

Development, Validation and Impact Evaluation of a Nutrition-Focused Website for Adolescents

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Abstract: This work focuses on the design, validation, and evaluation of a nutrition focused website developed to improve nutrition knowledge among adolescents aged 17 to 18 years. Adolescence is a sensitive stage for shaping long term dietary habits, yet many individuals in this age group continue to follow unhealthy eating patterns that increase future health risks. To address this gap, a mobile responsive website titled Nutribook was created using standard web technologies and evidence based nutrition guidelines, with content tailored to common adolescent nutrition concerns. The website included interactive features such as a BMI calculator, sample meal plans, and educational videos presented in simple, age appropriate language. Content accuracy, usability, and educational value were validated by a panel of dietitians, nutrition faculty members, and postgraduate interns. Effectiveness was assessed using a comparative pre test and post test design among 63 adolescents over three months. Statistical analysis showed a marked improvement in nutrition knowledge across all assessed topics, with mean scores increasing significantly after exposure to the website. Expert feedback highlighted overall usefulness while also pointing to areas for refinement in presentation and depth. The findings demonstrate that a well structured digital platform can serve as a practical and effective tool for adolescent nutrition education and support broader efforts to promote healthy dietary behaviours through accessible technology.

Keywords: Adolescent nutrition, Web based nutrition education, Digital health education, Nutrition knowledge, Dietary behaviour

1. Introduction

Adolescence is a critical developmental period marked by significant physical, emotional, and social changes and represents a crucial window for establishing lifelong health behaviours. Adequate nutrition during this stage plays a foundational role in promoting optimal growth, health, and overall well-being (World Health Organization). However, evidence from national health surveys indicates that many adolescents fail to follow recommended dietary guidelines, which may increase their risk of obesity, diabetes, cardiovascular diseases, and other chronic non-communicable diseases (NCDs) in adulthood (Chau et al., 2018).

The adolescent period is particularly sensitive to changes in body composition due to pubertal hormonal fluctuations that influence appetite regulation, fat distribution, and energy balance. Simultaneously, growing independence, peer influence, and behavioural experimentation often lead to unhealthy dietary patterns and reduced physical activity. Poor eating habits established during adolescence frequently persist into adulthood, making early intervention a public health priority (Diethelm et al., 2012).

Adolescent malnutrition presents a dual burden, encompassing obesity, undernutrition, and eating disorders, all of which pose significant public health challenges globally. These conditions are often driven by unhealthy eating behaviours, distorted body image, and psychosocial stressors. Promoting healthy dietary practices is a key preventive strategy to reduce nutritional deficiencies, eating disorders, and the rising prevalence of NCDs (Baldasso et al., 2016).

Nutrition education is a scientifically supported approach for improving dietary knowledge and fostering healthy eating behaviours among adolescents. Effective nutrition education equips individuals with the skills necessary to make informed food choices and supports long-term behaviour change. However, current research emphasizes the need for innovative, engaging, and accessible methods of delivering nutrition information to ensure sustained impact (Hand et al., 2015).

With the widespread use of digital technologies among adolescents, web-based platforms offer a promising avenue for nutrition education. Adolescents' dietary behaviours are strongly influenced by peers and social networks, and digital media has become a dominant source of information and communication in this age group (Chau et al., 2018). The Internet, particularly the World Wide Web, provides an interactive, accessible, and cost-effective medium for disseminating reliable health and nutrition information (Brug et al., 2005). Evidence suggests that web-based interventions can effectively enhance nutrition knowledge and support healthier lifestyle choices among adolescents (Ajie & Chapman-Novakofski, 2014).

A well-designed nutrition-focused website can deliver credible, evidence-based, and age-appropriate dietary guidance through interactive features such as videos and user-friendly interfaces. Mobile optimization and accessibility features further enhance reach and engagement, enabling adolescents to make informed decisions about their health and well-being.

2. Methodology

This study adopted a systematic and structured research methodology to develop, validate, and evaluate a nutrition-focused website designed for adolescents. A comparative pre-post intervention research design was employed to assess changes in nutrition knowledge following exposure to the web-based educational tool. The study was conducted over a period of three months at MMM College of Health Sciences, Mogappair, Chennai.

The study population comprised adolescents aged 17–18 years of both genders who were willing to participate and had the ability to access and use the website. Adolescents below 17 years of age, those unable to access the website, or those unwilling to participate were excluded. Ethical participation was ensured through voluntary involvement and informed consent.

The nutrition-focused website, titled “*Nutribook*”, was developed using a user-centered design approach to meet adolescents’ educational and technological needs. Standard web development tools, including Hypertext Markup Language (HTML) and Cascading Style Sheets (CSS) for front-end development and JavaScript for back-end functionality, were utilized. The website was optimized for mobile responsiveness to ensure accessibility across smartphones, tablets, and computers. Special attention was given to creating a visually appealing, age-appropriate, and easy-to-navigate interface using vibrant colours, simple layouts, and multimedia elements such as images and educational videos to enhance engagement and information retention.

Website content was developed based on credible and evidence-based sources, including World Health Organization guidelines, national dietary recommendations, and peer-reviewed nutrition literature. Key features included a Body Mass Index (BMI) calculator, which enabled users to input age, height, and weight to determine BMI classification. Based on BMI category, the website provided tailored sample meal plans and nutrition guidance. Additionally, educational videos addressed common adolescent nutrition concerns such as anemia, underweight and overweight conditions, Polycystic Ovarian Disease (PCOD), acne, thyroid disorders, constipation, muscle gain challenges, osteoporosis risk, and food intolerances. All content was presented in simple, age-appropriate language to promote understanding and proactive health management.

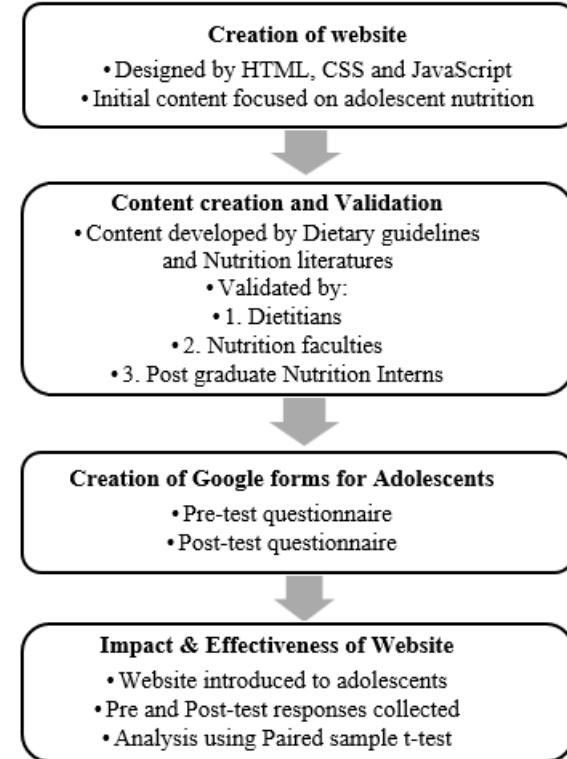
Content validity and usability of the website were evaluated by a panel of fifteen experts, comprising five registered dietitians, five nutrition faculty members, and five postgraduate nutrition interns. Validation was conducted using a structured Google Form that assessed content accuracy, clarity, visual appeal, language appropriateness, ease of navigation, and overall usefulness as an educational tool for adolescents. Expert feedback ensured the scientific reliability, relevance, and professional credibility of the website.

To assess the effectiveness of the website, a structured knowledge-based questionnaire was developed and administered using Google Forms before and after the intervention. The questionnaire consisted of ten multiple-choice questions covering key nutrition topics addressed on the website, including balanced diet, underweight and overweight management, anemia, constipation, PCOD, hypothyroidism, osteoporosis, muscle gain, and celiac disease. Each correct response was awarded one mark, yielding a maximum score of ten. Based on total scores, participants’ nutrition knowledge was categorized as low (1–3), moderate (4–6), or good (7–10).

Primary data for the study were obtained directly from adolescent participants through the pre-test and post-test questionnaires. Secondary data were collected from scientific journals, national and international reports on adolescent nutrition, and established dietary guidelines. Nutrition education formed the conceptual foundation of the intervention, emphasizing balanced diets, macronutrients and micronutrients, hydration, portion control, and the prevention of undernutrition and overnutrition.

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS). The Chi-square test was used to analyse expert validation responses and determine associations between categorical variables. A paired sample t-test was employed to compare pre- and post-intervention nutrition knowledge scores among adolescents, allowing assessment of the website’s impact. A p-value of less than 0.05 was considered statistically significant.

Flowchart For Development and Validation of Website



3. Results and Discussion

Table 1: Expert validation of the website

Website Validation		Dietitian	Intern	Professor	p value
Content accuracy	Completely accurate	4 (40%)	3 (30%)	3 (30%)	0.741
	Somewhat accurate	1 (20%)	2 (40%)	2 (40%)	
Usability and ease of navigation	Very easy	5 (38.50%)	3 (23.10%)	5 (38.50%)	0.099
	Somewhat easy	0 (0%)	2 (100%)	0 (0%)	
Language and presentation	Very appropriate	5 (38.50%)	5 (38.50%)	3 (23.10%)	0.099
	Moderately appropriate	0 (0%)	0 (0%)	2 (100%)	
Visual appeal and layout	Visually appealing	5 (38.50%)	5 (38.50%)	3 (23.10%)	0.099
	Average	0 (0%)	0 (0%)	2 (100%)	
Usefulness of website as educational tool	Very useful	4 (40%)	5 (50%)	1 (10%)	0.020*
	Somewhat useful	1 (20%)	0 (0%)	4 (80%)	

*Statistical significance with 95% CI

Table 1 presents the expert validation of the nutrition-focused website across five domains by dietitians, interns, and professors. For content accuracy, 40% of dietitians, 30% of interns, and 30% of professors rated the website as completely accurate, while 20%, 40%, and 40% of the respective groups rated it as somewhat accurate. No statistically significant difference was observed among the groups ($p = 0.741$).

Regarding usability and ease of navigation, 38.5% of dietitians and professors and 23.1% of interns rated the website as *very easy* to use. All interns (100%) rated it as *somewhat easy*. The differences were not statistically significant ($p = 0.099$).

In terms of language and presentation, 38.5% of dietitians and interns rated the website as *very appropriate*, compared to 23.1% of professors. All professors (100%) rated the language as *moderately appropriate*. This difference did not reach statistical significance ($p = 0.099$).

For visual appeal and layout, 38.5% of dietitians and interns rated the website as *visually appealing*, whereas only 23.1% of professors did so. All professors (100%) rated the visual presentation as *average*, with no significant difference among groups ($p = 0.099$).

With respect to usefulness as an educational tool, 40% of dietitians, 50% of interns, and 10% of professors rated the website as *very useful*. In contrast, 20% of dietitians and 80% of professors rated it as *somewhat useful*. This difference was statistically significant ($p = 0.020$), indicating comparatively lower satisfaction among professors regarding the educational utility of the website.

These findings are consistent with the study by Fatin Najihah Esam and Naleena Devi Muniandy (2024), in which expert reviewers acknowledged the usefulness of a nutrition-related website while recommending minor improvements in content clarity and presentation. Similarly, expert feedback in the present study supports the website's overall usefulness, with suggestions for modest enhancements to information quality and presentation.

Table 2: Pre-Test Vs Post-Test Comparison of Nutrition Knowledge

Comparison of Nutrition Knowledge	Pre-test		Post-test		p value
	Frequency	Percentage	Frequency	Percentage	
Which of the following food groups should be included in a balanced diet?	29	46	63	100	<0.001*
Which of the following food should be included in the diet of an underweight individual?	22	34.9	57	90.5	
Which of the following food should be excluded in the diet of an overweight individual?	13	20.6	58	92.1	
Which of the following foods inhibit the absorption of iron and results in anemia?	9	14.3	39	61.9	
Which of the following nutrient helps prevent constipation?	26	41.3	59	93.7	
Which type of carbohydrate is most beneficial for women with PCOD?	21	33.3	50	79.4	
Which of the following foods should be limited by a person with hypothyroidism?	17	27	51	81	
Which of the following foods can help to prevent predisposition to osteoporosis?	33	52.4	60	95.2	
Which of the following foods does not aid in muscle gain?	23	36.5	44	69.8	
Which of the following foods should not be taken by an individual with celiac disease?	29	46	56	88.9	

The comparison of pre-test and post-test nutrition knowledge scores (Table 2) demonstrates a substantial improvement in participants' understanding following the educational intervention. Across all ten nutrition-related domains, post-test percentages showed marked increases, indicating the effectiveness of the intervention in enhancing nutrition knowledge among adolescents.

Knowledge related to a balanced diet showed a complete improvement, increasing from 46% in the pre-test to 100% in the post-test. Similarly, awareness regarding diets for underweight and overweight conditions improved considerably, rising from 34.9% to 90.5% and from 20.6% to 92.1%, respectively. Knowledge of anemia-related dietary management increased from a low baseline of 14.3% to 61.9% post-intervention. The most pronounced

improvement was observed in knowledge related to constipation management, which rose sharply from 13.3% in the pre-test to 93.7% in the post-test. Awareness of dietary management for PCOD and hypothyroidism also improved substantially, increasing from 33.3% to 79.4% and from 27% to 81%, respectively. Furthermore, knowledge related to bone health improved from 52.4% to 95.2%, muscle gain from 36.4% to 69.8%, and food intolerance from 46% to 88.9% in the post-test.

Statistical analysis further confirmed the effectiveness of the intervention. The mean nutrition knowledge score increased significantly from 3.49 ± 1.94 in the pre-test to 8.52 ± 1.01 in the post-test among 63 participants. The reduction in standard deviation indicates that, in addition to increasing overall knowledge, the intervention also resulted in more consistent understanding across participants. The observed difference was statistically significant ($p < 0.001$), confirming that the improvement in knowledge was not due to chance.

These findings are consistent with the study conducted by Ruth Charles Shapu et al. (2020), which reported that structured nutrition education programs significantly improve adolescents' nutrition knowledge, attitudes, and dietary practices related to malnutrition. In concordance with this evidence, the present study demonstrates that a well-designed, nutrition-focused digital platform can effectively enhance adolescents' nutrition knowledge, supporting the role of technology-based educational interventions as a valuable tool in nutrition education.

4. Conclusion

The evaluation of the nutrition-focused website revealed variations in perception among dietitians, interns, and professors, particularly with respect to usefulness and visual appeal. Dietitians and interns rated the website more favorably, while professors expressed comparatively lower levels of acceptance. Nevertheless, the overall evaluation indicated that the website was well organized, user friendly, and effective as a nutrition education resource. Statistical findings confirmed significant improvements in nutrition knowledge, demonstrating the website's effectiveness in delivering structured and easily accessible learning content to adolescents.

Demographic analysis showed that the majority of participants were female adolescents, with a mean age of 17.7 years. Prior to the intervention, 58.73% of participants exhibited low nutrition knowledge, 31.75% had moderate knowledge, and only 9.52% demonstrated good knowledge. Following the intervention, a substantial improvement was observed, with 96.80% of participants attaining good nutrition knowledge and none remaining in the low knowledge category. This marked shift highlights the website's potential as an effective educational platform for improving nutrition awareness among adolescents.

Topic-wise analysis of pre-test and post-test scores further reinforced the positive impact of the intervention. Knowledge related to balanced diets increased from 46% to 100%, while awareness of dietary management for

constipation showed the greatest improvement, rising from 13.3% to 93.7%. Significant gains were also observed in knowledge of diets for underweight and overweight conditions, anemia, PCOD, hypothyroidism, bone health, and food intolerance. Additionally, the mean nutrition knowledge score increased significantly from 3.49 to 8.52, accompanied by reduced variability, indicating improved understanding and greater consistency among participants after the intervention.

Feedback from subject experts during the validation process emphasized the need for enhanced content depth, clearer explanations, and improvements in language and presentation style. Considering that visual engagement plays a crucial role in adolescent learning and retention, the website design was refined with more attractive and interactive elements. These expert recommendations were carefully incorporated, resulting in a more comprehensive, engaging, and user-friendly platform. Overall, the validated and improved website proved to be an effective nutrition education tool for enhancing nutrition knowledge among adolescents.

In addition, wider implementation of such digital nutrition platforms is recommended through government support and integration into school curricula. Collaboration among doctors, dietitians, and teachers is essential to ensure accuracy and regular content updates, while incorporating interactive features and regional language options can enhance engagement, inclusivity, and community-level outreach for sustained nutrition education among adolescents.

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Conflict of Interest

The authors declare no conflict of interest.

Financial Disclosure

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