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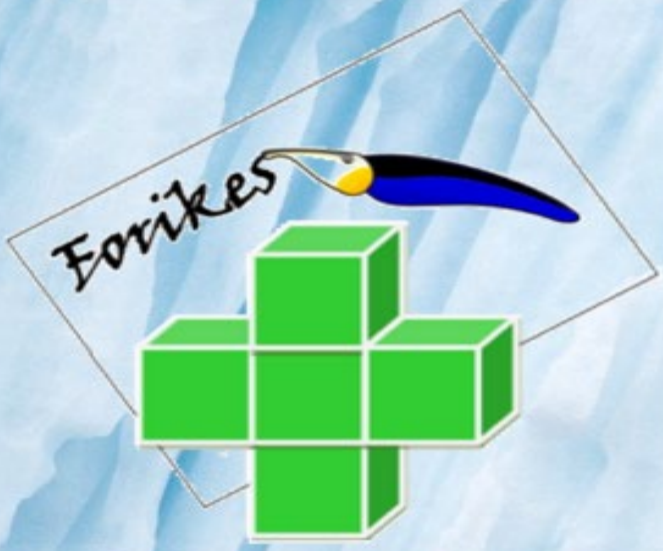

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Feasibility Analysis of Machine Learning-Based Smart Stunting Application

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ABSTRACT
Stunting is a chronic nutritional condition that requires rapid and accurate early detection. Conventional assessment methods that rely on the Indonesian Maternal and Child Health (MCH) handbook; commonly referred to as the MCH handbook or manual anthropometric tables often face challenges related to efficiency and susceptibility to human error. The digitization of anthropometric assessment through an Android-based application offers a promising solution for automating the evaluation of toddlers' nutritional status. This study aimed to examine the perceived benefits and user acceptance of a machine learning–based Android application designed for stunting detection and management. A descriptive quantitative design was employed. Consecutive sampling was used to recruit individuals who met the inclusion criteria, including the ability to operate the designated Android system, resulting in a sample of 37 respondents. Data were collected using a structured questionnaire with a 1–4 Likert scale. Descriptive statistics were applied to generate frequency distributions, percentages, and mean scores for the indicators of accuracy, usability, utility, and reliability. Findings indicate a high level of user acceptance. Usability received the highest mean score (3.28), followed by utility (3.25) and reliability (3.16). A total of 91.7% of respondents rated the prediction system as accurate, with an average accuracy score of 3.05. Respondents also reported that the application was substantially more efficient and faster than manual assessment methods. In conclusion, the machine learning–based stunting detection application effectively supports users in identifying stunting risk quickly and accurately. Its ease of use and strong perceived validity make it a practical tool for both healthcare workers and the general public, contributing to efforts to accelerate stunting reduction.
Keywords: anthropometry; Android-based application; machine learning; stunting

INTRODUCTION
Stunting is a form of chronic growth impairment in which a child's height falls significantly below the expected standard for their age, reflecting long-term nutritional deprivation and recurrent illness. A toddler is classified as short when their length-for-age (LFA) or height-for-age (HFA) Z-score is less than –2 SD (stunted) or less than –3 SD (severely stunted). These Z-scores are derived from standardized anthropometric measurements, which serve as essential indicators for evaluating body size, proportions, and composition. Length-for-age and height-for-age indices are widely used to categorize children as very short, short, normal, or tall, and they remain the cornerstone of child growth monitoring systems worldwide [1]. In Indonesia, stunting continues to be a major public health concern, largely driven by chronic malnutrition during the first 1,000 days of life; a critical developmental window that determines long-term health outcomes. Chronic malnutrition has persisted as one of the most pressing challenges in the national health sector, affecting not only individual well-being but also broader socioeconomic development [2,3].

Global trends indicate gradual progress in reducing stunting. According to the World Health Organization (WHO), the global prevalence of stunting declined by 22.3% between 1990 and 2022, reaching 17.9% in 2022 [4]. Indonesia has also demonstrated significant improvement, with prevalence decreasing from 30.8% in 2018 to 21.5% in 2023 [5]. At the regional level, Yogyakarta City reported a stunting prevalence of 10.6% as of 30 July 2024, showing improvement from 11.8% in 2023 [6]. Despite these positive trends, stunting remains a priority issue within national and global health agendas. It is included as a key indicator in the Sustainable Development Goals (SDGs), with a global target of achieving a 40% reduction in stunting among children under five by 2025 [7]. The persistence of stunting, even amid declining prevalence, underscores the need for sustained, innovative, and evidence-based strategies to accelerate progress.

The consequences of stunting extend far beyond impaired physical growth. Children who experience stunting are at increased risk of delayed cognitive development, reduced school performance, lower future productivity, and diminished quality of life. These long-term impacts highlight the importance of early identification and timely intervention. Effective stunting prevention requires an integrated approach grounded in accurate, reliable, and accessible data [8]. Early detection plays a pivotal role in this process, enabling health workers and caregivers to identify at-risk children before growth faltering becomes irreversible. However, current early detection efforts often encounter substantial barriers. Manual anthropometric assessments using the Maternal and Child Health (MCH) handbook or printed growth charts are time-consuming, prone to human error, and dependent on the availability of trained personnel. In many settings, limited human resources, inconsistent measurement practices, and restricted access to digital health tools hinder the efficiency and accuracy of stunting detection.

Advancements in digital health technologies offer promising opportunities to address these challenges. Machine learning-based detection systems integrated into smartphone applications can enhance the precision, speed, and accessibility of anthropometric assessments. By automating the interpretation of growth data, such systems reduce reliance on manual calculations and minimize the risk of misclassification. Moreover, smartphone-based applications can facilitate broader community engagement, allowing caregivers and health workers to access reliable information and recommendations directly from their devices. These innovations support the development of data-driven policies and strengthen the capacity of health systems to respond to stunting more effectively [9]. As digital transformation accelerates within the health sector, ensuring that new technologies are both beneficial and acceptable to users becomes increasingly important.

Therefore, this study aimed to evaluate the perceived benefits and user acceptance of a machine learning–based Android application designed for stunting detection and management, focusing on its accuracy, usability, utility, and reliability from the user perspective.

METHODS
This study was conducted in 2025 in Yogyakarta, Indonesia, where the Smart Stunting application was tested among community members and individuals familiar with Android-based devices. The feasibility assessment was carried out in collaboration with the Sekolah Tinggi Ilmu Kesehatan Panti Rapih Yogyakarta and supported by field implementation activities within the local community setting. A quantitative research

design with a descriptive analytical approach was employed. This design was selected to provide a systematic and comprehensive overview of user perceptions related to the accuracy, usability, utility, and reliability of the machine learning–based Smart Stunting application. The study did not involve hypothesis testing; instead, it focused on describing response patterns and feasibility indicators derived from user experiences.

The feasibility test involved human participants selected through a consecutive sampling technique. Individuals were recruited based on predetermined inclusion criteria: 1) owning and being able to operate an Android device; 2) willingness to download, install, and use the Smart Stunting application; 3) willingness to participate as respondents; and 4) willingness to complete the structured questionnaire. Exclusion criteria included respondents who experienced technical difficulties related to device incompatibility, particularly unsupported Android versions. After applying these criteria, a total of 37 respondents were included in the final analysis.

Data were collected using a structured questionnaire consisting of 30 items distributed across 11 sections and grouped into four assessment domains: accuracy, usability, utility, and reliability. All items were measured using a 1–4 Likert scale, where higher scores indicated more positive perceptions. The instrument had previously undergone validity and reliability testing and was confirmed to be appropriate for feasibility assessment. The research process comprised several sequential stages: 1) initial data collection and processing using the machine learning model output embedded in the Smart Stunting application; 2) selection and evaluation of the machine learning algorithm used for prediction; 3) system testing to ensure functional stability; and 4) feasibility testing through user interaction with the application followed by questionnaire completion. Respondents were guided to install the application, input anthropometric data, and observe the prediction results before completing the questionnaire.

Collected data were analyzed descriptively using frequency distributions, percentages, and mean scores for each indicator. These descriptive statistics were used to identify response tendencies and categorize user perceptions. Interpretation of results was supported by a score-interval table, enabling accurate identification of achievement levels for each domain. This analytical approach provided strong baseline evidence for evaluating the feasibility and acceptance of the machine learning–based application.

RESULTS

The results of this study present an overview of the results of the feasibility analysis and a summary of the feasibility analysis table from the results of data collection on 37 respondents as follows (Figure 1-11).

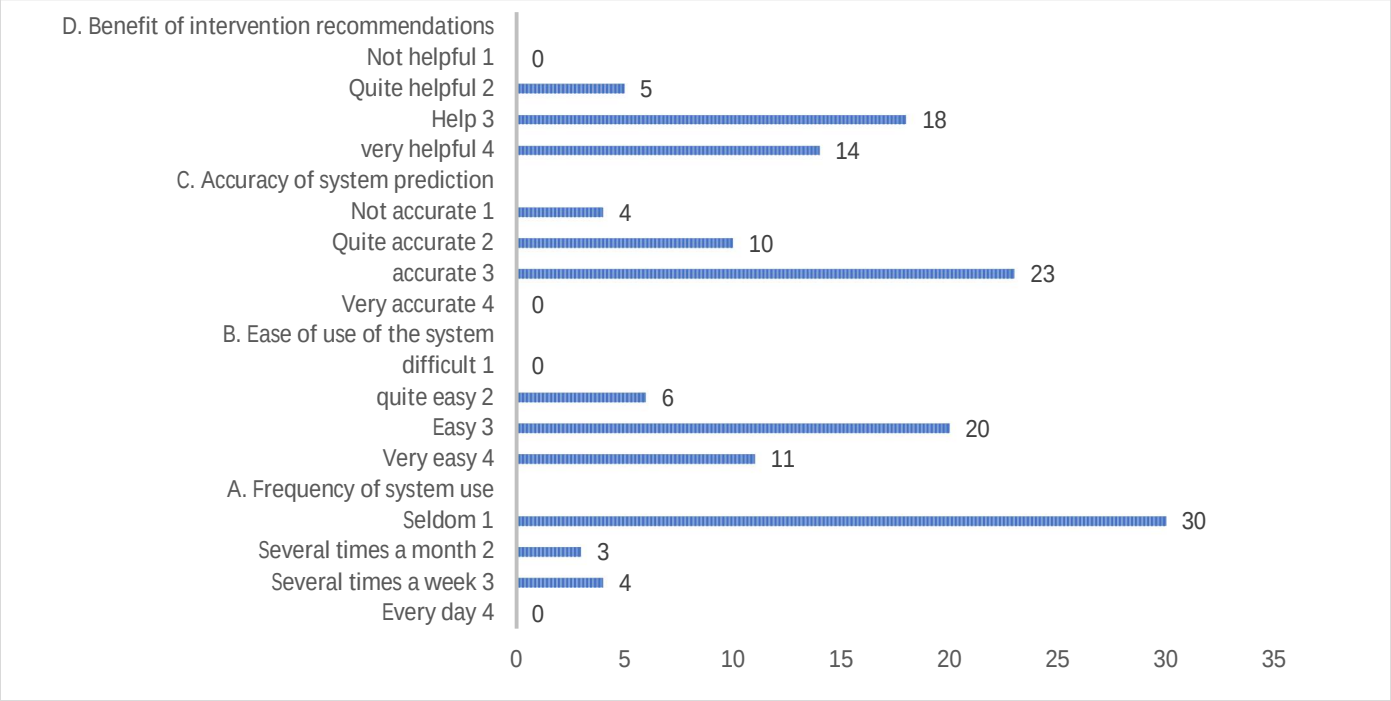

Figure 1. System usage

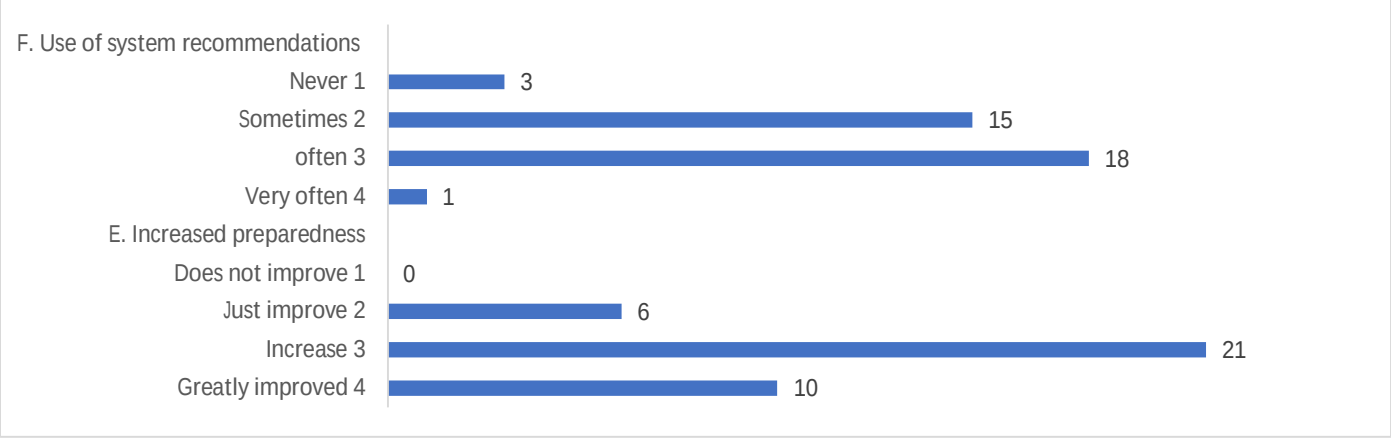

Figure 2. Impact of application use

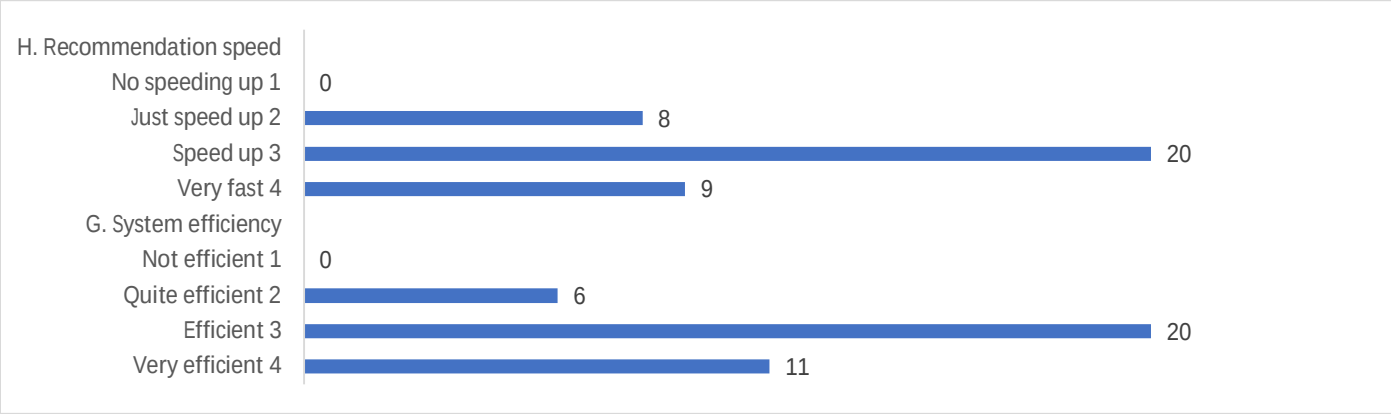

Figure 3. Benefits of technology

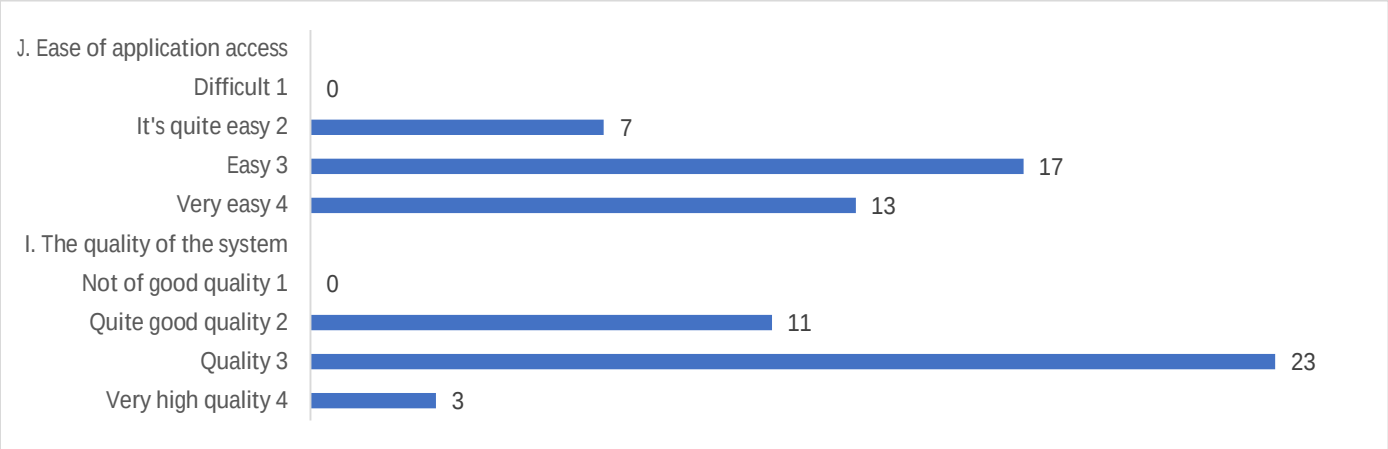

Figure 4. Data quality and access

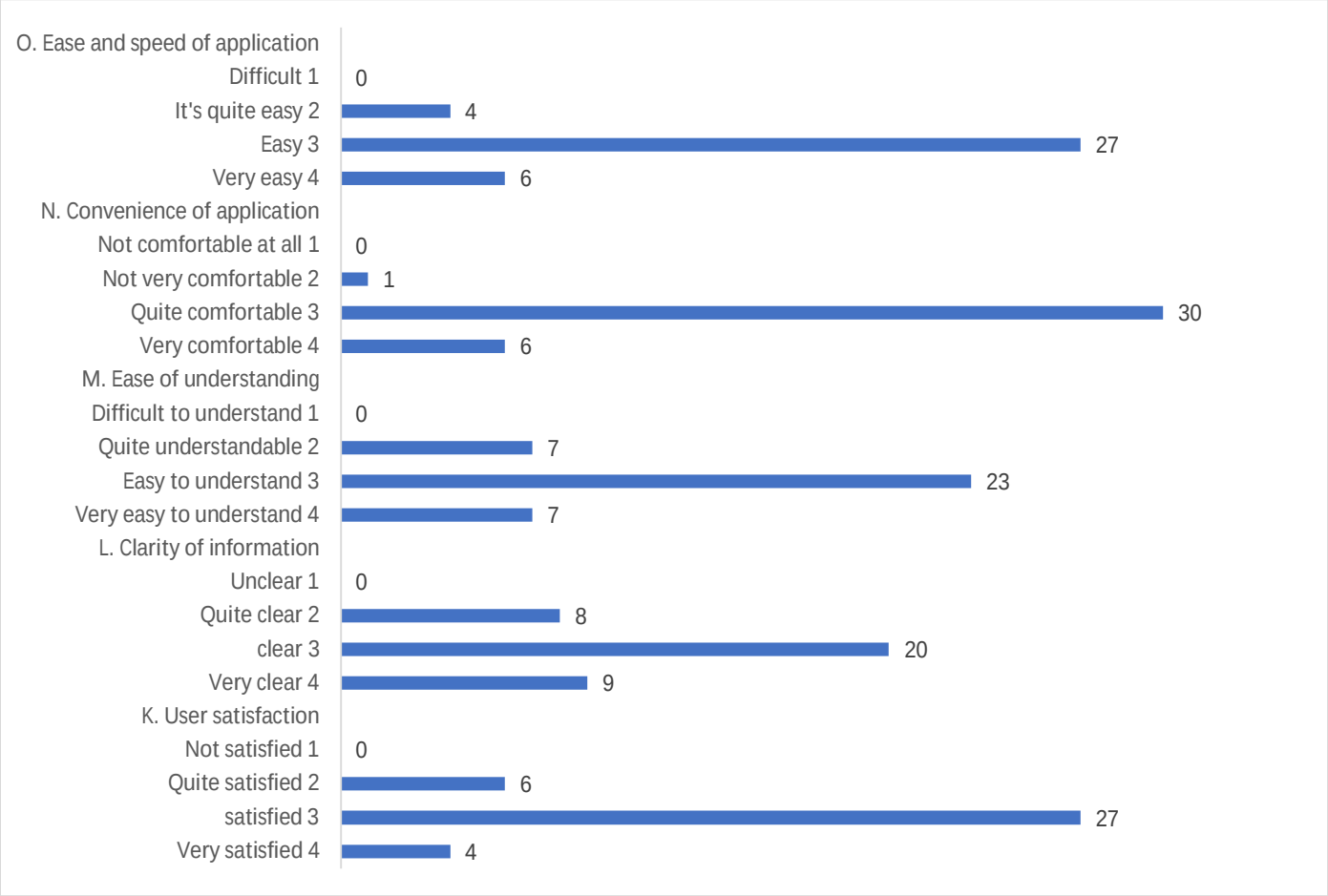

Figure 5. User experience

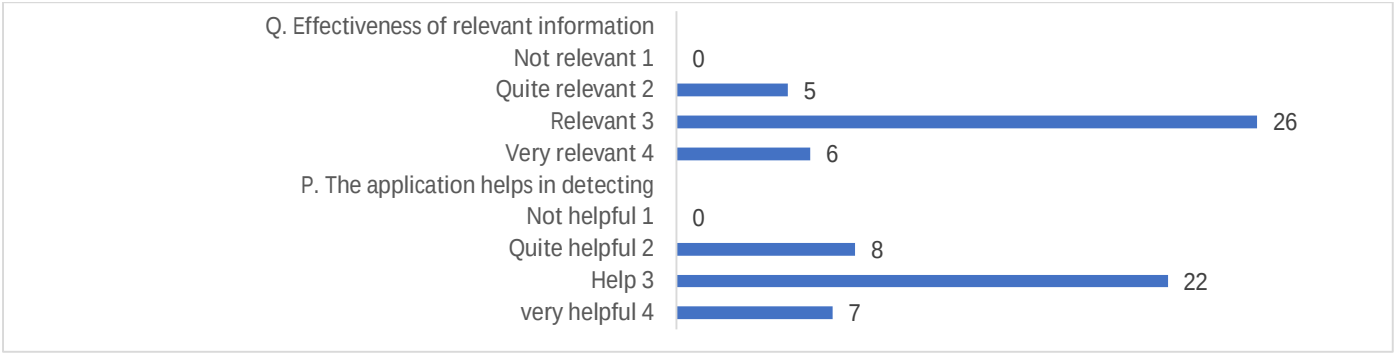

Figure 6. System effectiveness

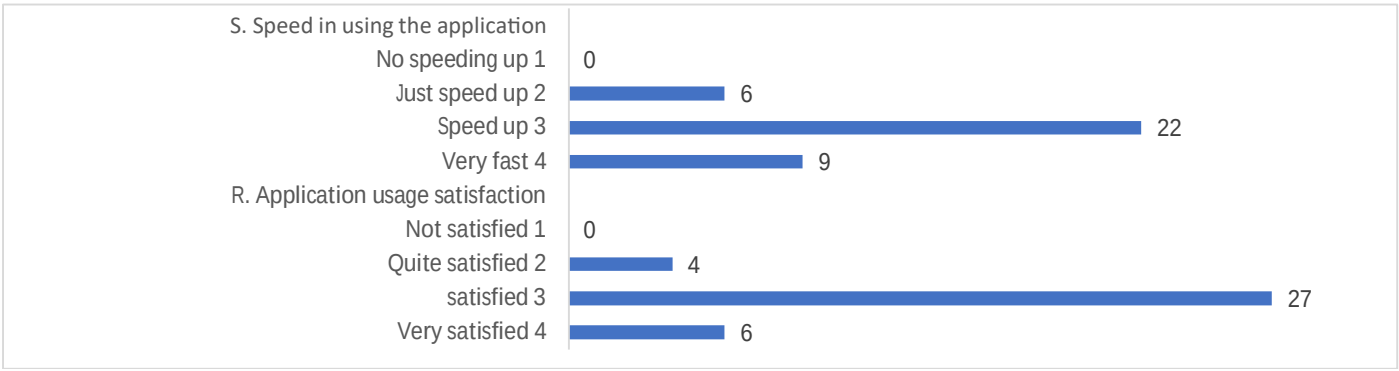

Figure 7. User satisfaction and overall experience

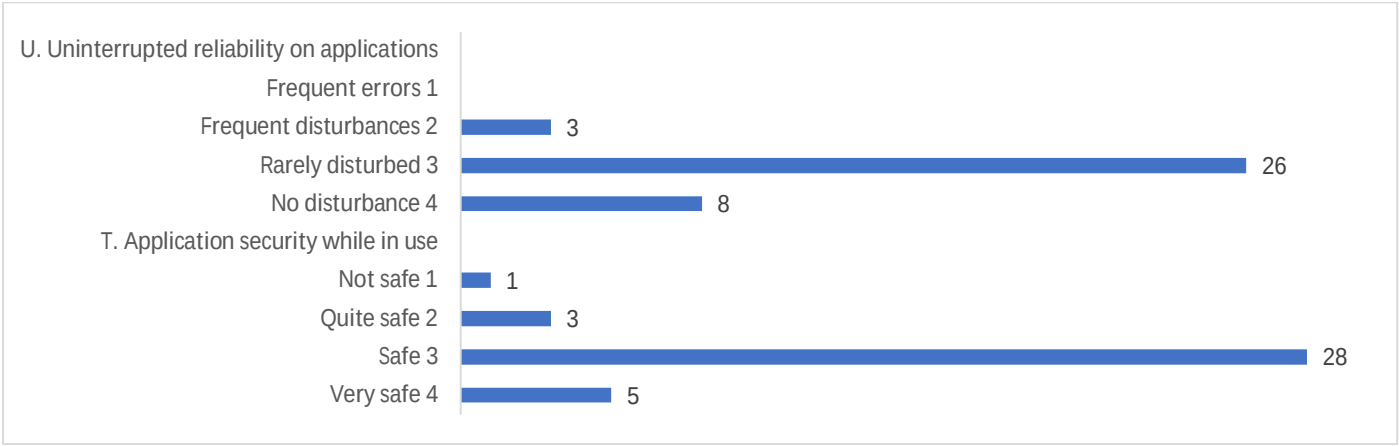

Figure 8. Application reliability and security

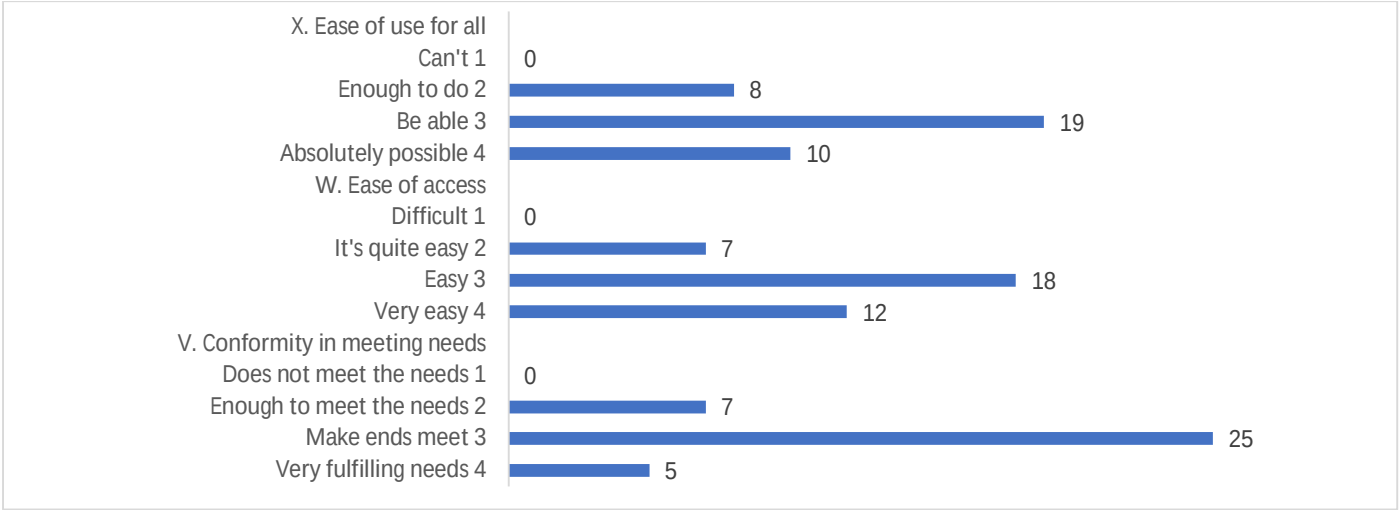

Figure 9. Compliance with user needs

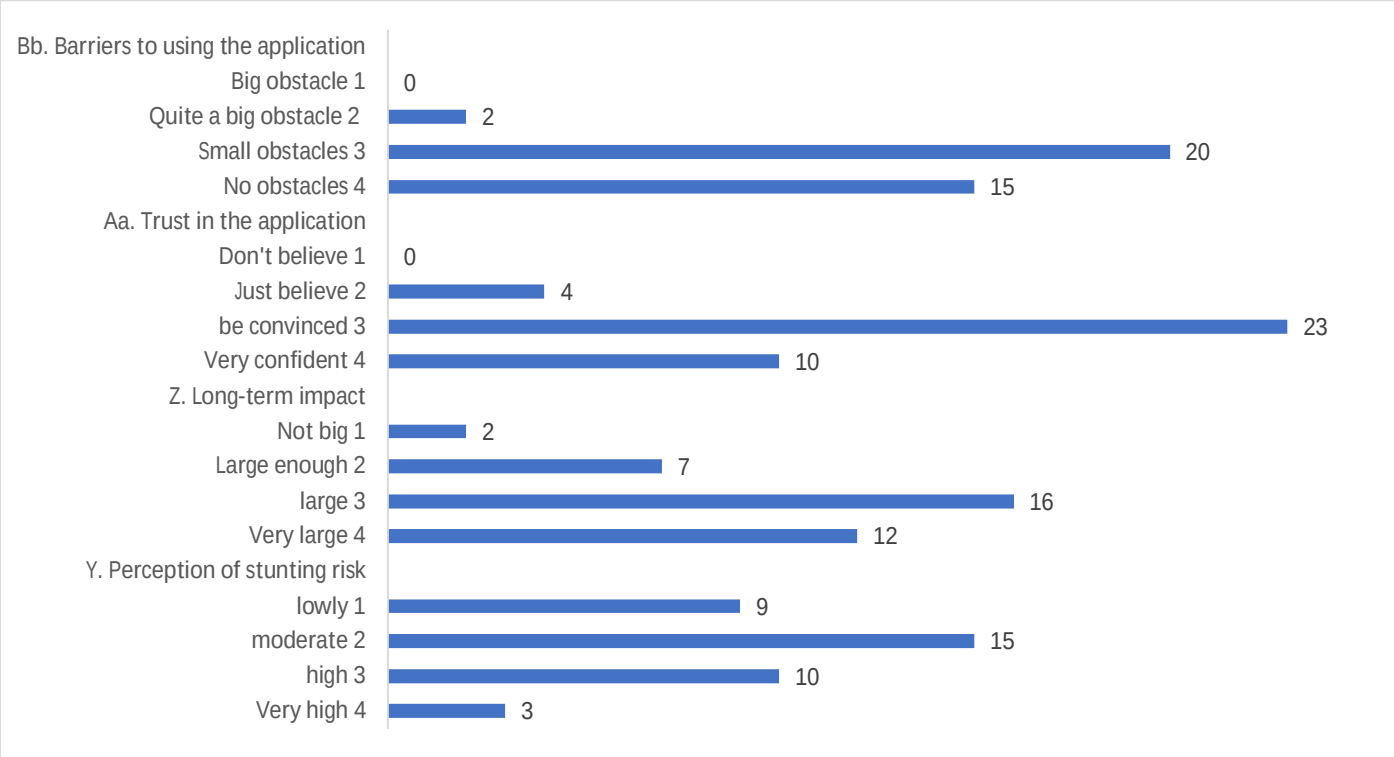

Figure 10. Perception of risk and benefits

Figure 11. Motivation for using the application

Based on the analysis of Figures 1–11, the indicators show that the visualisation of the usage and impact of Figures 1–4 demonstrates the positive impact of the application's users on efficiency, the benefits of the technology, as well as data quality and ease of access via the system. The experience and effectiveness shown in Figures 5–8 indicate a positive user experience, the system's operational effectiveness, user satisfaction, and the reliability and data security guaranteed by the application. The perceptions and motivation shown in Figures 9–11 represent the suitability of the application's features to users' actual needs, the balance between perceived risks and benefits, and the high level of motivation among respondents to continue adopting this application for nutritional monitoring.

Based on the data presented in Table 1, it can be concluded that respondents' assessments of the stunting detection and management application show a consistently positive trend across all key indicators. Regarding the accuracy indicator, the majority of respondents provided positive feedback, with 63.9% (23 people) rating it as 'accurate' and 27.8% (10 people) rating it as 'very accurate'. With an average score of 3.05, it is evident that the system is highly reliable in calculating the nutritional status of infants based on anthropometric data inputs. Furthermore, the usability indicator recorded the highest average score of 3.28. A total of 44.4% of respondents rated the application as 'very easy' to operate, while 38.9% rated it as 'easy'. This high score indicates that the application's user interface (UI) and navigation have been intuitively designed, thereby minimising technical barriers for users in the field. Regarding the utility, the research findings suggest that this application contributes to simple clinical decision-making processes. Half of the repondents (50%) found it 'helpful' and 38.9% found it 'very helpful'. An average score of 3.25 suggests that users consider the treatment recommendations provided by the application to be relevant and applicable as an initial course of action. Finally, regarding reliability, an average score of 3.16 was obtained. The majority of respondents (63.9%) stated that they trust the output generated by the app. A key finding of this study is that none of the respondents (0%) stated that they did not trust the results. This confirms that this machine learning–based stunting detection app is viewed as a credible digital tool to support programmes aimed at reducing stunting rates and has an excellent level of acceptance.

Table 1. Respondents' assessment of the stunting detection app (n=37)

Assessment indicator	Answer category	Frequency	Percentage	Average score	Interpretation
Accuracy	Very accurate (4) Accurate (3) Quite accurate (2) Inaccurate (1)	10 23 3 0	27.8 63.9 8.3 0	3.05	Accurate
Usability	Very easy (4) Easy (3) Quite easy (2) Hard (1)	16 14 6 0	44.4 38.9 16.7 0	3.28	Very easy
Utility	Very helpful (4) Helpful (3) Quite helpful (2) Not helpful (1)	14 18 4 0	38.9 50.0 11.1 0	3.25	Helpful
Reliability	Highly reliable (4) Reliable (3) Quite reliable (2) Unreliable (1)	10 23 3 0	27.8 63.9 8.3 0	3.16	Reliable

DISCUSSION

One way of interpreting stunting is through data derived from height-for-age anthropometric measurements taken by healthcare workers. The WHO promotes an online system that facilitates the analysis of children's anthropometric data. The WHO Anthro Survey Analyser aims to encourage best practice in collecting, analysing and reporting anthropometric data [10]. This WHO software comprises three components: an anthropometric calculator, an individual assessment tool, and a nutrition survey tool. Although Indonesia has adopted anthropometric standards and nutritional status measurement outcomes based on WHO guidelines, these are still recorded manually in the MCH handbook [1]. In light of this, an Android application based on machine learning has been developed to simplify and supplement content related to anthropometry, adopting the WHO application; particularly with regard to anthropometry with a primary focus on nutritional status in cases of stunting.

Machine learning (ML) is a branch of artificial intelligence which uses valid data to enable accurate and rapid decision-making and problem-solving [11]. Research findings support the effectiveness of this anthropometry-based machine learning approach in detecting stunting in children [12]. This study applied ML methods by beginning with the input of baseline data from two regions; Central Java (Banyumas) and the Special Region of Yogyakarta regarding factors that may contribute to stunting. This was followed by data collection and processing. The machine learning algorithm system was developed using the WHO's system for interpreting anthropometric data and was supplemented with appropriate interventions based on the MCH handbook, ensuring suitable efforts to prevent stunting. Random forest and neural network algorithms were used for multivariate analysis, as the data is quite complex. System testing utilised a testing framework for Android applications, while the validation of ML model results was carried out manually by healthcare workers. The next stage involves implementation and pilot testing to analyse the accuracy of the predictions and users' acceptance of the application.

The results of this study indicate that the Android-based stunting detection and management application utilising a machine learning approach received a very positive overall response from all 36 respondents. Based on all evaluation criteria, the application achieved an average score above 3.00 (out of 4). These key findings suggest that the system developed has met user expectations in terms of functionality and information accuracy. The dominance of responses in the 'accurate' (63.9%) and 'easy' (44.4%) categories demonstrates that the application successfully addresses the main challenge of the early detection of stunting: the need for a precise yet simple-to-operate screening tool. This high level of acceptance suggests that the digitisation of anthropometric procedures is viewed not only as a technical aid, but also as a credible instrument for monitoring the nutritional status of infants. Other research findings also suggest that machine learning-based applications offer excellent system, information, and service quality, providing a benefit score of 98% [13]. This supports the view that this ML-based Android application greatly facilitates user experience, with the system achieving a high score for its results..

Regarding the usefulness of the intervention, the study results show that this application makes a significant contribution to the simple clinical decision-making process. Fifty percent of respondents found it "helpful." An average score of 3.25 indicates that the treatment recommendation feature provided by the application is considered relevant and can be applied by users as an initial treatment step. Finally, regarding the aspect of public trust, an average score of 3.16 was obtained. The majority of respondents (63.9%) stated that they "trust" the output produced by the application. This confirms that this machine learning-based stunting detection application has a very good level of acceptance and is seen as a credible digital tool to support the stunting reduction program. The study also stated that the development of machine learning models is very useful and relevant for predicting whether a child will experience stunting or not in the future [13]. This condition is supported by research that with the existence of machine learning-based applications, the public can use them without time or space constraints [14].

The application plays an important role in supporting stunting prevention efforts because it provides users with accurate assessments and context-appropriate solutions. Digital precision has become increasingly attainable in anthropometric evaluation, particularly in the calculation and interpretation of Z-scores. The World Health Organization has long introduced digital tools for anthropometric analysis, demonstrating how modernization can substantially reduce human error in manual measurement and interpretation processes [14]. In this context, technology serves not only as a computational aid but also as a catalyst for improving early detection, enhancing real-time monitoring, and expanding public access to nutrition education through interactive digital platforms [15–21]. The findings of this study further emphasize the high utility of the Smart Stunting application, especially its ability to provide intervention recommendations aligned with the MCH handbook. This feature is crucial because, for the general public and community health workers, identifying a child as "stunted" is insufficient without clear guidance on appropriate follow-up actions, such as referral pathways or nutritional improvement strategies. By offering structured recommendations, the application strengthens decision-making at the community level and functions as an accessible digital health education medium (m-Health). Its role in bridging information gaps highlights the potential of digital innovations to support both preventive efforts and community empowerment in addressing stunting.

CONCLUSION

The Android-based stunting detection and management application was well received and viewed as highly effective by users. They reported that the system successfully modernizes conventional stunting assessment into a faster and more intuitive digital process while reducing the likelihood of human error. The inclusion of intervention recommendations was considered particularly valuable, as it strengthens preparedness for addressing nutritional problems at both family and community levels. This m-Health innovation enhances the efficiency of early detection compared with manual methods and holds strong potential to support national efforts to accelerate stunting reduction. The application can also assist families in monitoring children's growth trends over time. Future studies are encouraged to evaluate the application in larger and more diverse populations, especially in frontier, outermost, and underdeveloped regions where access to healthcare personnel is limited, to further assess its performance stability.

Ethical consideration, competing interest and source of funding

-All research procedures adhered to ethical standards for studies involving human participants. Ethical approval was obtained from the Health Research Ethics Committee (KEPK) of Panti Rapih Hospital Yogyakarta, with approval number 177/SKEPK-KKE/VII/2025. Participation was voluntary, and respondents were informed about the study objectives, procedures, and confidentiality measures. Informed consent was obtained prior to data collection.
-There is no conflict of interest related to this publication.
-This research was funded by Sekolah Tinggi Ilmu Kesehatan Panti Rapih Yogyakarta and Sekolah Tinggi Ilmu Komputer Yos Sudarso through their internal grant programs.

REFERENCES

1. Sayomi BA, Alabi AO, Onigbinde MO, Oladibu OT. Height as a key growth index in the paediatric age group: A comprehensive review. Asian Journal of Pediatric Research. 2025 Oct 27;15(11):11-20.
2. Wells JC, Marphatia AA, Amable G, Siervo M, Friis H, Miranda JJ, Haisma HH, Raubenheimer D. The future of human malnutrition: rebalancing agency for better nutritional health. Globalization and Health. 2021 Oct 9;17(1):119.
3. Wells JC, Sawaya AL, Wibaek R, Mwangome M, Poullas MS, Yajnik CS, Demaio A. The double burden of malnutrition: aetiological pathways and consequences for health. The Lancet. 2020 Jan 4;395(10217):75-88.
4. WHO. Prevalence of stunting in children under 5 (%). Geneva: World Health Organization; 2024.
5. Republik Indonesia. Strategi nasional percepatan pencegahan dan penurunan stunting 2025–2029. Jakarta: Republik Indonesia; 2024.
6. DP3AP2KB. Pemkot Yogya targetkan prevalensi stunting kurang dari 10 persen. Yogyakarta: Pemerintah Kota Yogyakarta; 2024.
7. Shekar M, Kakietek J, D'Alimonte MR, Rogers HE, Eberwein JD, Akuoku JK, Pereira A, Soe-Lin S, Hecht R. Reaching the global target to reduce stunting: an investment framework. Health Policy and Planning. 2017 Jun 1;32(5):657-68.
8. Jezue EM, Silitonga HTH, Rambung E. ASI eksklusif, status imunisasi dan kejadian stunting di Indonesia: studi literatur. Prominentia Medical Journal. 2021 Jul 19;2(1):72-78.
9. Indriana NP, Dewi IA, Darmayanti PA. Prediksi stunting berbasis machine learning melalui CERDIS: Cepat Resposif Deteksi Dini Stunting. J-REMI: Jurnal Rekam Medik dan Informasi Kesehatan. 2025 Dec 21;7(1):60-72.
10. WHO. WHO anthro survey analyser and other tools. Geneva: World Health Organization; 2019.
11. Nozari H, Sadeghi ME. Artificial intelligence and machine learning for real-world problems (a survey). International Journal of Innovation in Engineering. 2021 Oct 7;1(3):38-47.
12. Ratnasari R, Wahidin AJ, Andika TH. Deteksi dini stunting pada anak berdasarkan indikator antropometri dengan menggunakan algoritma machine learning. Jurnal Algoritma. 2024 Dec 30;21(2):378–87.
13. Arqam ML, Firdaus AA, Atmojo AM, Saputri GZ, Furizal, Palahuddin, et al. Integrating education-based interventions and machine learning for stunting prevention: a case study in East Lombok, Indonesia. Dialogues in Health. 2026 Jun 1;8(1):100264.
14. Rambe NL, Sebayang W. Aplikasi balita sehat terhadap keterampilan ibu terkait tumbuh kembang. Jurnal Kesehatan. 2021 Jan 18;11(3):341-8.
15. Coman LI, Ianculescu M, Paraschiv EA, Alexandru A, Bădărău IA. Smart solutions for diet-related disease management: connected care, remote health monitoring systems, and integrated insights for advanced evaluation. Applied Sciences. 2024 Mar 11;14(6):2351.
16. Abeltino A, Riente A, Bianchetti G, Serantoni C, De Spirito M, Capezzone S, Esposito R, Maulucci G. Digital applications for diet monitoring, planning, and precision nutrition for citizens and professionals: a state of the art. Nutrition Reviews. 2025 Feb;83(2):e574-601.
17. Başar HB, Bilici S. Does Technology Affect Nutrition Education Perspectives?. Artuklu International Journal of Health Sciences. 2023;3(3):335-42.
18. Tushir S, Aggarwal N, Sehrawat H, Yasmin S. Empowering nutrition and diet of elderly people using digital technology. Artificial Intelligence in Healthcare for the Elderly. 2025 Nov 15:251-80.
19. Aidoo EM. Advancing precision medicine and health education for chronic disease prevention in vulnerable maternal and child populations. World Journal of Advanced Research and Reviews. 2025;25(2):2355-76.
20. Limketkai BN, Mauldin K, Manitius N, Jalilian L, Salonen BR. The age of artificial intelligence: use of digital technology in clinical nutrition. Current Surgery Reports. 2021 Jun 8;9(7):20-8.
21. Kratzke C, Cox C. Smartphone technology and apps: rapidly changing health promotion. Global Journal of Health Education and Promotion. 2012;15(1):122-8.

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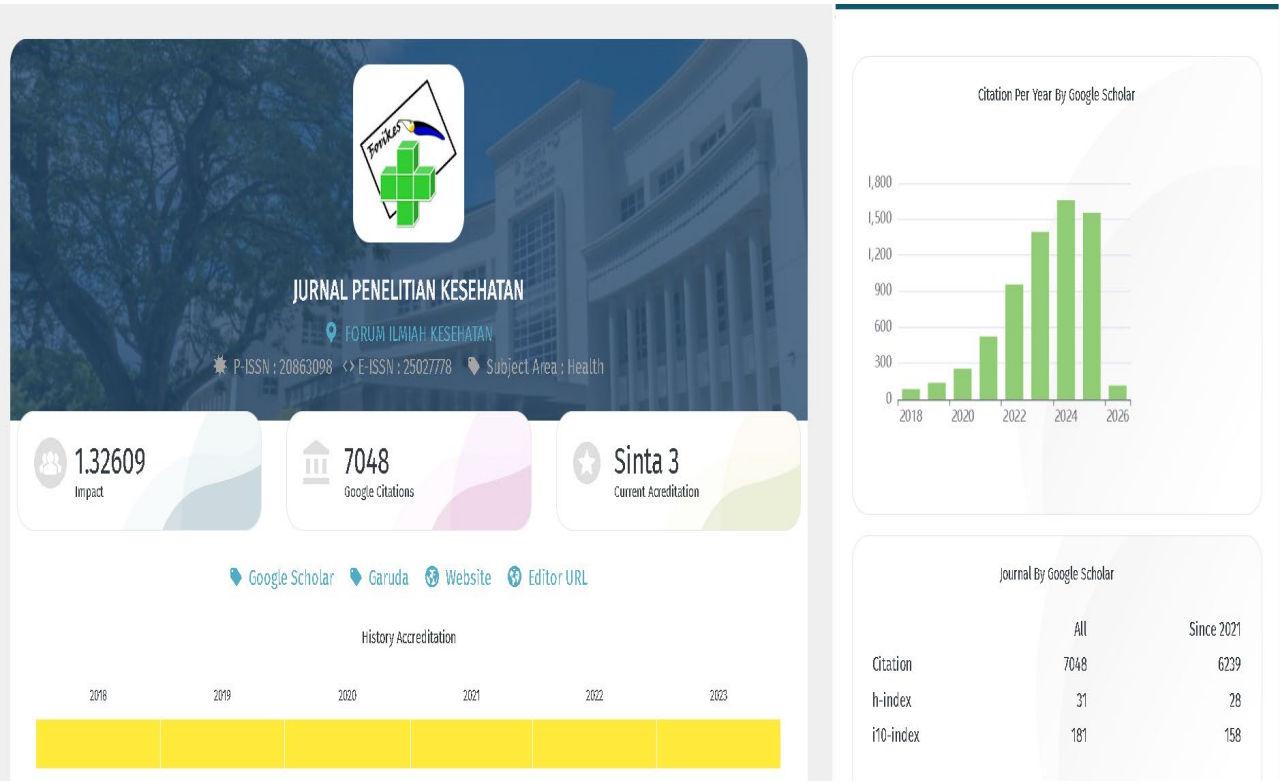

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Love that Renews

SURAT TUGAS

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Pimpinan STIKes Panti Rapih Yogyakarta, dengan ini memberikan tugas kepada Saudara:

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1. Ns. Riski Wulandari, M.Kep., Sp.Kep.M	0508039202	Dosen Prodi Pendidikan Profesi Ners Program Profesi
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Sehubungan dengan salah satu tugas dosen adalah melakukan publikasi ilmiah, maka dengan ini STIKes Panti Rapih Yogyakarta memberikan tugas pada Dosen tersebut untuk melakukan Publikasi Ilmiah pada Semester Genap Tahun Akademik 2025/2026.

Surat tugas ini berlaku mulai tanggal **02 Maret - 25 Agustus 2026** dan untuk dipergunakan sebagaimana mestinya.

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Ketua,

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Feasibility Analysis of Machine Learning-Based Smart Stunting Application

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ABSTRACT
Stunting is a chronic nutritional condition that requires rapid and accurate early detection. Conventional assessment methods that rely on the Indonesian Maternal and Child Health (MCH) handbook; commonly referred to as the MCH handbook or manual anthropometric tables often face challenges related to efficiency and susceptibility to human error. The digitization of anthropometric assessment through an Android-based application offers a promising solution for automating the evaluation of toddlers' nutritional status. This study aimed to examine the perceived benefits and user acceptance of a machine learning–based Android application designed for stunting detection and management. A descriptive quantitative design was employed. Consecutive sampling was used to recruit individuals who met the inclusion criteria, including the ability to operate the designated Android system, resulting in a sample of 37 respondents. Data were collected using a structured questionnaire with a 1–4 Likert scale. Descriptive statistics were applied to generate frequency distributions, percentages, and mean scores for the indicators of accuracy, usability, utility, and reliability. Findings indicate a high level of user acceptance. Usability received the highest mean score (3.28), followed by utility (3.25) and reliability (3.16). A total of 91.7% of respondents rated the prediction system as accurate, with an average accuracy score of 3.05. Respondents also reported that the application was substantially more efficient and faster than manual assessment methods. In conclusion, the machine learning–based stunting detection application effectively supports users in identifying stunting risk quickly and accurately. Its ease of use and strong perceived validity make it a practical tool for both healthcare workers and the general public, contributing to efforts to accelerate stunting reduction.
Keywords: anthropometry; Android-based application; machine learning; stunting

INTRODUCTION
Stunting is a form of chronic growth impairment in which a child's height falls significantly below the expected standard for their age, reflecting long-term nutritional deprivation and recurrent illness. A toddler is classified as short when their length-for-age (LFA) or height-for-age (HFA) Z-score is less than –2 SD (stunted) or less than –3 SD (severely stunted). These Z-scores are derived from standardized anthropometric measurements, which serve as essential indicators for evaluating body size, proportions, and composition. Length-for-age and height-for-age indices are widely used to categorize children as very short, short, normal, or tall, and they remain the cornerstone of child growth monitoring systems worldwide [1]. In Indonesia, stunting continues to be a major public health concern, largely driven by chronic malnutrition during the first 1,000 days of life; a critical developmental window that determines long-term health outcomes. Chronic malnutrition has persisted as one of the most pressing challenges in the national health sector, affecting not only individual well-being but also broader socioeconomic development [2,3].

Global trends indicate gradual progress in reducing stunting. According to the World Health Organization (WHO), the global prevalence of stunting declined by 22.3% between 1990 and 2022, reaching 17.9% in 2022 [4]. Indonesia has also demonstrated significant improvement, with prevalence decreasing from 30.8% in 2018 to 21.5% in 2023 [5]. At the regional level, Yogyakarta City reported a stunting prevalence of 10.6% as of 30 July 2024, showing improvement from 11.8% in 2023 [6]. Despite these positive trends, stunting remains a priority issue within national and global health agendas. It is included as a key indicator in the Sustainable Development Goals (SDGs), with a global target of achieving a 40% reduction in stunting among children under five by 2025 [7]. The persistence of stunting, even amid declining prevalence, underscores the need for sustained, innovative, and evidence-based strategies to accelerate progress.

The consequences of stunting extend far beyond impaired physical growth. Children who experience stunting are at increased risk of delayed cognitive development, reduced school performance, lower future productivity, and diminished quality of life. These long-term impacts highlight the importance of early identification and timely intervention. Effective stunting prevention requires an integrated approach grounded in accurate, reliable, and accessible data [8]. Early detection plays a pivotal role in this process, enabling health workers and caregivers to identify at-risk children before growth faltering becomes irreversible. However, current early detection efforts often encounter substantial barriers. Manual anthropometric assessments using the Maternal and Child Health (MCH) handbook or printed growth charts are time-consuming, prone to human error, and dependent on the availability of trained personnel. In many settings, limited human resources, inconsistent measurement practices, and restricted access to digital health tools hinder the efficiency and accuracy of stunting detection.

Advancements in digital health technologies offer promising opportunities to address these challenges. Machine learning-based detection systems integrated into smartphone applications can enhance the precision, speed, and accessibility of anthropometric assessments. By automating the interpretation of growth data, such systems reduce reliance on manual calculations and minimize the risk of misclassification. Moreover, smartphone-based applications can facilitate broader community engagement, allowing caregivers and health workers to access reliable information and recommendations directly from their devices. These innovations support the development of data-driven policies and strengthen the capacity of health systems to respond to stunting more effectively [9]. As digital transformation accelerates within the health sector, ensuring that new technologies are both beneficial and acceptable to users becomes increasingly important.

Therefore, this study aimed to evaluate the perceived benefits and user acceptance of a machine learning–based Android application designed for stunting detection and management, focusing on its accuracy, usability, utility, and reliability from the user perspective.

METHODS
This study was conducted in 2025 in Yogyakarta, Indonesia, where the Smart Stunting application was tested among community members and individuals familiar with Android-based devices. The feasibility assessment was carried out in collaboration with the Sekolah Tinggi Ilmu Kesehatan Panti Rapih Yogyakarta and supported by field implementation activities within the local community setting. A quantitative research

design with a descriptive analytical approach was employed. This design was selected to provide a systematic and comprehensive overview of user perceptions related to the accuracy, usability, utility, and reliability of the machine learning–based Smart Stunting application. The study did not involve hypothesis testing; instead, it focused on describing response patterns and feasibility indicators derived from user experiences.

The feasibility test involved human participants selected through a consecutive sampling technique. Individuals were recruited based on predetermined inclusion criteria: 1) owning and being able to operate an Android device; 2) willingness to download, install, and use the Smart Stunting application; 3) willingness to participate as respondents; and 4) willingness to complete the structured questionnaire. Exclusion criteria included respondents who experienced technical difficulties related to device incompatibility, particularly unsupported Android versions. After applying these criteria, a total of 37 respondents were included in the final analysis.

Data were collected using a structured questionnaire consisting of 30 items distributed across 11 sections and grouped into four assessment domains: accuracy, usability, utility, and reliability. All items were measured using a 1–4 Likert scale, where higher scores indicated more positive perceptions. The instrument had previously undergone validity and reliability testing and was confirmed to be appropriate for feasibility assessment. The research process comprised several sequential stages: 1) initial data collection and processing using the machine learning model output embedded in the Smart Stunting application; 2) selection and evaluation of the machine learning algorithm used for prediction; 3) system testing to ensure functional stability; and 4) feasibility testing through user interaction with the application followed by questionnaire completion. Respondents were guided to install the application, input anthropometric data, and observe the prediction results before completing the questionnaire.

Collected data were analyzed descriptively using frequency distributions, percentages, and mean scores for each indicator. These descriptive statistics were used to identify response tendencies and categorize user perceptions. Interpretation of results was supported by a score-interval table, enabling accurate identification of achievement levels for each domain. This analytical approach provided strong baseline evidence for evaluating the feasibility and acceptance of the machine learning–based application.

RESULTS

The results of this study present an overview of the results of the feasibility analysis and a summary of the feasibility analysis table from the results of data collection on 37 respondents as follows (Figure 1-11).

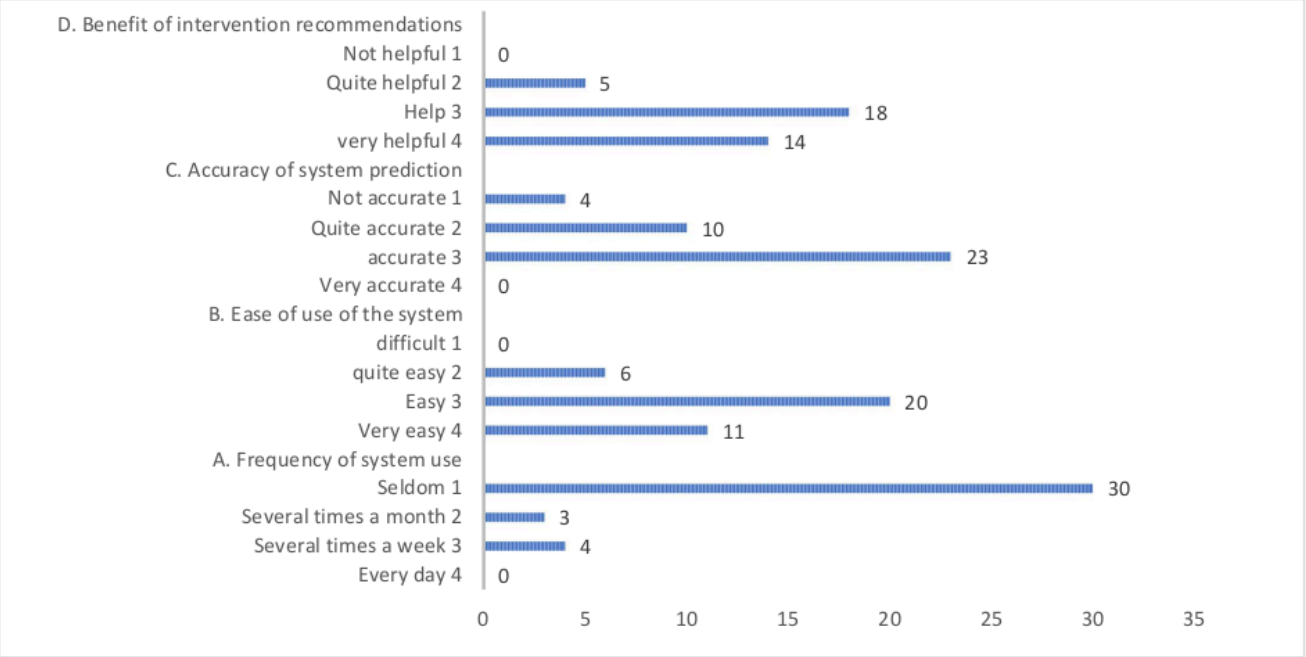

Figure 1. System usage

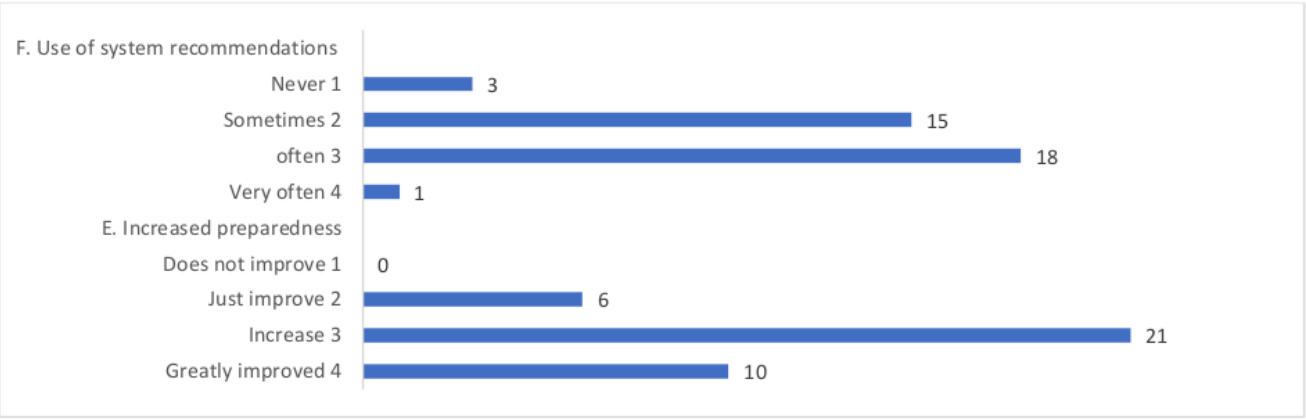

Figure 2. Impact of application use

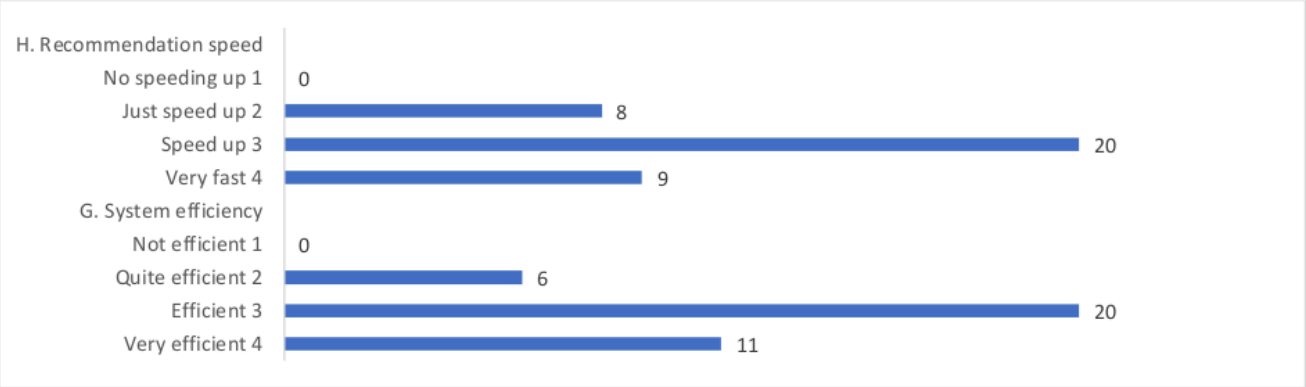

Figure 3. Benefits of technology

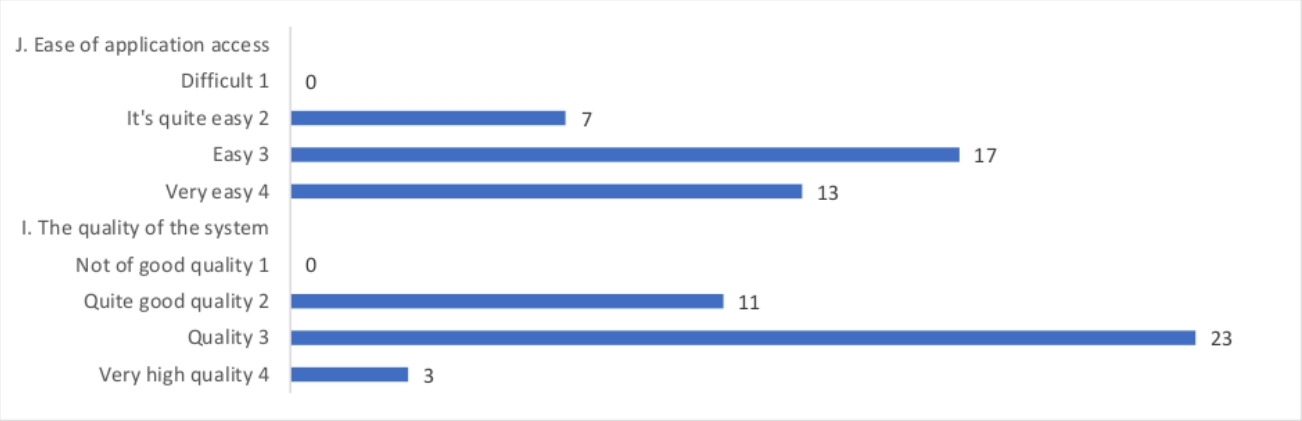

Figure 4. Data quality and access

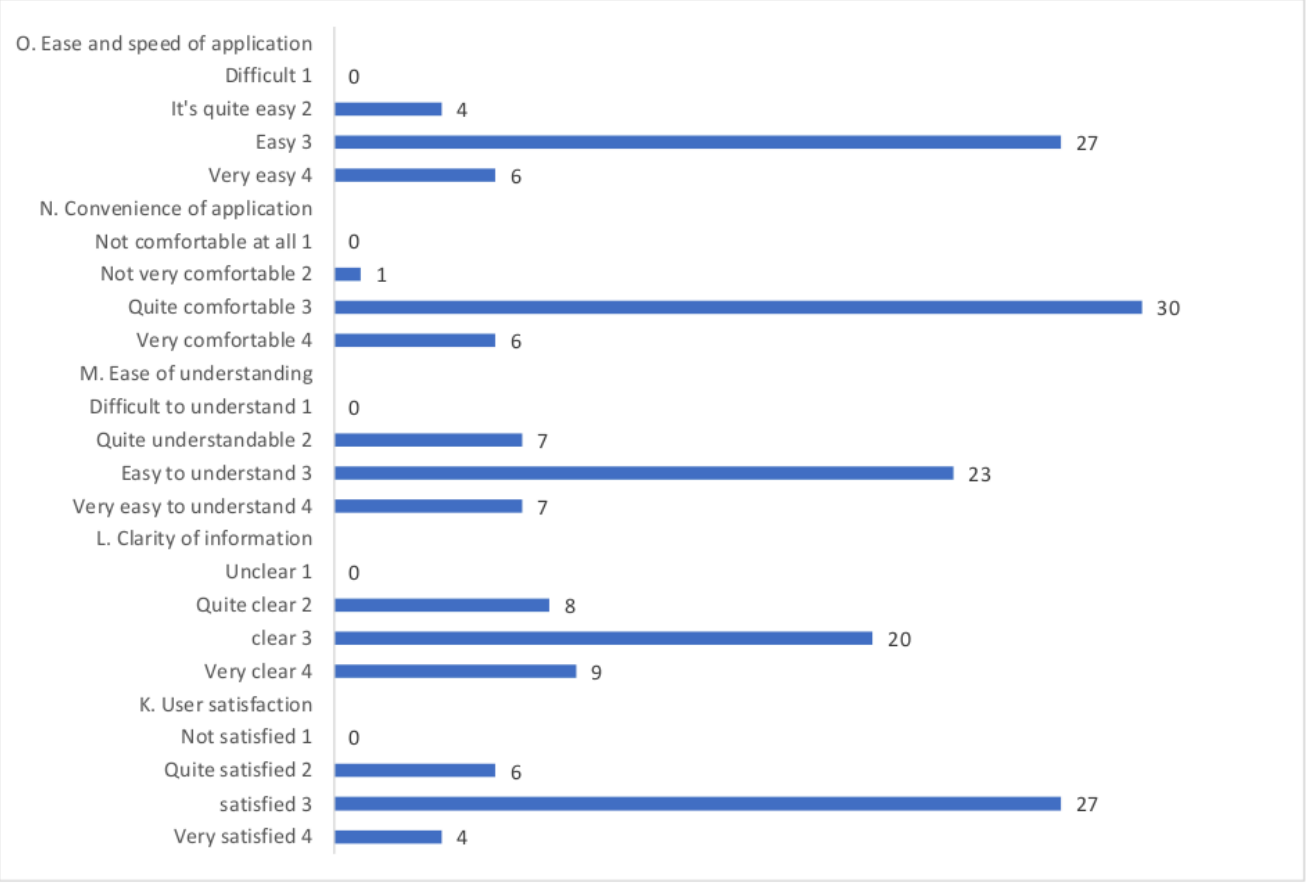

Figure 5. User experience

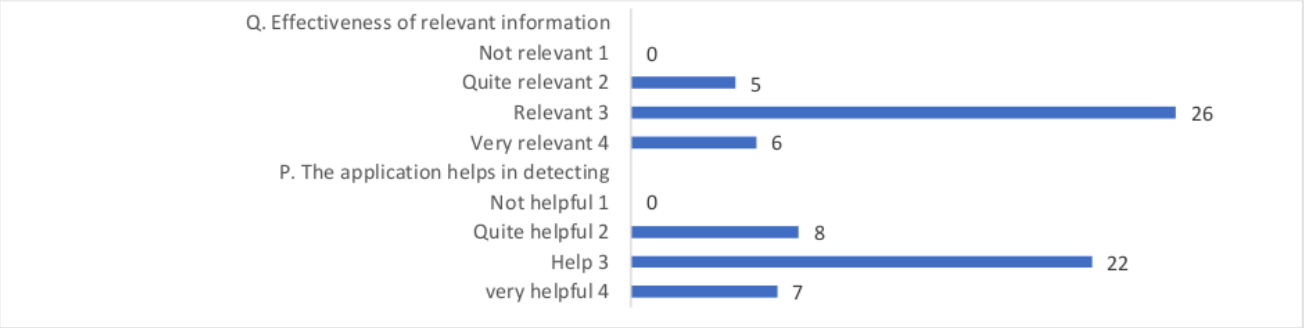

Figure 6. System effectiveness

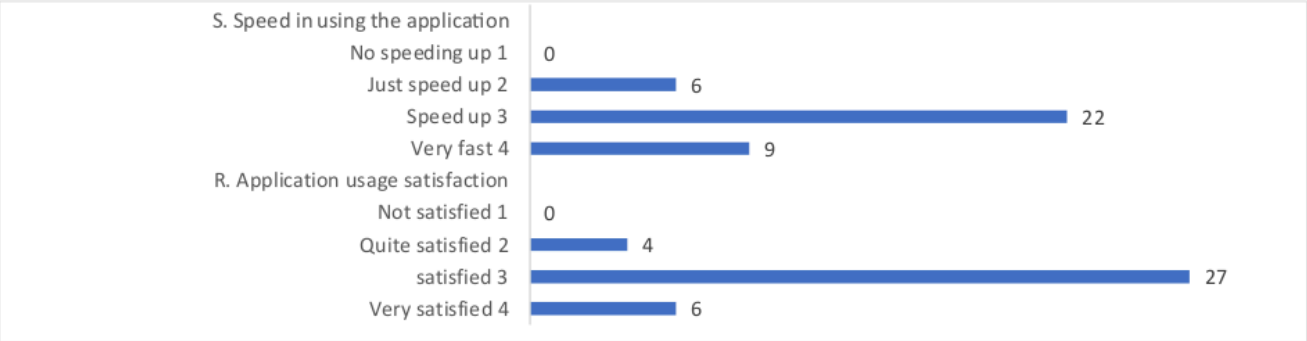

Figure 7. User satisfaction and overall experience

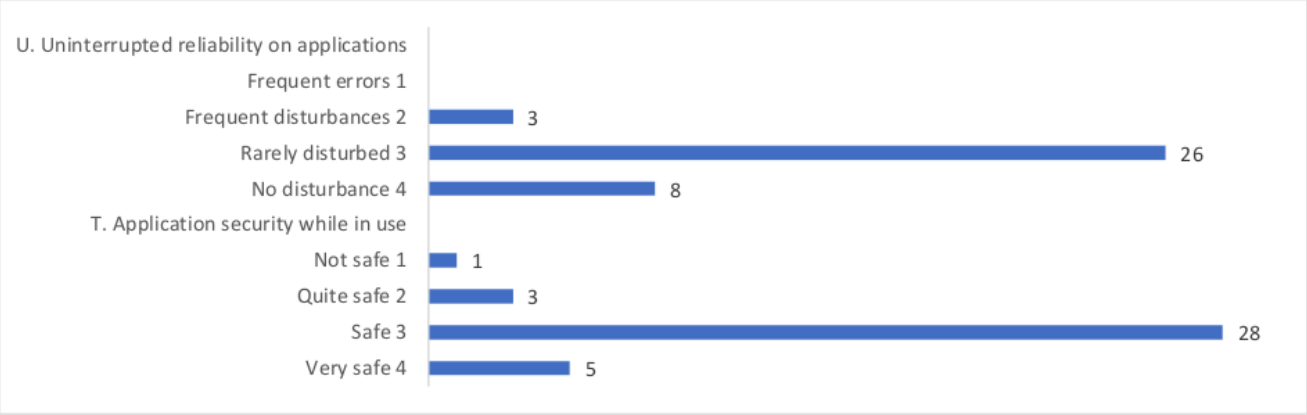

Figure 8. Application reliability and security

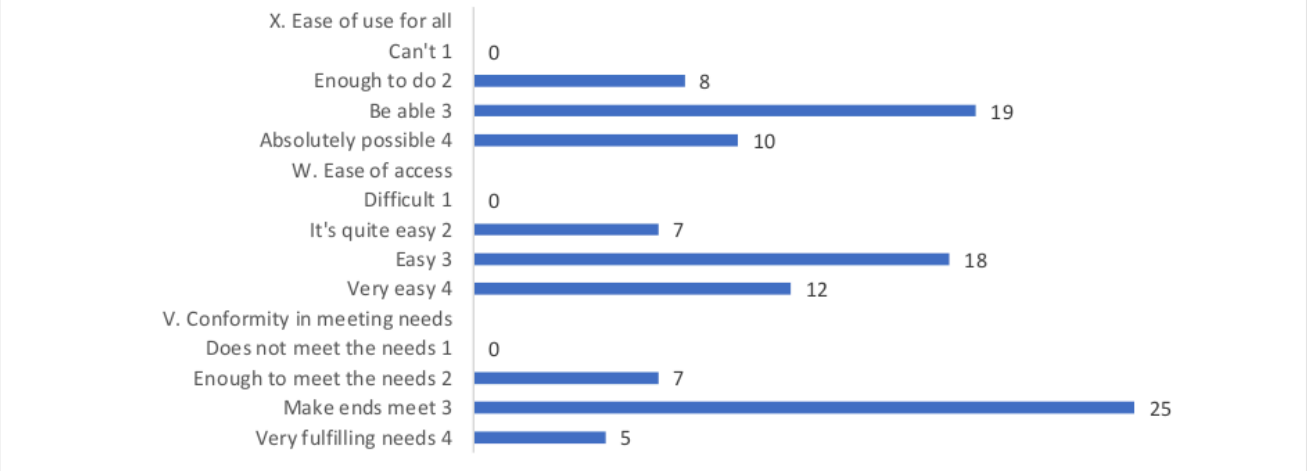

Figure 9. Compliance with user needs

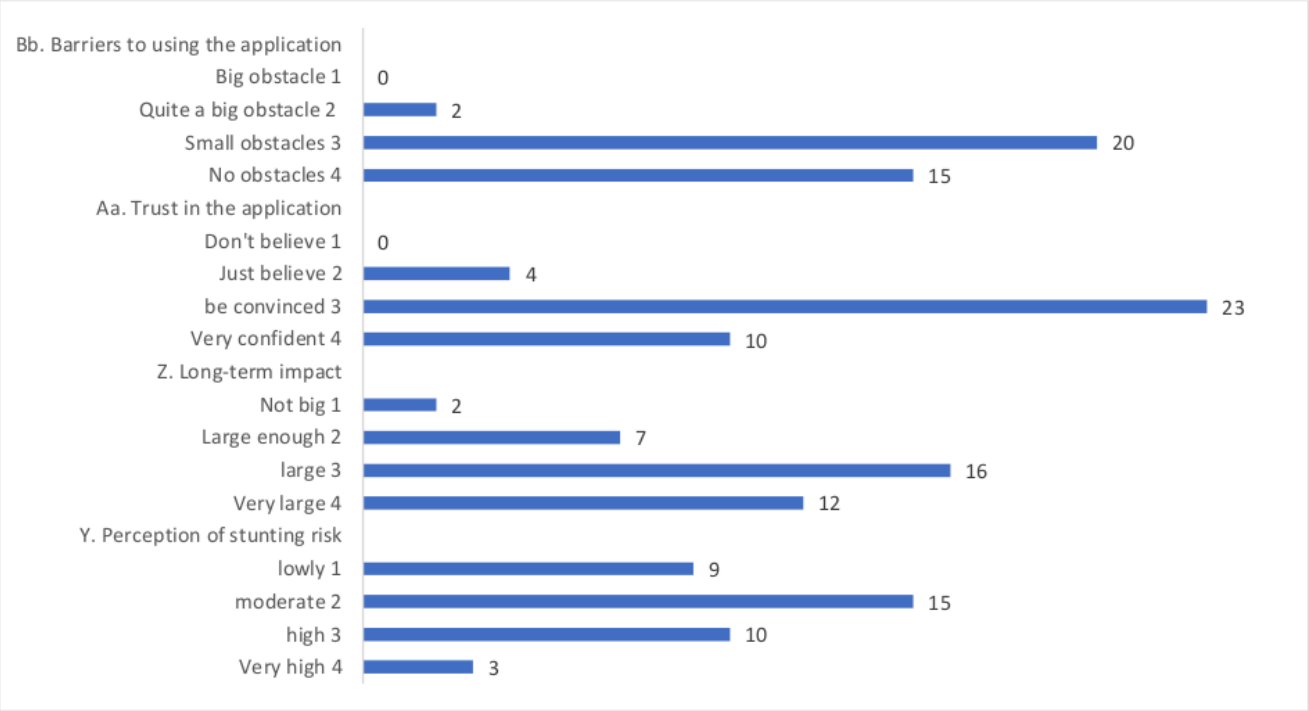

Figure 10. Perception of risk and benefits

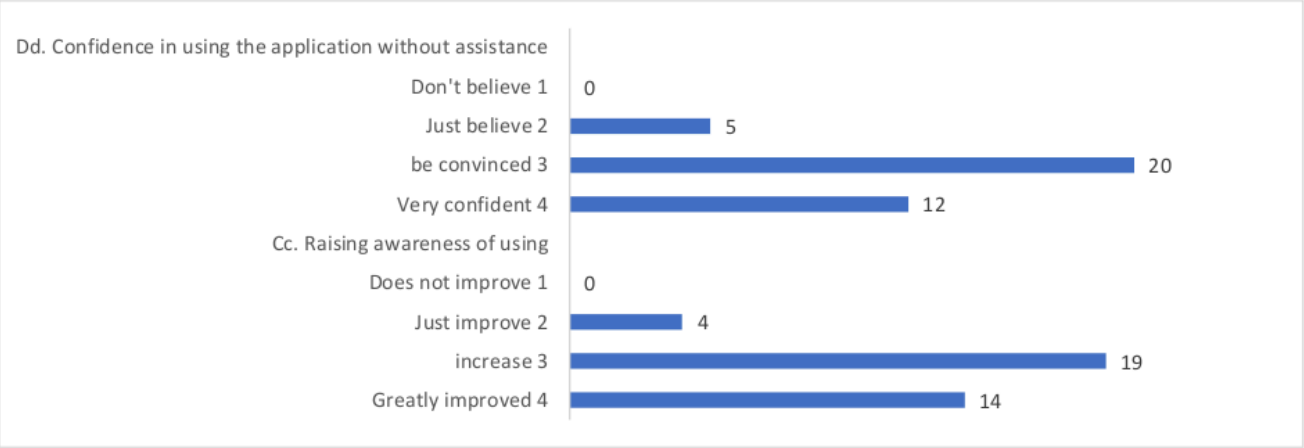

Figure 11. Motivation for using the application

Based on the analysis of Figures 1–11, the indicators show that the visualisation of the usage and impact of Figures 1–4 demonstrates the positive impact of the application's users on efficiency, the benefits of the technology, as well as data quality and ease of access via the system. The experience and effectiveness shown in Figures 5–8 indicate a positive user experience, the system's operational effectiveness, user satisfaction, and the reliability and data security guaranteed by the application. The perceptions and motivation shown in Figures 9–11 represent the suitability of the application's features to users' actual needs, the balance between perceived risks and benefits, and the high level of motivation among respondents to continue adopting this application for nutritional monitoring.

Based on the data presented in Table 1, it can be concluded that respondents' assessments of the stunting detection and management application show a consistently positive trend across all key indicators. Regarding the accuracy indicator, the majority of respondents provided positive feedback, with 63.9% (23 people) rating it as 'accurate' and 27.8% (10 people) rating it as 'very accurate'. With an average score of 3.05, it is evident that the system is highly reliable in calculating the nutritional status of infants based on anthropometric data inputs. Furthermore, the usability indicator recorded the highest average score of 3.28. A total of 44.4% of respondents rated the application as 'very easy' to operate, while 38.9% rated it as 'easy'. This high score indicates that the application's user interface (UI) and navigation have been intuitively designed, thereby minimising technical barriers for users in the field. Regarding the utility, the research findings suggest that this application contributes to simple clinical decision-making processes. Half of the repondents (50%) found it 'helpful' and 38.9% found it 'very helpful'. An average score of 3.25 suggests that users consider the treatment recommendations provided by the application to be relevant and applicable as an initial course of action. Finally, regarding reliability, an average score of 3.16 was obtained. The majority of respondents (63.9%) stated that they trust the output generated by the app. A key finding of this study is that none of the respondents (0%) stated that they did not trust the results. This confirms that this machine learning–based stunting detection app is viewed as a credible digital tool to support programmes aimed at reducing stunting rates and has an excellent level of acceptance.

Table 1. Respondents' assessment of the stunting detection app (n=37)

Assessment indicator	Answer category	Frequency	Percentage	Average score	Interpretation
Accuracy	Very accurate (4) Accurate (3) Quite accurate (2) Inaccurate (1)	10 23 3 0	27.8 63.9 8.3 0	3.05	Accurate
Usability	Very easy (4) Easy (3) Quite easy (2) Hard (1)	16 14 6 0	44.4 38.9 16.7 0	3.28	Very easy
Utility	Very helpful (4) Helpful (3) Quite helpful (2) Not helpful (1)	14 18 4 0	38.9 50.0 11.1 0	3.25	Helpful
Reliability	Highly reliable (4) Reliable (3) Quite reliable (2) Unreliable (1)	10 23 3 0	27.8 63.9 8.3 0	3.16	Reliable

DISCUSSION

One way of interpreting stunting is through data derived from height-for-age anthropometric measurements taken by healthcare workers. The WHO promotes an online system that facilitates the analysis of children's anthropometric data. The WHO Anthro Survey Analyser aims to encourage best practice in collecting, analysing and reporting anthropometric data [10]. This WHO software comprises three components: an anthropometric calculator, an individual assessment tool, and a nutrition survey tool. Although Indonesia has adopted anthropometric standards and nutritional status measurement outcomes based on WHO guidelines, these are still recorded manually in the MCH handbook [1]. In light of this, an Android application based on machine learning has been developed to simplify and supplement content related to anthropometry, adopting the WHO application; particularly with regard to anthropometry with a primary focus on nutritional status in cases of stunting.

Machine learning (ML) is a branch of artificial intelligence which uses valid data to enable accurate and rapid decision-making and problem-solving [11]. Research findings support the effectiveness of this anthropometry-based machine learning approach in detecting stunting in children [12]. This study applied ML methods by beginning with the input of baseline data from two regions; Central Java (Banyumas) and the Special Region of Yogyakarta regarding factors that may contribute to stunting. This was followed by data collection and processing. The machine learning algorithm system was developed using the WHO's system for interpreting anthropometric data and was supplemented with appropriate interventions based on the MCH handbook, ensuring suitable efforts to prevent stunting. Random forest and neural network algorithms were used for multivariate analysis, as the data is quite complex. System testing utilised a testing framework for Android applications, while the validation of ML model results was carried out manually by healthcare workers. The next stage involves implementation and pilot testing to analyse the accuracy of the predictions and users' acceptance of the application.

The results of this study indicate that the Android-based stunting detection and management application utilising a machine learning approach received a very positive overall response from all 36 respondents. Based on all evaluation criteria, the application achieved an average score above 3.00 (out of 4). These key findings suggest that the system developed has met user expectations in terms of functionality and information accuracy. The dominance of responses in the 'accurate' (63.9%) and 'easy' (44.4%) categories demonstrates that the application successfully addresses the main challenge of the early detection of stunting: the need for a precise yet simple-to-operate screening tool. This high level of acceptance suggests that the digitisation of anthropometric procedures is viewed not only as a technical aid, but also as a credible instrument for monitoring the nutritional status of infants. Other research findings also suggest that machine learning-based applications offer excellent system, information, and service quality, providing a benefit score of 98% [13]. This supports the view that this ML-based Android application greatly facilitates user experience, with the system achieving a high score for its results..

Regarding the usefulness of the intervention, the study results show that this application makes a significant contribution to the simple clinical decision-making process. Fifty percent of respondents found it "helpful." An average score of 3.25 indicates that the treatment recommendation feature provided by the application is considered relevant and can be applied by users as an initial treatment step. Finally, regarding the aspect of public trust, an average score of 3.16 was obtained. The majority of respondents (63.9%) stated that they "trust" the output produced by the application. This confirms that this machine learning-based stunting detection application has a very good level of acceptance and is seen as a credible digital tool to support the stunting reduction program. The study also stated that the development of machine learning models is very useful and relevant for predicting whether a child will experience stunting or not in the future [13]. This condition is supported by research that with the existence of machine learning-based applications, the public can use them without time or space constraints [14].

The application plays an important role in supporting stunting prevention efforts because it provides users with accurate assessments and context-appropriate solutions. Digital precision has become increasingly attainable in anthropometric evaluation, particularly in the calculation and interpretation of Z-scores. The World Health Organization has long introduced digital tools for anthropometric analysis, demonstrating how modernization can substantially reduce human error in manual measurement and interpretation processes [14]. In this context, technology serves not only as a computational aid but also as a catalyst for improving early detection, enhancing real-time monitoring, and expanding public access to nutrition education through interactive digital platforms [15–21]. The findings of this study further emphasize the high utility of the Smart Stunting application, especially its ability to provide intervention recommendations aligned with the MCH handbook. This feature is crucial because, for the general public and community health workers, identifying a child as "stunted" is insufficient without clear guidance on appropriate follow-up actions, such as referral pathways or nutritional improvement strategies. By offering structured recommendations, the application strengthens decision-making at the community level and functions as an accessible digital health education medium (m-Health). Its role in bridging information gaps highlights the potential of digital innovations to support both preventive efforts and community empowerment in addressing stunting.

CONCLUSION

The Android-based stunting detection and management application was well received and viewed as highly effective by users. They reported that the system successfully modernizes conventional stunting assessment into a faster and more intuitive digital process while reducing the likelihood of human error. The inclusion of intervention recommendations was considered particularly valuable, as it strengthens preparedness for addressing nutritional problems at both family and community levels. This m-Health innovation enhances the efficiency of early detection compared with manual methods and holds strong potential to support national efforts to accelerate stunting reduction. The application can also assist families in monitoring children's growth trends over time. Future studies are encouraged to evaluate the application in larger and more diverse populations, especially in frontier, outermost, and underdeveloped regions where access to healthcare personnel is limited, to further assess its performance stability.

1

Ethical consideration, competing interest and source of funding

-All research procedures adhered to ethical standards for studies involving human participants. Ethical approval was obtained from the Health Research Ethics Committee (KEPK) of Panti Rapih Hospital Yogyakarta, with approval number 177/SKEPK-KKE/VII/2025. Participation was voluntary, and respondents were informed about the study objectives, procedures, and confidentiality measures. Informed consent was obtained prior to data collection.

-There is no conflict of interest related to this publication.

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REFERENCES

1. Sayomi BA, Alabi AO, Onigbinde MO, Oladibu OT. Height as a key growth index in the paediatric age group: A comprehensive review. Asian Journal of Pediatric Research. 2025 Oct 27;15(11):11-20.
2. Wells JC, Marphatia AA, Amable G, Siervo M, Friis H, Miranda JJ, Haisma HH, Raubenheimer D. The future of human malnutrition: rebalancing agency for better nutritional health. Globalization and Health. 2021 Oct 9;17(1):119.
3. Wells JC, Sawaya AL, Wibaek R, Mwangome M, Poullas MS, Yajnik CS, Demaio A. The double burden of malnutrition: aetiological pathways and consequences for health. The Lancet. 2020 Jan 4;395(10217):75-88.
4. WHO. Prevalence of stunting in children under 5 (%). Geneva: World Health Organization; 2024.
5. Republik Indonesia. Strategi nasional percepatan pencegahan dan penurunan stunting 2025–2029. Jakarta: Republik Indonesia; 2024.
6. DP3AP2KB. Pemkot Yogya targetkan prevalensi stunting kurang dari 10 persen. Yogyakarta: Pemerintah Kota Yogyakarta; 2024.
7. Shekar M, Kakietek J, D'Alimonte MR, Rogers HE, Eberwein JD, Akuoku JK, Pereira A, Soe-Lin S, Hecht R. Reaching the global target to reduce stunting: an investment framework. Health Policy and Planning. 2017 Jun 1;32(5):657-68.
8. Jezue EM, Silitonga HTH, Rambung E. ASI eksklusif, status imunisasi dan kejadian stunting di Indonesia: studi literatur. Prominentia Medical Journal. 2021 Jul 19;2(1):72-78.
9. Indriana NP, Dewi IA, Darmayanti PA. Prediksi stunting berbasis machine learning melalui CERDIS: Cepat Resposif Deteksi Dini Stunting. J-REMI: Jurnal Rekam Medik dan Informasi Kesehatan. 2025 Dec 21;7(1):60-72.
10. WHO. WHO anthro survey analyser and other tools. Geneva: World Health Organization; 2019.
11. Nozari H, Sadeghi ME. Artificial intelligence and machine learning for real-world problems (a survey). International Journal of Innovation in Engineering. 2021 Oct 7;1(3):38-47.
12. Ratnasari R, Wahidin AJ, Andika TH. Deteksi dini stunting pada anak berdasarkan indikator antropometri dengan menggunakan algoritma machine learning. Jurnal Algoritma. 2024 Dec 30;21(2):378–87.
13. Arqam ML, Firdaus AA, Atmojo AM, Saputri GZ, Furizal, Palahuddin, et al. Integrating education-based interventions and machine learning for stunting prevention: a case study in East Lombok, Indonesia. Dialogues in Health. 2026 Jun 1;8(1):100264.
14. Rambe NL, Sebayang W. Aplikasi balita sehat terhadap keterampilan ibu terkait tumbuh kembang. Jurnal Kesehatan. 2021 Jan 18;11(3):341-8.
15. Coman LI, Ianculescu M, Paraschiv EA, Alexandru A, Bădărău IA. Smart solutions for diet-related disease management: connected care, remote health monitoring systems, and integrated insights for advanced evaluation. Applied Sciences. 2024 Mar 11;14(6):2351.
16. Abeltino A, Riente A, Bianchetti G, Serantoni C, De Spirito M, Capezzone S, Esposito R, Maulucci G. Digital applications for diet monitoring, planning, and precision nutrition for citizens and professionals: a state of the art. Nutrition Reviews. 2025 Feb;83(2):e574-601.
17. Başar HB, Bilici S. Does Technology Affect Nutrition Education Perspectives?. Artuklu International Journal of Health Sciences. 2023;3(3):335-42.
18. Tushir S, Aggarwal N, Sehrawat H, Yasmin S. Empowering nutrition and diet of elderly people using digital technology. Artificial Intelligence in Healthcare for the Elderly. 2025 Nov 15:251-80.
19. Aidoo EM. Advancing precision medicine and health education for chronic disease prevention in vulnerable maternal and child populations. World Journal of Advanced Research and Reviews. 2025;25(2):2355-76.
20. Limketkai BN, Mauldin K, Manitius N, Jalilian L, Salonen BR. The age of artificial intelligence: use of digital technology in clinical nutrition. Current Surgery Reports. 2021 Jun 8;9(7):20-8.
21. Kratzke C, Cox C. Smartphone technology and apps: rapidly changing health promotion. Global Journal of Health Education and Promotion. 2012;15(1):122-8.

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ABSTRACT

Background: Stunting is a chronic nutritional problem that requires accurate and rapid early detection. Conventional methods that utilize the Maternal and Child Health (MCH) handbook—in Indonesia, referred to as the KIA book—or manual tables frequently encounter challenges related to efficiency and the potential for human error. The utilization of an Android application for the purpose of digitization provides a viable solution for the automation of the assessment of toddlers' nutritional status. **Objective:** This study aims to assess the benefits and level of acceptance of an Android-based machine learning application for the detection and management of stunting from the users' perspective. **Method:** This study employs a descriptive, quantitative approach. Consecutive sampling was used to select individual subjects who met the predetermined inclusion and exclusion criteria, resulting in a sample of 36 respondents. Data were collected using a structured questionnaire with a 1–5 Likert scale. Descriptive statistics were used to analyse the data and calculate frequency distributions, percentages and mean values for the indicators of accuracy, usability, utility, and reliability. **Result:** The results of the analysis show that this application is highly accepted. The usability indicator had the highest score (3.28), followed by utility (3.25), and reliability (3.16). A total of 91.7% of respondents rated the prediction system as accurate, giving it an average score of 3.05. Furthermore, the app was rated as significantly more efficient and faster than manual methods in the detection process. **Conclusion:** This stunting detection app effectively helps users quickly and accurately identify the risk of stunting. Its ease of use and the high validity of its results make it a suitable tool for healthcare workers and the general public to accelerate the reduction of stunting rates.
Kata Kunci: anthropometry, Android app, machine learning, stunting

INTRODUCTION

Stunting is a condition in which a child experiences growth failure, resulting in a height that is inappropriate for their age. A toddler is considered short if their Z-score for length-for-age (LFA) or height-for-age (HFA) is less than -2 SD (stunted) or less than -3 SD (severely stunted). Z-scores are derived from anthropometric measurements, which are used to assess the size, proportions, and composition of the human body. Anthropometric measurements, specifically length-for-age or height-for-age indices, are used to categorize children as very short, short, normal, or tall [1]. Stunting is a health issue in Indonesia that requires attention. It is caused by chronic malnutrition, particularly during the first 1,000 days of life. Chronic malnutrition is one of the major challenges facing Indonesia's health sector [2][3].

According to the World Health Organization (WHO), the global prevalence of stunting decreased by 22.3% between 1990 and 2022, reaching 17.9% in 2022 [4]. In Indonesia, the prevalence of stunting decreased by 9.3% over the last five years, dropping from 30.8% in 2018 to 21.5% in 2023 [5]. Meanwhile, in Yogyakarta City, based on nutrition monitoring data as of 30 July 2024, the prevalence of stunting stands at 10.6%. This figure is lower than the stunting prevalence in 2023, which stood at 11.8% [6]. Stunting has even become a second Sustainable Development Goal (SDG) monitoring target, which must be addressed with a global nutrition target of a 40% reduction in stunting among children under five by 2025 [7]. Although there has been a decline in prevalence rates worldwide and even in Indonesia, this remains a critical issue within the health sector.

Stunting affects not only children's physical growth, but also their cognitive development, future productivity levels and quality of life. Therefore, tackling stunting requires an integrated approach based on accurate data [8]. A comprehensive approach is needed, ranging from early detection to evidence-based intervention recommendations. However, efforts to achieve early detection still face several challenges, including limited human resources, time-consuming manual detection methods, and limited public access to technology-based health information. A machine learning-based detection and recommendation system using smartphones is expected to provide an innovative solution to improve readiness in addressing stunting. This system helps to detect infants at risk of stunting and supports the development of data-driven policies to address this issue holistically [9]. This study aims to evaluate the benefits and level of acceptance of a stunting detection and management application using a machine learning–based Android app from the users' perspective.

METHODS

This study employs a quantitative design with a descriptive, analytical approach to provide a systematic overview of the variables under investigation, without testing hypotheses between variables. Sampling was carried out using consecutive sampling on individuals who met the inclusion criteria: owning and being able to operate an Android device, being willing to download and use the Smart Stunting app, and being willing to act as respondents and complete the questionnaire in full. Respondents who experienced technical difficulties with their devices (e.g., incompatible Android version) were excluded, resulting in a sample of 36 respondents. The research instrument—a structured questionnaire using a 1–5 Likert scale—has been validated and found to be reliable. The collected data were processed using descriptive statistics, including frequency distributions, percentages, and mean calculations, to determine the categorization of respondents' response trends. The results of the analysis were then interpreted using score interval tables to accurately identify the achievement levels or characteristics of the research subjects, thereby providing a robust foundation for evaluating the application of the methods employed. This research process is also approved by the Health Research Ethics Committee of Panti Rapih Hospital under reference number 177/SKEPK-KKE/VII/2025.

RESULTS

This study presents an overview of the feasibility analysis and a summary of the results, based on data collected from 36 respondents.

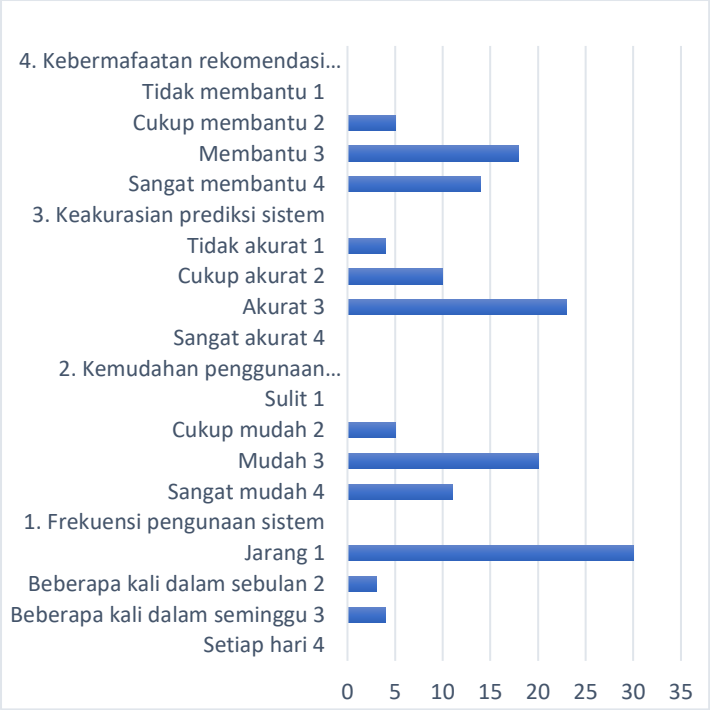

Figure 1. System usage

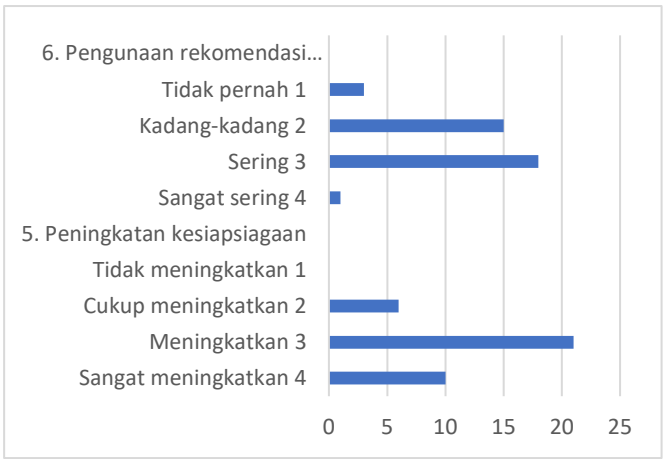

Figure 2. Impact of application usage

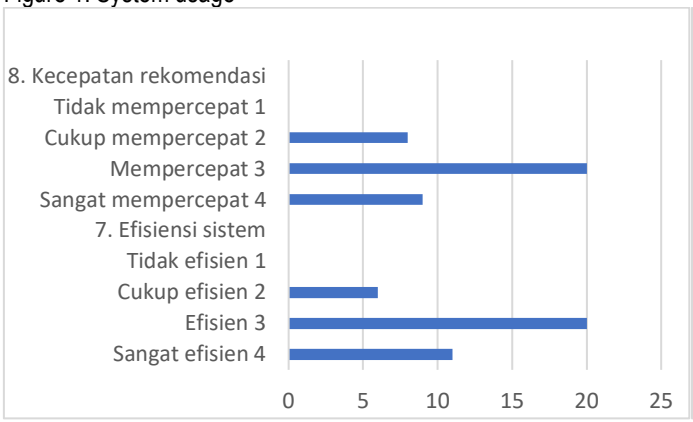

Figure 3. Benefits of technology

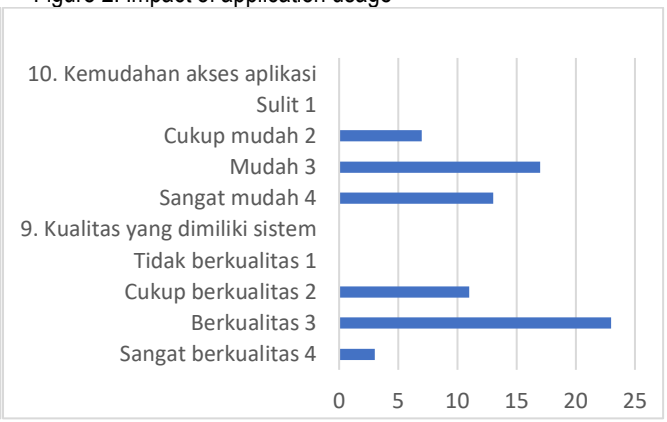

Figure 4. Data quality and access

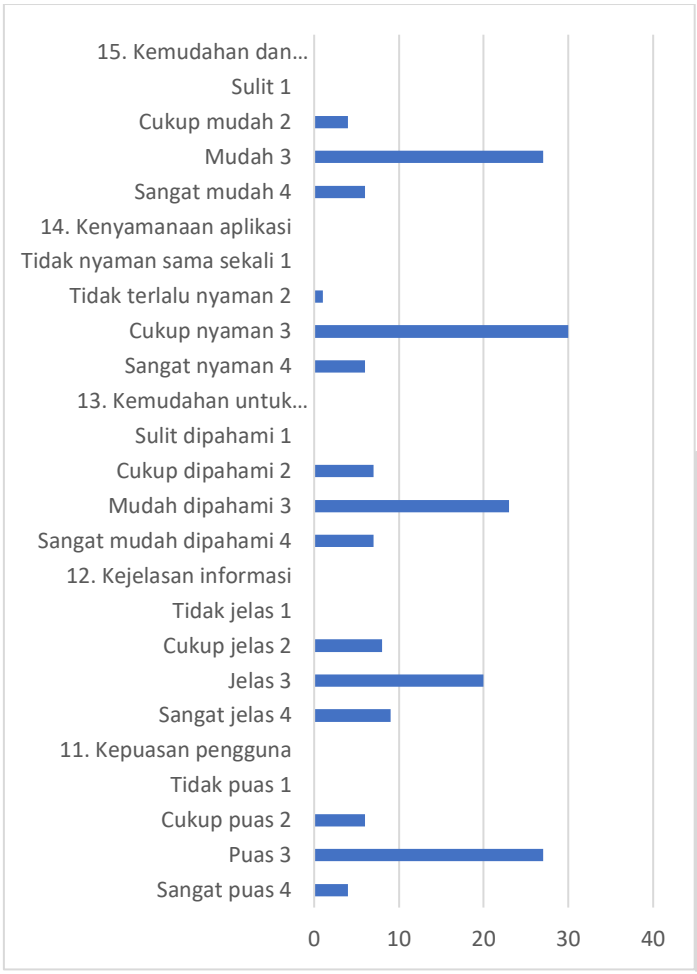

Figure 5. User experience

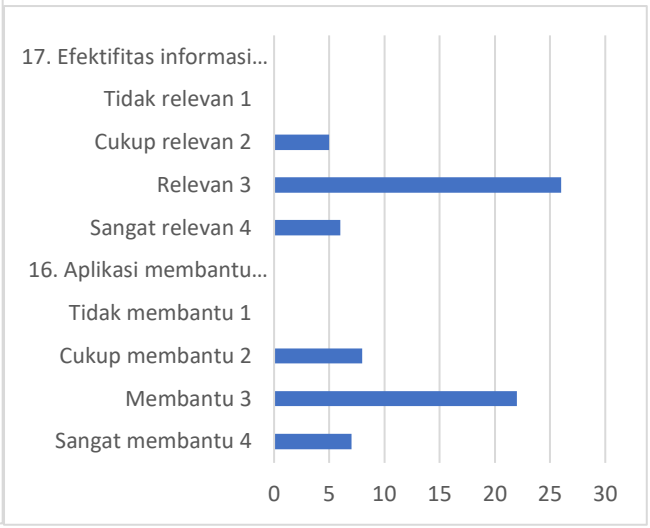

Figure 6. System effectiveness

Figure 7. User satisfaction

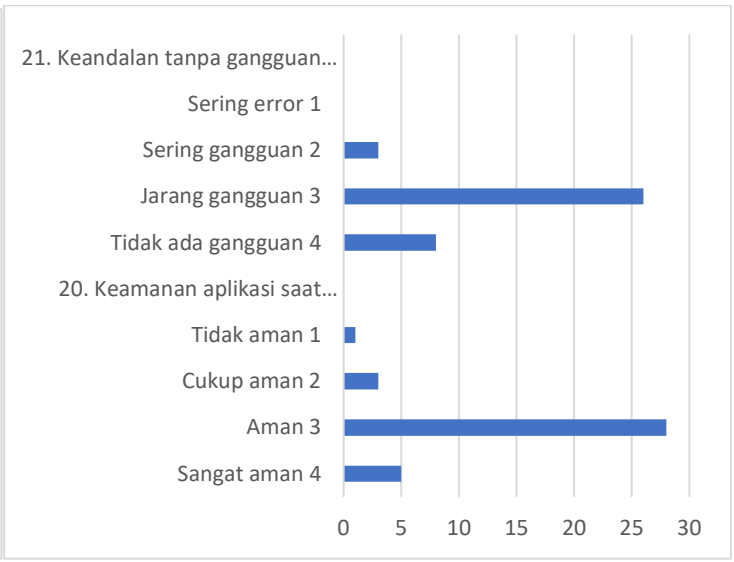

Figure 8. Application reliability and security

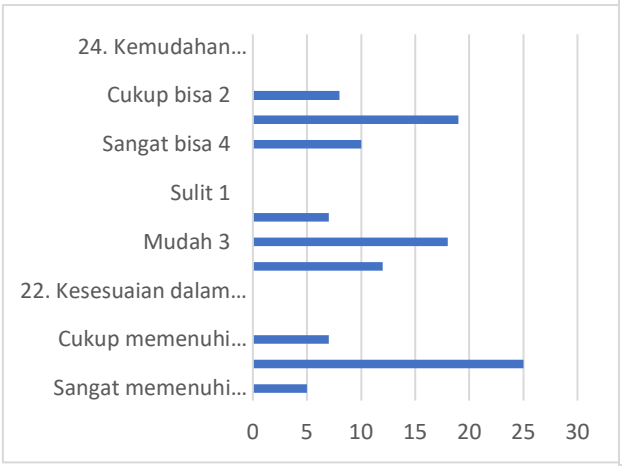

Figure 9. Suitability to user needs

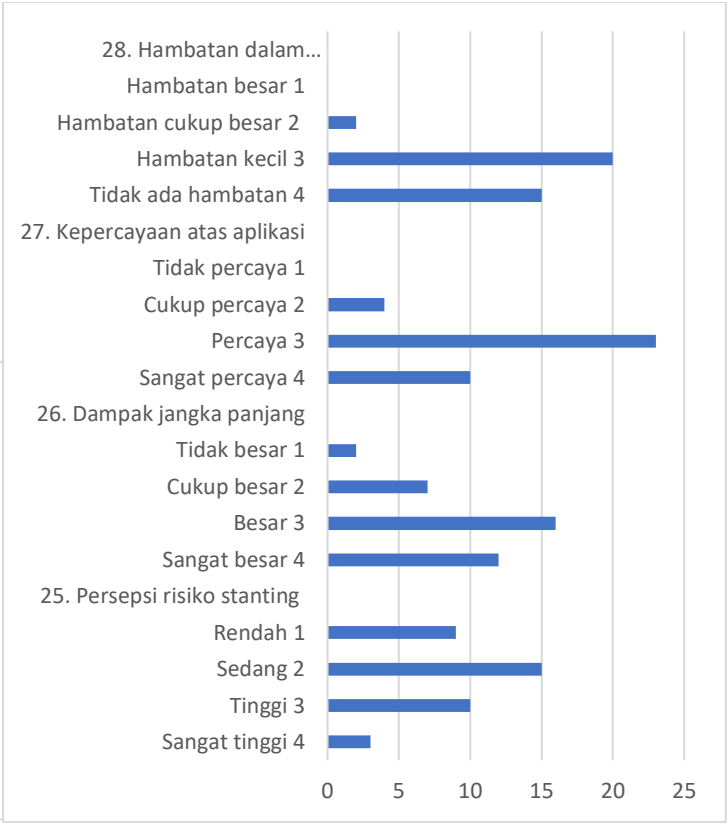

Figure 10. Risk and benefit perception

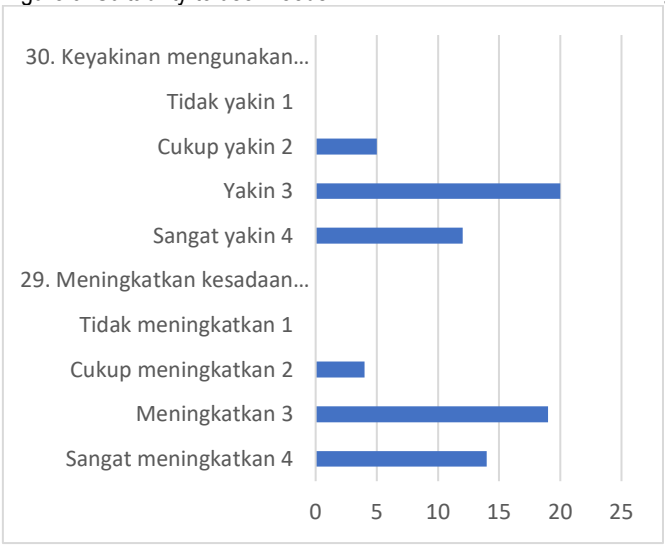

Figure 11. Motivation to Use the Application

Based on the analysis of Figures 1–11, the indicators show that the visualisation of the usage and impact of Figures 1–4 demonstrates the positive impact of the application's users on efficiency, the benefits of the technology, as well as data quality and ease of access via the system. The experience and effectiveness shown in Figures 5–8 indicate a positive user experience, the system's operational effectiveness, user satisfaction, and the reliability and data security guaranteed by the application. The perceptions and motivation shown in Figures 9–11 represent the suitability of the application's features to users' actual needs, the balance between perceived risks and benefits, and the high level of motivation among respondents to continue adopting this application for nutritional monitoring.

Table 1. Respondents' assessment of the stunting detection app (n=36)

Assessment indicator	Answer category	Frequency (f)	Percentage (%)	Average score	Interpretation
Accuracy	Very accurate (4)	10	27.8%	3.05	Accurate
	Accurate (3)	23	63.9%		
	Quite accurate (2)	3	8.3%		
	Inaccurate (1)	0	0%		
Usability	Very easy (4)	16	44.4%	3.28	Very easy
	Easy (3)	14	38.9%		
	Quite easy (2)	6	16.7%		
	Hard (1)	0	0%		
Utility	Very helpful (4)	14	38.9%	3.25	Helpful

	Helpful (3)	18	50.0%		
	Quite helpful (2)	4	11.1%		
	Not helpful (1)	0	0%		
Reliability	Highly reliable (4)	10	27.8%	3.16	Reliable
	Reliable (3)	23	63.9%		
	Quite reliable (2)	3	8.3%		
	Unreliable (1)	0	0%		

Based on the data presented in Table 1, it can be concluded that respondents' assessments of the stunting detection and management application show a consistently positive trend across all key indicators. Regarding the accuracy indicator, the majority of respondents provided positive feedback, with 63.9% (23 people) rating it as 'accurate' and 27.8% (10 people) rating it as 'very accurate'. With an average score of 3.05, it is evident that the system is highly reliable in calculating the nutritional status of infants based on anthropometric data inputs. Furthermore, the usability indicator recorded the highest average score of 3.28. A total of 44.4% of respondents rated the application as 'very easy' to operate, while 38.9% rated it as 'easy'. This high score indicates that the application's user interface (UI) and navigation have been intuitively designed, thereby minimising technical barriers for users in the field. Regarding the utility, the research findings suggest that this application contributes to simple clinical decision-making processes. Half of the repondents (50%) found it 'helpful' and 38.9% found it 'very helpful'. An average score of 3.25 suggests that users consider the treatment recommendations provided by the application to be relevant and applicable as an initial course of action. Finally, regarding reliability, an average score of 3.16 was obtained. The majority of respondents (63.9%) stated that they trust the output generated by the app. A key finding of this study is that none of the respondents (0%) stated that they did not trust the results. This confirms that this machine learning–based stunting detection app is viewed as a credible digital tool to support programmes aimed at reducing stunting rates and has an excellent level of acceptance.

DISCUSSION

One way of interpreting stunting is through data derived from height-for-age anthropometric measurements taken by healthcare workers. The WHO promotes an online system that facilitates the analysis of children's anthropometric data. The WHO Anthro Survey Analyser aims to encourage best practice in collecting, analysing and reporting anthropometric data [10]. This WHO software comprises three components: an anthropometric calculator, an individual assessment tool, and a nutrition survey tool. Although Indonesia has adopted anthropometric standards and nutritional status measurement outcomes based on WHO guidelines, these are still recorded manually in the MCH handbook [1]. In light of this, an Android application based on machine learning has been developed to simplify and supplement content related to anthropometry, adopting the WHO application — particularly with regard to anthropometry — with a primary focus on nutritional status in cases of stunting.

Machine learning (ML) is a branch of artificial intelligence which uses valid data to enable accurate and rapid decision-making and problem-solving [11]. Research findings support the effectiveness of this anthropometry-based machine learning approach in detecting stunting in children [12]. This study applied ML methods by beginning with the input of baseline data from two regions — Central Java (Banyumas) and the Special Region of Yogyakarta — regarding factors that may contribute to stunting. This was followed by data collection and processing. The machine learning algorithm system was developed using the WHO's system for interpreting anthropometric data and was supplemented with appropriate interventions based on the MCH handbook, ensuring suitable efforts to prevent stunting. Random forest and neural network algorithms were used for multivariate analysis, as the data is quite complex. System testing utilised a testing framework for Android applications, while the validation of ML model results was carried out manually by healthcare workers. The next stage involves implementation and pilot testing to analyse the accuracy of the predictions and users' acceptance of the application.

The results of this study indicate that the Android-based stunting detection and management application utilising a machine learning approach received a very positive overall response from all 36 respondents. Based on all evaluation criteria, the application achieved an average score above 3.00 (out of 4). These key findings suggest that the system developed has met user expectations in terms of functionality and information accuracy. The dominance of responses in the 'accurate' (63.9%) and 'easy' (44.4%) categories demonstrates that the application successfully addresses the main challenge of the early detection of stunting: the need for a precise yet simple-to-operate screening tool. This high level of acceptance suggests that the digitisation of anthropometric procedures is viewed not only as a technical aid, but also as a credible instrument for monitoring the nutritional status of infants. Other research findings also suggest that machine learning-based applications offer excellent system, information, and service quality, providing a benefit score of 98% [13]. This supports the view that this ML-based Android application greatly facilitates user experience, with the system achieving a high score for its results.

This application is important because it provides users with accurate results and appropriate solutions. Digital precision is now a reality when it comes to measuring and interpreting Z-scores. Indeed, the WHO developed an application for calculating anthropometric results long before this. The creation of such supporting applications is one of the ways in which modernization can reduce human error in manual calculation and interpretation processes [14]. A literature review also indicates that technology can enhance the effectiveness of early detection and the efficiency of real-time monitoring, as well as expanding the scope of nutrition education to the public via interactive digital media [15]. The findings of this study also highlight the high utility of this application, particularly with regard to its provision of intervention recommendations appropriate to the MCH handbook. This is important because, for the general public or community health workers in Pos Pelayanan Terpadu (Posyandu), simply identifying a child as 'stunted' is insufficient without accompanying education on the next steps to take (such as referral or nutritional improvement). This demonstrates the application's role as a digital health education medium (m-Health).

CONCLUSION

The Android-based stunting detection and management app has been very well received by users and has proven to be highly effective. With average usability and prediction accuracy scores of 3.28 and 3.05 respectively, the app has demonstrated its ability to transform conventional stunting detection procedures into a faster, more intuitive digital system that minimizes the risk of calculation errors. Respondents believe that the intervention recommendation feature provides added value by enhancing preparedness to address malnutrition at family and community levels. Using this m-Health technology significantly improves the efficiency of early detection compared to manual methods, and it has great potential to support national programs in reducing stunting prevalence in Indonesia more quickly. Members of the public can use the app to monitor their

children's growth trends on a monthly basis. Future researchers can conduct trials on a broader and more demographically diverse population, particularly in frontier, outermost, and underdeveloped (3T) regions with limited access to healthcare personnel, to test the app's performance stability.

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Ethical consideration, competing interest, and source of funding

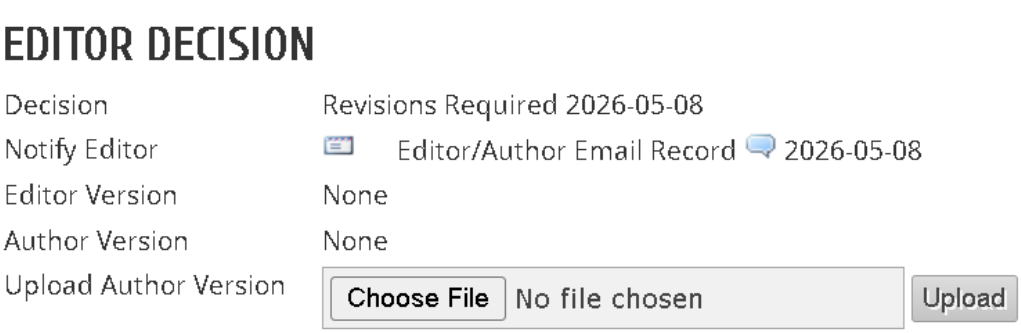
-This study received ethical approval from the Health Research Ethics Committee of Panti Rapih Hospital under reference number 177/SKEPK-KKE/VII/2025.
-There is no conflict of interest related to this publication.
-This research was funded by Sekolah Tinggi Ilmu Kesehatan Panti Rapih Yogyakarta and Sekolah Tinggi Ilmu Komputer Yos Sudarso through their internal grant programs.

REFERENCES

1. Kementerian Kesehatan Republik Indonesia. Peraturan Menteri Kesehatan Republik Indonesia Nomor 2 Tahun 2022 Tentang Standar Antropometri Anak. 2020 Jan 2.
2. Indonesia. Peraturan Presiden Republik Indonesia Nomor 72 Tahun 2021 tentang Percepatan Penurunan Stunting. 172. Indonesia; 2021 Sep 5.
3. WHO. Reducing stunting in children: equity considerations for achieving the Global Nutrition Targets 2025. 2018.
4. WHO. WHO. 2024. Prevalence of stunting in children under 5 (%).
5. Indonesia. Strategi Nasional Percepatan Pencegahan dan Penurunan Stunting 2025-2029. 2024.
6. DP3AP2KB. Portal Berita Pemerintah Kota Yogyakarta. 2024. Pemkot Yogya Targetkan Prevalensi Stunting Kurang Dari 10 Persen.
7. WHO. Reducing Stunting in Children. 2018.
8. Jezue EM, Silitonga HTH, Rambung E. ASI Eksklusif, Status Imunisasi dan Kejadian Stunting di Indonesia: Studi Literatur. Prominentia Medical Journal. 2021 Jul 19;2(1).
9. Putu Riza Kurnia Indriana N, Ayu Utari Dewi I, Ayu Ratna Darmayanti P. Prediksi Stunting Berbasis Machine Learning melalui CERDIS: Cepat Resposif Deteksi Dini Stunting. Jurnal Rekam Medik dan Informasi Kesehatan. 2025 Dec 19;7(1). doi:10.25047/j-remi.v7i1.6486
10. WHO. WHO. 2019. WHO Anthro Survey Analyser and other tools.
11. Budiasto J, Tallulembang TM, Pare S, Hasbi M. Machine Learning Untuk Pemula (Konsep dan Implementasi) [Internet]. 1st ed. Zalni TY, editor. Vol. 1. Jakarta: Penerbit Buku Indonesia; 2025. Available from: www.penerbitbukuindonesia.com
12. Ratnasari R, Wahidin AJ, Andika TH. Deteksi Dini Stunting Pada Anak Berdasarkan Indikator Antropometri dengan Menggunakan Algoritma Machine Learning. Jurnal Algoritma. 2024 Dec 30;21(2):378–87. doi:10.33364/algoritma/v.21-2.2122
13. Putu Riza Kurnia Indriana N, Ayu Utari Dewi I, Ayu Ratna Darmayanti P, Studi Kebidanan P, Kesehatan F, Teknologi dan Kesehatan Bali I. Prediksi Stunting Berbasis Machine Learning melalui CERDIS: Cepat Resposif Deteksi Dini Stunting. Jurnal Rekam Medik dan Informasi Kesehatan. 2025;7(1). doi:10.25047/j-remi.v7i1.6486
14. Aliya A. Anthrocalc: presisi digital dalam mengawal tumbuh kembang generasi. Bogor: Afdan Rojabi Publisher; 2026.
15. Malini RS, Adinandra S. Literature Review: Peran Sistem Smart Health sebagai Inovasi Digital dalam Upaya Pencegahan Stunting. Jurnal ELKON. 2025;5(2):2809–140.

1. Bukti submit 09 April 2026

2. Hasil review dari 2 reviewer



3. Korespondensi upload revisi

PEER REVIEW

ROUND 1

Review Version	7222-17555-1-RV.DOCX 2026-04-09
Initiated	2026-04-28
Last modified	2026-05-08
Uploaded file	None

EDITOR DECISION

Decision	Accept Submission 2026-06-09
Notify Editor	Editor/Author Email Record 2026-06-09
Editor Version	None
Author Version	7222-17695-1-ED.DOCX 2026-05-17 DELETE
Upload Author Version	Choose File No file chosen Upload

4. Accepted submission

Editor
2026-06-09 06:35 PM

Subject: [SF] Editor Decision DELETE

The following message is being delivered on behalf of Jurnal Penelitian Kesehatan SUARA FORIKES (Journal of Health Research FORIKES VOICE)

Dear
Riski Wulandari:

We have reached a decision regarding your submission to Jurnal Penelitian Kesehatan "SUARA FORIKES" (Journal of Health Research "Forikes Voice"), "F: Feasibility Analysis of Machine Learning-Based Smart Stunting Application".

Our decision is to: ACCEPT SUBMISSION

Keterangan:
Artikel dengan judul di atas dinyatakan sudah diterima (dinyatakan lulus) dan selanjutnya pemberitahuan bisa dianggap sebagai

-----"LETTER OF ACCEPTANCE (LoA)-----

Selanjutnya silakan melakukan pembayaran Rp. 400.000 untuk layanan normal, atau Rp. 700.000 (Rp. 400.000 + Rp. 300.000) untuk layanan fast tract, melalui transfer Bank MANDIRI dengan akun: 1710002457474 atas nama: FORUM ILMIAH KESEHATAN; dan konfirmasi dapat dilakukan di WhatsApp 082132259611 (pesan atau panggilan).

Setelah melakukan pembayaran, jika membutuhkan penulis, juga dapat mengajukan LoA versi PDF melalui nomor Whatsapp di atas.

Terimakasih telah memberikan kepercayaan kepada jurnal ini sebagai media publikasi

Prof. Heru Santoso Wahito Nugroho
Poltekkes Kemenkes Surabaya (SCOPUS ID: 57201277505)

EDITOR/AUTHOR CORRESPONDENCE

Section Editor
2026-05-08 10:03 AM

Subject: [SF] Editor Decision DELETE

The following message is being delivered on behalf of Jurnal Penelitian Kesehatan SUARA FORIKES (Journal of Health Research FORIKES VOICE)

Riski Wulandari, {$authorPhone}

We have reached a decision regarding your submission to Jurnal Penelitian Kesehatan "SUARA FORIKES" (Journal of Health Research "Forikes Voice"), "F: Feasibility Analysis of Machine Learning-Based Smart Stunting Application".

Our decision is to: REVISION REQUIRED

NOTE:
1. LOGIN with your USERNAME and PASSWORD
2. Read the review results
3. IF AVAILABLE, download the reviewed file (near Reviewer A, B, ...)
4. REVISE your file
5. UPLOAD your revised file on the "AUTHOR VERSION" button

Joel Rey Ugsang Acob
Department of Nursing, Visayas State University, Baybay City
aijhaaijha@gmail.com
Chief Editor:
Prof. Dr. Heru Santoso Wahito Nugroho, CPMC
FORIKES: WA/phone: 082132259611

Reviewer A:

A. Title assessment results (attractive, concise, and demonstrates the findings):
The title “Feasibility Analysis of Machine Learning-Based Smart Stunting Application” is concise, informative, and reflects the core content of the study. It clearly identifies the methodological approach (feasibility analysis), the technological component (machine learning), and the application domain (stunting detection). The title aligns well with the journal’s scientific style and meets the criteria of clarity and specificity.
Assessment: Appropriate and representative.

B. Abstract assessment results (concise, representing the overall content of the article):
The abstract provides a complete structure, covering background, objective, methods, results, and conclusion. The sentence “The results of the analysis show that this application is highly accepted” accurately reflects the findings. The methodological description is sufficiently clear, and the numerical results (e.g., usability score 3.28, accuracy 3.05) strengthen the abstract’s scientific value.
However, the abstract could be improved by adding a brief statement on the sampling context (e.g., user characteristics) and by clarifying the nature of the machine learning model used.
Assessment: Strong, representative, and aligned with journal standards.

C. Keyword assessment results (essential elements of the study):
The keywords—anthropometry, Android app, machine learning, stunting—are relevant, specific, and consistent with indexing requirements. They reflect the main constructs of the study and support discoverability.
Assessment: Appropriate and well-selected.

D. Background assessment results (problem formulation, problem justification, urgency of the problem, and state of the art)

:
The introduction provides a comprehensive overview of stunting, including definitions, prevalence trends, and global targets. The manuscript cites WHO and national regulations appropriately. The narrative “Stunting affects not only children’s physical growth, but also their cognitive development…” demonstrates relevance and urgency.
The rationale for digital innovation is well articulated, and the gap in manual anthropometric interpretation is clearly stated.
However, the introduction would benefit from a more explicit final paragraph stating the research objective, rather than embedding it within the narrative.
Assessment: Scientifically sound, but the final objective statement should be more explicit.

E. Objectives assessment results (operational and aligned with the problem)

:
The objective is clearly stated: “to assess the benefits and level of acceptance of an Android-based machine learning application for the detection and management of stunting.”
It is aligned with the study design and measurable through the indicators used.
Assessment: Clear and appropriate.

F. Methods assessment results (relevant to the objectives, replicable, complete, chronological, minimal bias, reliable, free from ethical issues)

:
The methods section is generally well structured. The study design (descriptive quantitative), sampling technique (consecutive sampling), inclusion/exclusion criteria, and sample size (n=36) are clearly described. The use of a validated Likert-scale questionnaire is appropriate for

feasibility and acceptance studies.
The manuscript states: "The collected data were processed using descriptive statistics...", which is consistent with the study aim.
However, the section would benefit from:
- A clearer description of the questionnaire domains and number of items.
- A brief explanation of the score interval interpretation.
- More detail on the ML model validation process, which is mentioned but not elaborated.
Assessment: Adequate but could be strengthened with more methodological transparency.

G. Analysis/synthesis assessment results (in accordance with the method, presented clearly and accurately, interpreted clearly and focused)

:
The results are presented comprehensively, supported by figures and a detailed Table 1. The narrative accurately reflects the data, for example: "A total of 91.7% of respondents rated the prediction system as accurate...".
The descriptive statistics are appropriate for the study design. The interpretation of mean scores (e.g., usability 3.28, utility 3.25) is consistent with the scoring rubric.
However, the results section contains some formatting inconsistencies due to figure placement and numerical lists, which may require editorial adjustment.
Assessment: Clear, accurate, and well aligned with the study objective.

H. Discussion assessment results (presentation of facts, opinions, and arguments based on references, comparison with other findings, and breadth/depth)

:
The discussion contextualizes the findings within existing literature and WHO standards. The manuscript effectively links the study results to broader issues in digital health and anthropometric accuracy.
The statement "This high level of acceptance suggests that the digitisation of anthropometric procedures is viewed not only as a technical aid..." demonstrates strong analytical interpretation.
The discussion also references relevant studies on ML-based stunting prediction, strengthening the scientific grounding.
Areas for improvement:
- The discussion could better differentiate between feasibility, usability, and accuracy.
- The ML algorithm description (random forest, neural network) appears in the discussion but should be introduced earlier in the methods.
Assessment: Strong and well contextualized, with minor structural refinements needed.

I. Conclusion assessment results (answers the objectives, qualitative, and concise):
The conclusion is concise, accurate, and aligned with the results. It highlights the practical implications and future research directions, particularly the need for testing in 3T regions.
Assessment: Appropriate and well formulated.

J. References assessment results (complete, accurate, relevant, up-to-date, global, dominance of primary references, and appropriateness of citations/bibliography)

:
The references are relevant, up-to-date, and include WHO documents, national regulations, and recent ML-based stunting studies. Citation style is consistent with Vancouver format.
However, two issues should be noted:
- Reference [1] lists "2020 Jan 2" but refers to Permenkes 2022; the year should be checked for accuracy.
- References [9] and [13] appear to be duplicates of the same article.
Assessment: Generally strong, but requires correction of duplication and date accuracy.

K. Novelty and innovation assessment results

:
The study demonstrates clear innovation by integrating machine learning with anthropometric interpretation and embedding intervention recommendations based on the MCH handbook.
The novelty lies in combining:
- ML-based prediction
- Android-based interface
- WHO-aligned anthropometric interpretation
- Intervention guidance for users
This positions the application as both a diagnostic support tool and an m-Health educational platform.
Assessment: High practical innovation with moderate methodological novelty.

L. Grammar assessment results (systematics, spelling, grammar)

:
The manuscript is written in clear Academic English with good coherence. Minor issues include:
- Occasional long sentences that could be streamlined.
- Some inconsistencies in tense usage.
- Minor typographical issues in figure captions.
Overall, the manuscript is readable and professionally written.
Assessment: Good linguistic quality with minor editorial refinements needed.

M. Results of the assessment of compliance with this journal's writing guidelines (adherence to the in-house style and use of article templates)

:
The manuscript adheres to IMRAD structure, uses appropriate scientific tone, and follows ethical reporting standards. The inclusion of ethical approval and funding statements meets journal requirements.
Formatting of figures and tables may require adjustment to meet Suara Forikes layout standards.
Assessment: Compliant with minor formatting corrections needed.

Overall Recommendation
The manuscript is suitable for publication after minor revisions, particularly in:
- Clarifying the objective in the introduction
- Strengthening methodological details
- Correcting reference duplication and date inconsistencies
- Refining figure formatting and minor language issues

The study contributes meaningfully to digital health innovation and stunting prevention efforts in Indonesia.

N. Results of the overall article quality assessment:
Good

O. Potential for publication of this article
:
Can be published with minor revisions
Can be published with moderate revisions

Reviewer C:

A. Title assessment results (attractive, concise, and demonstrates the findings):
Yes, the title of this research is attractive

B. Abstract assessment results (concise, representing the overall content of the article):
Kindly reevaluate the abstract and employ suitable sentence structures in its composition.
Elucidate the instrument section with greater specificity.

C. Keyword assessment results (essential elements of the study):
OK

D. Background assessment results (problem formulation, problem justification, urgency of the problem, and state of the art)

:
Enhance the immediacy of the issue to be investigated.Elucidate further on the significance of the investigated learning machine in the management of stunting cases within the community.

E. Objectives assessment results (operational and aligned with the problem)

:
OK

F. Methods assessment results (relevant to the objectives, replicable, complete, chronological, minimal bias, reliable, free from ethical issues)

:
An explanation on the instruments utilized in this research should be included.

G. Analysis/synthesis assessment results (in accordance with the method, presented clearly and accurately, interpreted clearly and focused)

:
This paper is in English; therefore, it is prudent to modify the research figures properly.

Presenting the study figures sequentially enhances clarity of flow.

H. Discussion assessment results (presentation of facts, opinions, and arguments based on references, comparison with other findings, and breadth/depth)

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The presentation of the discussion in this research should be aligned with the components of the research results.

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The conclusion's presentation requires conciseness.
Concentrate on the research's conclusion.

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Feasibility Analysis of Machine Learning-Based Smart Stunting Application

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ABSTRACT
Background: Stunting is a chronic nutritional problem that requires accurate and rapid early detection. Conventional methods that utilize the Maternal and Child Health (MCH) handbook—in Indonesia, referred to as the KIA book—or manual tables frequently encounter challenges related to efficiency and the potential for human error. The utilization of an Android application for the purpose of digitization provides a viable solution for the automation of the assessment of toddlers' nutritional status. **Objective:** This study aims to assess the benefits and level of acceptance of an Android-based machine learning application for the detection and management of stunting from the users' perspective. **Method:** This study employs a descriptive, quantitative approach. Consecutive sampling was used to select individual subjects who met the predetermined inclusion and exclusion criteria, one of which was being able to operate the predetermined Android system, resulting in a sample of 37 respondents. Data were collected using a structured questionnaire with a 1–4 Likert scale. Descriptive statistics were used to analyse the data and calculate frequency distributions, percentages and mean values for the indicators of accuracy, usability, utility, and reliability. **Result:** The results of the analysis show that this application is highly accepted. The usability indicator had the highest score (3.28), followed by utility (3.25), and reliability (3.16). A total of 91.7% of respondents rated the prediction system as accurate, giving it an average score of 3.05. Furthermore, the app was rated as significantly more efficient and faster than manual methods in the detection process. **Conclusion:** This stunting detection app effectively helps users quickly and accurately identify the risk of stunting. Its ease of use and the high validity of its results make it a suitable tool for healthcare workers and the general public to accelerate the reduction of stunting rates.
Kata Kunci: anthropometry, Android app, machine learning, stunting

INTRODUCTION
Stunting is a condition in which a child experiences growth failure, resulting in a height that is inappropriate for their age. A toddler is considered short if their Z-score for length-for-age (LFA) or height-for-age (HFA) is less than -2 SD (stunted) or less than -3 SD (severely stunted). Z-scores are derived from anthropometric measurements, which are used to assess the size, proportions, and composition of the human body. Anthropometric measurements, specifically length-for-age or height-for-age indices, are used to categorize children as very short, short, normal, or tall [1]. Stunting is a health issue in Indonesia that requires attention. It is caused by chronic malnutrition, particularly during the first 1,000 days of life. Chronic malnutrition is one of the major challenges facing Indonesia's health sector [2][3].

According to the World Health Organization (WHO), the global prevalence of stunting decreased by 22.3% between 1990 and 2022, reaching 17.9% in 2022 [4]. In Indonesia, the prevalence of stunting decreased by 9.3% over the last five years, dropping from 30.8% in 2018 to 21.5% in 2023 [5]. Meanwhile, in Yogyakarta City, based on nutrition monitoring data as of 30 July 2024, the prevalence of stunting stands at 10.6%. This figure is lower than the stunting prevalence in 2023, which stood at 11.8% [6]. Stunting has even become a second Sustainable Development Goal (SDG) monitoring target, which must be addressed with a global nutrition target of a 40% reduction in stunting among children under five by 2025 [7]. Although there has been a decline in prevalence rates worldwide and even in Indonesia, this remains a critical issue within the health sector.

Stunting affects not only children's physical growth, but also their cognitive development, future productivity levels and quality of life. Therefore, tackling stunting requires an integrated approach based on accurate data [8]. A comprehensive approach is needed, ranging from early detection to evidence-based intervention recommendations. However, efforts to achieve early detection still face several challenges, including limited human resources, time-consuming manual detection methods, and limited public access to technology-based health information. A machine learning-based detection and recommendation system using smartphones is expected to provide an innovative solution to improve readiness in addressing stunting. This system helps to detect infants at risk of stunting and supports the development of data-driven policies to address this issue holistically [9]. These aspects are crucial to develop due to the rapid advancement of technology. This study aims to evaluate the benefits and acceptance of a stunting detection and management application using a machine learning-based Android application from a user perspective.

METHODS
This study used a quantitative design with a descriptive analysis approach to provide a systematic overview of the variables studied without conducting hypothesis testing between variables. This study has stages starting from data collection and processing with machine learning model output, then selecting a machine learning model with an algorithm, then system testing and feasibility testing. The feasibility test began with sampling conducted using a consecutive sampling technique on individual subjects who met the inclusion criteria, namely owning and being able to operate an Android device, willing to download and operate the Smart Stunting application, willing to be respondents and complete the questionnaire. The exclusion criteria for respondents who experienced technical problems with the device (incompatible Android version) obtained 37 respondents. The research instrument was a questionnaire totaling 30 questions, 11 sections, with 4 domains structured using a Likert scale with a score interval of 1–4 that has been declared valid and reliable. The collected data were processed descriptively using frequency distribution, percentages, and the calculation of the average value (mean) to determine the categorization of respondents' response tendencies. The results of the analysis were then interpreted through a score interval table to accurately identify the level of achievement or characteristics of the research subjects, thus providing strong baseline data for evaluating the application of the applied method. This research process has also been declared worthy of ethical testing by the KEPK of Panti Rapih Hospital Yogyakarta with number 177/SKEPK-KKE/VII/2025.

RESULTS

The results of this study present an overview of the results of the feasibility analysis and a summary of the feasibility analysis table from the results of data collection on 37 respondents as follows.:

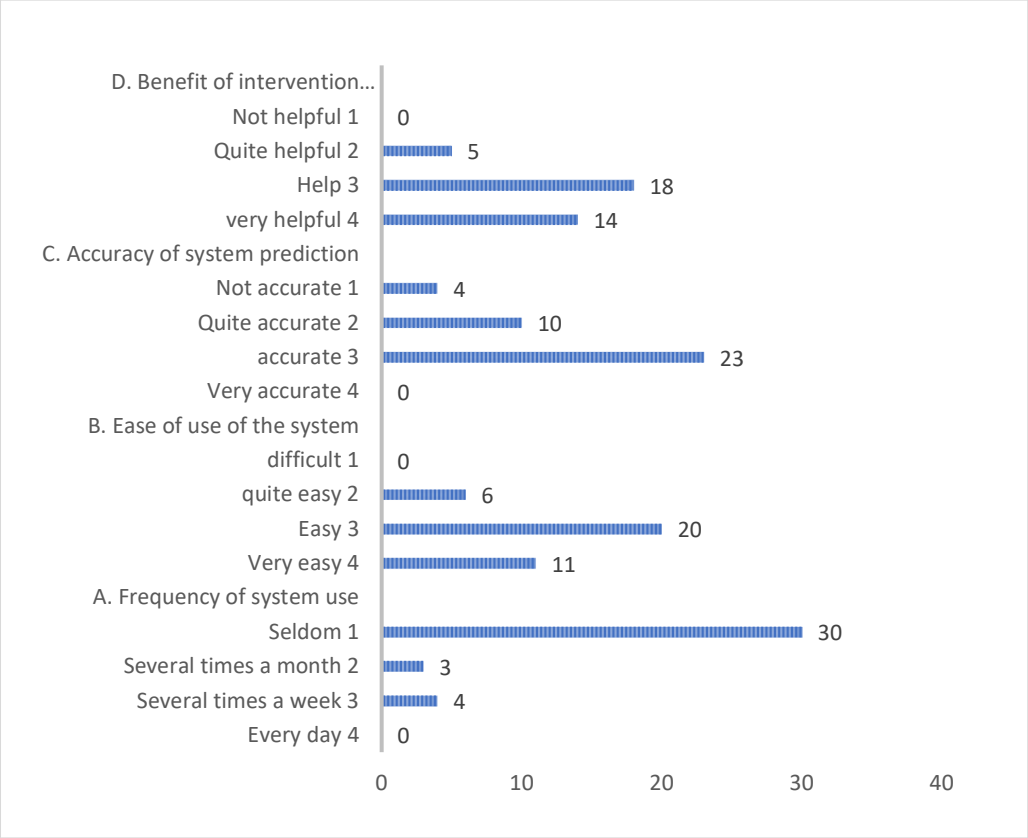

Figure 1. System usage

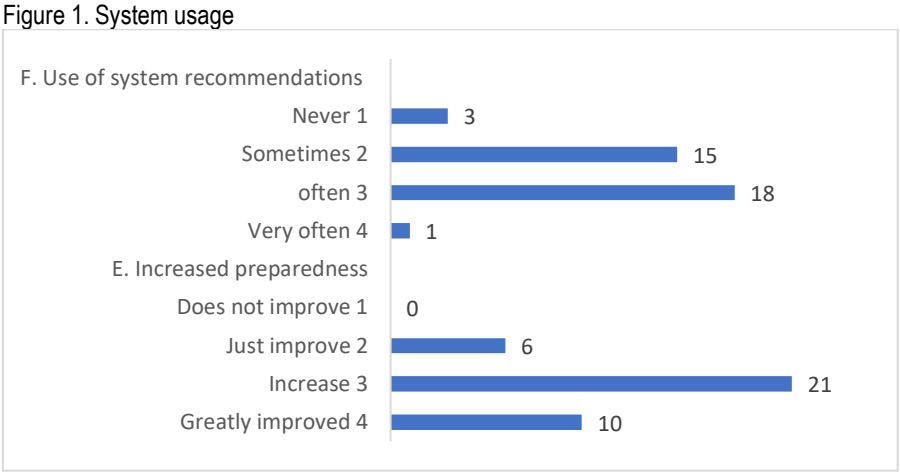

Figure 2. Impact of application use

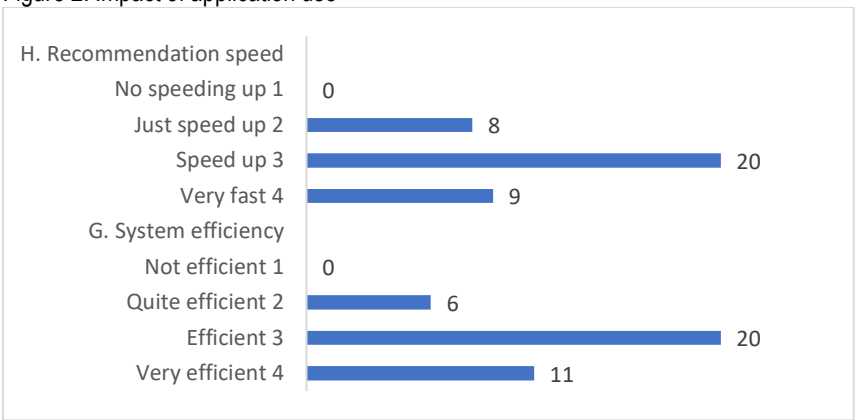

Figure 3. Benefits of technology

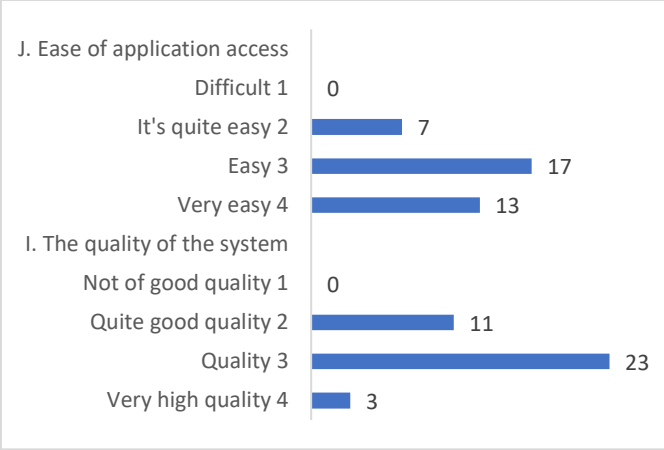

Figure 4 Data quality and access

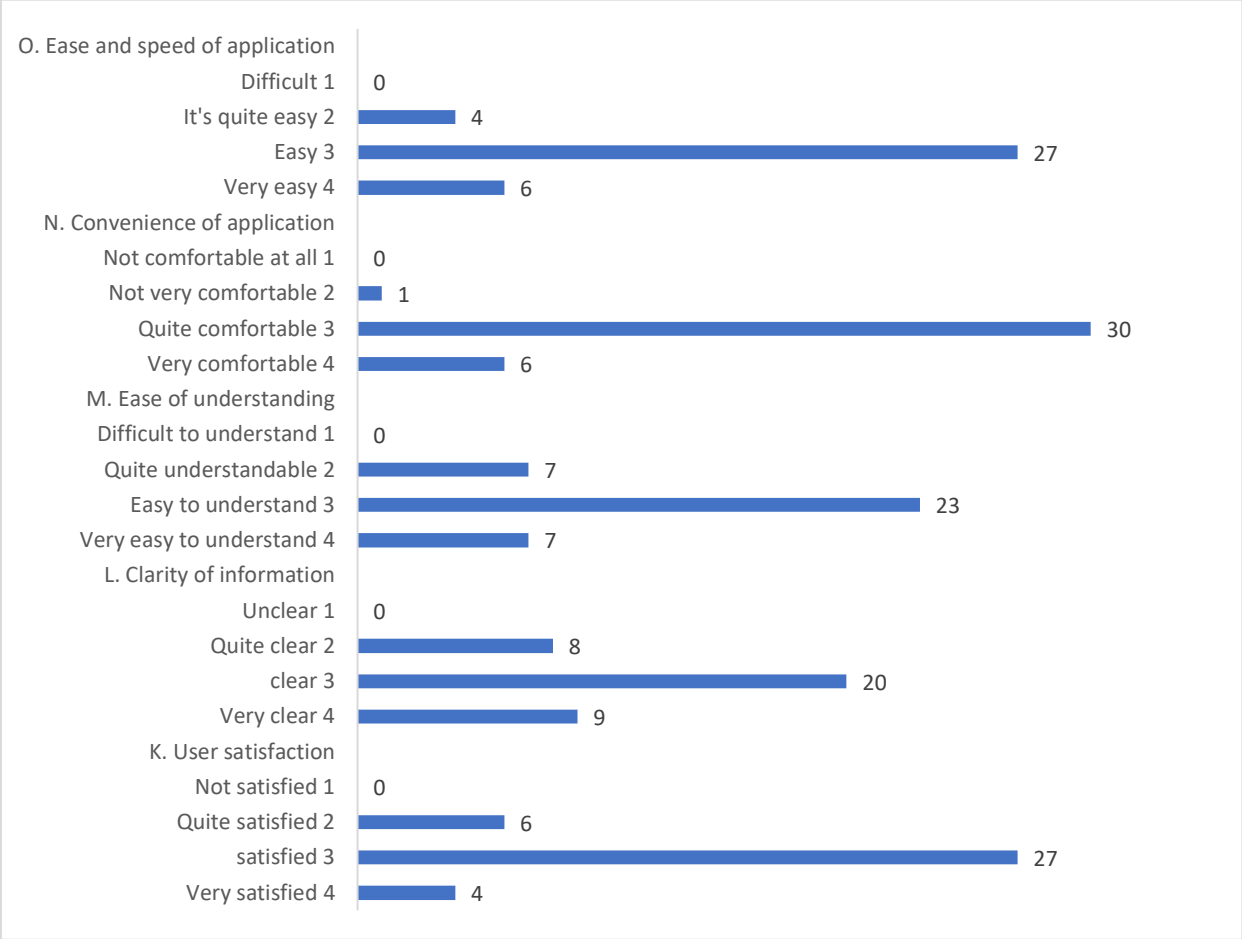

Figure 5. User experience

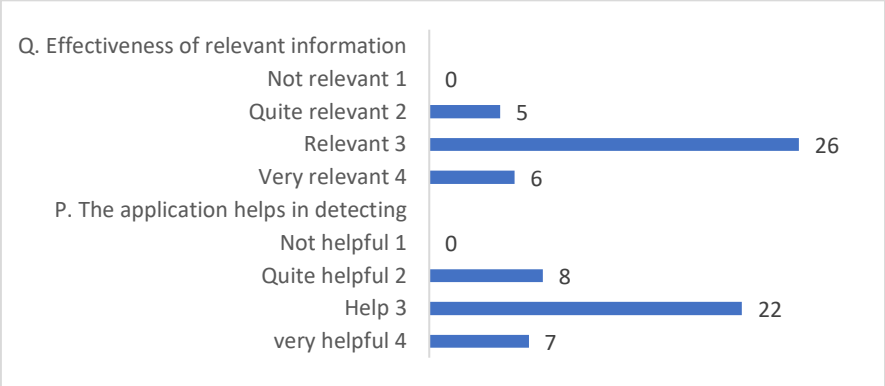

Figure 6 System Effectiveness

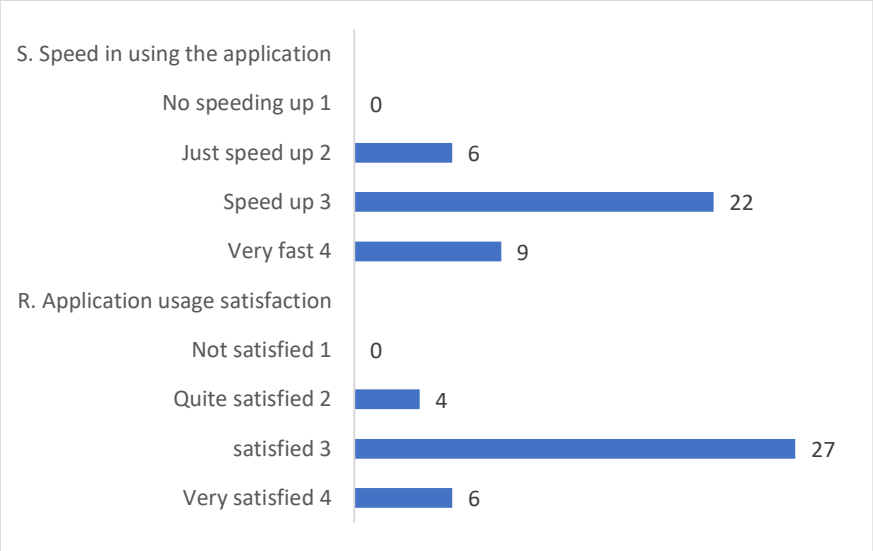

Figure 7 User satisfaction and overall experience

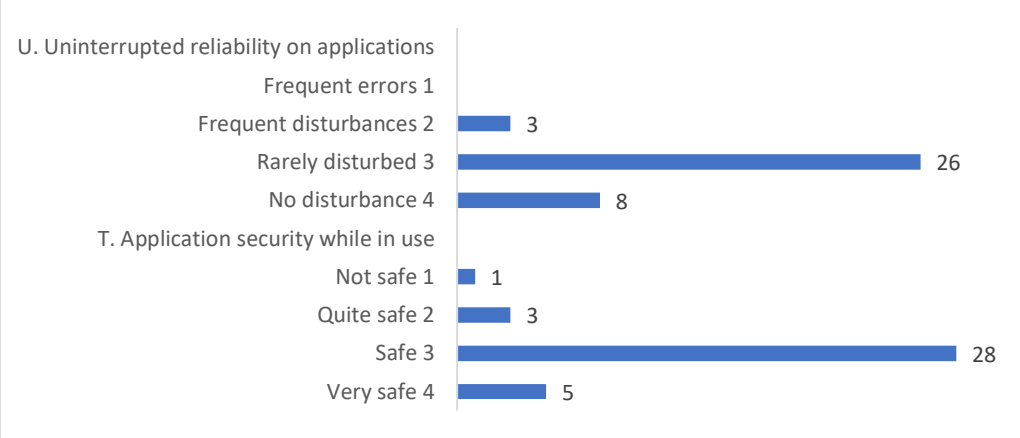

Figure 8. Application reliability and security

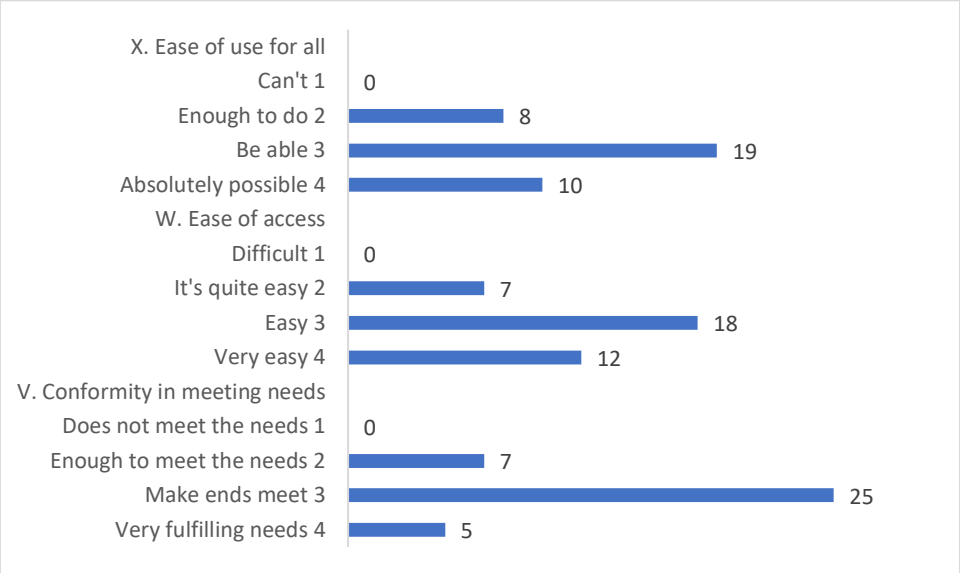

Figure 9. Compliance with user needs

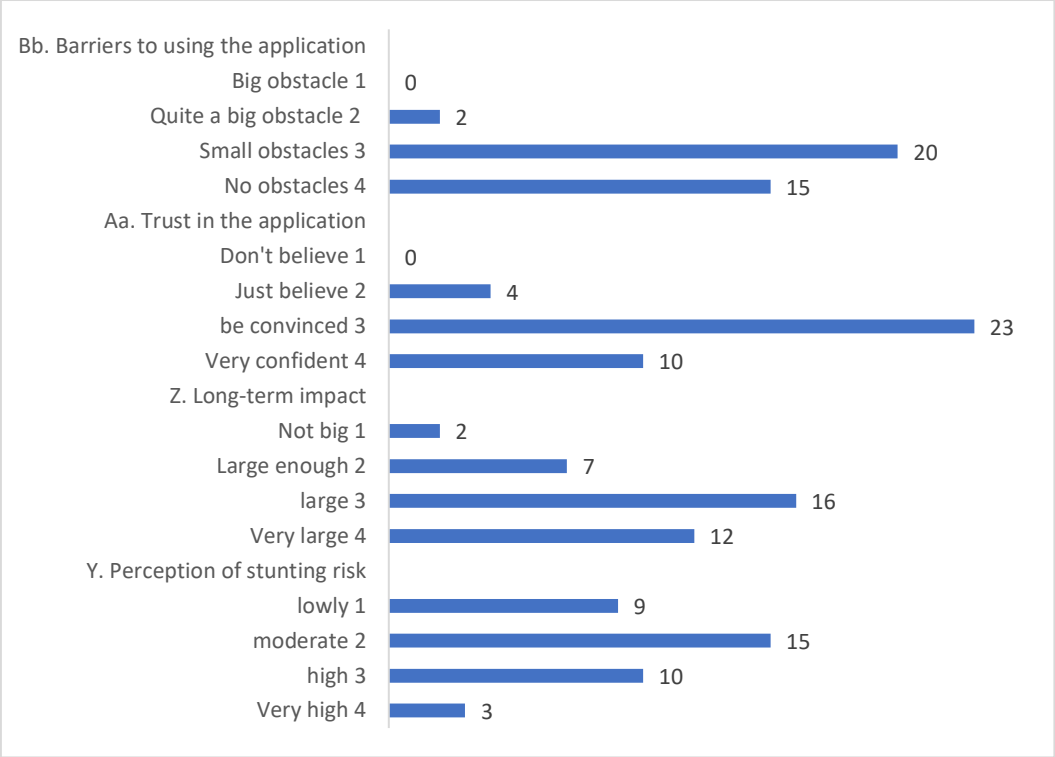

Figure 10 Perception of Risk and Benefits

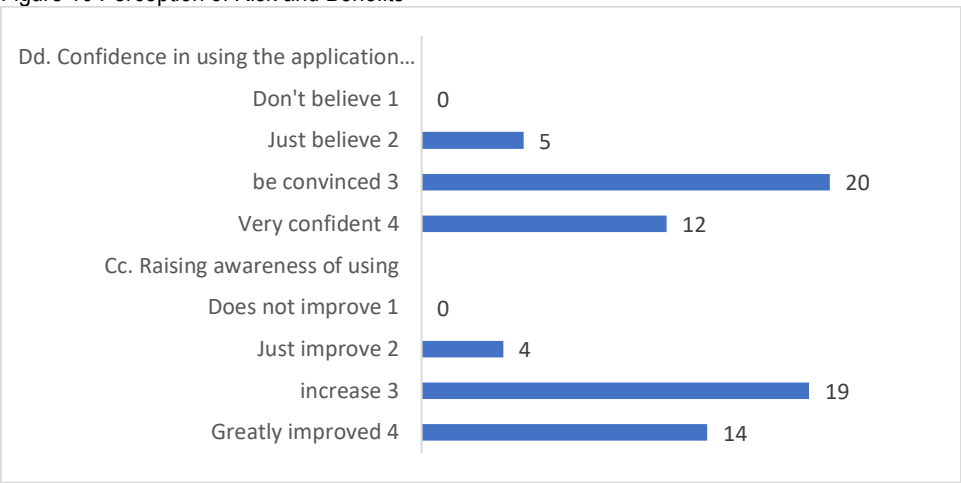

Figure 11 Motivation for using the application

Based on the analysis of Figures 1–11, the indicators show that the visualisation of the usage and impact of Figures 1–4 demonstrates the positive impact of the application's users on efficiency, the benefits of the technology, as well as data quality and ease of access via the system. The experience and effectiveness shown in Figures 5–8 indicate a positive user experience, the system's operational effectiveness, user satisfaction, and the reliability and data security guaranteed by the application. The perceptions and motivation shown in Figures 9–11 represent the suitability of the application's features to users' actual needs, the balance between perceived risks and benefits, and the high level of motivation among respondents to continue adopting this application for nutritional monitoring..

Table 1. Respondents' assessment of the stunting detection app (n=37)

Assessment indicator	Answer category	Frequency (f)	Percentage (%)	Average score	Interpretation
Accuracy	Very accurate (4)	10	27.8%	3.05	Accurate
	Accurate (3)	23	63.9%		
	Quite accurate (2)	3	8.3%		
	Inaccurate (1)	0	0%		
Usability	Very easy (4)	16	44.4%	3.28	Very easy
	Easy (3)	14	38.9%		
	Quite easy (2)	6	16.7%		
	Hard (1)	0	0%		
Utility	Very helpful (4)	14	38.9%	3.25	Helpful
	Helpful (3)	18	50.0%		
	Quite helpful (2)	4	11.1%		
	Not helpful (1)	0	0%		
Reliability	Highly reliable (4)	10	27.8%	3.16	Reliable
	Reliable (3)	23	63.9%		

	Quite reliable (2)	3	8.3%		
	Unreliable (1)	0	0%		

Based on the data presented in Table 1, it can be concluded that respondents' assessments of the stunting detection and management application show a consistently positive trend across all key indicators. Regarding the accuracy indicator, the majority of respondents provided positive feedback, with 63.9% (23 people) rating it as 'accurate' and 27.8% (10 people) rating it as 'very accurate'. With an average score of 3.05, it is evident that the system is highly reliable in calculating the nutritional status of infants based on anthropometric data inputs. Furthermore, the usability indicator recorded the highest average score of 3.28. A total of 44.4% of respondents rated the application as 'very easy' to operate, while 38.9% rated it as 'easy'. This high score indicates that the application's user interface (UI) and navigation have been intuitively designed, thereby minimising technical barriers for users in the field. Regarding the utility, the research findings suggest that this application contributes to simple clinical decision-making processes. Half of the repondents (50%) found it 'helpful' and 38.9% found it 'very helpful'. An average score of 3.25 suggests that users consider the treatment recommendations provided by the application to be relevant and applicable as an initial course of action. Finally, regarding reliability, an average score of 3.16 was obtained. The majority of respondents (63.9%) stated that they trust the output generated by the app. A key finding of this study is that none of the respondents (0%) stated that they did not trust the results. This confirms that this machine learning–based stunting detection app is viewed as a credible digital tool to support programmes aimed at reducing stunting rates and has an excellent level of acceptance.

DISCUSSION

One way of interpreting stunting is through data derived from height-for-age anthropometric measurements taken by healthcare workers. The WHO promotes an online system that facilitates the analysis of children's anthropometric data. The WHO Anthro Survey Analyser aims to encourage best practice in collecting, analysing and reporting anthropometric data [10]. This WHO software comprises three components: an anthropometric calculator, an individual assessment tool, and a nutrition survey tool. Although Indonesia has adopted anthropometric standards and nutritional status measurement outcomes based on WHO guidelines, these are still recorded manually in the MCH handbook [1]. In light of this, an Android application based on machine learning has been developed to simplify and supplement content related to anthropometry, adopting the WHO application — particularly with regard to anthropometry — with a primary focus on nutritional status in cases of stunting.

Machine learning (ML) is a branch of artificial intelligence which uses valid data to enable accurate and rapid decision-making and problem-solving [11]. Research findings support the effectiveness of this anthropometry-based machine learning approach in detecting stunting in children [12]. This study applied ML methods by beginning with the input of baseline data from two regions — Central Java (Banyumas) and the Special Region of Yogyakarta — regarding factors that may contribute to stunting. This was followed by data collection and processing. The machine learning algorithm system was developed using the WHO's system for interpreting anthropometric data and was supplemented with appropriate interventions based on the MCH handbook, ensuring suitable efforts to prevent stunting. Random forest and neural network algorithms were used for multivariate analysis, as the data is quite complex. System testing utilised a testing framework for Android applications, while the validation of ML model results was carried out manually by healthcare workers. The next stage involves implementation and pilot testing to analyse the accuracy of the predictions and users' acceptance of the application.

The results of this study indicate that the Android-based stunting detection and management application utilising a machine learning approach received a very positive overall response from all 36 respondents. Based on all evaluation criteria, the application achieved an average score above 3.00 (out of 4). These key findings suggest that the system developed has met user expectations in terms of functionality and information accuracy. The dominance of responses in the 'accurate' (63.9%) and 'easy' (44.4%) categories demonstrates that the application successfully addresses the main challenge of the early detection of stunting: the need for a precise yet simple-to-operate screening tool. This high level of acceptance suggests that the digitisation of anthropometric procedures is viewed not only as a technical aid, but also as a credible instrument for monitoring the nutritional status of infants. Other research findings also suggest that machine learning-based applications offer excellent system, information, and service quality, providing a benefit score of 98% [13]. This supports the view that this ML-based Android application greatly facilitates user experience, with the system achieving a high score for its results..

Regarding the usefulness of the intervention, the study results show that this application makes a significant contribution to the simple clinical decision-making process. Fifty percent of respondents found it "helpful." An average score of 3.25 indicates that the treatment recommendation feature provided by the application is considered relevant and can be applied by users as an initial treatment step. Finally, regarding the aspect of public trust, an average score of 3.16 was obtained. The majority of respondents (63.9%) stated that they "trust" the output produced by the application. This confirms that this machine learning-based stunting detection application has a very good level of acceptance and is seen as a credible digital tool to support the stunting reduction program. The study also stated that the development of machine learning models is very useful and relevant for predicting whether a child will experience stunting or not in the future (13). This condition is supported by research that with the existence of machine learning-based applications, the public can use them without time or space constraints (14).

This application is important because it provides users with accurate results and appropriate solutions. Digital precision is now a reality when it comes to measuring and interpreting Z-scores. Indeed, the WHO developed an application for calculating anthropometric results long before this. The creation of such supporting applications is one of the ways in which modernization can reduce human error in manual calculation and interpretation processes [14]. A literature review also indicates that technology can enhance the effectiveness of early detection and the efficiency of real-time monitoring, as well as expanding the scope of nutrition education to the public via interactive digital media [15]. The findings of this study also highlight the high utility of this application, particularly with regard to its provision of intervention recommendations appropriate to the MCH handbook. This is important because, for the general public or community health workers in Pos Pelayanan Terpadu (Posyandu), simply identifying a child as 'stunted' is insufficient without accompanying education on the next steps to take (such as referral or nutritional improvement). This demonstrates the application's role as a digital health education medium (m-Health).

CONCLUSION

The Android-based stunting detection and management app has been very well received by users and has proven to be highly effective. With average usability and prediction accuracy scores of 3.28 and 3.05 respectively, the app has demonstrated its ability to transform conventional stunting detection procedures into a faster, more intuitive digital system that minimizes the risk of calculation errors. Respondents believe that the intervention recommendation feature provides added value by enhancing preparedness to address malnutrition at family and community levels. Using this m-Health technology significantly improves the efficiency of early detection compared to manual methods, and it has great potential to

support national programs in reducing stunting prevalence in Indonesia more quickly. Members of the public can use the app to monitor their children's growth trends on a monthly basis. Future researchers can conduct trials on a broader and more demographically diverse population, particularly in frontier, outermost, and underdeveloped (3T) regions with limited access to healthcare personnel, to test the app's performance stability.

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Ethical consideration, competing interest and source of funding

-The ethical approval: This study had obtained ethical approval from the Health Research Ethics Commission of RS Panti Rapih, number: 177/SKEPK-KKE/VII/2025.
-There is no conflict of interest related to this publication.
-This research was funded by Sekolah Tinggi Ilmu Kesehatan Panti Rapih Yogyakarta and Sekolah Tinggi Ilmu Komputer Yos Sudarso through their internal grant programs.

REFERENCES

1. Kementerian Kesehatan Republik Indonesia. Peraturan Menteri Kesehatan Republik Indonesia Nomor 2 Tahun 2022 Tentang Standar Antropometri Anak. 2020 Jan 2.
2. Indonesia. Peraturan Presiden Republik Indonesia Nomor 72 Tahun 2021 tentang Percepatan Penurunan Stunting. 172. Indonesia; 2021 Sep 5.
3. WHO. Reducing stunting in children: equity considerations for achieving the Global Nutrition Targets 2025. 2018.
4. WHO. WHO. 2024. Prevalence of stunting in children under 5 (%).
5. Indonesia. Strategi Nasional Percepatan Pencegahan dan Penurunan Stunting 2025-2029. 2024.
6. DP3AP2KB. Portal Berita Pemerintah Kota Yogyakarta. 2024. Pemkot Yogya Targetkan Prevalensi Stunting Kurang Dari 10 Persen.
7. WHO. Reducing Stunting in Children. 2018.
8. Jezue EM, Silitonga HTH, Rambung E. ASI Eksklusif, Status Imunisasi dan Kejadian Stunting di Indonesia: Studi Literatur. Prominentia Medical Journal. 2021 Jul 19;2(1).
9. Putu Riza Kurnia Indriana N, Ayu Utari Dewi I, Ayu Ratna Darmayanti P. Prediksi Stunting Berbasis Machine Learning melalui CERDIS: Cepat Resposif Deteksi Dini Stunting. Jurnal Rekam Medik dan Informasi Kesehatan. 2025;7(1). doi:10.25047/j-remi.v7i1.6486
10. WHO. WHO. 2019. WHO Anthro Survey Analyser and other tools.
11. Budiasto J, Tallulembang TM, Pare S, Hasbi M. MACHINE LEARNING UNTUK PEMULA (Konsep dan Implementasi) [Internet]. 1st ed. Zalni TY, editor. Vol. 1. Jakarta: Penerbit Buku Indonesia; 2025. Available from: www.penerbitbukuindonesia.com
12. Ratnasari R, Wahidin AJ, Andika TH. Deteksi Dini Stunting Pada Anak Berdasarkan Indikator Antropometri dengan Menggunakan Algoritma Machine Learning. Jurnal Algoritma. 2024 Dec 30;21(2):378–87. doi:10.33364/algoritma/v.21-2.2122
13. Arqam ML, Firdaus AA, Atmojo AM, Saputri GZ, Furizal, Palahuddin, et al. Integrating education-based interventions and machine learning for stunting prevention: A case study in East Lombok, Indonesia. Dialogues in Health. 2026 Jun 1;8. doi:10.1016/j.dialog.2025.100264
14. Rambe NL, Sebayang W. Aplikasi Balita Sehat Terhadap Keterampilan Ibu Terkait Tumbuh Kembang. Jurnal Kesehatan. 2021 Jan 18;11(3):341. doi:10.35730/jk.v11i3.601
15. Aliya A. Anthrocalc: presisi digital dalam mengawal tumbuh kembang generasi. Bogor: Afdan Rojabi Publisher; 2026.
16. Malini RS, Adinandra S. Literature Review: Peran Sistem Smart Health sebagai Inovasi Digital dalam Upaya Pencegahan Stunting. Jurnal ELKON. 2025;5(2):2809–140.

5. Bukti Pembayaran

Feasibility Analysis of Machine Learning-Based Smart Stunting Application

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ABSTRACT
Stunting is a chronic nutritional condition that requires rapid and accurate early detection. Conventional assessment methods that rely on the Indonesian Maternal and Child Health (MCH) handbook; commonly referred to as the MCH handbook or manual anthropometric tables often face challenges related to efficiency and susceptibility to human error. The digitization of anthropometric assessment through an Android-based application offers a promising solution for automating the evaluation of toddlers' nutritional status. This study aimed to examine the perceived benefits and user acceptance of a machine learning–based Android application designed for stunting detection and management. A descriptive quantitative design was employed. Consecutive sampling was used to recruit individuals who met the inclusion criteria, including the ability to operate the designated Android system, resulting in a sample of 37 respondents. Data were collected using a structured questionnaire with a 1–4 Likert scale. Descriptive statistics were applied to generate frequency distributions, percentages, and mean scores for the indicators of accuracy, usability, utility, and reliability. Findings indicate a high level of user acceptance. Usability received the highest mean score (3.28), followed by utility (3.25) and reliability (3.16). A total of 91.7% of respondents rated the prediction system as accurate, with an average accuracy score of 3.05. Respondents also reported that the application was substantially more efficient and faster than manual assessment methods. In conclusion, the machine learning–based stunting detection application effectively supports users in identifying stunting risk quickly and accurately. Its ease of use and strong perceived validity make it a practical tool for both healthcare workers and the general public, contributing to efforts to accelerate stunting reduction.
Keywords: anthropometry; Android-based application; machine learning; stunting

INTRODUCTION
Stunting is a form of chronic growth impairment in which a child's height falls significantly below the expected standard for their age, reflecting long-term nutritional deprivation and recurrent illness. A toddler is classified as short when their length-for-age (LFA) or height-for-age (HFA) Z-score is less than –2 SD (stunted) or less than –3 SD (severely stunted). These Z-scores are derived from standardized anthropometric measurements, which serve as essential indicators for evaluating body size, proportions, and composition. Length-for-age and height-for-age indices are widely used to categorize children as very short, short, normal, or tall, and they remain the cornerstone of child growth monitoring systems worldwide [1]. In Indonesia, stunting continues to be a major public health concern, largely driven by chronic malnutrition during the first 1,000 days of life; a critical developmental window that determines long-term health outcomes. Chronic malnutrition has persisted as one of the most pressing challenges in the national health sector, affecting not only individual well-being but also broader socioeconomic development [2,3].

Global trends indicate gradual progress in reducing stunting. According to the World Health Organization (WHO), the global prevalence of stunting declined by 22.3% between 1990 and 2022, reaching 17.9% in 2022 [4]. Indonesia has also demonstrated significant improvement, with prevalence decreasing from 30.8% in 2018 to 21.5% in 2023 [5]. At the regional level, Yogyakarta City reported a stunting prevalence of 10.6% as of 30 July 2024, showing improvement from 11.8% in 2023 [6]. Despite these positive trends, stunting remains a priority issue within national and global health agendas. It is included as a key indicator in the Sustainable Development Goals (SDGs), with a global target of achieving a 40% reduction in stunting among children under five by 2025 [7]. The persistence of stunting, even amid declining prevalence, underscores the need for sustained, innovative, and evidence-based strategies to accelerate progress.

The consequences of stunting extend far beyond impaired physical growth. Children who experience stunting are at increased risk of delayed cognitive development, reduced school performance, lower future productivity, and diminished quality of life. These long-term impacts highlight the importance of early identification and timely intervention. Effective stunting prevention requires an integrated approach grounded in accurate, reliable, and accessible data [8]. Early detection plays a pivotal role in this process, enabling health workers and caregivers to identify at-risk children before growth faltering becomes irreversible. However, current early detection efforts often encounter substantial barriers. Manual anthropometric assessments using the Maternal and Child Health (MCH) handbook or printed growth charts are time-consuming, prone to human error, and dependent on the availability of trained personnel. In many settings, limited human resources, inconsistent measurement practices, and restricted access to digital health tools hinder the efficiency and accuracy of stunting detection.

Advancements in digital health technologies offer promising opportunities to address these challenges. Machine learning-based detection systems integrated into smartphone applications can enhance the precision, speed, and accessibility of anthropometric assessments. By automating the interpretation of growth data, such systems reduce reliance on manual calculations and minimize the risk of misclassification. Moreover, smartphone-based applications can facilitate broader community engagement, allowing caregivers and health workers to access reliable information and recommendations directly from their devices. These innovations support the development of data-driven policies and strengthen the capacity of health systems to respond to stunting more effectively [9]. As digital transformation accelerates within the health sector, ensuring that new technologies are both beneficial and acceptable to users becomes increasingly important.

Therefore, this study aimed to evaluate the perceived benefits and user acceptance of a machine learning–based Android application designed for stunting detection and management, focusing on its accuracy, usability, utility, and reliability from the user perspective.

METHODS
This study was conducted in 2025 in Yogyakarta, Indonesia, where the Smart Stunting application was tested among community members and individuals familiar with Android-based devices. The feasibility assessment was carried out in collaboration with the Sekolah Tinggi Ilmu Kesehatan Panti Rapih Yogyakarta and supported by field implementation activities within the local community setting. A quantitative research

design with a descriptive analytical approach was employed. This design was selected to provide a systematic and comprehensive overview of user perceptions related to the accuracy, usability, utility, and reliability of the machine learning–based Smart Stunting application. The study did not involve hypothesis testing; instead, it focused on describing response patterns and feasibility indicators derived from user experiences.

The feasibility test involved human participants selected through a consecutive sampling technique. Individuals were recruited based on predetermined inclusion criteria: 1) owning and being able to operate an Android device; 2) willingness to download, install, and use the Smart Stunting application; 3) willingness to participate as respondents; and 4) willingness to complete the structured questionnaire. Exclusion criteria included respondents who experienced technical difficulties related to device incompatibility, particularly unsupported Android versions. After applying these criteria, a total of 37 respondents were included in the final analysis.

Data were collected using a structured questionnaire consisting of 30 items distributed across 11 sections and grouped into four assessment domains: accuracy, usability, utility, and reliability. All items were measured using a 1–4 Likert scale, where higher scores indicated more positive perceptions. The instrument had previously undergone validity and reliability testing and was confirmed to be appropriate for feasibility assessment. The research process comprised several sequential stages: 1) initial data collection and processing using the machine learning model output embedded in the Smart Stunting application; 2) selection and evaluation of the machine learning algorithm used for prediction; 3) system testing to ensure functional stability; and 4) feasibility testing through user interaction with the application followed by questionnaire completion. Respondents were guided to install the application, input anthropometric data, and observe the prediction results before completing the questionnaire.

Collected data were analyzed descriptively using frequency distributions, percentages, and mean scores for each indicator. These descriptive statistics were used to identify response tendencies and categorize user perceptions. Interpretation of results was supported by a score-interval table, enabling accurate identification of achievement levels for each domain. This analytical approach provided strong baseline evidence for evaluating the feasibility and acceptance of the machine learning–based application.

RESULTS

The results of this study present an overview of the results of the feasibility analysis and a summary of the feasibility analysis table from the results of data collection on 37 respondents as follows (Figure 1-11).

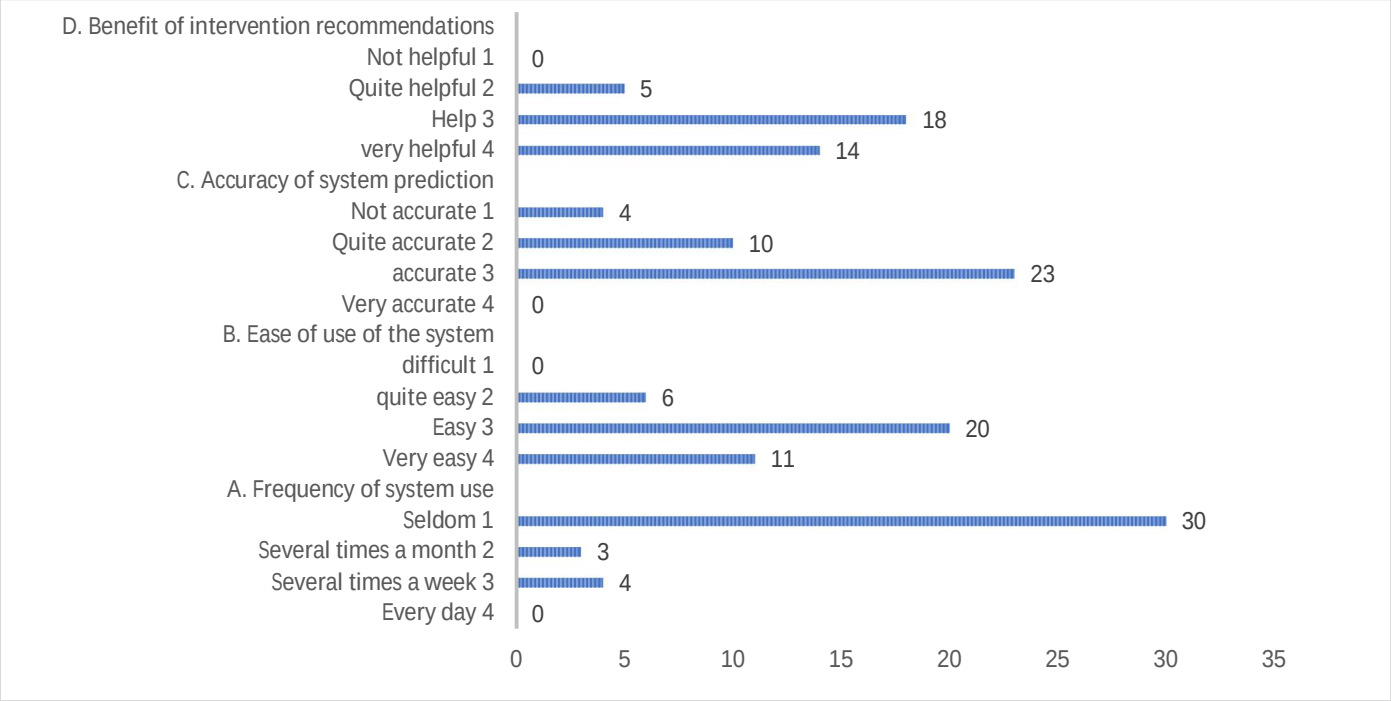

Figure 1. System usage

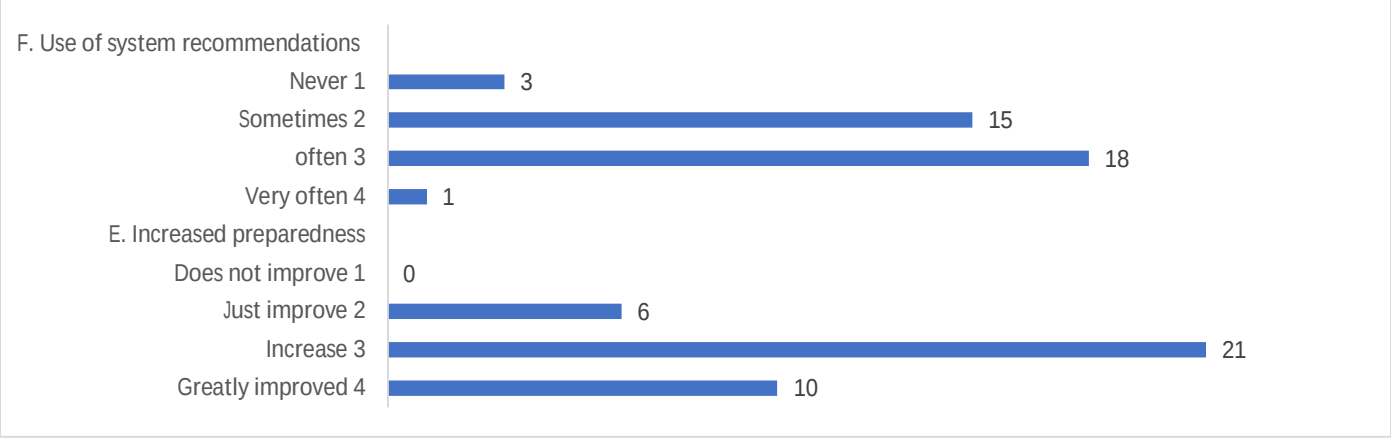

Figure 2. Impact of application use

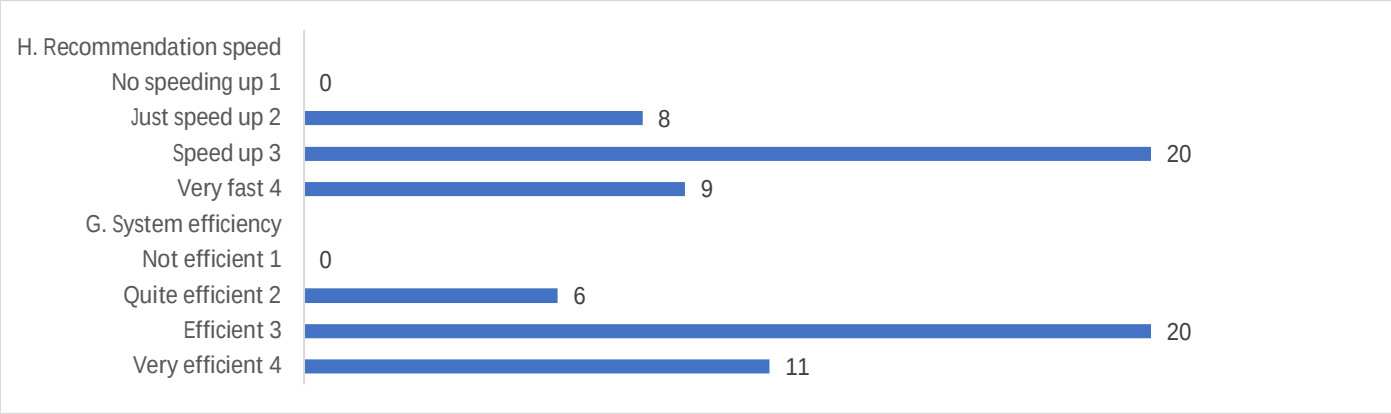

Figure 3. Benefits of technology

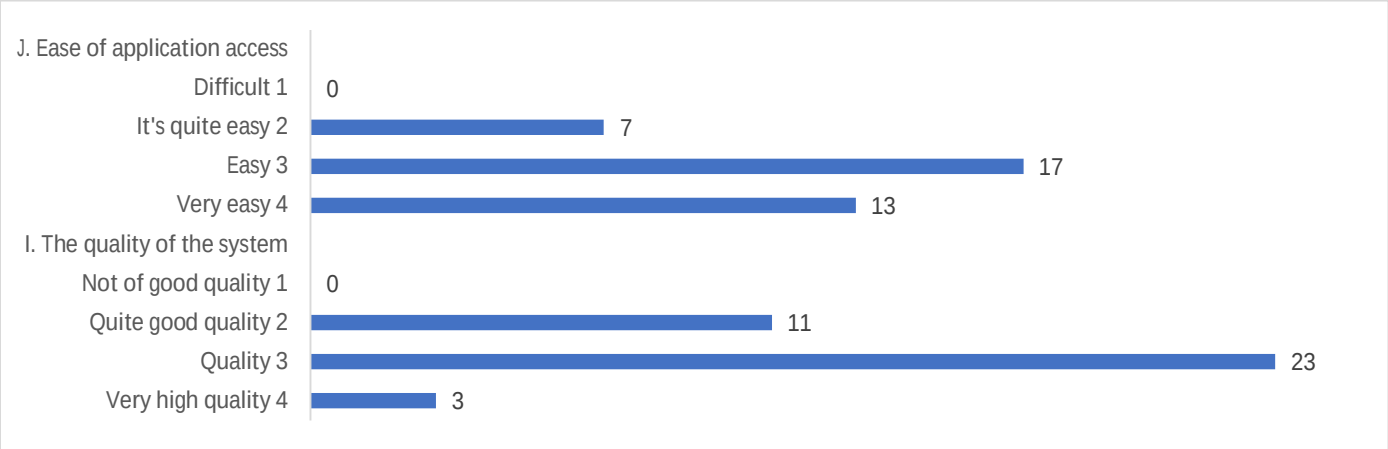

Figure 4. Data quality and access

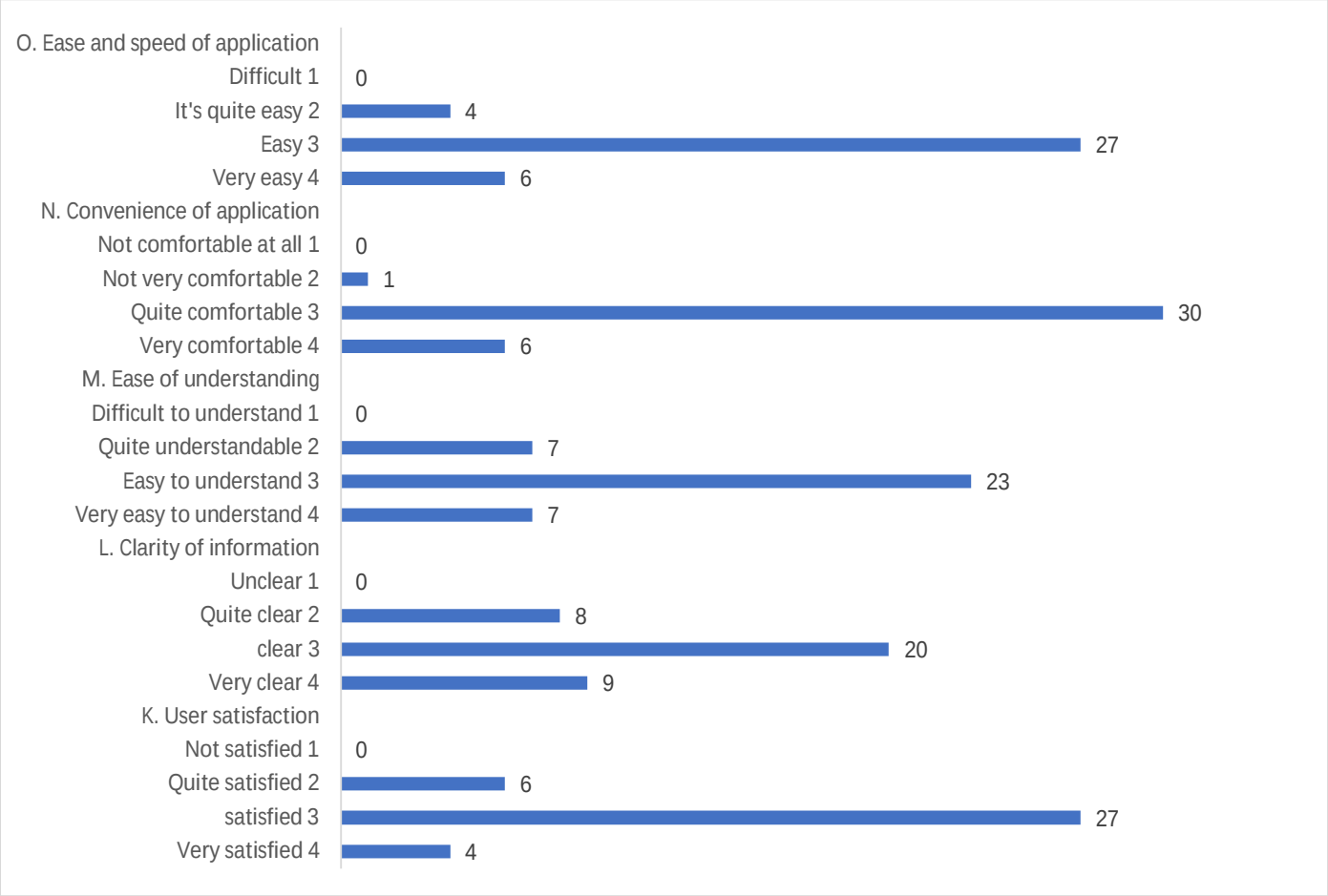

Figure 5. User experience

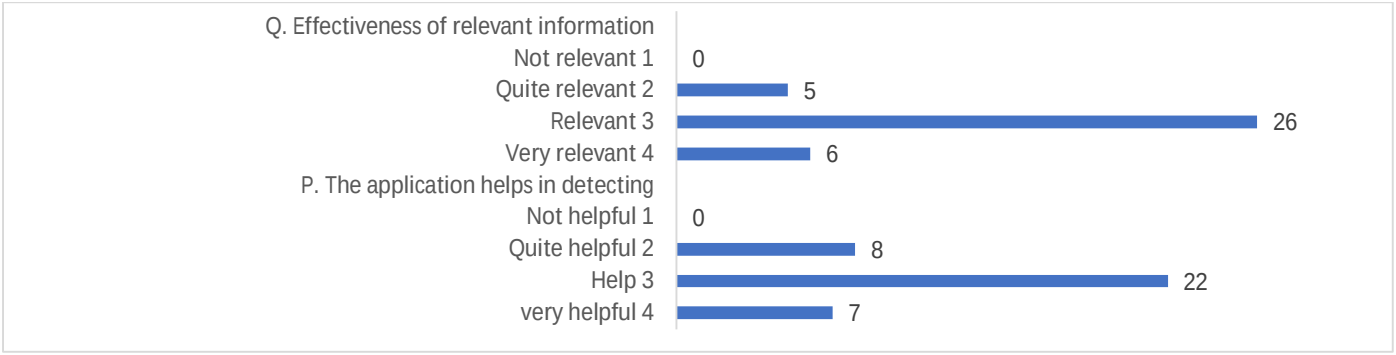

Figure 6. System effectiveness

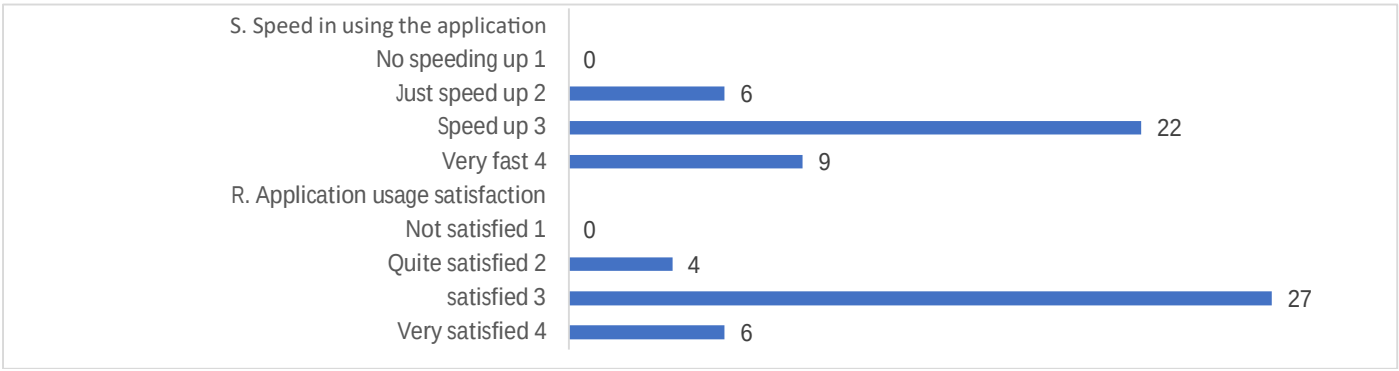

Figure 7. User satisfaction and overall experience

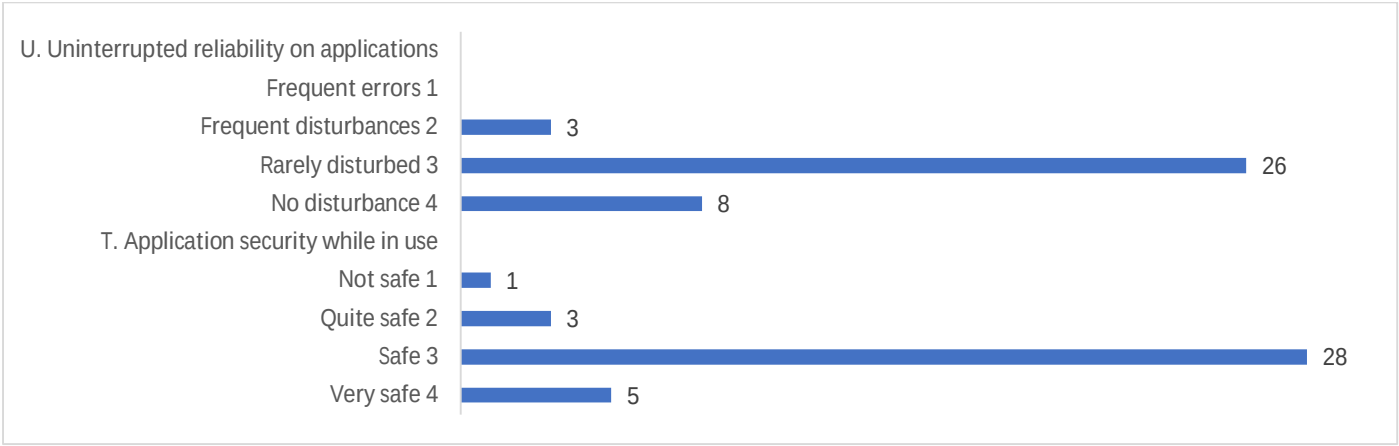

Figure 8. Application reliability and security

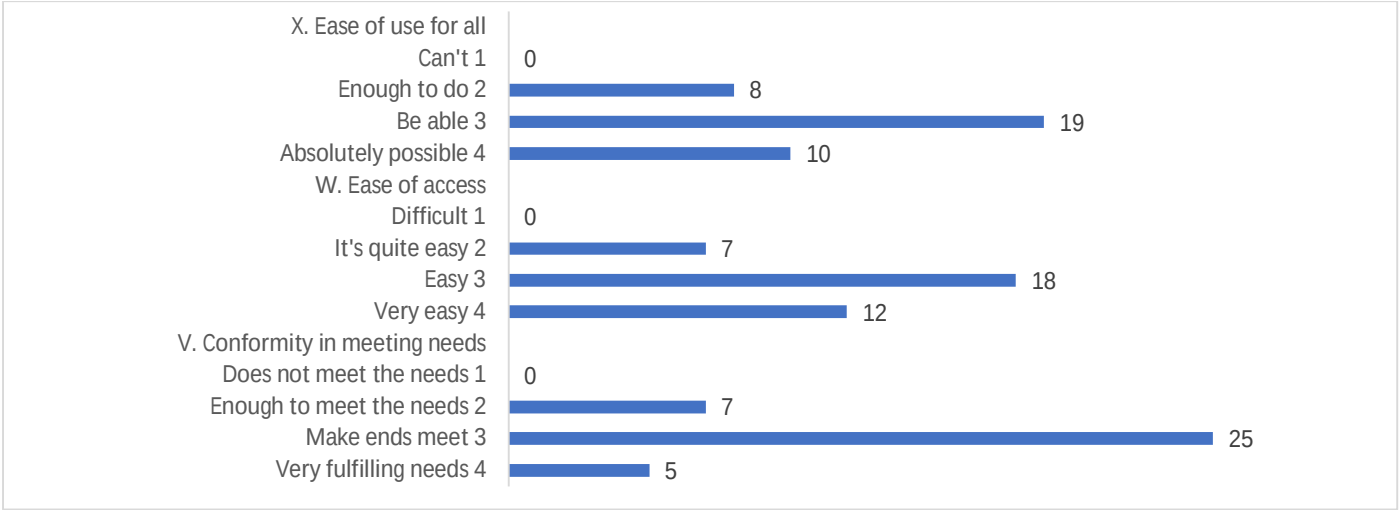

Figure 9. Compliance with user needs

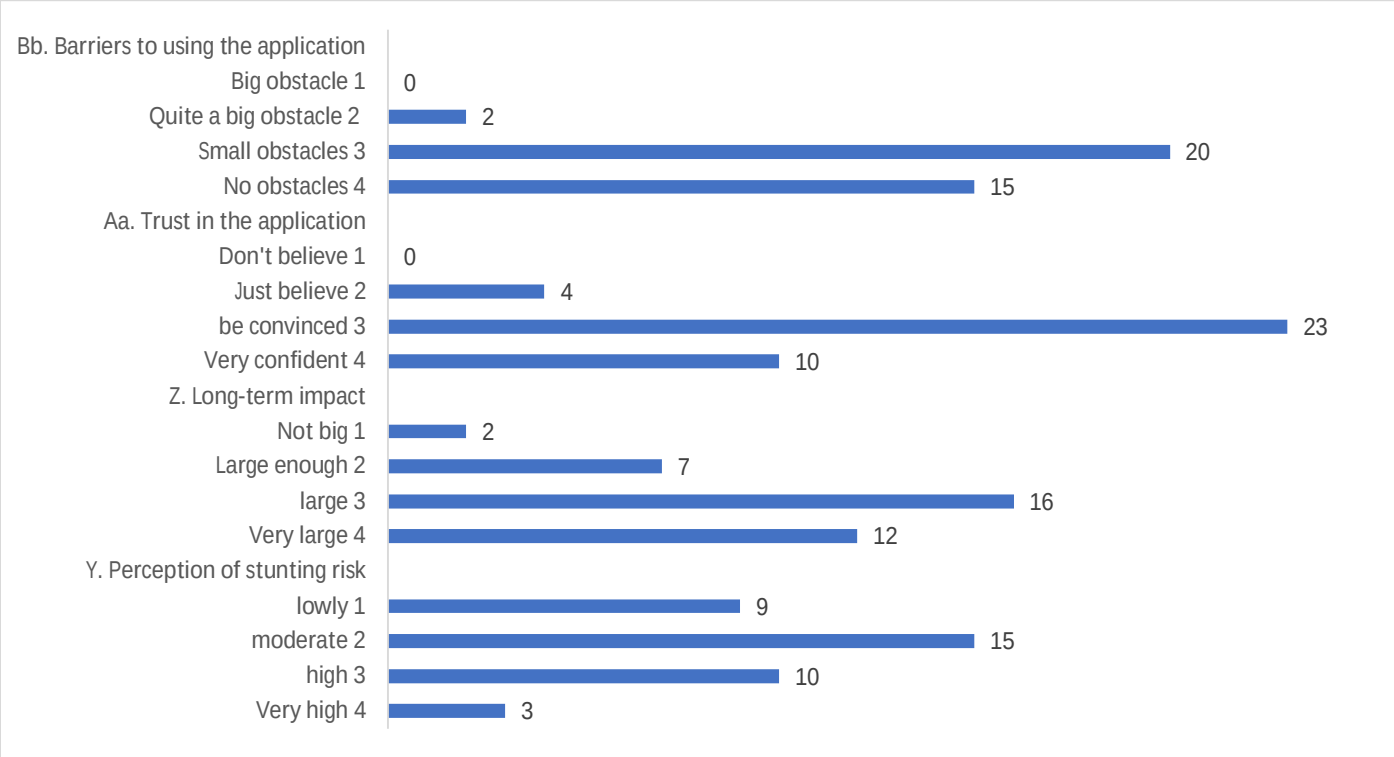

Figure 10. Perception of risk and benefits

Figure 11. Motivation for using the application

Based on the analysis of Figures 1–11, the indicators show that the visualisation of the usage and impact of Figures 1–4 demonstrates the positive impact of the application's users on efficiency, the benefits of the technology, as well as data quality and ease of access via the system. The experience and effectiveness shown in Figures 5–8 indicate a positive user experience, the system's operational effectiveness, user satisfaction, and the reliability and data security guaranteed by the application. The perceptions and motivation shown in Figures 9–11 represent the suitability of the application's features to users' actual needs, the balance between perceived risks and benefits, and the high level of motivation among respondents to continue adopting this application for nutritional monitoring.

Based on the data presented in Table 1, it can be concluded that respondents' assessments of the stunting detection and management application show a consistently positive trend across all key indicators. Regarding the accuracy indicator, the majority of respondents provided positive feedback, with 63.9% (23 people) rating it as 'accurate' and 27.8% (10 people) rating it as 'very accurate'. With an average score of 3.05, it is evident that the system is highly reliable in calculating the nutritional status of infants based on anthropometric data inputs. Furthermore, the usability indicator recorded the highest average score of 3.28. A total of 44.4% of respondents rated the application as 'very easy' to operate, while 38.9% rated it as 'easy'. This high score indicates that the application's user interface (UI) and navigation have been intuitively designed, thereby minimising technical barriers for users in the field. Regarding the utility, the research findings suggest that this application contributes to simple clinical decision-making processes. Half of the repondents (50%) found it 'helpful' and 38.9% found it 'very helpful'. An average score of 3.25 suggests that users consider the treatment recommendations provided by the application to be relevant and applicable as an initial course of action. Finally, regarding reliability, an average score of 3.16 was obtained. The majority of respondents (63.9%) stated that they trust the output generated by the app. A key finding of this study is that none of the respondents (0%) stated that they did not trust the results. This confirms that this machine learning–based stunting detection app is viewed as a credible digital tool to support programmes aimed at reducing stunting rates and has an excellent level of acceptance.

Table 1. Respondents' assessment of the stunting detection app (n=37)

Assessment indicator	Answer category	Frequency	Percentage	Average score	Interpretation
Accuracy	Very accurate (4) Accurate (3) Quite accurate (2) Inaccurate (1)	10 23 3 0	27.8 63.9 8.3 0	3.05	Accurate
Usability	Very easy (4) Easy (3) Quite easy (2) Hard (1)	16 14 6 0	44.4 38.9 16.7 0	3.28	Very easy
Utility	Very helpful (4) Helpful (3) Quite helpful (2) Not helpful (1)	14 18 4 0	38.9 50.0 11.1 0	3.25	Helpful
Reliability	Highly reliable (4) Reliable (3) Quite reliable (2) Unreliable (1)	10 23 3 0	27.8 63.9 8.3 0	3.16	Reliable

DISCUSSION

One way of interpreting stunting is through data derived from height-for-age anthropometric measurements taken by healthcare workers. The WHO promotes an online system that facilitates the analysis of children's anthropometric data. The WHO Anthro Survey Analyser aims to encourage best practice in collecting, analysing and reporting anthropometric data [10]. This WHO software comprises three components: an anthropometric calculator, an individual assessment tool, and a nutrition survey tool. Although Indonesia has adopted anthropometric standards and nutritional status measurement outcomes based on WHO guidelines, these are still recorded manually in the MCH handbook [1]. In light of this, an Android application based on machine learning has been developed to simplify and supplement content related to anthropometry, adopting the WHO application; particularly with regard to anthropometry with a primary focus on nutritional status in cases of stunting.

Machine learning (ML) is a branch of artificial intelligence which uses valid data to enable accurate and rapid decision-making and problem-solving [11]. Research findings support the effectiveness of this anthropometry-based machine learning approach in detecting stunting in children [12]. This study applied ML methods by beginning with the input of baseline data from two regions; Central Java (Banyumas) and the Special Region of Yogyakarta regarding factors that may contribute to stunting. This was followed by data collection and processing. The machine learning algorithm system was developed using the WHO's system for interpreting anthropometric data and was supplemented with appropriate interventions based on the MCH handbook, ensuring suitable efforts to prevent stunting. Random forest and neural network algorithms were used for multivariate analysis, as the data is quite complex. System testing utilised a testing framework for Android applications, while the validation of ML model results was carried out manually by healthcare workers. The next stage involves implementation and pilot testing to analyse the accuracy of the predictions and users' acceptance of the application.

The results of this study indicate that the Android-based stunting detection and management application utilising a machine learning approach received a very positive overall response from all 36 respondents. Based on all evaluation criteria, the application achieved an average score above 3.00 (out of 4). These key findings suggest that the system developed has met user expectations in terms of functionality and information accuracy. The dominance of responses in the 'accurate' (63.9%) and 'easy' (44.4%) categories demonstrates that the application successfully addresses the main challenge of the early detection of stunting: the need for a precise yet simple-to-operate screening tool. This high level of acceptance suggests that the digitisation of anthropometric procedures is viewed not only as a technical aid, but also as a credible instrument for monitoring the nutritional status of infants. Other research findings also suggest that machine learning-based applications offer excellent system, information, and service quality, providing a benefit score of 98% [13]. This supports the view that this ML-based Android application greatly facilitates user experience, with the system achieving a high score for its results..

Regarding the usefulness of the intervention, the study results show that this application makes a significant contribution to the simple clinical decision-making process. Fifty percent of respondents found it "helpful." An average score of 3.25 indicates that the treatment recommendation feature provided by the application is considered relevant and can be applied by users as an initial treatment step. Finally, regarding the aspect of public trust, an average score of 3.16 was obtained. The majority of respondents (63.9%) stated that they "trust" the output produced by the application. This confirms that this machine learning-based stunting detection application has a very good level of acceptance and is seen as a credible digital tool to support the stunting reduction program. The study also stated that the development of machine learning models is very useful and relevant for predicting whether a child will experience stunting or not in the future [13]. This condition is supported by research that with the existence of machine learning-based applications, the public can use them without time or space constraints [14].

The application plays an important role in supporting stunting prevention efforts because it provides users with accurate assessments and context-appropriate solutions. Digital precision has become increasingly attainable in anthropometric evaluation, particularly in the calculation and interpretation of Z-scores. The World Health Organization has long introduced digital tools for anthropometric analysis, demonstrating how modernization can substantially reduce human error in manual measurement and interpretation processes [14]. In this context, technology serves not only as a computational aid but also as a catalyst for improving early detection, enhancing real-time monitoring, and expanding public access to nutrition education through interactive digital platforms [15–21]. The findings of this study further emphasize the high utility of the Smart Stunting application, especially its ability to provide intervention recommendations aligned with the MCH handbook. This feature is crucial because, for the general public and community health workers, identifying a child as "stunted" is insufficient without clear guidance on appropriate follow-up actions, such as referral pathways or nutritional improvement strategies. By offering structured recommendations, the application strengthens decision-making at the community level and functions as an accessible digital health education medium (m-Health). Its role in bridging information gaps highlights the potential of digital innovations to support both preventive efforts and community empowerment in addressing stunting.

CONCLUSION

The Android-based stunting detection and management application was well received and viewed as highly effective by users. They reported that the system successfully modernizes conventional stunting assessment into a faster and more intuitive digital process while reducing the likelihood of human error. The inclusion of intervention recommendations was considered particularly valuable, as it strengthens preparedness for addressing nutritional problems at both family and community levels. This m-Health innovation enhances the efficiency of early detection compared with manual methods and holds strong potential to support national efforts to accelerate stunting reduction. The application can also assist families in monitoring children's growth trends over time. Future studies are encouraged to evaluate the application in larger and more diverse populations, especially in frontier, outermost, and underdeveloped regions where access to healthcare personnel is limited, to further assess its performance stability.

Ethical consideration, competing interest and source of funding

-All research procedures adhered to ethical standards for studies involving human participants. Ethical approval was obtained from the Health Research Ethics Committee (KEPK) of Panti Rapih Hospital Yogyakarta, with approval number 177/SKEPK-KKE/VII/2025. Participation was voluntary, and respondents were informed about the study objectives, procedures, and confidentiality measures. Informed consent was obtained prior to data collection.
-There is no conflict of interest related to this publication.
-This research was funded by Sekolah Tinggi Ilmu Kesehatan Panti Rapih Yogyakarta and Sekolah Tinggi Ilmu Komputer Yos Sudarso through their internal grant programs.

REFERENCES

1. Sayomi BA, Alabi AO, Onigbinde MO, Oladibu OT. Height as a key growth index in the paediatric age group: A comprehensive review. Asian Journal of Pediatric Research. 2025 Oct 27;15(11):11-20.
2. Wells JC, Marphatia AA, Amable G, Siervo M, Friis H, Miranda JJ, Haisma HH, Raubenheimer D. The future of human malnutrition: rebalancing agency for better nutritional health. Globalization and Health. 2021 Oct 9;17(1):119.
3. Wells JC, Sawaya AL, Wibaek R, Mwangome M, Poullas MS, Yajnik CS, Demaio A. The double burden of malnutrition: aetiological pathways and consequences for health. The Lancet. 2020 Jan 4;395(10217):75-88.
4. WHO. Prevalence of stunting in children under 5 (%). Geneva: World Health Organization; 2024.
5. Republik Indonesia. Strategi nasional percepatan pencegahan dan penurunan stunting 2025–2029. Jakarta: Republik Indonesia; 2024.
6. DP3AP2KB. Pemkot Yogya targetkan prevalensi stunting kurang dari 10 persen. Yogyakarta: Pemerintah Kota Yogyakarta; 2024.
7. Shekar M, Kakietek J, D'Alimonte MR, Rogers HE, Eberwein JD, Akuoku JK, Pereira A, Soe-Lin S, Hecht R. Reaching the global target to reduce stunting: an investment framework. Health Policy and Planning. 2017 Jun 1;32(5):657-68.
8. Jezue EM, Silitonga HTH, Rambung E. ASI eksklusif, status imunisasi dan kejadian stunting di Indonesia: studi literatur. Prominentia Medical Journal. 2021 Jul 19;2(1):72-78.
9. Indriana NP, Dewi IA, Darmayanti PA. Prediksi stunting berbasis machine learning melalui CERDIS: Cepat Resposif Deteksi Dini Stunting. J-REMI: Jurnal Rekam Medik dan Informasi Kesehatan. 2025 Dec 21;7(1):60-72.
10. WHO. WHO anthro survey analyser and other tools. Geneva: World Health Organization; 2019.
11. Nozari H, Sadeghi ME. Artificial intelligence and machine learning for real-world problems (a survey). International Journal of Innovation in Engineering. 2021 Oct 7;1(3):38-47.
12. Ratnasari R, Wahidin AJ, Andika TH. Deteksi dini stunting pada anak berdasarkan indikator antropometri dengan menggunakan algoritma machine learning. Jurnal Algoritma. 2024 Dec 30;21(2):378–87.
13. Arqam ML, Firdaus AA, Atmojo AM, Saputri GZ, Furizal, Palahuddin, et al. Integrating education-based interventions and machine learning for stunting prevention: a case study in East Lombok, Indonesia. Dialogues in Health. 2026 Jun 1;8(1):100264.
14. Rambe NL, Sebayang W. Aplikasi balita sehat terhadap keterampilan ibu terkait tumbuh kembang. Jurnal Kesehatan. 2021 Jan 18;11(3):341-8.
15. Coman LI, Ianculescu M, Paraschiv EA, Alexandru A, Bădărău IA. Smart solutions for diet-related disease management: connected care, remote health monitoring systems, and integrated insights for advanced evaluation. Applied Sciences. 2024 Mar 11;14(6):2351.
16. Abeltino A, Riente A, Bianchetti G, Serantoni C, De Spirito M, Capezzone S, Esposito R, Maulucci G. Digital applications for diet monitoring, planning, and precision nutrition for citizens and professionals: a state of the art. Nutrition Reviews. 2025 Feb;83(2):e574-601.
17. Başar HB, Bilici S. Does Technology Affect Nutrition Education Perspectives?. Artuklu International Journal of Health Sciences. 2023;3(3):335-42.
18. Tushir S, Aggarwal N, Sehrawat H, Yasmin S. Empowering nutrition and diet of elderly people using digital technology. Artificial Intelligence in Healthcare for the Elderly. 2025 Nov 15:251-80.
19. Aidoo EM. Advancing precision medicine and health education for chronic disease prevention in vulnerable maternal and child populations. World Journal of Advanced Research and Reviews. 2025;25(2):2355-76.
20. Limketkai BN, Mauldin K, Manitius N, Jalilian L, Salonen BR. The age of artificial intelligence: use of digital technology in clinical nutrition. Current Surgery Reports. 2021 Jun 8;9(7):20-8.
21. Kratzke C, Cox C. Smartphone technology and apps: rapidly changing health promotion. Global Journal of Health Education and Promotion. 2012;15(1):122-8.