



The Effectiveness of Technology-Based Daily Food Recording in Increasing Children's Daily Intake: Literature Review

Ulfa Fitriani Nafista^{1*}, Lailil Fatkuriyah¹

¹ Faculty of Nursing, Pediatric Nurse Department, University dr. Soebandi, Jember, Indonesia.

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ABSTRACT

The technology-based daily recording of children's dietary is expected to be able to provide an easier overview of children's nutritional status. So, it will reduce the number of nutritional imbalances in children. This research aimed to know to determine the effectiveness of children's daily dietary recording with an application to estimate children's nutritional needs. The research method was used a literature review study. Result: From the results of the study, it was concluded that the use of food recording applications, either using photos or not, provides increased information on children's daily nutrition. The application allows an estimation of children's diet's food portions and nutrition. It may become a benchmark for parents or health workers in providing children's diets. The dietary assessment application can be used in the community and hospitals to monitor children's nutrition status. It is recommended that further research include food waste in the calculation so that the daily energy estimate is more accurate.

Keywords: Children, dietary assessment, technology

Correspondence

Ulfa Fitriani Nafista

Faculty of Nursing, Pediatric Nurse Department, University dr. Soebandi, Jember, Indonesia.

Jl. DR. Soebandi No.99, Patrang, Kec. Patrang, Jember, East Java 68111

Email: ulfiatitrianinafista@gmail.com

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1. BACKGROUND

Meeting children's nutritional needs is still a concern internationally and in Indonesia. Stunting, one of the problems of child nutrition is estimated to be experienced by 155 million children in the world (De Onis et al., 2019). While in Indonesia alone stunting cases in 2018 were 29.9% (Riskesdas, 2018). Several things that are associated with poor children's

diet include lack of exclusive breastfeeding, complementary foods too early, lack of parental knowledge about children's diet, and economic status (Scaglioni et al., 2018). In line with those results, it was found that stunting related to inadequate breastfeeding, and low maternal education (Beal et al., 2018). In terms of increasing mothers' knowledge about breastfeeding and complementary foods, applications can

be a choice of modes that can be used (Subandra et al., 2018).

Increasing food variety was one of strategi to increase the quality of children's food, and it will eventually increase their nutritional status (Nafista et al., 2022). Dietary diversity become one of the significant issues in child feeding. The feeding problem is mostly found in households with lower maternal education and low socio-economic status. Because from this household, it was found that the diversity in child food was low in all child group ages (Gebremichael et al., 2017). The economic situation was one of the significant aspects of the diversity of child diet (Surijadi et al., 2021) In Indonesia, the situation was also found in Indonesia where the minimum acceptable diet (MAD) as part of minimum dietary diversity (MDD) and minimum meal frequency (MMF), the result show a low score. As part of the enhancement strategy, the government must strengthen the local food feeding and maternal behavior using local cadre (Pranita et al., 2023).

The design of a children's diet information system is expected to be able to provide an overview of children's nutritional status and be used as a guide in overcoming nutritional problems in children (Khusna & Rizkawati, 2018). Using smartphone applications was useful

and low-cost in increasing children's diet or the general population. It is rather easy to use and can manage the number of food intake and then promote self-awareness in eating (Coughlin et al., 2016). The development of dietary monitoring applications involves of deep monitoring of meal photos and nutrition calculation in terms of nutrition value. Food that is analyzed can be grouped into 14 different categories and classified into multiple labels. That will allow the application to show precise results on food analysis up to 81% (Nadeem et al., 2023). The application can also be used to increase health education as a foundation in developing future mobile health such as carries in children (Muhamat et al., 2021). Food monitoring usually measures preferable and non-preferable food in daily intake. The assessment might help people to engage in healthy behavior in the future (Ahn et al., 2019).

This research aims to analyze the use of smartphones and the internet increasing, the development of children's food monitoring. Food intake management was aimed to record daily food recording is applied not only in the community but also in the hospital environment. So that the number of child nutrition imbalances such as stunting and obesity can be reduced so

that children become healthy and grow optimally.

2. METHODS

This study used a literature study method with the aim of finding the effectiveness of technology-based daily food recording in children with various models. Material for the study was obtained using databases such as Scopus, Proquest, ClinicalKey, JStor, and Semantic Scholar to help find suitable literature.

Timeline for this database research was from 2015-2021 and used keywords namely (children AND dietary assessment and technology).

All accessed database was in the English language. And all the selected articles was using PRISMA flowchart to identify, screening, eligibility and determine inclusion or exclusion criteria. The following are the four stages of PRISMA Flow chart diagram.

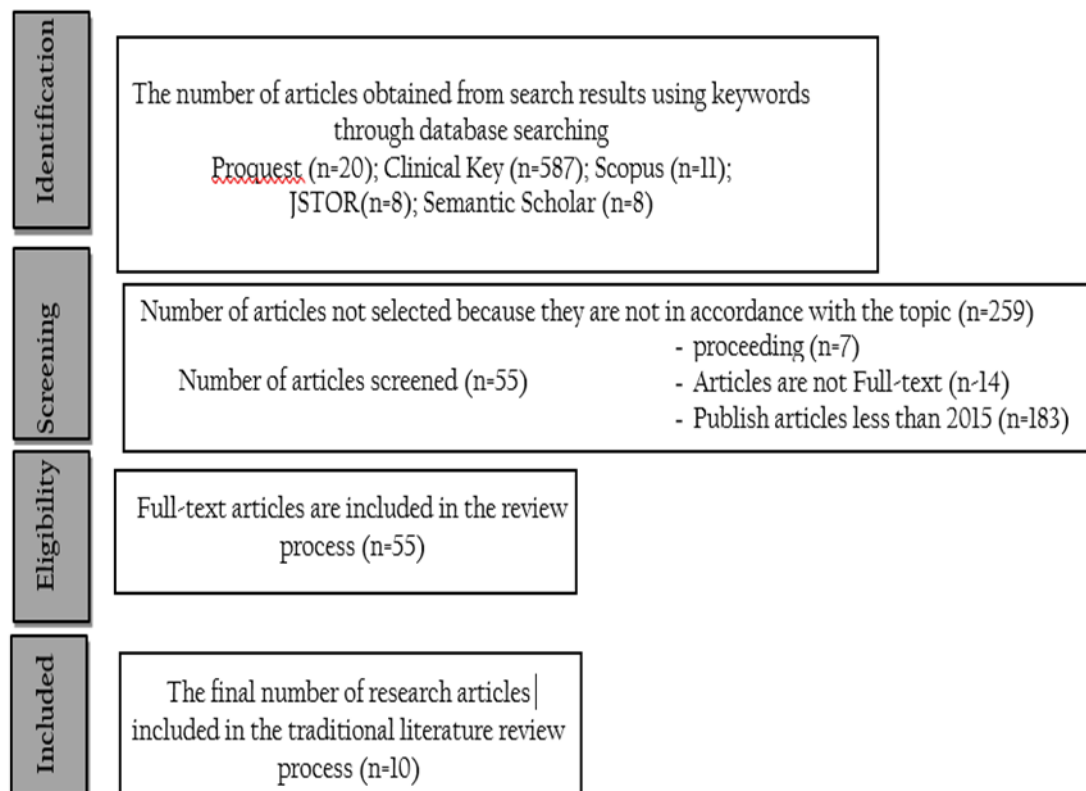


Figure 1. PRISMA Flow Chart

3. RESULTS

After searching articles from several databases from a total of 55 articles are eligible for review. After being divided

based on criteria supporting this study's objectives, 10 main articles were obtained, which will be discussed in detail in table 1. The ten articles discuss the use of a

technology-based daily children's food recording system. Some of them are application-based, or use the web. And in food recording applications are divided into two, namely those that use photos as recording validation, but there are some systems without photos. The system is designed to make it easier for both parents and children to independently monitor their food and nutritional status. Some of the articles reviewed in this study are:

- 1) The Use of Tablet-Based Multiple Pass 24-Hour Dietary Recall Application (MP24Diet) to Collect Dietary Intake of Children under Two Years Old in

the Prospective Cohort Study in Indonesia.

- 2) New mobile methods for dietary assessment: a review of image-assisted and image-based dietary assessment methods.
- 3) Feasibility and Use of the Mobile Food Record for Capturing Eating Occasions among Children Ages 3-10 Years in Guam.
- 4) Active Image-Assisted Food Records in Comparison to Regular Food Records: A Validation Study against Doubly Labeled Water in 12-Month-Old Infants.

Table 1. Article Research Result

No.	Author Name/ Year	Research Title / Journal and Keywords	Journal Name	Research Objectives	Method	Result
1.	Min Kyaw Htet, Umi Fahmida, Tran Thanh Do, Michael J. Dibley, and Elaine Ferguson. (Htet et al., 2019)	The Use of Tablet-Based Multiple-Pass 24-Hour Dietary Recall Application (MP24Diet) to Collect Dietary Intake of Children under Two Years Old in the Prospective Cohort Study in Indonesia	Journal of Nutrients.	This study aims to improve nutritional status and reduce stunting and anemia in Indonesia's children under 2 years old.	Prospective Cohort & cross-sectional Study.	Of the total initial sample of 680 children, 658 (96.1%) of the children were successfully followed up to the age of 18 months. Data is collected through traditional means using paper, and electronics. And it was found that the data showed that the average energy and nutrition in children from 2 types of data collection had similarities. Children aged 12-18 months also measured levels of niacin, folate, vitamin C and B6, which were slightly higher in electronic data collection. However, it is different from the results of calcium and vitamin A (only in groups 6-8) in children aged 6-8 and 9-11 months, where children aged 6-8 months have lower calcium levels in electronic data retrieval. This study shows that using tablets to document children's diets in low- to middle-income economic groups is very

No.	Author Name/ Year	Research Title / Journal and Keywords	Journal Name	Research Objectives	Method	Result
						possible and can record data for 24 hours. This data collection can also be used as a reference in longitudinal data collection for children in Southeast Asia. This study also showed a reduction in the amount of energy and excessive reporting compared to conventional data collection.
2.	Aflague, T. F., Boushey, C. J., Leon Guerrero, R. T., Ahmad, Z., Kerr, D. A., & Delp, E. J. (2015). (Aflague et al., 2015)	Feasibility and use of the mobile food record for capturing eating occasions among children ages 3–10 years in Guam.	Journal of Nutrients	Knowing the ability of children to use technology that serves to record their daily food.	Experimental Studies	The study focused on the ability of 3–10-year-olds in Guam to report daily meals using technology. The study was conducted 2 times, the first was in 2013 against 65, and in 2014 with 72 children. The result of this study is that the application of daily food logging in children is easy to use and can eliminate biased results because the input data comes from a second party such as parents. With the easy use of this technology is expected to reduce the burden associated with the difficulty of dietary history in children today.
3.	Polfuss, M., Moosreiner, A., Boushey, C. J., Delp, E. J., & Zhu, F. (2018). (Polfuss et al., 2018)	Technology-based dietary assessment in youth with and without developmental disabilities.	Journal of Nutrients	Knowing the ease of application and level of acceptance of the application and comparing the two methods used in recording children's food intake with or without disability.	Cross-Sectional Study.	This study used 2 methods, the first is MFr or mobile food record and facetime which is used to ask children's memories of children's food for 24 hours. With a sample of 36 children with and without disabilities. Food mutilation lasts for 6 days and evaluation thereafter. The result is that the use of MFr and 24 Hours recall with face time can be used easily and improve the accuracy of recording children's meals independently. And if these two methods are combined, the results obtained are much more maximal.
4.	Boushey, C. J., Spoden, M., Zhu, F. M., Delp, E. J., & Kerr, D. A. (2017). (Boushey et al., 2017)	New mobile methods for dietary assessment: Review of image-assisted and image-based dietary assessment methods.	Proceedings of the Nutrition Society,	This study is to find out about the development of technology related to digital food recording, the benefits provided and challenges in its application.	Systematic Review	Based on several studies on food recording technology discussed in this article. The application can be used easily in everyday life. Recording with photos also provides an overview of the energy in food, estimated portions and nutritional content that is included with good accuracy. With this use, nutritional assessment is maximized because it is able to improve food reporting than using traditional methods.
5.	Davison, B. K., Quigg, R.,	Pilot testing a photo-based food diary in	Journal of Nutrients	The purpose of this study was to determine the	Experimental Study	The results obtained based on Spearman's analysis are the amount of food and food portions can be estimated

No.	Author Name/ Year	Research Title / Journal and Keywords	Journal Name	Research Objectives	Method	Result
	& Skidmore, P. M. L. (2018). (Davison et al., 2018)	nine- to twelve- year old- children from Dunedin, New Zealand.		effectiveness of the Evernote application in recording and measuring the nutrition of children aged 9-12 years in New Zealand..	with Sequential Explanatory Mixed Method	easily with the help of photos uploaded by children. Nutritional calculations can also be done more optimally. Kids also easily use the daily food app in the Evernote app on Ipod. The research load decreases with high child participation.
6.	Wallace, A., Kirkpatrick, S. I., Darlingston, G., & Haines, J. (2018). (Wallace et al., 2018)	Accuracy of parental reporting of preschoolers' dietary intake using an online self-administered 24-h recall.	Journal of Nutrients	The purpose of this study was to assess the validity of the web-based personal record keeping (Automated Self-Administered 24-h Dietary Assessment Tool (ASA24-Canada) on the diets of children aged 2-5 years conducted through parents.	Experimental Studies	From this study, it was found that the level of accuracy of recording children's food with the help of parents was accurate. In terms of estimated nutrition and the portion given by parents is written higher than the original portion.
7.	Johansson, U., Venables, M., Öhlund, I., & Lind, T. (2018). (Johansson et al., 2018)	Active image-assisted food records in comparison to regular food records: A validation study against doubly labeled water in 12-month-old infants	Journal of Nutrients	This study aims to compare total energy and macronutrients in the diet of children aged 8-12 months. With the help of daily reported food pictures.	Randomized Controlled Trial.	In this study, the results of using photos before and after food helped assess portions and nutrition of food better than the method of recording what food photos. It also improves the accuracy of macronutrient counting. The weakness of this study is that it did not consider leftovers from children's meals and how to maximize the images and information inputted in the application in order to minimize bias in the study.
8.	Deierlein, A. L., Bihuniak, J. D., Nagi, E., Litvak, J., Victoria, C., Braune, T., Weiss, R., &	Development of a technology-assisted food frequency questionnaire for elementary and middle school children:	Journal of Nutrients	The purpose of this study is to determine the use of VioScreen FFQ questioner which is usually used on adults will be used to children from elementary to junior high school groups.	Experimental Studies	From this study, it was found that VioScreen FFQ can be understood by children aged 6-14 years. In data collection for 3 days, children fill in food data thoroughly. Although some children question the food in question is not on the web list. Children also actively participate in discussion groups about questions on the web. This preliminary research is expected to be able to provide an overview of

No.	Author Name/ Year	Research Title / Journal and Keywords	Journal Name	Research Objectives	Method	Result
	Parekh, N. (2019). (Deierlein et al., 2019)	Findings from a pilot study.				questioner development for children in the future.
9.	Erkilic, T. O., & Pekcan, G. (2020) (Erkilic & Pekcan, 2020)	Evaluation of validity of digital photograph based dietary intake in school children.	Journal of Progress in Nutrition	This study aims to compare the accuracy of recording food for school-age children for 24 hours using manual recording (Manual Record) and the use of photos (Digital Photograph).	Experimental Studies	Based on the results of this study, it was found that food recording uses RM more because it does not include the remaining food on the plate. It also shows that food recording using photos is better used in children but needs to be in conjunction with RM for maximum results. And this also shows that the use of technology can help solve problems in recording children's food easily, practically, and have their own preferred methods. And the use of DM needs to be reviewed for the elderly, adults, school-age children and disabled people.
10.	Norman, Å., Kjellenberg, K., Torres Aréchiga, D., Löf, M., & Patterson, E. (2020). (Norman et al., 2020)	Everyone can take photos." Feasibility and relative validity of phone photography-based assessment of children's diets - A mixed methods study.	Nutrition Journal.	The objectives of this study are: 1. Assess the validity level of photos taken by parents with cellphone cameras on food of children aged 5-7 years for 24 hours. 2. evaluate alternative methods of FFQ adaptation for 24 hours. 3. Find out how parents experience using this mode. And is that this mode is accepted by the subject.	Mixed-Methods Design	The use of this mobile camera is considered by parents as an easy mode in reporting children's food for 24 hours. Although by parents with low socioeconomic backgrounds, and no language barrier was found. This application is considered easier than other programs. And able to estimate the child's meaningful intake. As well as reducing the burden on children and parents answering long questions in questioners.

4. DISCUSSION

Food monitoring in children diet can be done to both healthy and sick children, it can help not only on monitoring but also shows their daily diet. For example, the use

of digital food recording in children with or without disabilities can be easier to do and apply than when children are expected to remember food for 24 hours and then record it (Polfuss et al., 2018).



Figure 2. Mobile Food Record application display before and after child eats (Polfuss et al., 2018).

The use of smartphone-based applications such as INDDExX 24 turned out to be able to be applied in low-income countries. With this application, it is

expected to be able to solve nutritional problems and provide an overview for the formation of nutrition-related policies in the future (Coates et al., 2017).

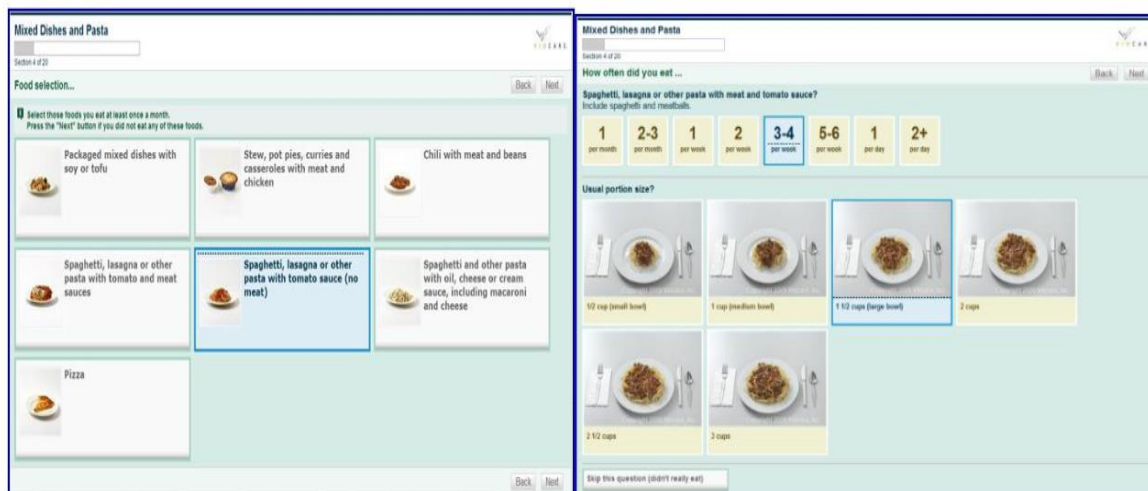


Figure 3. VioScreen app that provides an overview of food choices and portions (Deierlein et al., 2019)

The use of a child food recording system can not only be used as a preventive and monitoring measure but also as a method of treating patients with eating disorders. The use of food recording applications in patients with anorexia nervosa and bulimia nervosa found that the knowledge of parents and children increased in line with the improvement of their recovery (Darcy & Lock, 2017). This is because the MOOC application used provides an overview of the body image and good portions of food and how to manage portions well. The data collection on diet monitoring have significant role on projecting food information and tract the individual meal time (Guyon et al., 2016).

In this literature review, it was found that there are several groups of children's food recording information systems. Children aged 4-6 months in New Zealand were 27 children with a study period of September 2016-July 2017 with parents as the people who recorded the diet. Energy results and portion estimates are better done with a photo assistant as a reference. However, the rest of the meal is not taken into account so that it can become biased (Johansson et al., 2018). Shooting with assistants provides better accuracy so as to reduce bias in research when children because it reduces parental involvement in taking pictures (Aflague et al., 2015).

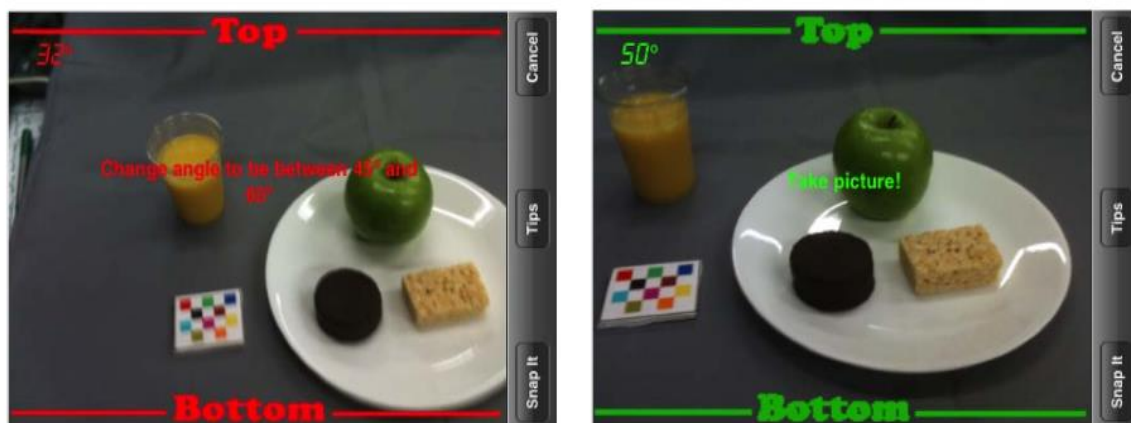


Figure 4. Assistant in an application to help a child take pictures (Aflague et al., 2015).

The use of children's food recording applications to estimate children's energy and nutrition can also be applied in hospitals. In the application of the MyFood application to children in the hospital, it

was found to record energy in children's food, protein and the number of drinks. Due to the good results, this application can be recommended for use in hospital areas (Paulsen et al., 2018).

5. CONCLUSION

From literature studies that have been read, all of them show the effectiveness of food recording in children using technology-based systems. From the application of children's nutritional needs and status is easier to monitor than using conventional nutritional assessments. So that later it is expected that the application can reduce the number of nutritional imbalances in children.

AUTHOR CONTRIBUTIONS

Substantial contributions to conceptualization, data curation, analysis, Supervision Writing - review & editing: Ulfia Fitriani Nafista and Lailil Fatkuriyah. Manuscript revisions: Ulfia Fitriani Nafista.

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CONFLICT OF INTEREST

The authors declare no conflict of interest for this publication.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the

corresponding author upon reasonable request.

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