

From headphone to health: utilizing podcast to improve the nutrition literacy of high school students De los auriculares a la salud: utilización de podcasts para mejorar la alfabetización nutricional de los estudiantes de secundaria

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Abstract. Most of adolescents, especially high school students, have not been able to consume food that fulfills balanced nutrition principles. Low nutrition literacy is one of the causes of nutrition-related problems. In addition, Physical Education teachers' inability to provide balanced nutrition material needs to be addressed a solution, one of which is by using podcast. This study aims to determine the effectiveness of providing balanced nutrition material podcasts to improve nutrition literacy of high school students. Quantitative research with a single group pre-experimental research design with pretest-posttest (one group pretest-posttest design) was used as the method of research. The study sample was 36 people [male: 16, female:20] selected by using proportional random sampling. Data collection technique to measure the students' nutrition literacy level used multiple choice question instruments [Aiken Validation V: 0.83, Alpha Cronbach's reliability value: 0.749]. Data analysis used paired t-tests, with hypothesis test calculation using IBM SPSS version 23.0. The results showed that there was an increase in nutrition literacy of high school students which was indicated by the results of pretest-posttest of 32.81 to 38.15, and the results of the SPSS test showed the effectiveness of providing balanced nutrition podcast media to improve the nutrition literacy of high school students with a sig value of $0.000 < 0.005$. Based on these results, it can be concluded that it is effective to provide podcast media to improve the nutrition literacy of high school students. The application of balanced nutrition podcasts in learning helps students gain broad and more accurate insights because they present speakers from nutritionists so that students' nutrition literacy increases.

Keywords: Balanced Nutrition, Nutrition Literacy, Podcast, High School

Resumen. Los adolescentes de secundaria aún no son capaces de consumir alimentos con una composición que cumpla con los principios de una nutrición equilibrada, la baja alfabetización nutricional es una de las causas de los problemas relacionados con la nutrición. Además, la falta de capacidad de los profesores de educación física para proporcionar material nutricional equilibrado requiere una solución: el uso de podcasts. El objetivo de esta investigación es determinar la efectividad de proporcionar podcasts con material de nutrición equilibrada para aumentar la alfabetización nutricional en estudiantes de secundaria. Este método de investigación es una investigación cuantitativa con un diseño de investigación preexperimental de un solo grupo con pretest-posttest (diseño de pretest-posttest de un grupo). La muestra de la investigación fue de 36 personas [hombres: 16, mujeres: 20] seleccionadas mediante muestreo aleatorio proporcional. La técnica de recolección de datos para medir el nivel de alfabetización nutricional de los estudiantes se midió utilizando un instrumento de preguntas de opción múltiple [Validación V de Aiken: 0,83, confiabilidad del valor Alfa de Cronbach 0,749]. El análisis de datos utilizó la prueba t pareada, con cálculos de prueba de hipótesis utilizando IBM SPSS versión 23.0. Los resultados de la investigación muestran que hay un aumento en la alfabetización nutricional en los estudiantes de secundaria, es decir, a partir del resultado previo a la prueba de 32,81, el resultado posterior a la prueba aumentó a 38,15 y los resultados de la prueba SPSS muestran la eficacia de proporcionar medios de podcast de nutrición equilibrada para aumentar la alfabetización nutricional de estudiantes de secundaria con un valor sig de $0,000 < 0,005$. Con base en estos resultados, se puede concluir que existe efectividad en proporcionar medios podcast para aumentar la alfabetización nutricional de los estudiantes de secundaria. La aplicación de podcasts de nutrición equilibrada en el aprendizaje ayuda a los estudiantes a obtener una visión más amplia y precisa porque presentan recursos de expertos en nutrición para que aumente la alfabetización nutricional de los estudiantes.

Palabras clave: Nutrición equilibrada, Alfabetización nutricional, Podcast, Escuela secundaria

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Introduction

Education is a very important and inseparable part of life. Education determines the ability of qualified human resources forward and backward. Education is a process of conscious and planned knowledge transfer to change human behavior and mature humans through the teaching process in the form of formal, non-formal, and informal education (Solissa et al., 2022). Therefore, education is important for humans to gain extensive knowledge to face challenges in life. The subject matter refers to the curriculum to achieve predetermined competency standards and basic competencies (Aisyah et al., 2020). Teaching materials must be made systematically and refer to the syllabus created to achieve predetermined competency standards and basic competencies. Physical education learning on healthy lifestyle

material focuses on efforts to familiarize healthy living behavior. World Health Organization considers schools a formal and ideal space to provide literacy of healthy lifestyles (Betancur et al., 2024). Overweight and obesity in teenagers is caused by unhealthy lifestyles and eating behavior (Flores-Paredes et al., 2024). It is because students stay between 6 to 8 hours a day to study at school (Betancur et al., 2024). The importance of healthy lifestyle material as health promotion in Physical Education subjects is to overcome problems resulting from lack of physical activity, obesity and overweight in society, including in children and adolescents (García-Pérez et al., 2024). A healthy lifestyle is a set of maintaining diet, hygiene, personal care, self-regulation, physical activity, and adequate rest (Betancur et al., 2024). Improving health is improving a healthy living environment by exercising, carrying out disease eradication, providing

education, improving nutrition quality, and counseling on hygiene and health (Noviyanti & Marfuah, 2019). Therefore, the provision of healthy lifestyle materials and balanced nutrition materials must be conveyed optimally so that students have an awareness of maintaining good habits so as not to harm their health.

During the learning break, adolescents buy food in the canteen without considering its nutrition. The variety of food served in the canteen is classified as less healthy, less nutritious, and less balanced (Anta et al., 2016). Several foods contain preservatives, dyes, and artificial sweeteners. It gives negative impacts to students, and the negative impact of eating less healthy, less nutritious, and less balanced is malnutrition. Malnutrition problems that occur a lot in children include undernutrition and overnutrition. Malnutrition can affect physical growth and intelligence, cause disease, cause diarrhea, and even increase obesity (Anta et al., 2016).

Based on the results of interviews and preliminary study questionnaires on balanced nutrition material by researchers on 36 students of SMK 1 Depok Yogyakarta, it was found that 1) many students still did not understand the benefits or disadvantages of consuming food products, 2) many students did not know how to assess the proper portion size of food to maintain balanced nutrition, 3) students did not understand how to read food labels and nutritional value information on food products, so they could not know the benefits or disadvantages of consuming food products, 4) students did not have adequate awareness or understanding of the importance of nutrition literacy and its impact on health, 5) many students did not consume nutritious foods, 6) Students found it difficult to access accurate and relevant nutritional information.

In line with the opinion (Fayasari & Juanita, 2023) that students have not been able to consume food with a composition that meets the principles of balanced nutrition, regular and thorough counseling is needed to increase knowledge about balanced nutrition and is expected to increase awareness of balanced nutritional behavior in the future that students have not been able to consume food with a composition that meets the principles of balanced nutrition, regular and thorough counseling is needed to increase knowledge about balanced nutrition and is expected to increase awareness of balanced nutritional behavior in the future. Furthermore, (Tawali et al., 2022) state that adolescents are vulnerable to various nutritional problems, such as undernutrition and overnutrition. Nutritional problems in adolescents hurt public health, such as decreased learning concentration, the risk of giving birth to babies with low birth weight (LBW), and decreased physical freshness (Noviyanti & Marfuah, 2019). In the world, there are more than 340 million children and adolescents aged between 5 and 19 years who are overweight or obese (Betancur et al., 2024). (Waluyani et al., 2022) reveal that there are many more adolescent nutritional problems, namely (1) anemia, which is a medical condition in which the levels of red blood cells in the body are not by the levels of red blood cells that

should be normal, (2) stunting, which is a medical problem characterized by a lack of nutritional intake in the body for a long time caused by the food consumed that does not contain enough nutrients, (3) obesity, this problem is one of the biggest causes of death in the world because it is a risk factor for the occurrence of Type 2 Diabetes Mellitus, Coronary heart disease, Hypertension, and several cancers. (4) wasting, which is poor food intake and the presence of an infection. Adolescents who suffer from wasting have the risk of experiencing nutritional deficiencies that have an impact on body health and development, such as disease infection and brain workability in adolescents. An unhealthy diet is one of the main catalysts for the emergence of medical conditions such as obesity, diabetes, hypertension, and metabolic syndrome (Warnier-Medina, A. et al., 2024). In addition, unhealthy eating behavior, excess weight, excessive energy consumption, saturated fat, trans fat, sugar, and salt, and low consumption of vegetables, fruits, and grains, are also important risk factors and health problems (Warnier-Medina, A., et al., 2024).

Adolescents aged 12-18 have the habit of choosing the foods they like and tend to consume unhealthy foods such as fried foods, drinking colored drinks and soft drinks, and consuming fast food. Behavioral habits that are carried out will be related to health (Warnier-Medina, A. et al., 2024). Adolescents also have the perception that by eating a lot of food and being full, their nutritional needs have been met (Alwi et al., 2024). It is in line with the 2018 Riskesdas report on adolescent eating habits, which shows that the prevalence of adolescents who do not eat breakfast is 62.2%, adolescents who do not consume vegetables and fruits as much as 95.5%, and adolescents who often eat flavoring foods are 75.7%. In addition, the population aged over ten years in Indonesia has a habit of eating fried, cholesterol, and fatty foods of 40.7%, consumption of salty foods of 26.2%, and consumption of sweet foods of 53.1%, but the behavior of lack of vegetable and fruit consumption reaches 93.6% (Syafei & Badriyah, 2019). Therefore, it is important to provide balanced nutritional materials to improve nutrition literacy to minimize the occurrence of malnutrition, anemia, risk of obesity, wasting, and diabetes in students, which can later increase growth, physical development, and intelligence and prevent the occurrence of chronic diseases, non-communicable diseases related to nutrition. An unhealthy diet, lack of physical activity, and a sedentary lifestyle are among the most important risk factors for chronic non-communicable diseases (Warnier-Medina, A. et al., 2024).

The delivery of balanced nutritional materials in schools tends to be monotonous and theoretical, so it makes students bored. Therefore, variations in learning media are needed in the delivery of materials. The teaching and learning process in the classroom cannot be separated from the use of learning media that supports the delivery of material from teachers to students (Taningrum et al., 2024). The role of teachers and digital competencies is increasing, and teachers are expected to be the vanguard in the changes

presented and propose new teaching methodologies (Bernate & Fonseca, 2023). Learning media is a tool used to convey information to students using various techniques so that they can understand the substance of the information presented (Zega, 2022). Learning media can be used to convey messages from educational materials. Various media can be developed, such as video, animation, podcast audio, PowerPoint, etc. Each media has its weaknesses and advantages. Media development must align with the teacher's ability to create and design learning. The learning design is adjusted to the learning objectives, followed by the media selection. Teachers must find adequate strategies to achieve quality education through technology (Bernate et al., 2021). The media used in learning can now use digital media, including podcast. (Media et al., 2020) state that podcast has recently become the most popular media and is one of teachers' choices in supporting teaching and learning activities. Podcasts are a communication medium that can be used to communicate with others and share interesting and relevant information. Podcast media can be a useful teaching tool for teachers and help students learn from within and outside the classroom (Zakaria, 2022). It can be concluded that podcasts can be an effective media alternative to increase student engagement and interest in learning.

Based on the results of interviews and preliminary study questionnaires to six high school teachers in Yogyakarta, the conclusions are: 1) Material on healthy lifestyle in balanced sub-nutrition is not found in the package book, 2) Learning objectives in healthy lifestyle material is not achieved due to lack of time allocation, 3) Teachers lack mastery in balanced nutrition material 4) Teachers are less able to develop variations in the delivery of learning material, especially in balanced nutrition material, 5) Teachers have not used podcast technology in variations in the delivery of teaching material, 6) Teachers need to develop podcast-based balanced nutrition material as an alternative to delivering learning material.

Physical Education focuses on acquiring healthy living habits that can be mediated by technology (García-Pérez et al., 2024), one of which is using podcasts. Educational podcasts are new media that provide content and special knowledge (McNamara, et al, 2024). (Zakaria, 2022) states that the delivery of teaching materials using podcasts is

effective because podcasts can be used as a variety of learning and learning media, the player device is simple and easy to find and can be listened to anywhere at any time, even for those who are accustomed to multitasking, this podcast is called efficient because it is practical and friendly. Podcasts are also practical, meaning they can be taken anywhere and only require a small amount of storage space due to the small file size (Media et al., 2020). Through podcasts, internet data quotas are not sucked up much, so it will ease the parents of students. Another opinion stated by Media, et al (2020) said that that 1) podcasts are timeless and offer easy access at any time and thus are very valuable as a source of material before the exam, 2) podcasts become a reminder of what, how the material is because it is presented briefly and gradually, 3) podcasts provide a solution to the limited learning time, thus providing an opportunity to strengthen learning materials through podcasts that can be listened to anywhere and anytime.

Based on the background above, it can be concluded that podcast media is an alternative that can be used in the delivery of learning materials, especially in physical education, where learning balanced nutrition materials is expected to improve the nutrition literacy of high school students. This podcast-based material can be accessed through the Spotify platform, and the material is presented in stages/episodes so that students do not feel bored. Balanced nutrition material will be expanded on (1) Nutritional Components, (2) the Concept of Body Mass Index by Age, (3) Balanced Eating Portions, (4) Nutritional Impact, (5) Reading Food Labels, (6) Tips for Preparing Meals and Snacks.

Material & Methods

The research used a quantitative method with an experimental research design with a single group with a pretest-posttest (one group pretest-posttest design). This research approach allows the researchers to measure changes in the variables studied before and after the intervention given to the same group.

Instrument

The balanced nutrition podcast media has Aiken V 0.89 validation and Alpha Cronbach's 0.772 value reliability.

Table 1.
Validation of the Balanced Nutrition Audio Podcast Media Instrument

No	Rated Aspect	Σ_s	V	Description
1	The audio quality in the podcast is clear	20	1	Very high
2	Audio distortion doesn't interfere with hearing.	19	0.95	Very high
3	The music background aligns with the podcast theme without disrupting comprehension	20	1	Very high
4	The content in the podcast provides useful information and supports the learning of balanced nutrition material.	18	0,9	Very high
5	The podcast content attracts the attention and interest of high school students.	15	0.75	High
6	The podcast content is suitable for the ease of understanding the material presented.	18	0.9	Very high
7	The podcast duration is neither too long nor too short, fitting the needs and preferences of high school students.	18	0.9	Very high
8	Each episode has a clear focus aligned with the balanced nutrition theme.	19	0.95	Very high
9	The podcast content is relevant to the topic of balanced nutrition.	18	0,9	Very high
10	There is a interconnection between episodes to build a consistent narrative	17	0.85	Very high
11	The language meets the characteristics of high school students.	15	0,75	High
12	The language used suits the characteristics of high school students	16	0,8	High
13	The language used describes situations or contexts familiar to the students.	19	0,95	Very high

14	The language used avoids words or phrases that may cause double interpretation.	17	0,85	Very high
Average		18	0,89	Very high

Table 2.
Reliability Statistics

Cronbach's Alpha	N of Items
0.772	14

The instrument used to measure students' nutrition literacy levels is a multiple-choice questionnaire consisting of 45 questions. The table 3 specification the multiple-choice questions. After preparing the multiple-choice instrument, the next step is to conduct validation testing. The students' nutrition literacy level was measured by multiple choice

Table 4.
Validation Literacy Instruments

No	Rated Aspect	Σ s	V	Description
1	The questions presented include balanced nutrition material	18	0.9	Very high
2	The questions presented are to improve the nutrition literacy of Senior High School / Vocational High School students	16	0.8	High
3	The presentation of the questions is presented with demands from easy to difficult	16	0.8	High
4	The questions cover the material of nutritional components	20	1	Very high
5	The questions include <i>IMT</i> or Body Mass Index (BMI) concept material based on age	17	0.85	Very high
6	The questions include the material of eating balanced nutritional portions	15	0.75	High
7	The questions include nutritional impact material	15	0.75	High
8	The questions include material on reading food labels	17	0.85	Very high
9	The questions presented are not too easy but also not too difficult	14	0.7	High
10	The questions presented are based on the curriculum standards applicable to the senior high school/vocational high school level	16	0.8	High
11	The use of words by the level of understanding of senior high school/vocational high school students	17	0.85	Very high
12	The language used is based on <i>PUEBI</i> or Indonesian Spelling General Guidelines	18	0.9	Very high
Average		17	0.83	Very high

Table 5.
Reliability Statistics

Cronbach's Alpha	N of Items
0.749	12

Data collection

After completing the instrument, the next step is to conduct the pretest to measure initial nutrition literacy using the prepared instrument. Subsequently, the intervention is implemented by listening to the balanced nutrition podcast. Once the students have finished understanding and listening to the balanced nutrition podcast, the posttest is conducted to measure final nutrition literacy.

Data analysis

Data during the pretest and posttest are then entered into the Microsoft Excel program to facilitate data recording. Next, the pretest-posttest data is inputted into IBM SPSS version 23.0. Data analysis used paired t-tests the significance of the differences in nutrition literacy among students before and after the intervention. Finally, interpreting the statistical test results to determine the effectiveness of the intervention provided.

Results

The study's results were tested on 36 students in the 10th grade of high school. Table 3 presents a summary of statistical description.

question instruments with Aiken V 0.83 validation level and Alpha Cronbach's 0.749 value reliability.

Table 3.
The table of specification the balanced nutrition literacy instrument

No	Indicator
1	Nutrient Components
2	Body Mass Index (BMI)
3	Balanced Nutrition Serving Sizes
4	Impact of Nutritional Issues
5	Reading Food Labels

Table 6.
Paired Sample of Nutrition Literacy Statistics Pretest and Posttest

	Mean	N	Std. Deviation	Std. Mean Error
Pretest	32.81	36	8.832	1.732
Posttest	38.15	36	5.883	1.154

Based on the results in Table 3, there was an increase in the mean value from the pretest to the posttest, namely from the results of students' nutrition literacy before the application of balanced nutritional podcast media by 32.81 and after the application of balanced nutritional podcast media rose to 38.15. It shows that there was an increase before the application of balanced nutritional podcast media and after the application of balanced nutritional podcast media. Furthermore, a lower standard deviation in the posttest results of 5.883 showed that posttest data had a more concentrated distribution around the average value and smaller variations compared to pretest data.

Table 4 shows the correlation between pretest and posttest results, in this case, is the use of podcast media on balanced nutrition material that is effective in increasing nutrition literacy as measured during the posttest.

Table 7.
Paired Sample Correlation

Pair 1	N	Correlation	Sig.
Pretest & Post-test	36	0.946	0.000

Based on the results in Table 4, the correlation value was close to 1, 0.946, which shows a strong correlation

between pretest and posttest results. It means that there is a strong relationship between the two variables and that the treatment given, which in this case is the use of podcast media on balanced nutritional material, is effective in improving nutrition literacy as measured at the post-test.

In Table 5, the statistical differences for pretest and posttest data were analyzed using a paired t-test with a significance level of 5%.

Table 8.
Paired Sample T-Test

Pre-Post	T	df	Sig. (2-tailed)
Effectiveness	-7.205	35	0.000

Based on the results of Table 5, the significance value showed $0.000 < 0.005$. It can be concluded that the difference between the pretest and posttest values is statistically significant. Therefore, it can be concluded that the application of balanced nutrition podcasts effectively improves the nutrition literacy of high school students.

Discussion

This study aims to determine the effectiveness of providing balanced nutrition material podcasts to improve nutrition literacy of high school students. The results showed that there was an increase in nutrition literacy of high school students which was indicated by the results of pretest-posttest of 32.81 to 38.15, and the results of the SPSS test showed the effectiveness of providing balanced nutrition pod-cast media to improve the nutrition literacy of high school students with a sig value of $0.000 < 0.005$.

Similar findings in research by (Maharani & Kurniasari, 2022), their study showed an improvement in balanced nutrition knowledge among elementary school children, from 40.0% having adequate knowledge before media intervention to 86.7% having good knowledge after receiving counseling via podcasts. Another research by (Young et al., 2021) indicated that podcasts have advantages over traditional medical education tools because they are enjoyable and concise learning methods. The podcast garnered 122,709 downloads, gained 311 Twitter followers, and 249 followers on Podbean, with an iTunes rating of 114 and an average rating of 5.0 stars, accompanied by entirely positive reviewer comments.

The results of this study show the success of the learning media function. Learning media is a tool that can help the teaching and learning process so that the message's meaning becomes clearer with learning objectives that can be achieved effectively and efficiently (Zega, 2022). In this case, podcasts as learning media developed to improve the nutrition literacy of 10th-grade high school students are effective and efficient. Media becomes effective because students' potential is more aroused when assisted by several media or facilities and infrastructure that support the interaction process (Zakaria, 2022). Podcast is a source of information, education, and entertainment. Digital innovation of podcast (Gusvero, 2020) is also used in various fields, one of which is as a learning media. (Indriastuti & Saksono,

2015) state that in the field of education, the use of podcasts as e-learning media has several advantages, including reusability and replaying teaching materials, availability and independence from one technology, because podcasts can be used through various playback media such as MP3 players, MP4 players, mobile phones/smartphones, and others. Flexibility, immediacy, and ease of production make podcasting a logical technology to implement in a flexible educational context (Drew, 2017). Podcasts have an educational function, can increase the knowledge of their listeners, and can bridge cultural gaps (Indriastuti & Saksono, 2015). Therefore, interactive podcast media stimulates students' understanding on balanced nutrition. In addition, it provides opportunities for students to construct their knowledge through podcasts that are presented interactively.

Increasing nutrition literacy is the goal of implementing balanced nutrition podcast media. The indicators of nutrition literacy achieved are known through the effectiveness test conducted in this study. It includes understanding healthy food, nutrients needed by the body, and good eating habits. The extent to which someone, especially adolescents, obtaining information related to nutrition, processes the information, and understands the information obtained so that they can make the right decisions related to nutrition is closely related to a nutritional concept known as nutrition literacy (Fathonah et al., 2020).

However, it is important to mention the limitations of this study, such as the limited sample size, which only involved 36 students from one high school, making the results potentially non-generalizable to a broader population. Additionally, this study only measured the immediate increase in nutrition literacy following the intervention, without considering the long-term retention of the acquired knowledge. While this study demonstrates the successful use of podcasts as a learning medium to improve nutrition literacy, further studies with larger samples and long-term measurements are needed.

Conclusion

Based on the results of the effectiveness test conducted on 36 students, the results showed that there was an increase in nutrition literacy of high school students which was indicated by the results of pretest-posttest of 32.81 to 38.15, and the results of the SPSS test showed the effectiveness of providing balanced nutrition pod-cast media to improve the nutrition literacy of high school students with a sig value of $0.000 < 0.005$. It shows that applying balanced nutrition materials using podcasts effectively improves the nutrition literacy of high school students. Overall, it can be concluded that students experienced a significant increase after implementing balanced nutrition podcasts. There are significant differences in nutrition literacy knowledge before and after using balanced nutrition podcasts. The balanced nutrition podcast proved to be an effective learning method in helping students understand balanced nutrition

material, a material that many students do not know. This podcast covers important topics such as balanced nutrition components, the concept of body mass index for adolescents, balanced nutritional portions, the impact of nutritional problems, how to read food labels and tips on preparing reliable and relevant meals and snacks.

Teachers must be able to provide learning alternatives such as using balanced nutrition podcasts, which contain educational content related to nutritional material delivered by nutritionists so that information related to nutritional material presented is accurate. The material presented in the nutrition podcast is delivered in episodes so that students can understand and review material that is not yet understood. Through this learning process, students will gain knowledge related to nutrition that is adjusted to their age level so that students' nutrition literacy will increase. It is expected that students will live healthier and be able to make the right nutritional decisions for a better future. Learning through podcasts can provide stimuli to encourage students to think critically. Therefore, learning to use podcasts is an effective method that is easy for students to understand, and podcasts can be listened to anytime and anywhere according to student's needs.

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