

## ORIGINAL ARTICLE

# Development and Validation of Website on Nutrition for Premature Baby

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## ABSTRACT

**Introduction:** Proper nutrition for premature babies is vital for optimal growth. However, a lack of confidence and knowledge among parents causes them to search for online information which may sometimes be misleading or unreliable. The primary objective of this study is to develop a validated website as an educational tool for parents about nutrition for premature babies. **Methods:** This study was conducted by referring to the Waterfall Software Development Life Cycle (SDLC) model, which consists of five main stages. Stages one to three are related to the development of the website, namely, the requirements stage, design stage and implementation stage. This is then followed by a testing stage where 11 expert panels evaluated the content and face validity of the website. The final stage is the maintenance stage. **Results:** The website was developed with nine topics. The value of Item Content Validity Index (I-CVI) for every item exceeded the minimum value of I-CVI (0.78), the value of the content validity index by scale, average (S-CVI/Ave) is 0.98, and the content validity index by scale, universal agreement (S-CVI/UA) is 0.83. Both S-CVIs have exceeded the minimum value, which is 0.90 and 0.80 respectively. The value of Krippendorff's Alpha (Kalpha) for the overall section of face validity is 0.53, which does not achieve the minimum acceptable value of Kalpha (0.67). **Conclusion:** The content validation has high agreement among the expert panels. However, the interphase, layout, and design of the website need to be improvised.

**Keywords:** Website Development; Nutrition; Premature Baby; Content Validity, Face Validity

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## INTRODUCTION

Premature birth incidents have increased during the past 20 years (1). The survival of premature babies has also increased, primarily due to the use of modern technology (2). However, there remains a significant number of morbidity and lifelong disabilities among premature babies (3). Besides, a premature baby is at risk to develop many diseases during adulthood such as diabetes, coronary heart disease and obesity (1,4). Moreover, they also tend to become autistic or develop cerebral palsy, which are related to their nutrition (1).

Optimal nutrition in premature babies results in improved overall cognitive function and higher verbal intelligence in the long term, and this effect may remain until adolescence (1,19). High energy and protein for premature babies has a significant effect in faster head growth and increased head circumference, which are correlated with improved cognitive outcome (1). Besides, adequate protein and energy are important to promote weight gain of lean body mass, and prevent

growth failure (20). Other nutrition such as long-chain polyunsaturated fatty acids, electrolytes, minerals and trace elements are also important for growth, bone mineralization and development outcome for premature babies (21).

There are numerous approaches in NICU to help parents with premature babies to cope with the stress that focuses on maternal psychological care such as physical care and health education. However, the approaches have not been able to cope with the rapid advancements in technology. Consequently, a study was conducted on the effectiveness of nursing intervention programs in Malaysia to help mothers accept their condition and continue to develop the parent-child relationship. The study shows a positive effect in reducing maternal stress and improve maternal abilities through psychological and educational approaches (22).

There are several available international websites on raising children, such as an Australian website on premature babies, a British website on national health services, and other several websites which have a vast amount of information about the nutrition for premature babies. However, the websites are written in English, and this may cause language barriers for parents that are not fluent in English. Many websites in Malaysia discuss

nutrition for babies. However, those websites only focus on term babies, and some information is not applicable for premature babies. Some websites have posts about premature babies, such as the Asian parents, hello doctor, and baby center, which are written in Malay, but are superficial and not cover the whole concept of nutrition and development of the premature baby.

Therefore, proper care for a premature babies at the home is important. However, parents of premature babies have a lack of confidence to take care of their babies due to a lack of knowledge (5,6). Thus, parents tend to browse the internet to find information (7). Some parents get support from other parents with the same experience (8). However, this information that is gathered from the internet or shared between parents may be misleading or unreliable.

This study aims to develop and validate website as an educational tool for parents with a premature baby. This study is important for parents with a premature baby to obtain important information on how to properly take care of their baby and give him or her good nutrition. It is because parents of premature babies have a lack of confidence to take care of their babies due to an insufficient amount of knowledge regarding their babies. According to Alderdice, Gargan and Mc call (2018), there is a demand for web-based information about premature babies. Based on this research, the parents also always seek information about feeding and digestion for their babies (9).

## MATERIALS AND METHODS

This research involved a cross-sectional design that consists of two steps. The first step is the development of the website, and the second step is the content and face validity of the website by expert panels. The process of developing and validating the website is conducted by referring to the Waterfall SDLC model. In this model, several consecutive phases must be completed one after another. After one phase is completely done, it will move directly to the next phase. Therefore, the Waterfall SDLC model is recursive in that each phase can be endlessly repeated until it is perfected. There are five stages in this model, namely, requirements stage, design stage, implementing stage, testing stage, and maintenance stage (10). Ethical approval has been obtained from the Universiti Teknologi MARA (UiTM) ethics committee prior to this study (Ref No: 600-IRMI (5/1/6)).

### Step 1: Website Development

The process of developing the website involves three stages from the waterfall SDLC model. The first stage is the requirements stage, where the problem was identified, and the details of the project were gathered. In this stage, an extensive literature review was performed using research journal articles, books and trusted websites to study about nutrition on premature babies.

To tailor the cultural and local needs, we also search for needed information from Malaysia's online NICU support group (Facebook). From this group, we identified various important pieces of information needed by the parents, including general information on calories needed, breastfeeding and intrauterine growth. We listed the queries by the parents, together with literature review and other nutrition-related websites. The next stage is the design stage, which involves the process of planning for solutions. Creating the website with useful content is the solution for the requirements stage. Thus, the web hosting service, content, features and theme of the website were planned and chosen. Next is the design stage, which involves the process of planning for the solution. The solution is to create the website as a platform for parents to search for the information needed and increase their overall knowledge on the subject. In this stage, the content of the website was gathered from different sources, such as paediatrics protocols for Malaysian Hospitals, Krause's Food and The Nutrition Care Process, Medlineplus and Kidshealth. At the same time, the process of searching and selecting the possible web hosting to develop the website was also carried out. Next, the content, features, theme, and web hosting to create the website were planned based on the literature review conducted in the requirement analysis stage.

After that is the implementation stage, whereby all the planned details in the design stage were implemented on the website. The website was then uploaded to the web hosting service provider, and all the plans in the design stage were implemented on the website. The content gathered from the design stage was categorized by topic before being uploaded on the website. The evidence-based content that was originally in the English language was translated and typed in the Malay language, which is suitable for the public reader in Malaysia.

### Step 2: Validity

After the website was developed, the validity test was carried out by an expert panel that consists of 11 experts in the field. All of the experts in this study are dietitians, consisting of five lecturers and six clinical instructors from the Centre of Nutrition and Dietetics (NAD) at UiTM, Campus of Puncak Alam. The testing stage is the fourth stage of the waterfall SDLC model. The experts were requested to answer a questionnaire, and answer five questions during an interview session. The questionnaire consists of demographic data, and the evaluation items are based on the Evaluation of the Printed Educational Material (EVALPEM). The expert panel was required to answer all the seven sections in the EVALPEM. Two sections are related to content validity (scientific accuracy, content) and another five sections are related to face validity (literary presentation, illustration, sufficiently specific and understandable material, legibility and printing characteristics, and quality information) (11). The experts were given an outline of the website, which contains the objective

of every topic, the subtopics, the learning aids used to help the parent, and the references used to develop the website.

The interview was carried out after the experts evaluated the website and answered the EVALPEM questionnaire. There are five questions on how to improve the website during the interview:

1. Do you have any suggestions regarding the definition of the topics or medical terms?
2. Do the subtopics appear to cover the full range of content on the website?
3. Are the sentences clearly worded and easy to understand?
4. Are the sentences on the website appropriate for the parents of a premature baby? Do you have any suggestions for improving the website? (Please feel free to provide comments directly on the sentences regarding rewording and/or removing the words.).
5. Do you have anything that you would like to add? Please feel free to comment.

The 5 questions during the interview session were used to obtain feedback from the experts. Based on the questions, the experts were required to identify the deficient areas of the website by providing suggestions and comments to improve it (12).

### Statistical Analysis

The content validation was analyzed using the item-content validity index (I-CVI) and content validity index by scale (S-CVI) (13). The I-CVI was used to rate the relevance of every item by the expert panel. A four-point Likert-scale was used as a measurement scale instead of a five-point or three-point scale to avoid a neutral or ambivalent midpoint (13). The experts answered based on the degree of agreement. Each item on a four-point Likert scale was classified by 1= totally disagree, 2= partially agree, 3 = agree, and 4 = totally agree (14). The I-CVI was computed based on the total number of experts give a rating of 3 or 4, divided by the total number of experts. The scoring system for I-CVI is based on the 4 point Likert-scale. If the expert rating was 1-2, the score will be 0, and if they rate 3-4 for the item, the score will be 1. Thus, I-CVI is calculated based on the rate given by the expert panel, where the score is either 0 or 1, then the total score from all experts will be divided by total number of experts involved (13). The values of I-CVI range between 0 to 1. The item is considered relevant if the value of I-CVI is more than 0.78. If the value is less than 0.78, the item would be revised (14).

S-CVI is used to rate the content validity for the overall scale. There are two methods for calculating S-CVI (13). The first method is the Universal Agreement (UA) among experts (S-CVI/UA), and the second method is Average S-CVI (S-CVI/Ave). S-CVI/UA is the universal agreement among experts. In other words, it is the total agreement

among the experts. Therefore, for all of the items that the experts agree on (rate 3 or 4), the I-CVI score is 1. Next, all of the I-CVI that obtain the score of 1 are added together and divided by the total items. On the other hand, S-CVI/Ave is the average score for I-CVI. It is measured by the sum of the I-CVI divided by the total number of items. The values of S-CVI/UA  $\geq$  0.80 and S-CVI/Ave  $\geq$  0.90 were considered excellent content validity (13,15).

Face validation was examined using a dichotomous scale, with the categorical option being either agree or disagree (15). The data were then analyzed using Krippendorff's Alpha (Kalpha). Kalpha measures the agreement among the experts on the panel to indicate the validity (17). The Kalpha statistic varies from 0 to 1, where 0 indicates the absence of agreement, while 1 indicates perfect agreement (17,18). The Kalpha value  $\geq$  0.80 is considered as good agreement among the experts and face validation is valid. However, the lowest acceptable value of Kalpha is  $\geq$  0.67 (18).

## RESULTS

### Website development

The title of the web-based educational tool is 'Buah Hatiku Pramatang' (Fig. 1). It was developed using Weebly, which is a web hosting service. The website can be accessed via the following URL: [https:// buahhatikupramatang.weebly.com/](https://buahhatikupramatang.weebly.com/). The title and content of the website have been developed based on the literature review undertaken about the nutrition for premature babies from journals, books, and trusted websites.

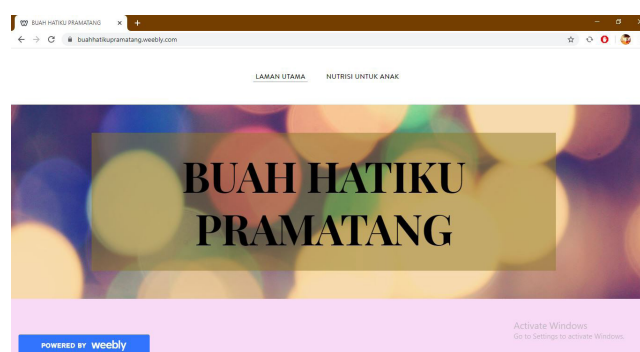


Figure 1: Title of the website

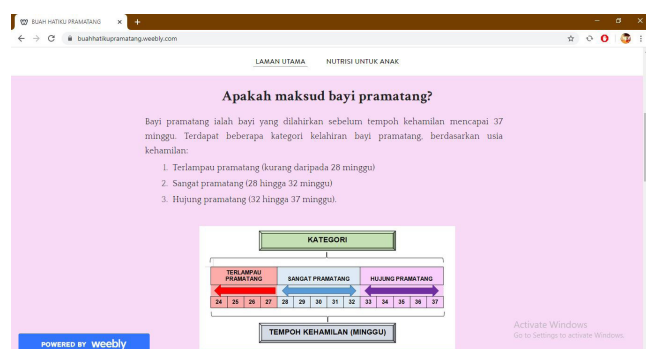
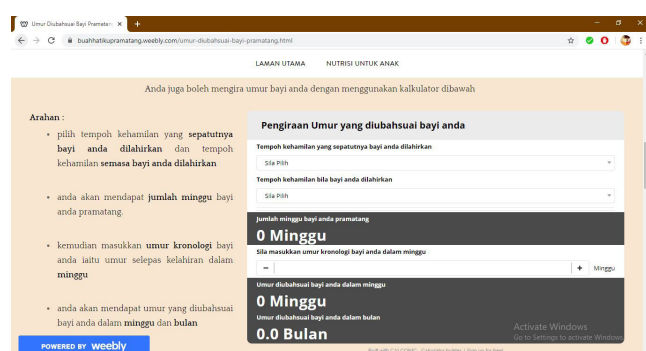
The website contains the home page, which is the introduction about premature babies, as well as nine different topics about nutrition for premature babies, as shown in Table I. The content was written in the Malay language to give more understanding for parents with premature babies that use the Malay language as their primary language.

The website contains 11 pages, namely, the home page, the list of every topic with their subtopics, one page for

**Table 1: Topics in the web-based educational tool**

	Educational tools
Home page	Introduction about a premature baby
Topic 1	Corrected age
Topic 2	Growth chart
Topic 3	Nutrition for the premature baby
Topic 4	Energy requirement
Topic 5	Breast milk
Topic 6	Formula milk
Topic 7	Extra calories
Topic 8	Caring for the premature baby after discharge from NICU
Topic 9	Weaning

each topic, and an 'about us' page. Some topics were presented with illustrations such as tables and figures to help the parent to better understand the content (Fig. 2). Besides, there is a calculator and some files on the website to help the parent obtain information directly from the page (Fig. 3).

**Figure 2: Illustration of the prematurity category****Figure 3: Calculator for corrected age**

The home page consists of a simple introduction about premature babies and the need to give special care for a premature baby. The first topic is corrected age, and it discusses the definition of the chronological age and the corrected age of the premature baby, the importance of using the corrected age and when to stop using it. Besides, there is also a calculator used to calculate the correct age of the premature baby.

The second topic is the growth chart. In this topic, an intrauterine growth chart for the premature baby

is introduced. There is an example of how to plot the graph. There is also a brief explanation about when to stop using the intrauterine growth chart, and replace it with a growth chart from the WHO, but by using the corrected age. In addition, there is also a growth chart file from the WHO and Fenton that is available for the parents to download. The third topic is nutrition for the premature baby. This topic briefly explains the best type of milk for the premature baby. There is also other alternative types of milk for the premature baby if the mother does not have an adequate supply of milk. After that, there is an explanation on the nutritional support for the premature baby, which involves enteral feeding and parenteral feeding.

The fourth topic discusses the energy requirements for the premature baby. In this topic, there is also a calculator to help the parents to calculate their premature baby's requirements for a day. Besides, there is also information about the recommendation for carbohydrates, protein and fat intake for the premature baby. The fifth topic is about breast milk. This topic discusses how to handle the express breast milk from expressing, storing, defrosting and warming. It is important to ensure the baby ingests the milk without any complication of hygiene or injury due to mishandling the expressed breast milk.

The sixth topic is formula milk. There are two types of formula milk for a premature baby and the table that shows the differences between standard formula milk and preterm formula milk. There is also a suggestion for preterm milk in Malaysia. The seventh topic is on extra calories, which emphasizes the importance of extra calories in nutrition for premature babies. There is also information about the different types of fortifiers to add in expressed breast milk.

The eighth topic is weaning. This topic discusses the importance of weaning. This involves the time and how to start weaning, manage the allergy reaction, and manage the situation when the baby refuses to eat and type of fluids for the premature baby. The ninth topic is caring for a premature baby after being discharged from the NICU. This topic explains the four most important physiological competencies before premature babies are discharged from the NICU, and the important things the parents need to pay attention to when caring for the premature baby at home.

### Content Validation

The website was reviewed by an expert team that consisted of experts in the field of study to indicate whether the content of the website is relevant for parents with a premature baby (13). It is also important to ensure all the essential content are included and eliminate the undesirable content (16).

The validation of the item achieved when the agreement among the expert panel based on I-CVI is more than



0.78, for more than 6 experts (13). According to the result, all the items achieved more than 0.78, where only the value of item 'recommendations are necessary and are correctly approached' is 0.90, while the other items achieved a value of 1 (Table II). The I-CVI shows the agreement between experts for each item, while S-CVI is used to determine the agreement of the experts for overall items. There are two methods involved in calculating S-CVI, which is S-CVI/Ave (the average of total I-CVI) and S-CVI/UA (the proportion on the scale that achieves an agreement rating of 3 or 4 by all the experts). Based on the result, the value of S-CVI/Ave is 0.98, while the recommended minimum value is 0.90 (13). The value of calculated S-CVI/UA from the result is 0.83, which also achieved the minimum recommended value (0.80) (13).

Based on Table II, the score of I-CVI is: 1, 0.9, 1, 1, 1, and 1. The calculation of S-CVI/Ave is  $(1+0.9+1+1+1+1) / 6 = 0.98$ . The final total agreement (value of I-CVI is 1) is 5. Thus, the calculation for S-CVI/UA is  $5 \div 6 = 0.83$ .

Although the results were satisfactory, the experts also suggested adding some content to improve the website. In summary, all the values of CVI have achieved more than the minimum recommendation (Table III). The experts agreed that the content of the website achieved the objectives of the study, but with the addition of some content to improve the website.

### Face Validation

The face validation was also reviewed by the expert panel. The expert panel was requested to evaluate the face validation based on the EVALPEM questionnaire. The criteria for the evaluation are literary presentation, illustration, the materials are sufficiently specific and understandable, legibility and quality information.

The data was analyzed by using Kalpha. Based on the data gathered, the value of Kalpha for the data is

**Table III: Summary of the judges' comment and suggestions**

Criteria	Recommendation of the judges	Action
<b>Definition</b>	Give the definition and explain about 'Sudden Infant Death Syndrome' (SIDS) Neonatal Intensive Care Unit (NICU) and 'Body Mass Index'	Pending
<b>Term use and spelling</b>	Check the correct Malay term for 'breast milk' and 'corrected age'	Has been done
	Correct the spelling and use the more suitable word. For example, ' <i>lemak MCT</i> ' change to ' <i>minyak MCT</i> ' and ' <i>manusia</i> ' change to ' <i>bayi</i> '	Has been done
<b>Content</b>	Eliminate the content of 'probiotic' because not related	Has been done
	Add important subtopics in some topics, like add about the modular product in extra calories and post-discharge formula in formula milk.	Pending
	Add topic to support the emotion of the mother, for example, the role of father.	Pending
<b>Illustration</b>	Add more and video picture related to content	Pending
	Transform lengthy word to point form or illustration	Pending
<b>Reliability</b>	Add information that shows the website is reliable like add about us, put the date for the last update and add more references from reliable websites, journals, and books.	Pending

0.53 (Table IV). The value does not achieve the target value; the minimum value to consider sufficient is 0.67. However, the value of Kalpha on the individual section is different; the section that achieved the target values is only the quality information and literary presentation.

## DISCUSSION

### Website Development

The web-based educational tools were developed for parents with premature babies because parents tend to obtain information from the internet that can sometimes be misleading (9). This website is more focused on nutrition for premature babies, because the parent is

**Table II: Content validation index**

Items	Expert Panels											Number of Agreement	I-CVI
	Lecturer of NAD UiTM					CI of NAD UiTM							
	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6		
Contents are in agreement with the current knowledge	3	3	4	3	3	4	3	4	3	3	4	11	1
Recommendations are necessary and are correctly approached	3	2	4	3	4	3	4	4	3	3	3	10	0.90
Objectives are evident	3	3	4	3	4	4	3	4	4	3	3	11	1
Recommendation about the desired behavior is satisfactory	3	3	4	4	3	4	3	3	3	3	3	11	1
There is no unnecessary information	4	3	4	4	3	4	3	4	3	3	3	11	1
Important points are reviewed	3	3	4	4	3	4	3	3	3	3	3	11	1
												S-CVI/AVE	0.98
												S-CVI/UA	0.83

I-CVI, Item content validity index, S-CVI/Ave, content validity index by scale, average, S-CVI/UA, content validity index by scale, universal agreement  
Rating: 1= totally disagree, 2= partially agree, 3 = agree, 4 = totally agree

**Table IV: Kalpha Result for every section in Face Validation**

Section	Units	Pairs	Kalpa Value
Literacy presentation	14	701	0.77
Illustration	6	330	0.55
Materials are sufficiently specific and understandable	11	410	0.40
Legibility	12	660	0.43
Quality of information	6	290	0.81
Overall	49	2421	0.53

concerned about their baby's feeding and digestion, the amount of milk and the weight gain of their baby (9). Thus, this study has proven that this website was valid as a source of information for parents with a premature baby.

This website will help them gain more knowledge that is reliable about nutrition for a premature baby. It is because there are many websites about the care and feeding of the baby, but they discuss normal babies, and are not relevant to premature babies (9).

### Content Validation

The website was reviewed by experts in the field of study to indicate the content of the website is relevant for parents with a premature baby (13). It is also important to ensure all the essential content are included and eliminate the undesirable content (16).

The validation of the item achieved when the agreement among the expert panel based on I-CVI is more than 0.78 for more than 6 experts (13). According to the result, all the items achieved more than 0.78, where only the value of item 'recommendations are necessary and are correctly approached' is 0.90, while the other items achieved a value of 1. The I-CVI shows the agreement between experts for each item, while S-CVI is used to determine the agreement of experts for all the items. There are two methods in calculating S-CVI, which are S-CVI/Ave (the average of total I-CVI) and S-CVI/UA (the proportion on the scale that achieves an agreement rating of 3 or 4 by all the experts). Based on the result, the value of S-CVI/Ave is 0.98, while the recommended minimum value is 0.90 (13). The value of calculated S-CVI/UA from the results is 0.83, which also achieved the minimum recommended value (0.80) (13).

Although the result was satisfactory, the expert also suggests adding some content to improve the website. In summary, all the values of CVI achieved more than the minimum recommendation. It is concluded that the experts agree that the content of the website has achieved the objective of the study, but with the addition of some content to improve the website.

### Face Validation

The face validation was also reviewed by the experts in terms of the literary presentation, illustration, the

materials are sufficiently specific and understandable, legibility and quality information. There are some missing data because some of the experts believe that the statements are not related to the study. Fortunately, Kalpha can tolerate the missing data (17). The validation is achieved when the value of Kalpha is 0.80, and the lowest acceptable value is 0.67 (18).

Based on the result, the value of Kalpha for literacy presentation is 0.77, which is within the range of acceptable values. However, the literacy on the website needs to be revised in terms of some spelling errors, arrangement of words and continuity of the content. The section illustration has a Kalpha value 0.55, which is lower than the acceptable value. This is because some tables on the website have no explanation, the parents are not familiar with some of the illustrations on the website, and there is a lack of illustrations on the website.

Meanwhile, the Kalpha value for section three is 0.40. Section three is about sufficiently specific and understandable materials. This section has many statements that are not related to the content of the website. It is because there are some statements that are mentioned about medication, drugs, treatment, and complication, which are not related to the content of the website. While some statements are closely related to the content of the website, the mix of the related items and unrelated items cause a disagreement among the experts, and this results with a lower Kalpha value. The next section is about legibility. This value of Kalpha is 0.43. In this section, the experts evaluated the format on the website, which includes the size of the paragraphing the style, the spacing, the use of bullets, the background, the contrast, and the margins. Based on the Kalpha result on the comment from experts, the format needs to be revised to improve the legibility. This section only has a fair agreement.

The last section is the quality of information. This section has a Kalpha value of 0.83. This section evaluates the actions of the parents after reading the information on the website. A high kalpha value shows that the expert panel agrees that from the website created, the parents can gain benefit and take action for caring for their premature baby. However, some experts disagree with the statement 'it is integrated to the local culture' and 'it is adapted to the current culture' because the picture used on the website was not a local picture and the content was not touched about any culture. The value of Kalpha for the overall result is 0.53, which indicates that the face validation has not achieved the minimum recommended value of the Kalpha. Therefore, the inter-phase, layout, and design of the website needs to be revised.

### Future Planning

Improving the website based on the suggestions and recommendations from the expert panel is considered as

future work. After the website has been improvised based on the comments, the website needs to undergo content and face validation among experts. If the excellent results of content and face validation among expert have been achieved, the last step is that the website need to be face validated by the parents of a premature baby. The website will be relevant and reliable after all the validation process has achieved excellent results by obtaining more than the minimum recommendations of the I-CVI, S-CVI, and Kalpha values.

## CONCLUSION

In conclusion, the website about nutrition for premature babies has been developed with nine topics related to nutrition for the premature baby. The topics on the website are predicted to help the parents to better understand the condition of their baby, and gain knowledge about nutrition for their baby. Therefore, this will improve their confidence in caring for their baby at home. The website has been content validated and face validated by an expert panel that consist of lecturers and clinical instructors in the NAD field. The result for content validation has achieved an excellent result. But there is some information that needs to be added on the website to give more knowledge to the parents. However, in terms of face validation, the result is unsatisfying and needs to be revised and improvised, especially in the section of sufficiently specific and understandable material, illustration, and legibility. Another two sections (literacy presentation and quality of information) needed minimal correction. Overall, the developed website acts as an educational tool about the nutrition requirements of premature babies, and is predicted to increase the confidence and knowledge among parents regarding taking better care of their premature baby.

## ACKNOWLEDGEMENTS

The authors appreciate the effort of all the judges involved in this study. We would like to thank Universiti Teknologi MARA and Ministry of Higher Education Malaysia. This study is funded by FRGS grant (600-IRMI/FRGS 5/3 (460/2019).

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