International Journal of Public Health Science (IJPHS)
Vol. 12, No. 2, June 2023, pp. 898~908
ISSN: 2252-8806, DOI: 10.11591/ijphs.v12i2.22797

Eco-health survey effort to diagnose readiness for sustainability dengue prevention and control

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Article Info

Article history:

Received Dec 4, 2022
Revised Feb 22, 2023
Accepted Mar 11, 2023

Keywords:

Barriers
Behavior
Environment
Household
Vector control

ABSTRACT

The prevention and control of dengue fever with the eco-health approach are crucial especially at the household level. However, the implementation is still limited and has continued to experience several obstacles. This study aimed to analyze the eco-health-based dengue vector control at the household level, identify the factors influencing decision-making, and assess household readiness towards the implementation. The study was conducted in Bandarharjo Village, the coastal area of Semarang City and the samples were residents who had settled for at least six months, selected using the purposive sampling technique. Furthermore, the household survey used a mixed method with quantitative and qualitative approaches. Data were collected through a Google Form, which consists of a questionnaire, an observation checklist by respondents, and interview guidelines with open-ended answer questions. The data were further analyzed with Univariate Analysis and qualitative data were processed with the Uwe Flick method. The results showed that the majority or 65.1% of the community is ready to carry out prevention and control with the eco-health method as indicated by the excellent and good readiness criteria of 14.7% and 50.5% respectively. Social capital and support from stakeholders, as well as community leaders, were found to strengthen community readiness for sustainable eco-health prevention and control of dengue fever.

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1. INTRODUCTION

Disease prevention and control are crucial for the sustainability of human life and the environment [1]. Areas with endemic vector infectious diseases often rely on chemical vector control which often causes environmental pollution [2]. Waste generated from the use of insect control chemicals also causes adverse effects on body health, ranging from mild impacts such as nausea, vomiting, and dizziness to severe poisoning which can lead to death [3]. Furthermore, the misuse of chemical substances above recommended dosage can cause resistance in mosquito vectors, thereby rendering the control ineffective [4].

Dengue hemorrhagic fever (DHF) is a potentially fatal infectious disease that is endemic to the outskirts of Semarang City. The disease can affect anyone regardless of age or gender and has serious repercussions. Furthermore, DHF is closely related to environmental factors, climate, geographical conditions, and community behavior [5]. The *Aedes aegypti* mosquito is an efficient vector for the transmission of the dengue virus, causing a large epidemic and a significant socio-economic burden throughout the tropics and subtropics [6]. Climate change has also culminated in rapid alterations in the

proliferation of mosquito vectors. The increasing temperature of the earth accelerates the life cycle from eggs to adults in less than one week. Meanwhile, the use of larvicide in the prevention of *Aedes aegypti* mosquito vector with improper chemical techniques can cause resistance to the larvae [7]. Aside from being harmful to health, dengue fever is also a burden on the country's economy [8], [9].

Dengue fever cases in Indonesia are spread across 472 regencies/cities in 34 provinces. In 2020 up to week 49, there were 95,893 cases of DHF with 661 deaths, while the latest information on November 30, 2020, revealed 51 additional cases and one death. Approximately 73.35% or 377 districts/cities have reached an incident rate (IR) of less than 49/100,000 residents. The Ministry of Health has always urged the public to implement the 3M Plus mosquito nest eradication (PSN) and to pursue DHF prevention and control programs in biotechnology such as the use of Wolbachia bacteria in several regions in Indonesia. However, trends in society prioritize chemical prevention over environmentally friendly physical or biological methods [10].

Data from the Health Office of Semarang City shows that there has been an increase in the number of dengue cases from 2015 to 2019. In 2019, the number of dengue cases was 441 with a case fatality rate (CFR) of 3.17%, while in 2020, it reached 309 with a CFR of 1.29%. Therefore, Semarang City, the capital of Jawa Tengah Province is considered an endemic city of dengue fever and has a high risk of disease transmission. Bandarharjo Village is a suburban area whose community is at high risk of contracting dengue fever. The village is a densely populated area that has a potential environment for the breeding of *Aedes aegypti* mosquitoes. This is due to its rapid development with very high population mobility, and many industrial areas consisting of buildings/factories. The coverage of the larvae-free number (ABJ) in Semarang City is still below 95% and has a high dengue vector density.

The increase in dengue cases is a considerable threat to public health and causes huge economic losses due to the costs of treatment [4]. Moreover, the COVID-19 pandemic affected the country's economy, health status, as well as the control of dengue fever at various levels including households [11]. Although the government has implemented efforts to control the disease vectors, the level of sustainability is still lacking. Chemical eradication is still considered the most practical method for controlling dengue vectors even though it does not prioritize community-based control. The level of sustainability is also very dependent on the effectiveness of active substances which are not environmentally friendly and require expensive costs [12].

Meanwhile, the eco-health-based dengue control uses an ecosystem approach that considers the human environment [3]. This concept recognizes the inseparable relationship between humans and their biophysical, social, and economic environment, which are reflected in the health status of the population. Indicators in the application of eco-health are ecosystem factors including physical, biological, and social conditions that affect the prevention and control of dengue fever [13]. The purpose of the eco-health survey is to examine the efforts made by the community in preventing and controlling dengue fever by pursuing sustainable health for humans, natural life, and ecosystems to support nature conservation. Furthermore, eco-health factors that affect the prevention and control of dengue fever need attention to ensure the optimization and sustainability of control programs. There is also a need to examine how community participation affects the implementation of environmentally friendly controls [2]. Data from a previous study [14], mentioned that the obstacles to implementing eco-health dengue control include lack of interest and dependence on actions from the community committee on health, enthusiasm of community organizations and leaders, extremely heavy workload and lack of communication skills from the health sector, public knowledge, as well as awareness and readiness of the community [12].

The primary way to prevent DHF disease is eco-health-based household-level mosquito control. This is because the economic burden of controlling Ae. aegypti is quite high in communities that have limited resources, especially during the COVID-19 pandemic [15]. Households use an average of five different mosquito control and dengue prevention interventions, including aerosols, liquid sprays, mosquito repellent, and a small amount of anti-invisibility mosquito nets. Based on the results, people still prioritize buying products that are not environmentally friendly for mosquito control. This is also the case in sub-urban densely populated areas that have economic limitations [6].

This study aimed to assess the implementation of eco-health-based dengue vector control at the household level in high-density communities on the outskirts of Semarang City, and determine the factors that influence the decision to control the *Aedes aegypti* vector by applying the eco-health principle. It will also identify obstacles to controlling the vector and evaluate household readiness in the implementation of eco-health-based dengue control. The readiness of eco-health dengue control will be assessed based on ecological criteria, as well as economic, biological, and social conditions. Other criteria include knowledge, perceptions, and behaviors of eco-health-based prevention, as well as the participation of community figures, health workers, and the presence of forces and obstacles in dengue control in households. The results can serve as a reference for policymakers to take appropriate actions related to environmentally friendly and sustainable dengue control to reduce the risk/adverse impact of inappropriate control.

2. RESEARCH METHOD

The research began by compiling a document to obtain ethical clearance from KEPK UNNES with No. The study began by compiling a document to obtain ethical clearance from KEPK UNNES with No. 172/KEPK/EC/2022 dated March 30, 2022. The next stage included licensing, coordinating, and socializing the implementation of the study instruments such as interview guidelines and questionnaires, input on google forms, as well as conducting tests on the validity and reliability of instruments. Other steps taken were conducting data collection, input processing, analyzing and interpreting data, compiling results and writing the manuscript. The study was conducted in the suburban area of Semarang City, Bandarharjo Village with 109 samples spread across 12 RWs, which is a high-risk community for dengue fever. The household survey used a mixed method with quantitative and qualitative approaches. It involved eco-health-based households dengue control which includes two types, namely vector control (*Aedes aegypti* Mosquito) and strategies. The survey was conducted in relation to i) the knowledge of the family head towards eco-health-based dhf control, ii) the perception of the family head about the ease of eco-health-based dengue control, iii) the perception of the family head about the costlessness of eco-health-based DHF control, iv) factors influencing the decision to prevent and control dengue based on eco-health in the household including knowledge, perception, anxiety, recommendation from friends/family/neighbors, accessibility in the neighborhood, habitual behavior, advise from cadres and health workers, support from community leaders and stakeholders, as well as information from TV/newspaper/radio. Moreover, qualitative data related to barriers to eco-health control of DHF in households were collected with questionnaires, observation checklists by respondents, and guidelines for structured interviews with Google Forms.

Data Analysis was carried out using both the qualitative and quantitative approaches. Univariable analysis was used to describe the study results in percentage distribution and presented in the form of tables, graphs, as well as narratives for respondents' characteristics data, vector control, and barriers. Meanwhile, for the qualitative data, interview outcomes were analyzed using Uwe Flick analysis. The analysis began with reducing data to search for and examine phenomena of interest. In this phase, the interview was transcribed, then the data were read and re-read. The next phase involved reorganizing, classifying, and categorizing data, to generate statements on topics by reordering and reorganizing data, codes, categories, and stories. The final phase was interpreting and writing the findings. In this phase, the statements and propositions were considered based on previous studies and theories to develop arguments. The developed argument conveys the main ideas in data analysis and presents data citations or stories to support statements. The stories were sorted to examine barriers in the prevention and control of DHF. Moreover, resistance data were sorted and grouped according to the theoretical framework.

3. RESULTS AND DISCUSSION

3.1. Household demographics

The age The Demographic characteristics of respondents based on the survey results are shown in Table 1. The majority or 89.9% of the heads of households were over 25 years old and 44.4% worked as laborers furthermore, 91 respondents or 83.5% had an average monthly family income which is less than the regional minimum wage (UMR), while the percentage of respondents with primary education was 41.3%. A total of 15 or 13.8% lived in rented apartments, while most families or 75.2% had about five people living per house.

Table 2 describes the environmental conditions of households in Bandarharjo Village. Approximately 34.9% of households experienced disruptions in the availability of water to meet their needs. Most respondents or 69.7% used permanent bathtubs, while 53 or 48.6% stated that there was unmanaged standing water in their neighborhoods. The majority or 93.6% resided in densely populated settlements, and 37.6% agreed that there were no unoccupied buildings. Moreover, 22% stated that some public places including play areas, schools, places of worship, and markets were not well maintained. Approximately 39.4% mentioned that mosquitoes are more present in/around the house in the morning (07.00-10.00 WIB), while 74.3% believed the population is higher in the evening (15.00-17.00 WIB). There was one household that used air conditioning (0.9%), and 34.9% stated that there were family members/residents affected by dengue fever in the last six months.

Characteristics of household knowledge and perception of DHF are shown in Table 3. The majority or 99.1% of the respondents agreed that dengue transmission occurs due to mosquito intermediaries. Furthermore, most households (87.2%) know the place where dengue mosquito vectors are located, namely in puddles that are not directly related to the soil, and about 98.2% have a good perception regarding the prevention and control of DHF.

Tabel 1. Data demographic information from survey respondents (n=109)

Demographic characteristics	Number (n)	Percentage (%)
Aged of the head of household		
<25 years	11	10.1
≥25 years	98	89.9
The work of the head of the household		
Public/Private sector	21	19.3
Enterpreneurial	24	22.0
Laborer	48	44.0
Not working	16	14.7
Average monthly household income		22.0
<Rp2,800,000,-/month	91	83.5
≥Rp2,800,000,-/month	18	16.5
The last education of the head of the household		19.3
Not in school/not finishing elementary school	8	7.3
Graduated from elementary/junior high school	45	41.3
SMA/D3/S1-S3	56	51.4
Homeownership		
Own	94	86.2
Rent	15	13.8
The number of people sleeping in the house		
≤5 people	82	75.2
>5 people	27	24.8

Table 2. Household environment data

Household environment	n	%
Water flow used		
Fluent	71	65.1
Not fluent	38	34.9
Bathtub used		
Permanent bathtub	76	69.7
Bucket/shower	33	30.3
The existence of unmanaged puddles (on used goods, old tires, bird drinking places) around the home/village environment		
Yes	53	48.6
No	56	51.4
Place the house		
Densely populated settlements	102	93.6
Not densely populated	7	6.4
The existence of unoccupied buildings		
Exist	41	37.6
None	68	62.4
The existence of public places (play areas, schools, places of worship, markets) that are not well maintained		
Exist	24	22
None	85	78
The presence of mosquitoes in the house/around the house in the morning (07.00-10.00 WIB)		
Yes	43	39.4
No	66	60.6
The presence of mosquitoes in the house/around the house in the afternoon (15.00-17.00 WIB)		
Yes	81	74.3
No	28	25.7
Intensity of garbage collection		
Never/none	28	25.7
1-3 times per week	81	74.3
Ventilation used		
Open window/fan	108	99.1
AC	1	0.9
The presence of family members/residents affected by dengue fever		
Yes	38	34.9
No	71	65.1

Table 3. Knowledge and perception of DHF

Knowledge and perception	n	%
Knowledge of DHF transmission		
Know	108	99.1
Don't know	1	0.9
Knowledge of dengue vectors		
Know	108	99.1
Don't know	1	0.9
Perception of the dangers of dengue fever to the implementation of prevention and control of dengue fever		
Appropriate	107	98.2
Not appropriate	2	1.8

3.2. The implementation of eco-health-based dengue vector control

Assessing the implementation of eco-health-based dengue vector control at the household level in high-risk communities on the outskirts of Semarang City. The results of the study also mentioned related strategies for preventing DHF in households shown in Table 4. Most communities have implemented good practices draining bathtubs/water reservoirs (84.4%) and not hanging clothes (79.8%). However, public practice in the use of mosquito repellent (lotion and mosquito repellent was still high (71.6%) and practices in wearing mosquito nets during sleep, installing gauze on the ventilation holes of the house, and keeping fish in the bath to eat larvae was still lacking. In fact, wearing mosquito nets during sleep, installing gauze on the ventilation holes of the house, and keeping fish in the bath to eat larvae is an environmentally friendly, inexpensive, with high effectiveness to prevent and control mosquito vectors from eggs to adults.

Table 4. Strategies for preventing DHF in households

DHF prevention strategies	n	percentage
Using mosquito repellent	78	71.6
Using mosquito repellent spray	41	37.6
Using mosquito repellent rackets/others	16	14.7
Wearing mosquito nets during sleep	25	22.9
Installing gauze on the ventilation holes of the house	29	26.6
Keeping fish in the bath to eat larvae	39	35.8
Draining bathtubs/water reservoirs	92	84.4
Not hanging clothes	87	79.8

In a follow-up question related to strategies for preventing DHF in households, it was found that the use of mosquito repellent lotion was highest at 76 (69.7%), followed by mosquito repellent 45 (41.3%), spray or seprey 24 (22%), electric 16 (11.9%), mosquito racket 13 (11.9%), larvicide abate 14 (12.8%), others 5 (4.6%), and not wearing 2 (1.8%).

The average use of mosquito repellent products by the community was as follows; daily (91, 83.5%), 2-3 times per week (14, 12.8%), and never (4, 3.7%). The reasons for using various chemical substances in the prevention of mosquito bites based on the respondents include: it is effective for killing mosquitoes 39 (35.8%), low prices (22, 20.2%), easy to use 20 (18.3%), and easy to get 13 (11.9%). Moreover, 5 respondents (4.6%) reported using repellant products because they are accustomed to them and due to their minimal effects on health.

3.3. Factors influencing the decision to control *Aedes aegypti* by applying the eco-health principle

Factors that influence the implementation of dengue prevention and control behavior using the eco-health principle are shown in Table 5. More than half or 56.9% of households stated that they knew about eco-health/environmentally friendly control. The majority of households or 95.4% had a good perception of decisions in the management/cleanup of the environment. Furthermore, 59.7% of public perceptions regarding eco-health control are good, while 41.3% of households think it is time-consuming and complicated. The perception about the implementation of chemical control in the community is quite good at 59.7%, but 41.3% of households assumed that chemical control facilitates mosquito control, will not pollute the environment, and kills mosquitoes quickly. About 59.6% of the respondents were committed to implementing eco-health prevention, while 30.3% were skeptical.

Table 5. Factors influencing the decision to control *Aedes aegypti* by applying the eco-health principle

No.	Characteristic	Category	n	%
1	Knowledge of eco-health/environmentally friendly control	Know	62	56.9
		Do not know	47	43.1
2	Perception about decisions in DHF management/ cleanup based on environmental management/ cleaning	Not good enough	5	4.6
		Good	104	95.4
3	Perceptions of eco-health control	Not good enough	45	41.3
		Good	64	59.7
4	Chemical control detection	Not good enough	45	41.3
		Good	64	59.7
5	Commitment to the implementation of environmentally friendly prevention/eco-health	Yes	65	59.6
		Maybe	33	30.3
		No	11	10.1

3.4. Assessing the strength and strength of controlling dengue vectors by applying eco-health principles to noisyor high communities on the outskirts of Semarang City

3.4.1. Strength

The majority of people or 84.4% in Bandarharjo Village have no difficulty in preventing dengue hemorrhagic fever vectors, but 33% still consider chemicals such as mosquito repellent lotion, mosquito repellent, spray, electricity which are costly as the best method. Moreover, 36% of the public needed information about the prevention and control of DHF, and 26.6% assumed that they had difficulties related to the time for the control and prevention of dengue with mechanical methods.

Based on the results of a survey on the application of eco-health prevention, 56.9% of the respondents were aware of environmentally friendly prevention, while 43.1% were not. According to some respondents, environmentally friendly control emphasizes efforts to instill cleanliness to avoid mosquitoes. Meanwhile, others think that the implementation of eco-health environmental prevention is only about how to utilize mosquito repellent plants such as lavender and lemongrass, as revealed by residents:

"Grow lavender at home because it can reduce mosquitoes and the house is more beautiful." (R2)

"Eradicate mosquitoes by using lavender plants." (R103)

Moreover, some respondents revealed that eco-health control is carried out with the use of fish as predators of mosquito larvae:

"Raising fish in the bathtub." (R16)

"With fishization." (R43)

Some respondents also stated that eco-health prevention is mosquito control carried out with emphasis on environmental sustainability, no harm to humans, prioritizing environmental management such as draining, burying, and closing water reservoirs, managing waste, holding devotional work for environmental cleaning, and eradicating mosquito nests, as revealed by respondents:

"*Preventing mosquito growth using environmentally friendly materials or means."* (R26)

"It poses no risk either to the environment or to human health." (R68)

"Creating a clean environment, carrying out devotional work, carrying out PJN (mosquito larvae monitoring) once a week." (R86)

Good knowledge and understanding of eco-health control are needed by the community to implement prevention and control that prioritizes environmental sustainability, health, safety, and the use of social capital. The community possesses good social capital for the prevention and control of dengue fever from village stakeholders, health workers, cadres, and mother group/family welfare development (PKK) group, *Dasa wisma (*a group of mothers from 10 households (heads of families) who are neighbors to facilitate the running of a program called *dawis, and* subdistrict health forum (FKK) in Bandarharjo Village.

3.4.2. Obstacles

Some respondents who consider chemical mosquito control to be the most powerful method revealed that eco-health control is complicated and time-consuming. They claim that implementing eco-health measures such as cleaning up the environment or planting lavender plants can be expensive and challenging, especially in the absence of land to plant:

"*Absence of large places/ vacant lots for planting."* (R63)

"Sometimes it dies quickly." (R43)

"Work constraints," "if the husband often overtime," "time constraints." (R09, R58, R80)

The lack of public awareness about the importance of a clean and healthy environment makes some people prefer the use of chemicals such as mosquito repellent lotions, mosquito coils, sprays, and electricity because they think cleaning the environment is complicated and time-consuming.

"The obstacle is that people who have been urged and given counseling do not want to do what has been informed." (R20)

"The need for awareness and willpower requires consistency that creates habits." (R06 and R14)

"Difficult and complicated." (R23)

In addition, the lack of knowledge and understanding of the community can also cause low participation in carrying out prevention and control of dengue in an eco-health manner.

"Lazy." (R47 and R76)

3.5. Assessing household readiness in the implementation of eco-health-based dengue control.

Indicators of household characteristics include environment, knowledge, perception of DHF, prevention strategies, expenditures, social and economic factors of the community, perceptions of related network support (tenaga keshealth and cadres) and stakeholders.

As shown in Table 6, more than half of the respondents or 50.5% have good readiness, meaning that most of the people in Bandarharjo village are ready to carry out prevention and control with eco-health as indicated by their excellent and good readiness criteria of 65.1%.

Table 6. Household readiness criteria in the implementation of of eco-health-based dengue control

Household readiness criteria	Percentage of value	N	%
Excellent	81-100%	16	14.7
Good	61-80%	55	50.5
Good enough	41-60%	34	31.2
Not good enough	≤40%	4	3.7
		109	100

According to previous studies, the prevention and control of dengue fever are influenced by family demographic characteristics such as age conditions, employment, income, and education [16], [17], [12]. Families who have a better economic status tend to have more stable conditions to properly prevent and control dengue fever [18]. Those who have advanced education will also have good knowledge and perception regarding disease control [19]. Furthermore, home ownership affects residents' care and concern for the home itself and the surrounding environment [20]. The number of family members living in a house will affect the health of its residents, while the density of occupancy, in turn, greatly affects the presence of *Aedes aegypti* mosquitoes in a place of residence [14]. The denser the household, the more dirty the house and the higher the CO_2 levels which can be a factor driving the arrival of mosquitoes [21].

The physical, biological, and chemical environment of a household can provoke the presence of mosquitoes or larvae [21]. Limited water availability cause households to become reluctant in draining the bathtub because they have trouble getting water back. Meanwhile, the existence of a permanent bathtub used by most households is also a potential place for mosquito eggs to grow into adults when it is not drained and cleaned at least once a week regularly, simultaneously, and continuously [22]. Unmanaged puddles such as scrap items, old tires, and bird drinking places in the home environment can also serve as breeding grounds for mosquitoes. Based on the results of field observations, in the environment around the village, small ponds were found to contain many mosquito larvae. This includes unused ponds inundated by rainwater that was previously used to raise fish. There were also unoccupied/vacant buildings that were not maintained such as former offices, factories, and residents' homes as well as public places including play areas and markets. Meanwhile, neglected places/buildings and the presence of uncontrolled puddles are often a source of infections not realized by the community [23]. Although people have PSN regularly at home, they are still affected by dengue outbreaks from these aforementioned places.

The existence of A. egypti is inseparable from household behavior and habits to control mosquito nests [24]. People's behavior towards the use of gauze wire in low house ventilation, the use of mosquito nets during sleep, and draining the bathtub can all influence mosquito bites and increase vulnerability to dengue fever [25]. The active period of *Aedes aegypti* mosquitoes is around 07.00-17.00 WIB, while the peak occurs at 10.00 WIB and 17.00 WIB [22]. Residents who use mosquito nets while sleeping either on doors, windows, or beds can reduce the risk of developing DHF [26]. Similarly, installing gauze wire on the ventilation and practicing PSN will reduce the risk [27].

The results show that the use of chemical substances in the prevention and control of mosquitoes remains very high in the community. Chemical mosquito control is considered the easiest way to kill or repel mosquitoes due to its low cost and ease of application [28]. However, some households were unaware of the dangers of using chemicals for a long period and above the proper dosage. The use of larvicides and insecticides in vector control affects the human body and might also pollute or even damage the environment [17], [29]. Mosquito vectors can become resistant to certain chemicals that are used continuously, and

eventually require higher doses than normal [30], [31]. This condition has the potential to pollute the environment and endanger the health of the community [32]. Previous studies stated that the use of mosquito-repellent lotion every day can cause skin irritation. Prolonged use of mosquito coils also leads to respiratory problems such as acute respiratory infection (ARI). Besides, Aedes aegypty mosquitoes can become resistant thereby requiring higher doses [33]. The use of insecticides made from other chemicals such as mosquito repellent spray and electricity also causes resistance to vectors and health problems in individuals [32].

The principle of mosquito prevention and control based on ecosystem and environmental sustainability needs to be instilled early jn the community [34]. The eco-health control principle pays attention to environmental aspects, including physical, biological, social, economic, as well as local potential and community culture, while also considering the preservation of nature and sustainability [35]. Based on the results, community readiness in the prevention and control of dengue fever must always be monitored and improved to prevent the rapid spread of the disease. Eco-health is an ecosystem approach model that focuses on humans' habits in their environment. This concept recognizes the inseparable relationship between humans and their biophysical, social, and economic environment, which are reflected in the health status of the population. The factors assessed in the eco-health survey include physical, biological, and social environments that affect the prevention and control of dengue fever [36].

Furthermore, the success of eco-health dengue fever prevention and control depends on the public's knowledge and perception of good environmental management practices [37], [38]. Strong social capital and support from village stakeholders, health workers, cadres, and community association groups such as the *PKK* group, *Dasa wisma, FKK* will strengthen the implementation of the eco-health approach. Social capital also helps to promote positive behavior and adherence to guidelines set by key community groups [39], [40]. The inhibiting factor for the implementation of eco-health is the high public's perception about the use of chemical substances for mosquito control [28], [32]. Nevertheless, continuous support from community groups including PKK, Dawis, and FKK has embedded good practices in controlling dengue fever. The possible good practices for the community to realize eco-health are physical control carried out through PSN, cleaning the environment with devotional work, as well as modification and manipulation of the environment by installing gauze wire on the ventilation of the house. Other good practices include using non-permanent bathtubs, planting natural enemies of mosquitoes (lavender and *sereh (Citronella*), using natural larvicides such as turmeric, sereh, and papaya leaves, wearing mosquito nets during sleep, not hanging clothes, monitoring water reservoirs, and carrying out control actions immediately on mosquito breeding places. These comprehensive methods need to be implemented by the community to realize sustainable prevention and control of dengue fever [34], [35], [38], [39].

4. CONCLUSION

Based on ecological, economic, biological, social conditions, as well as factors related to knowledge, perceptions, behavior, and the participation of community figures including health workers, it can be concluded that most Bandarharjo residents are ready to adopt the prevention and control of DHF with the eco-health approach. More than half of the population expressed their commitment to implementing eco-health prevention, while less than half are still skeptical about the concept. Social capital and support from stakeholders, as well as community leaders, were found to strengthen the readiness for sustainable eco-health prevention and control. Communities should also begin to apply eco-health principles through good habits in maintaining environmental sanitation. Furthermore, stakeholders and health workers should always provide direction to the community on environmentally friendly prevention and control, as well as reducing the use of insecticides in the household. There is also a need to improve communication, education, and information related to the implementation of prevention and control of dengue fever based on the eco-health approach to create sustainability of communities and ecosystems. Further studies are needed to implement community-based eco-health prevention and control.

ACKNOWLEDGEMENTS

The authors are grateful to the Research and Community Service (Lembaga Penelitian and Pengabdian Masyarakat/LP2M) Universitas Negeri Semarang for funding this study with contract No.: SP DIPA-023.17.2.677507/2022, dated November 17, 2021, according to the Letter of Agreement for the Implementation of DIPA UNNES Funds in 2022 Number 21.8.3/ UN37/ PPK.3.1/ 2022, dated March 8, 2022.

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