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Innovation Article

The effectivity of mindfulness-based art therapy application-based artificial intelligence on the mental health of pregnant women

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A B S T R A C T

Background: The COVID-19 pandemic has become a new stressor with significant pregnancy consequences, limiting access to health services. Mindfulness-Based Art Therapy (MBAT) has been proven to intervene in the body-mind-soul and improve mental health problems. However, no research has developed it into a form of artificial intelligence for use by pregnant women in supporting the current situation of access to health services.

Purpose: This study aims to produce a system of MBAT based on artificial intelligence for early detection and to prove the effectiveness of improving mental health in pregnant women.

Methods: This study employed Research & Development consisting of 4 stages, namely Literature Study, Development Stage, Validity Expert, and Trial.

Results: The MBAT application has five features, from mental health information to history. The validity score of the application system is 87.33%. The trial results showed that the application effectively reduces stress levels by 91.26% and anxiety by 90.24%. Also, the application can predict the percentage reduction in stress and anxiety levels correctly and without errors using the decision tree.

Conclusion: This application is helpful for pregnant women and health workers in detecting stress and anxiety levels early in pregnancy and improving mental health.

INTRODUCTION

The World Health Organization (WHO) states that 10% of pregnant women and 13% of postpartum mothers worldwide experience mental health disorders, with the most common forms being anxiety and stress. Developing countries have a higher prevalence of 15.6% during pregnancy and 19.8% after birth.[1] Since the COVID-19 pandemic (December 2019), the incidence of mental health disorders has increased, where anxiety symptoms increased from 10% to 37%, and depressive symptoms increased by 25% to 57%.[2] During the pandemic, 83.1% of women felt anxious about their health, 50,7% of pregnant women experienced increased anxiety, 66.7% related to their pregnancy, and 35% related to baby care.[3]

The impact of mental health disorders on pregnant women due to the COVID-19 pandemic is a significant challenge in health services. Mental health disorders can get worse because, during the pandemic, pregnant women have limited access to health services, so maternal and neonatal care needs are not met; apart from social restrictions, there are also various problems, such as the lack of availability of mental health care services, difficulties in adjusting schedules between clients and practitioners, clients have difficulty expressing themselves in face-to-face dialogue, lousy time, cost and distance from health services, stigma, and poor mental health literacy in the community.[4,5] This situation creates more pressure on pregnant women, harming the mother's mental health.[6] Appropriate and rapid mental health care support efforts are needed to face mental health challenges and prevent adverse health impacts in the future.[7,8]

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Mindfulness-Based Art Therapy (MBAT) can fill this gap by providing a holistic body-mind-soul approach that encourages body recovery and rest related to balance and improving psychophysiological regulation.[9] The provision of MBAT intervention services can overcome the weaknesses of existing types of therapy but has covered overall deficiencies in the implementation of existing mental health services. MBAT interventions art therapy became a verbal communication method that was able to minimize intimidation compared to commonly used verbal communication methods and was able to advocate for mental health, breaking the stigma of legal counseling services, and offer proactive support through minimal contact that serves as a gateway to those who need help to manage their mental health disorders without feeling intimidated.[4] In addition, the Ministry of Health is currently directing health interventions in providing information on nursing and proper support, especially for pregnant women, to be carried out online.[10,11]

However, the development of this therapy is still limited because there has been no specific research discussing the effectiveness of this therapy in pregnant women, especially in supporting pregnant women in the current pandemic. So by developing it in the form of an artificial intelligence application, it is hoped that it will be the primary solution to meet the needs of pregnant women for mental health services during a pandemic. In this regard, this study aims to develop an application for the application of MBAT in the form of a mobile application to detect early and provide intervention for mental health disorders in pregnant women.

METHOD

The research and development model used in the research consists of a literature study, development stage, validity expert, and trials.

Stage 1 Literature study

The first stage is the initial stage of preparation for development by collecting information from a literature review, two practitioners, a psychologist, and facilitators of prenatal yoga in preparing material for the MBAT mobile application. This information will be a reference for creating the product.

Stage 2 Application Development

Researchers designed a framework application created by information technology experts or application developers. In doing this, the developer of this mobile application is an expert in systems and machine learning.

Stage 3 Expert Validity

Expert validation tests were conducted on six experts (two information technology experts, two practitioners midwives, and two practitioners psychologists)—the validation using an ISO 9126 questionnaire. The application is tested for effectiveness in terms of usability, reliability, functionality, efficiency, maintainability, and portability. Researchers revise before being tested.[12]

Stage 4 Application Testing

The research used is a quantitative study using a True Experiment design with a pretest-post-test control group design. The sample in this study was 32 second-trimester of pregnant women who were recorded at the Kamonji Health Center, West Palu District, and Singgani Health Center, East Palu District, Province of Central Sulawesi, with the criteria of pregnant women a second trimester of pregnancy, primigravida, with the results of the Perceived Stress Scale (PSS) questionnaire score being at the moderate and severe levels, the results of the Hamilton Anxiety Rating Scale (HARS) questionnaire were at the moderate, severe and burdensome levels, having no complications related to heart problems, owned and could operate an Android smartphone and were willing to be respondents.[13] The intervention group was given an intervention using the MBAT mobile application. The MBAT mobile application is an android mobile application that contains mental health services that are packaged into a complete package in the form of information-early detection and early mental health intervention. The control group was given standard antenatal care services in the form of education on mental health and heart rate by midwives who had become enumerators.

Researchers measured the pretest, first post-test, and second post-test on mental health levels using the PSS, the HARS questionnaire included in the mobile application.[14,15] In the control group, the data collection of the pretest, first post-test, and second post-test on mental health levels used a manual method by enumerators—the data analysis using the Independent T-test and Mann-Whitney.

RESULTS

Results of the Literature Review

Based on the literature review, educational materials are basic things pregnant women need to know, such as the standard types, causes, symptoms, impact, and mental health problems. Then the preventive material contains prevention that pregnant women can do at home, such as early detection of stress and anxiety assessment using the PSS and HARS questionnaires. Furthermore, curative education material ensures that pregnant women can be accessed independently anytime and anywhere.[4,14-16]

Results of Application Development

The MBAT app has seven features available. Once downloaded, a homepage will appear in the application

(Figure 1). Furthermore, to access features, the user presses the 3-line mark in the right corner of the display, then the seven features will appear in the application (Figure 2). In feature 1 (Figure 3), identity is a menu to fill in your identity, including name, birth place, birth date, the first day of the last menstrual period, parity, education, occupation, and phone number. Feature 2 (Figure 4) mental health is a menu containing brief information about women's mental health, including definitions, causes, symptoms, and impact on pregnancy. Feature 3 (Figure 5) MBAT Therapy is a menu that can be experienced by brief pregnant information about MBAT therapy and ten sessions of MBAT therapy that pregnant women will carry out. Feature 4 (Figure 6) Stress Screening is a screening menu to detect stress levels of pregnant women using the Perceived Stress Scale (PSS) questionnaire. Feature 5 (Figure 7) Anxiety Screening is a screening menu to detect pregnant women's anxiety levels using the HARS questionnaire. Feature 6 (Figure 8) History is a menu that displays the history of the time and the results of screening and therapy implementation. The application can be downloaded at https://bit.ly/3LKfsyF.

Results of Trial

The application was an expert validation test and obtained 87,33% results with very high categories of means worth using. The results of data processing with machine learning which aims to obtain the actual value of mental health decline data are tested using seven different algorithms, namely Linear Regression, Decision Tree, Random Forest, Support Vector Machine (SVM), Backpropagation Multi-Layer Perceptron, Stochastic Gradient Descent (SGD), and k-Nearest Neighbor. The decision tree outperformed the other classifier with an accuracy of 100%.

In Table 1, both groups showed a significant reduction in stress levels. However, a more evident difference can be seen based on the effect size of the application of artificial intelligence-based MBAT on reducing stress levels, which is proven to have a more significant effect, namely 91.26%, compared to antenatal care mental health education care by 89.87%. In Table 2, a more evident difference in the value of the decline can be seen based on the effect size value of the application of artificial intelligence-based MBAT on reducing anxiety levels, which is proven to have a more significant effect of 90.24%, compared to 89.19% mental health education antenatal care services. Meanwhile, the difference in the effect between the group's stress levels was 66.99%, and anxiety levels were 60.49%, indicating that the reduction in the intervention group was more significant than in the control group.

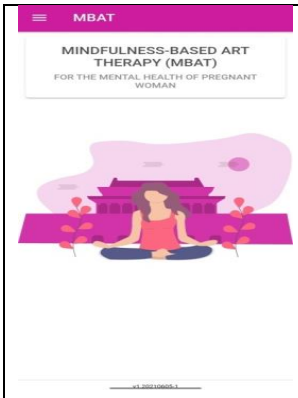

Figure 1. Homepage

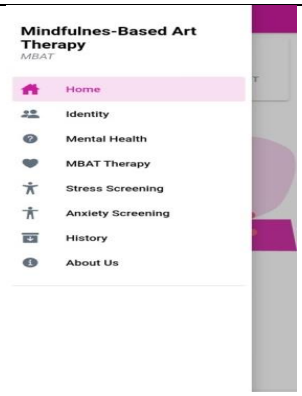

Figure 2. Apps Menu

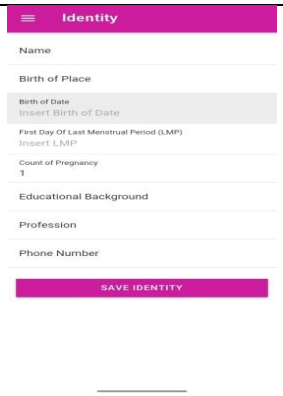

Figure 3. Identity

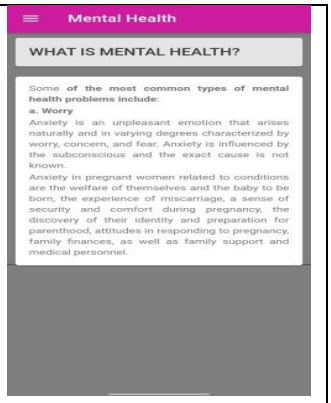

Figure 4. Mental Health Info

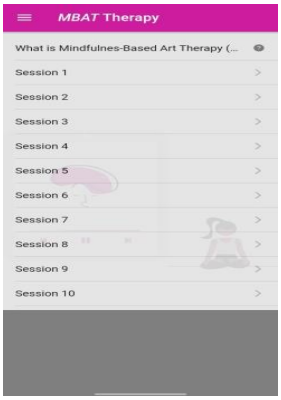

Figure 5. MBAT Therapy

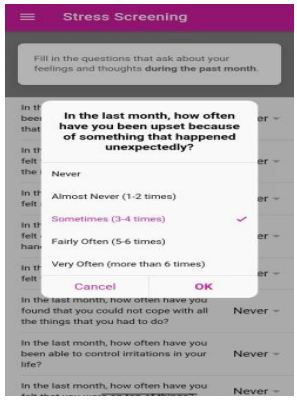

Figure 6. Stress Screening

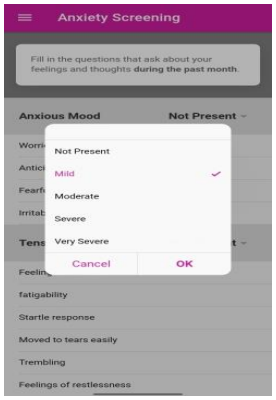

Figure 7. Anxiety Screening

Figure 8. History

Table 1. The Effectivity of MBAT Application on Stress

Groups	Measuring Time (Mean±SD)			∆Mean	Cohen's d	Effect Size
	Pre-test	Post-test 1	Post-test 2			
Intervention	24.06±4.057	16.81±3.290	8.12±3.008	15.94	4.46	91.26%
Control	24.62±3.159	19.25±2.620	13.06±2.434	11.56	4.10	89.87%
p-value*	0.665	0.027	0.000	4.94	1.80	66.99%

*Independent T-test

Table 2. The Effectivity of MBAT Application on Anxiety

Groups	Measuring Time (Mean±SD)			∆Mean	Cohen's d	Effect Size
	Pre-test	Post-test 1	Post-test 2			
Intervention	25.68±4.615	17.93±3.837	8.56±3.482	17.12	4.19	90.24%
Control	26.44±3.204	20.31±3.553	13.68±3.260	12.76	3.94	89.19%
p-value*	0.298*	0.079**	0.000**	5.12	1.52	60.49%

*Independent T-test; **Mann-Whitney Test

DISCUSSION

The features of this application are the feature of identity, mental health info, MBAT, early detection of mental health independently such as stress screening and anxiety screening, history, and about us. The essential thing in the application is the MBAT menu which contains all components of therapy that use arts, guided imagery, and videos. Pregnant women can access the MBAT menu by following the sessions. There is also a stress screening menu with a Perceived Stress Scale questionnaire and an anxiety screening menu with a Hamilton Anxiety Rating Scale questionnaire, which helps determine the stress and anxiety levels based on what pregnant women feel.[14,15] Then, the stress and anxiety screenings results can be seen on the history menu. The mental health menu explains about mental health that pregnant women, including definitions, causes, symptoms, and impact on pregnancy can experience.

An expert test is an activity to assess the model's design by presenting several experts, such as IT experts, practitioners, midwives, and practitioners psychologists, to provide that the results are reliable. From expert advice, This application can add time information to the history menu, which shows the time of carrying out therapy sessions, stress screening, and anxiety screening to make it more detailed and help health workers to monitor the timeliness of carrying out the sessions of therapy.

This study found significant differences in the results of the analysis of the decrease in stress and anxiety levels in the two groups. However, it can be seen that the decrease in stress and anxiety levels in the intervention group was not much different from the control group by the effect size. This can happen because, in the control group who received antenatal care services for mental health education, pregnant women were indirectly involved in two-way communication so that mothers not only received education but in the process, there was also feedback that allowed mothers to have opportunities as communicators in conveying things that make her uncomfortable during pregnancy. This can indirectly make mothers more open in telling stories and help mothers channel their feelings of stress and anxiety.[17]

Meanwhile, in the intervention group, the decrease in stress and anxiety levels was due to the artificial intelligence-based MBAT, which can simultaneously increase mind and body outcomes, encourage brain wave frequencies, and activate memory and emotional processes.[18] The achievement of this condition encourages changes in sympathetic nerve activity to be slower, resulting in a decrease in oxygen consumption by the body and causing muscles to relax and feel relaxed, comfortable, and calm so that the mother's stress and anxiety levels to decrease maximally.[16]

A person's mental health disorders can be assessed through physiological indicators, namely heart rate because it can detect changes in a person's emotions. The results of this study indicated that the heart rate values in both groups tended to decrease after being given treatment, with the intervention group experiencing a decrease of 2 times greater.

According to experts, non-verbal communication methods applied in the artificial intelligence-based MBAT intervention group had a more significant effect than verbal communication in the control group in terms of feeling expression. In artificial intelligence-based MBAT, the individual's concentration is directed at the mind and body, meditating or thinking cognitively, feeling the energy that comes from within the body, and then expressing these feelings in the form of works of art and body movements that can stimulate individual coping mechanisms which then inhibits the release of stress hormones which are responsible for emotional, physiological changes that make individuals more calm and relaxed and can be assessed and characterized easily through a decrease in heart rate, respiration, and blood pressure.[19,20] Previous literature reviews on pregnant women also support this study, stating that MBAT helps in relaxation practices but

also helps in changing psychological factors such as heart rate and breathing and simultaneously increases patient satisfaction.[21]

Meanwhile, in the control group who received mental health education antenatal care, the decrease in heart rate was not that large. This can be caused by not a few pregnant women who have difficulty being open, honest, and able to express their feelings in the form of verbal communication, so pregnant women need a long time to be able to establish a relationship of trust between the counselor and pregnant women and then get a significant change in heart rate.[17] Other studies also show a correlation between a gradual decrease in heart rate during the counseling process for clients.[22]

Looking back at the situation during this pandemic, the use of artificial intelligence is very appropriate and in line with the needs of pregnant women, making it impossible to hold face-to-face meetings freely, making it more difficult to obtain mental health management. Facts obtained in the field, respondents in the intervention group had no complaints about using this application. They felt the benefits, such as being cheap and easy to use so that they were considered able to accommodate mothers to be empowered independently in conducting early detection of mental health and as soon as possible to get the proper intervention so that Mother's rights to access and obtain quality services are not hampered and can still be fulfilled during the COVID-19 pandemic, especially mental health services during pregnancy. Other literature studies also show that using electronic media helps minimize costs and can be applied to pregnant women undergoing hospital treatment.[23]

For health workers, especially midwives closely related to pregnant women, this artificial intelligence-based MBAT can be a medium for mental health intervention services to recognize mental health disorders and how to overcome them early. It is also a recommendation for services that pregnant women can carry out independently at home. This app can help the midwife's work because it provides essential information on mental health and its impacts on pregnancy, early detection, and management. Achieved the need for information about complaints, early detection, and handling of pregnancy care that can be accessed easily through the m-health application encourages increased knowledge and changes in attitudes and behavior that will reduce stress and anxiety to improve the health level of mothers and babies during pregnancy.[24,25]

CONCLUSIONS AND RECOMMENDATION

Applying mental health services to pregnant women based on artificial intelligence has been built. This application can be used to detect stress and anxiety levels and accompanied by intervention to overcome it. The education, screenings, and intervention listed in this application can provide effectiveness to pregnant women dealing with mental health problems during this COVID-19 pandemic. For midwifery practitioners, this application can be used as a medium for training and control given to pregnant women at home.

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