Using Antibiotic Game In Improving Antibiotics Knowledge: A Pilot Study In Banyumas District Women

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ABSTRACT

Background: The lack of antibiotic knowledge is identified as one of major problems in combating antimicrobial resistance (AMR) in Indonesia. More interactive ways added to educational tools may be more effective. **Objective**: This study aims to determine the impact of Focus Group Discussion (FGD) and Antibiotic Game (AG) as educational interventions in improving antibiotics knowledge among women in Banyumas District, Central Java Province, Indonesia. **Methods**: A quasi-experimental study with pre-/post-test design method was conducted between June–July 2023. **Results**: There was statistically significant difference between FGD and AG groups in improving knowledge of antibiotics in Indonesian women (p value = 0.034). **Conclusion**: The findings of our study will be useful for Indonesian policymakers to develop future educational interventions in improving knowledge and promoting rational antibiotic use, especially in Indonesian housewives.

Keywords: Antibiotics knowledge, interactive education, women

Introduction

Antibiotic resistance is rising to dangerously high levels in all parts of the world (World Health Organization, 2020). It is accelerated by the misuse and overuse of antibiotics, as well as poor infection prevention and control. It is particularly a challenge in regions such as Southeast Asia which are highly populated and burdened with infectious diseases (Ström et al., 2018), especially in Indonesia.

Steps can be taken at all levels of society to reduce the impact and limit the spread of resistance. It has been found that lack of community antibiotic knowledge, and common non-prescription antibiotic self-medication were the identified problems in Indonesia (Ferdiana et al., 2021; Limato et al., 2022). Such targeted interventions require further research in knowledge and practices related to antibiotic use among males and females (Pham-Duc & Sriparamananthan, 2021). Moreover, WHO suggested to target and refine behavior change among the general population and/or certain occupations as one of national action plan to combat antimicrobial resistance (World Health Organization, 2018). Hence, women who usually have main role in managing family healthcare, are important target population in promoting the appropriate use of antibiotics in Indonesia.

Previous studies reported that several types of education interventions were used in improving knowledge of antibiotics (Hansen et al., 2023; Herawati et al., 2021; Thong et al., 2021). In addition, more interactive ways added to educational tools may be more efficient than those containing only plain text (Andrews et al., 2012; Herawati et al., 2021; Iskandar et al., 2023). In light of the lack of interactive education intervention study in Indonesia, this research as a pilot study, sought to determine the impact of Focus Group Discussion (FGD) and Antibiotic Game (AB) as educational interventions in improving antibiotics knowledge among women in Indonesia.

Material and Methods

Study Design

A cross sectional study was conducted in Banyumas district, Central Java province, Indonesia between June–July 2023. This was a quasi-experimental type of research with pre-/post-test design method.

Participants

Women who joining in a community group, called Pembinaan Kesejahteraan Keluarga (PKK), were eligible to participate in the study. PKK is a social organization that empowers women to participate in Indonesia's development. The PKK also has the task of assisting the government and become the partner in empowering and improving family welfare. The locations were selected by purposive sampling, based on the highest population area in Banyumas district in the period of 2022 including Kecamatan Sokaraja, Kecamatan Cilongok, Kecamatan Sumbang and Kecamatan Kemranjen. Furthermore, intervention types in each location were chosen randomly (see Table 1).

Minimal sample size calculation (using Slovin formula) was 72 participants in each location. However, due to socio-cultural issue (at the time of study it was near Eid al Fitr period, some people usually prefer to spend time with family rather than do other activities outside), in this study 124 women were participated.

Data Collection

Data of participants' knowledge of antibiotics were gathered from pre- and post-test scores. Pre-test was conducted before the education intervention, and post-test followed afterward. Participants' knowledge of antibiotics was calculated as percentage of right answers.

There were three steps in this study, explained as follows:
1. *Education material development*

    This part was conducted by literature review. Several articles published in national and international journals related to community's antibiotic knowledge topics were being reviewed. There were four areas obtained as key topics in measuring community's antibiotic knowledge: antibiotic definition, how to get antibiotic, how to use antibiotic, and knowledge regarding antibiotic resistance.
2. *Instrument (of pre-/post-test) development*

    The instrument was developed based on the result of literature review and expert judgments (GFG and AMK) were obtained to assess the main content of education. Face validity of the instrument was conducted subsequently with 30 participants. Pre- and post-test contained seven questions regarding: definition of antibiotics (2 questions), how to get antibiotics (2 questions), how to use antibiotics (1 question), and antibiotic resistance (2 questions).
3. *Education intervention*

    Each location was divided into two groups and got different methods of educational intervention (one group with Focus Group Discussion and another with Antibiotic Game). Pre-test and post-test were delivered in every group. Interventions were given by final year Faculty of Pharmacy (Universitas Muhammadiyah Purwokerto) bachelor students with professional supervision.

Education Interventions

Focus Group Discussion was conducted in 60 minutes discussion. It was divided into groups with 3–5 participants. There was a facilitator in each group who lead the discussion, and a secretary who documented the flow of discussion. In the first 15 minutes, facilitator explained education materials related to antibiotics as mentioned in the questions for pre- and post-test. Furthermore, facilitator

asked some questions to encouraged the participants discussion.

Antibiotic Game was done in 60 minutes duration. It was divided into groups with 3 – 5 participants. In the first 15 minutes, facilitator explained education materials related to antibiotics as mentioned in the questions for pre- and post-test. In the game playing part, participants were playing as a couple.
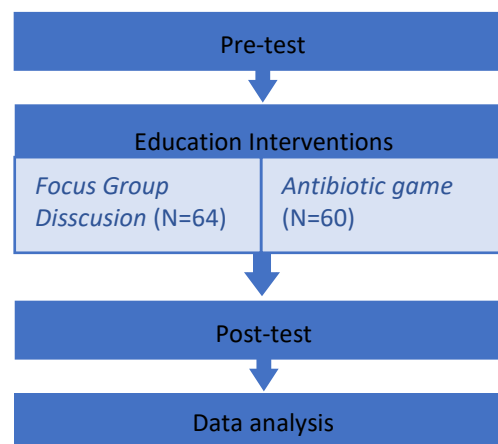

Figure 1. Flow chart of study

Each participants got a card with antibiotic related term (e.g. antibiotics, antimicrobial resistance, doctor prescription) without their knowing and would be placed facing to their peers. In turn, each participant would explain the written term in the card and would be guessed by their peers.

Data Analysis

The descriptive analysis considered the demographic characteristics expressed as absolute frequencies and percentages and quantitative variables as means and standard deviations. The IBM SPSS software version 26 was used to perform the data analysis. The assumption of normality data was not normally distributed (p-value of the Shapiro-Wilk test < 0.05). For each question, Wilcoxon signed Rank tests were applied to analyze the pre- and post-test responses of participants. The comparison of two groups educational intervention was performed using the Mann-Whitney test. A p-value less than 0.05 was considered significant.

Ethical Clearance

Approval was obtained from the Universitas Muhammadiyah Purwokerto Health Research Ethics Commission, with certificate: No. KEPK/UMP/70/III/2023 issued on March 16, 2023.

Results and Discussion
Demographic Characteristics

Of 124 participants women from four different areas in Banyumas district were covered in

this study. The distribution of the participants' age, education level, and occupation is further shown in Table 2. There are no significant differences in age between two groups. Majority of participants have graduated from secondary level of education (senior high school) and have status as housewives. Baseline knowledge of antibiotics in two groups was more than 80%.

Sources of Antibiotics Information

Almost all of participants said that the information sources of antibiotics were come from healthcare professionals, but the distribution is uneven. The information mainly come from physicians (47.58%) and other healthcare professionals (37.10%), meanwhile information from pharmacists was only 8.87% (Table 3).

Focus Group Discussion

Based on the results shown in Table 4, there is significant difference between pre- and post-test scores in question number 4, regarding the source of getting antibiotics knowledge from (p value > 0.05).

Table 1. Distribution of interventions and number of participants in each location

Location	Type of intervention	Number of participants	Total number of participants within intervention
Kecamatan Sokaraja	Focus Group Discussion	35	64
Kecamatan Cilongok	Focus Group Discussion	29	
Kecamatan Sumbang	Antibiotic Game	19	60
Kecamatan Kemranjen	Antibiotic Game	41	

Table 2. Demographic characteristics of participants

Characteristics	Focus group discussion (N=64)		Antibiotic game (N=60)		p-value
	n	(%)	n	(%)	
Age (years)					
17-25	1	(1)	1	(2)	
26-35	7	(11)	1	(2)	
36-45	19	(30)	28	(47)	0.565
46-55	23	(36)	25	(41)	
56-65	14	(22)	5	(8)	
Average (mean±SD)	49.47 ± 10.03		46.10 ± 7.58		
Education level					
Elementary	17	(27)	14	(23)	
Junior high school	12	(19)	16	(26)	0.062
Senior high school	31	(48)	28	(47)	
University	4	(6)	2	(4)	
Occupation					
Housewives	61	(95)	59	(98)	a
Self-employed	1	(2)	1	(2)	
Government employee	2	(3)	0	(0)	
Baseline knowledge of antibiotics*					
	FGD (N=128)		Game (N=120)		
Definition of antibiotics	107	84	95	79	
How to get antibiotics	117	91	108	90	
How to use antibiotics	64	100	60	100	0.996
Antibiotic resistance	79	62	64	53	
Average (mean±SD)	84% ± 1.043		81% ± 1.209		

*Baseline knowledge of antibiotics is the percentage of average right scores for each topic.

Table 3. Information sources of antibiotics

Information sources*	Focus group discussion (N=64)		Antibiotic game (N=60)	
	n	(%)	n	(%)
Physicians	28	39	31	52
Nurses	2	3	1	7
Pharmacists	11	15	0	0
Other healthcare professionals	23	32	23	38
Friends and family	3	4	1	2
Social media	4	5	1	2
Website	1	1	0	0
Total	72	100	60	100

* Participant can choose more than one answer

Table 4. Pre- and post-test score in Focus Group Discussion group (N=64)

		Test	Correct (%)	Wrong (%)	p value
	Definition of antibiotics				
Q1	Antibiotics are medicines used to treat infectious disease	Pre	80	20	0.046
		Post	98	2	
Q2	Antibiotics treat diseases that caused by bacterial infection	Pre	88	12	0.008
		Post	98	2	
	How to get antibiotics				
Q3	Antibiotics has to be prescribed by physician	Pre	98	2	a
		Post	100	0	
Q4	Antibiotics are medicines that can be purchased at groceries without a doctor's prescription	Pre	84	16	0.664
		Post	98	2	
	How to use antibiotics				
Q5	Antibiotics must be taken every day following the schedule until the course of antibiotics is finished	Pre	100	0	a
		Post	100	0	
	Antibiotic resistance				
Q6	Antibiotic resistance is the loss of capacity of antibiotics to treat bacterial infections	Pre	83	17	0.000
		Post	91	9	
Q7	Irrational used of antibiotics lead to antibiotic resistance	Pre	41	59	0.000
		Post	66	34	

[a] no statistical difference

Table 5. Pre- and post-test score in Antibiotic Game group (N=60)

		Test	Correct (%)	Wrong (%)	p value
	Definition of antibiotics				
Q1	Antibiotics are medicines used to treat infectious disease	Pre	82	12	0.296
		Post	83	17	
Q2	Antibiotics treat diseases that caused by bacterial infection	Pre	77	23	0.068
		Post	98	2	
	How to get antibiotics				
Q3	Antibiotics has to be prescribed by physician	Pre	100	0	a
		Post	100	0	
Q4	Antibiotics are medicines that can be purchased at groceries without a doctor's prescription	Pre	80	20	a
		Post	100	0	
	How to use antibiotics				
Q5	Antibiotics must be taken every day following the schedule until the course of antibiotics is finished	Pre	93	7	a
		Post	100	0	
	Antibiotic resistance				
Q6	Antibiotic resistance is the loss of capacity of antibiotics to treat bacterial infections	Pre	68	32	0.676
		Post	92	8	
Q7	Irrational used of antibiotics lead to antibiotic resistance	Pre	38	62	0.004
		Post	83	17	

[a] no statistical difference

Table 6. Comparison of correct pre- and post-test scores between Focus Group Discussion and Antibiotic Game groups

	Focus group discussion			Antibiotic game		
	Pre-test (%)	Post-test (%)	p-value	Pre-test (%)	Post-test (%)	p-value
Definition of antibiotics	84	98	0.001	79	91	0.183
How to get antibiotics	91	99	0.001	90	100	a
How to use antibiotics	100	100	a	100	100	a
Antibiotic resistance	62	78	0.000	53	88	0.027

Antibiotic Game

Table 5 depicts the significant differences between pre- and post-test scores in Antibiotic Game group. It can be seen that in 3 out of 7 numbers of question (Q1, Q2, and Q6) have statistically significant differences (p value > 0.05). The topics are about definition of antibiotic and antibiotic resistance.

This study compared two different education approaches in delivering antibiotic knowledge: Focus Group Discussion and Antibiotic Game in women locally group, called PKK. Women as mothers in a family has main role to manage their own family, including maintain the whole family's health. Thus, targeting PKK women become the agent of change of antimicrobial resistant in the smallest unit of community is considered as the proper way in Indonesia.

Table 7. Average scores of antibiotic knowledges in Focus Group Discussion and Antibiotic Game groups

	Average scores	Standard deviation
Pre-test	79.50%	± 0.401
Post-test	93.00%	± 0.248

Table 8. Comparison of pre- and post-test scores in both education groups

Educational interventions	N	Statistic test	p-value
Focus Group Discussion	64	Wilcoxon	0.000
Antibiotic Game	60		0.000

Table 9. Comparison of Mann-Whitney test between two educational intervention groups

Variable	Educational interventions	Mean rank	Sum of rank	p-value
Knowledge	Focus Group Discussion	56.69	3628.00	0.034
	Antibiotic Game	68.70	4122.50	

Majority of participants have graduated from secondary level of education (senior high school). The finding regarding education level of respondents was slightly different with data from Indonesian national survey called Survei Sosial Ekonomi Nasional (Susenas) in 2021, stated that in Indonesian women population elementary school (97.78%) was the highest, followed by junior high school (80.73%), senior high school (62.30%) and college (21.20%) (Ministry of Women Empowerment and Child Protection Indonesia, 2022). This assumed that the Indonesian women nowadays are more aware of the important of formal education. It also can be seen from the baseline knowledge of antibiotics resulted in two groups was more than 80%.

Majority of participants have status as housewives, a woman who stays at home and mainly taking care of their family member. Neither the finding regarding the occupation was not aligned with whole Indonesian population. Previous data from Indonesian national survey called Survei Angkatan Kerja Nasional (Sakernas) in 2021, reported that 50.80% of Indonesian women age >15 years old were working, 35.52% of them stay at home mainly taking care of household, while the rest were seeking for jobs, studying and others (Ministry of Women Empowerment and Child Protection Indonesia, 2022). However, the majority of participants as housewives was one of our strengths since the aim of study was targeting women who are in charge of managing their own family members.

Based on the study results, information of antibiotics from pharmacists was low rated, only 8.87%. This finding showed that pharmacists need to do more actions in terms of educating community about antibiotics. Pharmacist as drug expert supposed to be one of healthcare professionals who are giving the reliable drug information.

Baseline Knowledge of Antibiotics

The pre-test knowledge of antibiotics in both FGD and AG groups were considered as high (score >80) in all questions except question number 7. The participants have known well the definition,

how to get and how to use antibiotics. This basic knowledge was a good start in improving appropriate use of antibiotics in community. However, less known in the cause of antibiotic resistance still appeared in the pre-test results of more than half of participants in both groups (FGD and AG; 59% and 62% respectively). This result aligned with previous study in Indonesia reported that the caregivers' knowledge about antibiotic use was identified to be sufficient, particularly, the antibiotic definition, but belief about antibiotic use and microbial resistance was neutral (Herawati et al., 2020). Thus, proper education interventions regarding antimicrobial resistance were urgently needed.

Educational Interventions in Knowledge of Antibiotics

There were several education interventions developed in promoting rational use of antibiotics and combating antibiotic resistance. Recent publications in Malaysia (Thong et al., 2021) and Denmark (Hansen et al., 2023) showed that leaflet and booklet can be used as effective interventions in increasing knowledge of antibiotics. There was a publication from Indonesia showed that an educational video provides a useful method to improve the knowledge of the outpatients regarding antibiotics (Herawati et al., 2021). In this study, we used two other types of interactive education interventions: FGD and AG.

Both of FGD and AG were considered as education interventions in the context of healthcare. FGD is known as a technique for eliciting information from specific population subgroups and most effectively used when the objective of the investigation is to elicit points of view of clients (Bender & Ewbank, 1994). This method is also known as a research tool within the context of health research (Huston & Hobson, 2008; Wong, 2008). Furthermore, gamification method was proven had significant gains in knowledge and improving healthier lifestyle (Bartfay & Bartfay, 1994; Martos-Cabrera et al., 2020). There was suggestion to applied game-informed learning in healthcare education teaching practices. In this study, a new game was developed, namely

Antibiotic Game, as new approaches to be compared with FGD.

Based on the results of this study, both of FGD and AG improved participants' knowledge of antibiotics (see Table 8). In comparison with FGD, AG improved knowledge of antibiotics in participants more (see Table 9). In AG group, participants experienced more interesting way of learning since the teaching practices was more game-like by applying the principals of game play. Thus, this game-learning approach assumed to be an appropriate way to educate women in Indonesia.

Limitations

This study has certain limitations, particularly regarding the numbers of participants. Since this was a pilot study, participation was limited to only local community. To address these limitations, future investigations should validate the findings using larger and more diverse population. Despite this limitation, the present research highlights the importance key persons as antibiotic information sources. Pharmacists as professional healthcare providers who are available in the community need to improving their capacity in giving information and promoting the rational use of antibiotics.

Conclusions

The findings of our study will be useful for Indonesian educators, in this case pharmacists, to develop interactive educational interventions (e.g. Antibiotic Game) in improving knowledge and promoting rational antibiotic use, especially in Indonesian housewives.

Funding

References

Andrews, T., Thompson, M., Buckley, D. I., Heneghan, C., Deyo, R., Redmond, N., Lucas, P. J., Blair, P. S., & Hay, A. D. (2012). Interventions to Influence Consulting and Antibiotic Use for Acute Respiratory Tract Infections in Children: A Systematic Review and Meta-Analysis. *PLoS ONE*, *7*(1), e30334. https://doi.org/10.1371/journal.pone.0030334

Bartfay, W. J., & Bartfay, E. (1994). Promoting Health in Schools through a Board Game. *Western Journal of Nursing Research*, *16*(4), 438–446. https://doi.org/10.1177/019394599401600408

Bender, D. E., & Ewbank, D. (1994). The focus group as a tool for health research: issues in design and analysis. *Health Transition Review: The Cultural, Social, and Behavioural Determinants of Health*, *4*(1), 63–80.

Ferdiana, A., Liverani, M., Khan, M., Wulandari, L. P. L., Mashuri, Y. A., Batura, N., Wibawa, T., Yeung, S., Day, R., Jan, S., Wiseman, V., & Probandari, A. (2021). Community pharmacies, drug stores, and antibiotic dispensing in Indonesia: a qualitative study.

BMC Public Health, *21*(1), 1800. https://doi.org/10.1186/s12889-021-11885-4

Hansen, M. B., Rasmussen, I. S., Marloth, T., Jarløv, J. O., Arpi, M., Mogensen, D., & Jensen, J. N. (2023). A pre-post intervention study: Knowledge among parents about child infections and antibiotic use facilitated by maternal and child health nurses. *Nursing Open*, *10*(2), 641–648. https://doi.org/10.1002/nop2.1330

Herawati, F., Setiasih, Alhabsyi, M. M., Gunawan, W., Palijama, D. E., Diah, L. F., Adriansyah, N. A., Yulia, R., & Avanti, C. (2020). A patient caregiver survey in Indonesia: Knowledge and perception of antibiotic use and microbial resistance. *Journal of Infection and Public Health*, *13*(12), 2087–2091. https://doi.org/10.1016/j.jiph.2019.05.006

Herawati, F., Yulia, R., Arifin, B., Frasetyo, I., Setiasih, Woerdenbag, H. J., Avanti, C., & Andrajati, R. (2021). Educational Video Improves Knowledge about Outpatients' Usage of Antibiotics in Two Public Hospitals in Indonesia. *Antibiotics*, *10*(5), 606. https://doi.org/10.3390/antibiotics10050606

Huston, S. A., & Hobson, E. H. (2008). Using focus groups to inform pharmacy research. *Research in Social and Administrative Pharmacy*, *4*(3), 186–205. https://doi.org/10.1016/j.sapharm.2007.09.001

Iskandar, K., Makhoul, E., Haddad, C., Hammoudi, D., EL Khatib, S., Jomha, I. A., Khanafer, N., Van Dungen, M., & Salameh, P. (2023). Using a pharmacist-led educational tool to teach elementary and middle-school students in Lebanon about microbes, antibiotic use and antimicrobial resistance: A pilot study. *Pharmacy Education*, *23*(1), 47–60. https://doi.org/10.46542/pe.2023.231.4760

Limato, R., Lazarus, G., Dernison, P., Mudia, M., Alamanda, M., Nelwan, E. J., Sinto, R., Karuniawati, A., Rogier van Doorn, H., & Hamers, R. L. (2022). Optimizing antibiotic use in Indonesia: A systematic review and evidence synthesis to inform opportunities for intervention. *The Lancet Regional Health - Southeast Asia*, *2*, 100013. https://doi.org/10.1016/j.lansea.2022.05.002

Martos-Cabrera, M. B., Membrive-Jiménez, M. J., Suleiman-Martos, N., Mota-Romero, E., Cañadas-De la Fuente, G. A., Gómez-Urquiza, J. L., & Albendín-García, L. (2020). Games and Health Education for Diabetes Control: A Systematic Review with Meta-Analysis. *Healthcare*, *8*(4), 399. https://doi.org/10.3390/healthcare8040399

Ministry of Women Empowerment and Child Protection Indonesia. (2022). *Indonesian women profile in 2022*.

Pham-Duc, P., & Sriparamananthan, K. (2021). Exploring gender differences in knowledge and practices related to antibiotic use in Southeast Asia: A scoping review. *PLOS ONE*, *16*(10), e0259069. https://doi.org/10.1371/journal.pone.0259069

Ström, G., Boqvist, S., Albihn, A., Fernström, L.-L., Andersson Djurfeldt, A., Sokerya, S., Sothyra, T., & Magnusson, U. (2018). Antimicrobials in small-scale urban pig farming in a lower middle-income country – arbitrary use and high resistance levels. *Antimicrobial Resistance & Infection Control*, *7*(1), 35. https://doi.org/10.1186/s13756-018-0328-y

Thong, K. S., Chang, C. T., Lee, M., Lee, J. C. Y., Tan, H. S., & Shafie, A. A. (2021). Impact of targeted educational intervention towards public knowledge and perception of antibiotic use and resistance in the state of Perak, Malaysia. *Antimicrobial Resistance*

& Infection Control, 10(1), 29. https://doi.org/10.1186/s13756-021-00892-0

Wong, L. P. (2008). Focus group discussion: a tool for health and medical research. *Singapore Medical Journal*, *49*(3), 256–260; quiz 261.

World Health Organization. (2018). *Tackling antimicrobial resistance (AMR) together: working paper 5.0: enhancing the focus on gender and equity.*

World Health Organization. (2020, July 21). *Antibiotic Resistance.* Https://Www.Who.Int/News-Room/Fact-Sheets/Detail/Antibiotic-Resistance.