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Development and Validation of Hypertension Educational e-Book for Children Aged 10 to 12 Years Old

Nazrul Hadi Ismail^{1,2*}, Athirah Fathnin Aziran¹, Mohd Ramadan Ab Hamid^{1,2}, Al Mukhlas Fikri³

** Corresponding Author*

¹ Centre for Dietetics Studies, Faculty of Health Sciences, Universiti Teknologi MARA, Malaysia

² Integrated Nutrition Science and Therapy Research Group (INSPIRE), Faculty of Health Sciences, Universiti Teknologi MARA, Malaysia

³ Department of Nutrition, Faculty of Health Sciences, Universitas Singaperbangsa Karawang, Indonesia

nazrul2923@uitm.edu.my, athirahfathninaziran@gmail.com, ramadan7230@uitm.edu.my, mukhlas.fikri@fikes.unsika.ac.id
Tel: +60133843795

Abstract

Early childhood education is crucial in preventing disease, and the sustainability of healthy behaviour throughout this stage will develop a healthy adult in the future. To our knowledge, no widely specific booklet is documented in Malay that emphasises the targeted population, which is primary school kids for public use. Therefore, this study intended to develop a child-friendly hypertension e-book for children aged 10-12. This research employed design and development research, which embodied three phases: (I) analysis of hypertension-related information, (II) design and development, and (III) expert validation. Seven experts selected and used the ECVIH to validate the e-book content.

Keywords: children; educational booklet; healthy lifestyle; hypertension

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1.0 Introduction

Hypertension is a condition whereby the pressure in the blood is extremely high due to the narrowing of blood arteries, forcing the heart to work harder to maintain the pressure. In the updated Clinical Practice Guidelines Management of Hypertension 2018, normotensive or normal blood pressure for children under 13 years is interpreted as blood pressure under the 90th percentile (Hypertension Guideline Working Group, 2018).

Previous research from secondary data analysis from the National Health and Morbidity Survey 2015, which was conducted nationwide in Malaysia for adults ≥ 18 years old, reported that the overall prevalence of raised blood pressure was 66.8%, with 45.8% having prehypertension, 15.1% having Stage 1 hypertension, and 5.9% having Stage 2 hypertension (Mahadir Naidu et al., 2019). Factors associated with hypertension are older age, rural residency, Malay ethnicity, diabetes, hypercholesterolemia, overweight, obesity, and lower socioeconomic status. If we can control the modifiable risk factors of hypertension, thus the number of annual high blood pressure deaths will reduce. Moreover, early childhood education is crucial in preventing disease, and the sustainability of healthy behaviour throughout this stage will develop a healthy adult in the future (Maziah et al., 2015). Childhood is vital for developing health-

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related behaviours, such as food and physical activity habits, that might influence BMI and blood pressure and last into adulthood (Falkner & Lurbe, 2020). Hence, childhood affords a golden opportunity to promote or interrupt unhealthy long-term trajectories. Moreover, early education confirmed that it is effective and, if sustained throughout childhood, could contribute to a healthier young adulthood.

Educational tools can come in many forms, such as games, videos, 3D modelling, and e-books. Above all, the maximised learning quality of e-books is more significant for children (Eschallier et al., 2013). Therefore, this study's e-book, which has a child-friendly concept, will help motivate children to apply their knowledge in their daily routines.

Moreover, the prevalence of hypertension in childhood increases with decreasing age and has become a serious concern worldwide. Getting hypertension at an early age will reduce the quality of life. Children's lack of knowledge and skills may contribute to childhood hypertension (Bello et al., 2017). We can find a lot of information on hypertension online and offline, like a hypertension diet menu, tips for lowering high blood pressure, and guidelines for measuring blood pressure. However, that information is widely available in English, which might be limited to those who understand English only. To our knowledge, no widely specific booklet in Malay emphasises the targeted population, primary school kids, for public use. The only brochure available in text form does not attract children to read it, and it is mainly for clinical practice guidelines. Therefore, we are developing a hypertension e-book with a child-friendly concept to increase their hypertension knowledge. Perhaps they are motivated to practice a healthy lifestyle to prevent hypertension.

This study intended to develop and validate a child-friendly e-book to help increase hypertension knowledge among children between 10 and 12 years old and prevent hypertension in adulthood. Specifically, we first aimed to develop a child-friendly hypertension e-book for children aged 10-12. Next, we planned to validate the content and structure of the e-book among professional panels. We also aimed to determine the content validation index (CVI) of the newly developed e-book among the experts.

2.0 Literature Review

Primary or essential high blood pressure is a medical condition that is often due to an unhealthy lifestyle, family history and obesity. The prevalence of childhood hypertension in South Asia country showed that the prevalence of childhood prehypertension was 14.62%. Childhood hypertension was 5.54% (Nayak et al., 2018), while local studies on hypertension among primary school children in Malaysia showed a higher prevalence than in preschool children, ranging from 13.9 to 14.0% (Cheah et al., 2019).

In a nutrition setting, the dietitian, nutritionist, or nurse assists or enables individuals to incorporate eating patterns and behavioural changes into their lives (Deshpande, 2003). Therefore, nutrition education must continue throughout life to accommodate a high quality of life. The use of electronic devices has been increasing. A recent study was conducted on the effects of interactive e-book interventions on young children's literacy development compared to listening to print books, regular school programs, and reading non-enhanced and non-interactive e-books. The study resulted in e-books helping children develop literacy skills equally and sometimes better than printed ones (López-Escribano et al., 2021). According to Maziah et al. (2015), the best teaching approach is a child-friendly concept, which we recommend for any modules, activities, or programs aimed at early childhood education. A child-friendly idea known as global child indicators can be characterised as a tool for educating children about their health. It includes cartoon drawings, animation, colourful objects, simple languages such as storytelling, and activities with game elements.

3.0 Methodology

3.1 Study design

This study implemented Design and Development Research (DDR) between December 2021 and August 2022, which embodied three phases: (I) content analysis of hypertension-related information and a literature review, (II) design and development of an e-book, and (III) content validation by expert judges.

3.2 Phase I: Content analysis and literature review

Phase I involved analysing the current trend of hypertension progression, the latest guidelines, and evidence-based materials to develop e-book content. A social culture and literature review was also conducted to meet the target preferences. We employed the latest guidelines in this study, including Malaysian Dietary Guidelines (2020), Krause's Food and The Nutrition Care Process, Panduan Penjualan dan Penyajian Makanan dan Minuman Sihat di Sekolah, and Garis Panduan Aktiviti Fizikal Malaysia. The articles were selected from five databases: PubMed, BioMed Central (BMC), ScienceDirect, Scientific Electronic Library Online (SciELO), ResearchGate, and the International Journal of Health & Allied Sciences. Further discussion revealed that the adapted information was modified into pictures, illustrations, graphics, texts, and figures as the newly developed e-book content. We chose to write this e-book in Bahasa Melayu since it is the official language in Malaysia. The e-books that were designed included ethnocultural groups, Malay and Bumiputera, as well as Chinese and Indian. This e-book focused on school kids ages 10 to 12 years old. Hence, this e-book is visually friendly and has unique features such as cartoon drawings of children, animation, simple language, and activities with game elements.

3.3 Phase II: Design and development of e-book

The first step was structuring the content and drafting the design of the e-book. The learning objective for each topic is considered when preparing the content. Then, the draft was converted into an e-book that employed a child-friendly concept illustrated by animation, colourful pictures, and playing activities. Previous research pointed out that the child-friendly concept in childhood learning positively impacted children (Maziah et al., 2015). Next, the script was performed alongside the presentation ideas. The e-book included information and recommendations about hypertension, some exercises, and game elements. Meanwhile, text, photos, cartoons, and colour illustrations were included in the e-book layout. Each exercise page has a description and guides explaining how the exercise should be completed. The references are also provided on the last page of the e-book.

3.4 Phase III: Content validation by expert judges

The number of expert panels needed for content validation is at least six, and the maximum is ten (Yusoff, 2019). Seven expert judges with at least three years of working experience and who were contacted via email were selected using purposive sampling. Our interdisciplinary panels comprised four nutrition and dietetics experts, two from education and design professionals and one from a medical background. The expert judges were provided with Google Drive, which consisted of e-books and Google Forms of Educational Content Validation Instrument in Health (ECVIH), to evaluate the educational content.

The ECVIH was employed to validate the e-book content as a valid and reliable instrument for assessing educational content in health settings (Leite et al., 2018). ECVIH contains 18 questions with three subdomains: objective, structure/presentation, and relevance. The 'objective' part covers the purpose, goals, or target. The 'structure/presentation' part focuses on organisation, structure, strategy, consistency, and sufficiency. The last subdomain's relevance is intended in significance, impact, motivation, and interest. The item is a Likert scale rating: 0 = disagree, 1 = partially agree, and 2 = totally agree. A minimum value of 0.83 CVI is acceptable to prove the validity of the content.

Table 3.1 Formula of I-CVI, S-CVI/Ave and S-CVI/UA

	Formula
I-CVI	Agreed item/number of experts
S-CVI/Ave	The Sum of I-CVI scores/number of items
	The Sum of proportion relevance rating/number of experts
S-CVI/UA	The Sum of UA scores/number of items
	*The Universal Agreement (UA) score is 1 when the item achieved 100% experts in agreement. Otherwise, the UA score is given 0.

3.5 Statistical analysis

Descriptive statistics were used to analyse the data collected in this study. The CVI score was computed by adding the total points and dividing by the total number of expert judges.

3.6 Ethical consideration

This study obtained ethical clearance from the Research Ethics Committee (REC) Universiti Teknologi MARA with reference number FERC/FSK/MR/2022/0101.

4.0 Findings

4.1 Development of The Booklet

The hypertension e-book was developed based on the latest guidelines and findings and is child-friendly for conception, referring to content, language, organisation, layout, illustration, and learning outcomes. The dimensions of the final version of this booklet are 2953 x 4169 pixels. The hypertension e-book has 39 pages, with a front cover, back cover, table of contents, page for notes and reference page. The e-book consists of a total of 10 chapters. The chapters, topics, learning objectives and pages of the hypertension e-book are summarised in Table 4.1. Figs 4.1, 4.2, and 4.3 show some snapshot pages of the booklet.



Senarai Kandungan	
Pengenalan hipertensi	2-3
Gaya hidup tidak sihat	4-7
Nasihat doktor	8-10
Diagnosis hipertensi	11
Riadah petang	12-14
Kemali Diet DRSH	15-17
Beli-belah	18-21
Label makanan	22-24
Pilihan sjah	25-29
Resepi ringkas	30-33

Fig. 4.1: Frontpage and content list of the booklet



Fig. 4.2: Snapshots of e-book's content



Fig. 4.3: Snapshot of game elements of the e-book

Table 4.1 Chapters, topics, learning objectives and pages of hypertension e-book

Unit	Chapters	Topics	Learning objective	Pages
1	Introduction to Hypertension (Pengenalan Hipertensi)	<ul style="list-style-type: none"> Development of hypertension Risk factors of hypertension Hypertension measurement 	<ul style="list-style-type: none"> Participants can describe how hypertension developed. Participants are able to state the risk factor for hypertension. Participants state the tools used to measure hypertension. 	2-3
2	Unhealthy Lifestyle (Gaya Hidup Tidak Sihat)	<ul style="list-style-type: none"> Lifestyle 	<ul style="list-style-type: none"> Participants are able to state examples of an unhealthy lifestyle. 	4-7
3	Doctor's Advise (Nasihat Doktor)	<ul style="list-style-type: none"> Definition and classification of hypertension 	<ul style="list-style-type: none"> Participants are able to state the effect of a healthy and unhealthy lifestyle. Participants are able to state the definition and classification of hypertension. 	8-10
4	Diagnosis of Hypertension (Diagnosis Hipertensi)	<ul style="list-style-type: none"> Effect of hypertension Classification of hypertension 	<ul style="list-style-type: none"> Participants are able to state the adverse effect of hypertension. Participants are able to state the classification of hypertension. 	11
5	Evening Exercise (Riadah Petang)	<ul style="list-style-type: none"> Physical activity 	<ul style="list-style-type: none"> Participants are able to state the duration of physical activities. Participants are able to give examples of physical activities. Participants are able to state the steps before and after physical activities. 	12-14
6	Introduction to DASH Diet (Kenali Diet DASH)	<ul style="list-style-type: none"> DASH diet 	<ul style="list-style-type: none"> Participants are able to describe the DASH diet. 	15-17

7	Shopping (Beli-belah)	• Healthy eating	<ul style="list-style-type: none"> Participants are able to describe healthy and unhealthy food. Participants are able to differentiate between healthy and unhealthy food choices. 	18-21
8	Food Label (Label Makanan)	• Food labels	<ul style="list-style-type: none"> Participants are able to read the food label and food ingredients. Participants are able to make low-sodium food choices. Participants are able to identify the other names of sodium. 	22-24
9	Magic Choices (Pilihan Ajaib)	• Healthy eating	<ul style="list-style-type: none"> Participants are able to make the better exchange for unhealthy food. 	25-29
10	Simple Recipes (Resipi Ringkas)	•	<ul style="list-style-type: none"> Participants are able to cook simple and healthy menus. 	30-33

4.2 Validation by expert judges

The booklet was validated among seven professional panels. The demographic details of the panel were recorded in Table 4.2.

Table 4.2 Demographic data of the seven professional panels

Panel	Position	Workplace
1	Dietitian	Faculty of Health Sciences, UiTM Puncak Alam
2	Dietitian	Jabatan Dietetik dan Sajian, Hospital Kulim, Kedah
3	Teacher	Sekolah Menengah Kebangsaan Agama Melor, Padang Raja, Melor, Kota Bharu.
4	Senior lecturer	Industrial Design Department, College of Creative Arts, Kompleks Ilham, UiTM Shah Alam
5	Senior lecturer	Faculty of Health Sciences, UiTM Puncak Alam
6	Dietitian	Faculty of Health Sciences, UiTM Puncak Alam
7	Senior lecturer and Consultant Paediatric Endocrinologist	Faculty of Medicine, UiTM Sungai Buloh

Table 4.3 shows the results for the 'objectives' area, comprising purposes, goals or targets. The finding for Items 1,2,3,4, and 5 in the 'objective' area delivered the agreement score of 7 out of 7. As the I-CVI value 1.0 indicates, the booklet's content meets the development's purpose, and the scenarios were well-worked. Moreover, the 'objective' area obtained an excellent universal agreement among the professionals by meeting the maximum CVI/UA score (S-CVI/UA: 1.0). Same goes for the 'structure/presentation' area, which composes organisation, structure, strategy, consistency, and sufficiency, are disclosed in Table 4.4. The 'structure/presentation' area, Items 6 to 15, reached the I-CVI value 1.0. The panels admitted the booklet's theme, language, and information following the targeted ages. In consequence, all items in 'the structure/presentation claimed a universal agreement among the experts (S-CVI/UA: 1.0). Besides, in the area of 'relevance', the experts undivided that the content of the booklet encourages learning, enhances the knowledge of hypertension, and captivates interest in the subject. Thus, a score of 1.0 was attained for CVI and S-CVI/UA, as presented in Table 4.5.

Table 4.3 Rating of domain objective by expert judges

Item	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Experts in agreement	I-CVI	UA
1	1	1	1	1	1	1	1	7	1.00	1.0
2	1	1	1	1	1	1	1	7	1.00	1.0
3	1	1	1	1	1	1	1	7	1.00	1.0
4	1	1	1	1	1	1	1	7	1.00	1.0
5	1	1	1	1	1	1	1	7	1.00	1.0
S-CVI/AVE								1.00		
Proportion relevance								S-CVI/UA	1.00	
Average Proportion of Items Judged as Relevance Across the Seven Judges								1.00		

Table 4.4 Rating of domain structure/presentation by expert judges

Item	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Experts in agreement	I-CVI	UA
6	1	1	1	1	1	1	1	7	1.00	1.0
7	1	1	1	1	1	1	1	7	1.00	1.0
8	1	1	1	1	1	1	1	7	1.00	1.0
9	1	1	1	1	1	1	1	7	1.00	1.0
10	1	1	1	1	1	1	1	7	1.00	1.0
11	1	1	1	1	1	1	1	7	1.00	1.0
12	1	1	1	1	1	1	1	7	1.00	1.0
13	1	1	1	1	1	1	1	7	1.00	1.0
14	1	1	1	1	1	1	1	7	1.00	1.0
15	1	1	1	1	1	1	1	7	1.00	1.0
S-CVI/AVE								1.00		

Proportion relevance	1.00	1.00	1.00	1.00	1.00	1.00	1.00	S-CVI/UA	1.00
Average Proportion of Items Judged as Relevance Across the Seven Judges									1.00

Table 4.5 Rating of domain relevance by expert judges

Item	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Experts in agreement	I-CVI	UA
1 Encourages learning	1	1	1	1	1	1	1	7	1.00	1.0
2 Contributes to knowledge in the area	1	1	1	1	1	1	1	7	1.00	1.0
3 Arouses interest in the theme	1	1	1	1	1	1	1	7	1.00	1.0
S-CVI/AVE									1.00	
Proportion relevance	1.00	1.00	1.00	1.00	1.00	1.00	1.00	S-CVI/UA	1.00	
Average Proportion of Items Judged as Relevance Across the Seven Judges									1.00	

4.3 Qualitative data

The themes were organised into six domains: 1) Content, 2) Words of choice, 3) Use of numbers, 4) Organization, 5) Layout and Design, and 7) Use of Visual Aids.

Several changes have been made to the inaccurate facts in the content domain. "Bacaan normal tekanan darah ialah 120/75 mmHg untuk kanak-kanak berumur 6-12 tahun." (Panel 7). That part was replaced by a blood pressure range of 120/80 mmHg according to Clinical Practice Guidelines, American Academy of Pediatrics, as recommended by Panel 7. A suggestion from Panel 5 was considered, and she advocated adding information on how much sodium is considered low or high. "Suggest adding how much sodium is considered low or high" (Panel 5). Therefore, an additional page for choosing low salt has been added and presented in the illustration approach. Panels 1 and 4 agreed that this e-book is informative and meets the objectives. For instance, Panel 1 quoted, "Information direct to the points". Panel 4 mentioned, "The information is sufficient accordance with age goals" and "The scenario of the story is well-worked and meets the objectives". Moreover, a panel reported that a matched activity of the e-book should meet the objective of the booklet. Identify healthy/unhealthy foods: My suggestion is to focus on the objective of this e-book, which is to educate on sodium/salt intake (Panel 5).

Most of the panels agreed with the words chosen for this booklet: "The message is clear, simple, and cohesive" (Panel 1). However, several panels commented on several typing errors. For example, Panel 2 remarked on the words 'ciken cop', which were not in Malay. Moreover, there was a suggestion about dialogue. Suggestion for Asif's answer is "Baiklah doktor, saya akan cuba turunkan berat badan, lakukan senaman, amalkan makan makanan sihat dan hadkan waktu menonton televisyen serta bermain gadget" (Panel 2).

The use of numbers covered regarding the numbers appearing in the material is straightforward to understand. From the evaluation, a panel suggested using ratios instead of percentages: "Instead of putting a percentage, try to put a ratio. For every ten children in Malaysia, one person will have hypertension" (Panel 5).

The layout and design area includes visual cues (e.g., arrows, boxes, bullets, bold, larger font, highlighting) to highlight key points. Panels 1, 2 and 6 agreed that there needed to be more dialogue in the picture, and it was crowded for several parts. "There are too many conversations between Asif and his father in one picture. To the point of confusion about which question/answer is relevant to the conversation" (Panel 2). "There is a lot of dialogue in one picture; suggest putting a number in the dialogue to tell the reader which dialogue to read first" (Panel 6).

Following the comments from the panels, a new cartoon was added, and the dialogue was separated accordingly. Furthermore, a few panel suggestions are accepted and applied to the e-book. For instance, the pros and cons of an unhealthy lifestyle, elements of the plan for leisure activities and illustration of the DASH diet. Generally, the panel concurred that the design was suitable for the targeted age. "I love the infographic and images used! Talented! The choice of font and colour is suitable" (Panel 1). Panel 4 hinted at the "storytelling of the scenario is appropriate and precise with objectives".

5.0 Discussion

Seven professionals rated the items of the instruments in the following three categories: Objectives, Structure/Presentation and Relevance. All the categories carried an acceptable CVI score of 1.0, confirming that the e-book was developed and validated with a high degree of agreement between the panels, which suggested changes that further improved the module.

The 'objective' domain attained an outstanding S-CVI/UA score of 1.0. Most experts agreed that the module meets the objective and has been designed according to the targeted age. In addition, the e-book's content demonstrated the importance of changing behaviour in children to prevent high blood pressure in adulthood. Afterwards, in the 'structure/presentation' area, all the panels acknowledged universal agreement with the CVI score of 1.0. This health educational booklet conveyed the idea using cartoons, colourful infographics, straightforward language, and a few interactive games that burden the kids less to finish the booklet. The facts were explained using the simplest terms and layman's terminology, attended by visuals and illustrations to enhance the children's understanding. Even so, a panel suggested adding interactive elements such as QR codes or links for case videos to the appropriate situations. However, the comment was not implemented due to time constraints for getting the creator's permission. The 'Relevance: significance, impact, motivation and interest' part distributed distinctive excellent content validity (S-CVI/Ave: 1.0) together with superior universal agreement among the professionals (S-CVI/UA: 1.0). The experts accorded that the module content promotes learning (Item 16), enhances knowledge in the area (Item 17), and stimulates interest in the subject matter (Item 18).

One limitation of this study was that the e-book was developed only in one language, i.e. Malay. Translating the booklet into English and other languages commonly used in Malaysia will minimise language barriers for children attending various types of schools with

different mediums of instruction. Another limitation was that only panels validated the booklet's content. Therefore, new studies could expand the face and content validity of the targeted participants. The strength of this study is that the educational hypertension e-book was explicitly designed to educate children aged 10-12 years old. This e-book is intended to supplement the clinical practice guidelines. In addition, this e-book was validated for use among potential participants and had content validation among the professional panels. Moreover, the content has been modified and implemented in the booklet based on the suggestions.

6.0 Conclusion & Recommendations

In conclusion, professional panels validated this educational e-book with a high agreement rate. This study designed an educational e-book focused on hypertension knowledge for 10 to 12-year-old children and was not intended to replace current guidelines used by healthcare providers.

We recommend further research to measure this booklet's understandability, actionability and suitability among the targeted populations. This step aimed to measure the effectiveness of the educational material in increasing hypertension knowledge among 10 to 12-year-old children.

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Paper Contribution to Related Field of Study

The development of a hypertension educational e-book for children aged 10 to 12 can serve as a valuable resource for education, empowerment, and support in preventing and managing this common medical condition.

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