demonstrate therapeutic effects in humans. Therefore, education regarding herbal ingredients should also emphasize appropriate use, safety, and the limitations of interpreting laboratory or phytochemical findings as clinical benefits (Gondokesumo & Purnamayanti, 2021).

Educational leaflets were used to support the delivery of information, as simple printed educational media can help reinforce health information among older adults (Kusuma et al., 2024). The activity was complemented by practical training in preparing lemon, cucumber, and cinnamon-infused water. This practical component was selected to provide participants with a simple, water-based beverage preparation that could be practiced directly during the activity, while emphasizing that it was not intended to replace prescribed treatment.

Community-based education that combines information delivery with practical activities may provide older adults with both conceptual and applicable knowledge. Previous community-service activities have reported the use of herbal beverage preparation as an educational and empowerment approach (Lahardo et al., 2024). Therefore, this community service activity aimed to improve health-related knowledge among older adults in Mangunrejo Village regarding DM, hypertension, herbal plants, bioactive compounds, and the appropriate use of natural ingredients through health education and functional beverage training. Knowledge was evaluated before and after the activity using a pretest–post-test approach.

METHOD

Study Design and Setting

This community service activity employed an educational approach with quantitative evaluation using a one-group pretest–post-test design. The activity was conducted on September 3, 2026, in Mangunrejo Village, Ngadiluwih District, Kediri Regency, Indonesia. Participants were older adults who were members of the local elderly Posyandu group and were willing to participate in the activity. Participant recruitment was facilitated by the village government and Posyandu cadres, who informed eligible community members about the activity. No additional inclusion or exclusion criteria were applied. Participation was voluntary. A total of 20 older adults participated in the activity and completed the entire activity, including the educational sessions, functional beverage training, pretest, and post-test. The pretest and post-test scores were used to evaluate changes in participants' health-related knowledge following the community service activity.

Activity Implementation

The activity was implemented in three stages: preparation, education and training, and evaluation. The implementation details are presented in Table 1.

Table.1 Activity Implementation of the Community Service Program

Stage	Activity	Duration	Content	Method	Output
Preparation	Coordination and participant preparation	—	Coordination with the village government and Posyandu cadres and preparation of activity materials	Coordination and discussion	Participants and activity materials prepared
Education	Health education	25 minutes	Diabetes mellitus, hypertension, herbal plants, bioactive compounds, and appropriate use of herbal ingredients	Presentation, discussion, Q&A, and leaflet	Participants received health-related information
Training	Functional beverage preparation	15 minutes*	Preparation of lemon, cucumber, and cinnamon-infused water	Demonstration and hands-on practice	Participants practiced preparing infused water
Evaluation	Knowledge evaluation	—	20-item true/false questionnaire	Pretest and post-test	Pretest and post-test knowledge scores

* 15 minutes refers to the duration of the training/practical session, whereas 30 minutes refers to the infusion time.

The activity began with a pretest to assess participants' initial knowledge, followed by interactive health education delivered through presentations, discussions, question-and-answer sessions, and supporting leaflets. Participants then received training in preparing lemon, cucumber, and cinnamon-infused water through demonstration and hands-on practice. The

beverage was introduced as a simple water-based drink and was not presented as a treatment or substitute for prescribed medication for diabetes mellitus or hypertension. The activity involved 20 older adults as participants and three facilitators who delivered the education and guided the practical training. The local Posyandu cadres and village government supported participant coordination and activity implementation.

Educational leaflets were used as supporting media during the health education session to reinforce the information presented to participants. Three leaflets were provided, covering hypertension, diabetes mellitus, and functional beverages (*infused water*).

Hypertension Education Leaflet. This leaflet was used to support education on hypertension, including basic information about hypertension, risk factors, prevention, and appropriate health management.



Figure.1 Hypertension Education Leaflet.

Diabetes Mellitus Education Leaflet. This leaflet provided supporting information on diabetes mellitus, including basic disease information, risk factors, prevention, and appropriate health management.

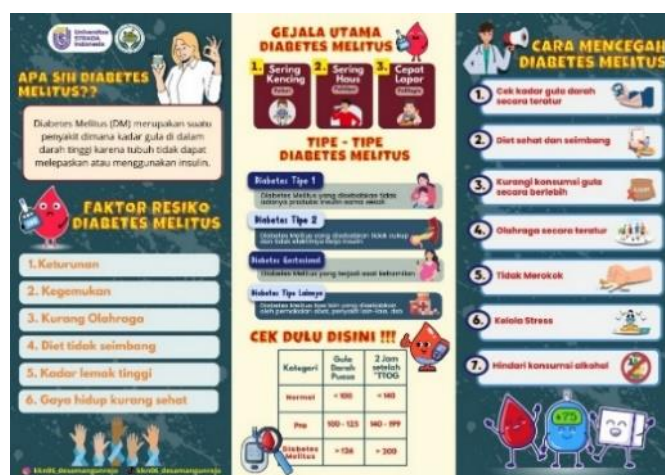


Figure.2 Diabetes Mellitus Education Leaflet.

Functional Beverage (Infused Water) Education Leaflet. This leaflet introduced the ingredients used in the infused water preparation, their bioactive compounds, and information on the appropriate use of natural ingredients.



Figure.3 Functional Beverage (*Infused Water*) Education Leaflet.

Health Screening Procedure

Blood pressure was measured once after participants had rested in a seated position, and the results were recorded in mmHg. Because blood pressure was measured only once, the findings were interpreted as screening results rather than a clinical diagnosis of hypertension. Random blood glucose was measured once using a point-of-care glucometer from a capillary blood sample obtained by finger prick, without requiring fasting, and the results were recorded in mg/dL. Participants with abnormal screening findings received health advice and were encouraged to seek further evaluation at a primary health care center (Puskesmas). No participant was directly referred during the activity.

Instrument and Evaluation

Knowledge was assessed using a 20-item true/false questionnaire administered before (*pretest*) and after (*post-test*) the activity. The questionnaire covered six domains: diabetes mellitus (DM), hypertension, herbal plants and their active compounds, appropriate use of herbal products, functional beverages, and lemon, cucumber, and cinnamon. Each correct response was scored 1 and each incorrect response was scored 0, resulting in a total knowledge score ranging from 0 to 20, which was subsequently converted to a percentage.

The questionnaire was developed based on the learning objectives and educational materials used in the activity, covering the six educational domains addressed during the session: diabetes mellitus, hypertension, herbal plants and their bioactive compounds, appropriate use of herbal products, functional beverages, and the ingredients used in the infused-water preparation. The questionnaire was reviewed by five pharmacy lecturers with expertise collectively covering pharmacy, pharmacology, natural products, and chemistry to assess content appropriateness and language clarity. Minor revisions were made to improve the clarity and appropriateness of several items.

The same questionnaire was administered for both the *pretest* and *post-test*. Formal reliability testing was not conducted. The use of the same questionnaire for the *pretest* and *post-test* may have introduced a testing effect, as participants may have become familiar with the questions during the *pretest*. This possibility was considered when interpreting the observed changes in knowledge scores.

Data Analysis

Pretest and post-test knowledge scores were summarized using descriptive statistics, including mean, standard deviation, median, interquartile range (IQR), minimum, and maximum values. The normality of the change scores (post-test minus pretest) was assessed using the Shapiro–Wilk test. A paired *t*-test was planned for normally distributed change scores, whereas the Wilcoxon signed-rank test was used for non-normally distributed change scores. Statistical significance was set at $\alpha = 0.05$. For the Wilcoxon signed-rank test, the test statistic, exact *p*-value, and effect size were reported where applicable. Statistical analysis was used to support the evaluation of changes in participants' knowledge rather than to establish causal effectiveness of the community service activity.

RESULTS



Figure .4 Blood Pressure Measurement and Diabetes Mellitus Screening



Figure.5 Functional Beverage Preparation Training

Participant Characteristics

The community service activity involved 20 older adults in Mangunrejo Village.

Table.2 Participant Characteristics (n = 20)

Characteristics	Category	n	%
Sex	Male	8	40.0
	Female	12	60.0
Age (years)	60–69	16	80.0
	70–79	4	20.0
Education	Elementary school	8	40.0
	Junior high school	7	35.0
	Senior high school	5	25.0
Total		20	100.0

Additional participant characteristics directly related to the intervention, such as previous participation in elderly health programs, history of diabetes mellitus or hypertension,

current medication use, previous use of herbal products, and prior exposure to herbal education, were not systematically collected during the activity. Therefore, these variables were not included in the baseline characterization and could not be used to further contextualize differences in participants' pretest knowledge scores.

Knowledge Evaluation Results

Table.3 Participants' Knowledge Scores Before and After the Activity

Variable	N	Minimum	Maximum	Mean $\pm$ SD	Median (IQR)
Pretest	20	8	12	9.85 $\pm$ 1.23	10 (9–11)
Post-test	20	14	19	16.15 $\pm$ 1.46	16 (15–17)

Source: Processed data (2026)

Based on Table 3, the mean knowledge score increased from 9.85 $\pm$ 1.23 (49.25%) in the *pretest* to 16.15 $\pm$ 1.46 (80.75%) in the *post-test*. The mean score increased by 6.30 points, representing an absolute increase of 31.50 percentage points. The median knowledge score increased from 10 (IQR 9–11) to 16 (IQR 15–17).

Table.4 Wilcoxon Signed-Rank Test Results for Participants' Knowledge Scores

Rank Category	N	Mean Rank	Sum of Ranks
Negative Ranks (Post-test < Pretest)	0	0.00	0.00
Positive Ranks (Post-test > Pretest)	20	10.50	210.00
Ties (Post-test = Pretest)	0	0.00	0.00
Total	20		

Source: Processed data (2026)

Based on Table 4, all 20 participants showed higher knowledge scores in the post-test than in the pretest, as indicated by 20 positive ranks. No negative ranks or ties were observed. The Wilcoxon signed-rank test showed a statistically significant difference between pretest and post-test knowledge scores ($W = 0$, exact $p < 0.001$), with a large effect size ($r = 0.88$). These findings indicate an improvement in participants' knowledge following the health education and functional beverage training.

Health Screening Results

Blood pressure and random blood glucose screening were conducted to provide a descriptive overview of the participants' health status. These screening results were not used as clinical outcomes to evaluate the effectiveness of the community service activity.

Table.5 Health Screening Results of Participants (n = 20)

Parameter	Category	n	%
Blood pressure screening	Normal	2	10.0
	Prehypertensive range	8	40.0
	Hypertensive range	10	50.0
Random blood glucose	Within reference range	12	60.0
	Above reference range	8	40.0
Total participants		20	100.0

Source: Processed data (2026)

Blood pressure screening showed that 2 participants (10.0%) were classified within the normal range, 8 (40.0%) were within the prehypertensive range, and 10 (50.0%) were within the hypertensive range at the time of screening. Regarding random blood glucose screening, 12 participants (60.0%) were recorded as being within the reference range, while 8 (40.0%) were recorded as having values above the reference range. These findings were reported descriptively based on the available screening records and were not used to establish a clinical diagnosis of hypertension or diabetes mellitus or to evaluate the clinical effectiveness of the community service activity.

DISCUSSION

The community service activity, which combined health education and functional beverage training, was associated with an increase in participants' knowledge. The mean knowledge score increased from 9.85 ± 1.23 (49.25%) in the *pretest* to 16.15 ± 1.46 (80.75%) in the *post-test* with a mean increase of 6.30 points, representing an absolute increase of 31.50 percentage points. All participants showed higher scores in the *post-test*. The Wilcoxon signed-rank test showed a statistically significant difference between the pretest and post-test scores ($p < 0.001$). The activity was associated with improved knowledge regarding DM, hypertension, herbal plants, the appropriate use of natural ingredients, and functional beverages.

The improvement in knowledge may be related to the direct delivery of educational materials supported by leaflets. The materials were presented using language adapted to the participants, followed by discussions and question-and-answer sessions that allowed participants to clarify information and relate the topics to their daily experiences. The leaflets on hypertension, DM, and functional beverages provided participants with materials that could be reviewed after the activity. Similar community-based health education has been reported to improve knowledge among older adults with hypertension (Dafriani et al., 2023). Community-based education addressing hypertension and diabetes mellitus has also been conducted among older adults to increase health-related knowledge (Pomalingo et al., 2023). Previous research has shown that leaflet-based education can improve knowledge among older adults with hypertension (Sinaga et al., 2025). Similarly, leaflet-based education has been reported to improve hypertension knowledge among older adults in community settings (Kusuma et al., 2024). The use of booklets has also been reported to improve knowledge regarding hypertension prevention among older adults (Saing et al., 2026).

The education on herbal plants included information on bioactive compounds as well as the appropriate and safe use of natural ingredients. This aspect is important because herbal use among older adults should take into account their health conditions and regular medication use. Previous community education has emphasized the importance of knowledge regarding the appropriate use and safety of herbal products (Gondokesumo & Purnamayanti, 2021). Community-based education on herbal plants has also been used to introduce the potential use of herbal ingredients for health purposes (Dwiningrum & Amelia, 2023). In addition, practical training in herbal preparation can provide participants with direct experience in utilizing herbal ingredients (Santi et al., 2022). In this activity, herbal plants were introduced as part of health education focused on improving participants' knowledge and promoting the appropriate and safe use of natural ingredients, rather than as an alternative treatment for DM or hypertension.

Lemon, cucumber, and cinnamon were selected as examples of natural ingredients to relate the use of food ingredients to their bioactive compounds. Lemon contains vitamin C and has demonstrated antioxidant activity in laboratory testing (Puspitasari et al., 2019). Cucumber contains secondary metabolites, including phenolic compounds and flavonoids (Agustin &

Gunawan, 2019), while cinnamon contains phenolic and flavonoid compounds and has demonstrated antioxidant activity in laboratory testing (Antasionasti & Jayanto, 2021). These findings do not establish that the *infused water* prepared during the activity has therapeutic effects (Maulana et al., 2022). The three ingredients were used primarily as educational materials and as practical examples of the appropriate use of natural ingredients. Functional food education has also been used as an approach to support health-related knowledge among older adults (Kesuma, 2026).

The infused-water training allowed participants to directly apply the information provided during the education. The demonstration provided participants with a clear example of the preparation steps, while the hands-on practice enabled them to directly practice handling the ingredients, maintaining the cleanliness of the ingredients and equipment, and preparing the beverage (Lahardo et al. 2025). This combination of demonstration and hands-on practice helped participants relate theoretical information to a simple activity that could be encountered in daily life. Community-based functional food training has been reported to provide older adults with practical experience in preparing health-oriented food products (Lahardo et al., 2024). Similarly, training in herbal beverage preparation can provide participants with direct experience in utilizing natural ingredients (Sugiyanto & Dini, 2021).

The health screening found that most participants had blood pressure classified as prehypertensive or hypertensive, while some participants had blood glucose levels above the reference range. Community-based health screening among older adults commonly includes blood pressure and blood glucose measurements to identify health conditions and increase health awareness (Sari et al., 2024). Early detection activities involving blood pressure and random blood glucose measurements have also been conducted to increase awareness of hypertension and diabetes mellitus among older adults (Sinaga, 2024). These findings demonstrate the relevance of the DM and hypertension topics addressed during the activity. However, the screening results describe the participants' health status at the time of the activity and were not used to evaluate the clinical effectiveness of the intervention (Dewi & Setiawan, 2024).

Community Empowerment and Follow-Up

The activity provided participants with practical knowledge that could be applied in daily life, particularly in recognizing common risk factors for diabetes mellitus and hypertension, understanding the appropriate use of herbal ingredients, and preparing a simple *infused-water* beverage. The hands-on training enabled participants to directly practice the preparation of the beverage, including handling the ingredients and maintaining cleanliness during preparation. This practical experience complemented the educational information and provided an example of how health-related knowledge could be translated into a simple daily activity.

The involvement of the local elderly Posyandu group and Posyandu cadres provided a community-based setting for delivering health information to older adults. The educational leaflets used during the activity may also serve as simple reference materials that participants can review after the session and share with family members or other community members. In the future, similar educational messages could be incorporated into routine elderly Posyandu activities with support from Posyandu cadres and the village government.

However, no formal follow-up assessment was conducted after the activity, and the cadres did not receive a structured training program specifically designed to independently reproduce the education. Therefore, the sustainability of the activity and its influence on subsequent health-related behavior could not be evaluated. Future programs could strengthen community empowerment by providing brief training for Posyandu cadres, encouraging

continued use of the educational leaflets, and coordinating periodic health education and screening activities with the local Puskesmas.

The increase in knowledge scores indicates improvement in an important component of health literacy, namely health-related knowledge; however, knowledge improvement alone does not represent health literacy as a whole. Community-based diabetes education has also been reported to support improvements in health-related knowledge among older adults (Hidayah & Salsabila, 2026). The use of simple educational media combined with practical training provided both informational and practical learning experiences. The findings should be interpreted in light of the limited number of participants, the absence of a comparison group, and the assessment conducted only before and immediately after the activity. Therefore, the increase in *post-test* scores reflects a change in knowledge and does not establish changes in participants' behavior or long-term clinical outcomes.

CONCLUSION

Health education on diabetes mellitus (DM), hypertension, herbal plants, and the appropriate use of natural ingredients, combined with practical *infused-water* training, was associated with improved health-related knowledge among older adults in Mangunrejo Village. Mean knowledge scores increased from 9.85 ± 1.23 (49.25%) to 16.15 ± 1.46 (80.75%), representing an absolute increase of 31.50 percentage points ($p < 0.001$). These findings suggest improvement in an important component of health literacy, particularly health-related knowledge. However, health literacy as a broader construct, changes in health-related behavior or self-management practices, and long-term clinical outcomes were not assessed.

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