Effect of Digital Storytelling and Leaflets on Improving Knowledge of Adequate Nutrition Among In-School Adolescents in Selected Public Secondary Schools in Ibadan, Oyo State

Oyelaran I.[1], Balogun O. O.[1], Olaniran O. P.[1]*, and Alade M.[1]

[1]*Department of Human Nutrition and Dietetics, Lead City University, Ibadan, Nigeria*

***Corresponding author:** olaniran765@gmail.com **Phone number:** +2348105051939

ABSTRACT

Background: *Adolescents in urban Nigeria face significant challenges in adopting healthy dietary behaviors, partly due to ineffective and unengaging educational delivery methods. Conventional tools like leaflets may be less effective in sustaining adolescent attention. Digital storytelling, a technology-driven approach, offers interactive and relatable content that may enhance learning.*

Objective: *This study compared the effect of nutrition education using digital storytelling and leaflets on nutrition knowledge and dietary intake among in-school adolescents in Ibadan.*

Methodology: *A quasi-experimental study was conducted among 343 adolescents aged 10–19 years in three public secondary schools, assigned to digital storytelling, leaflet, or control groups. Data were collected at baseline and endline using structured questionnaires. Nutritional knowledge and dietary intake were assessed, and the data were analysed using SPSS version 25 at a 5% significance level.*

Results: *Most participants were females (60.1%), aged 14–16 years (53.9%), and in SS1 (45.2%). At baseline, 63.0% had fair dietary intake. After intervention, the proportion with healthy intake increased in the digital group (26.1% to 33.9%) and the leaflet group (25.2% to 21.7%). Adequate nutrition knowledge was significantly higher at endline among digital group participants (98.3%) and leaflet group participants (93.0%), compared with 50.4% in the control ($p < 0.01$). This stronger level of significance ($p < 0.01$) implies that the difference in nutrition knowledge between the intervention and control groups was highly unlikely to have occurred by chance.*

Conclusion: *This study concluded that integrating digital storytelling into school-based nutrition education can promote healthier dietary behaviours among adolescents.*

Keywords: Adolescents, Digital storytelling, Knowledge, Leaflet, Nutrition education

Doi: https://dx.doi.org/10.4314/njns.v47i1.3

INTRODUCTION

Nutrition education plays a crucial role in promoting healthy eating habits and preventing nutrition-related disorders among young people. The effectiveness of such education, however, depends largely on the methods and tools used to communicate key messages (1). Digital storytelling, a modern, technology-driven approach, has recently emerged as a promising strategy for delivering health education in more engaging and relatable ways, especially among adolescents.

Adequate nutrition during adolescence is essential for healthy growth, cognitive performance, and the prevention of both immediate and long-term health complications (2). In Nigeria, these challenges are compounded by poor dietary practices, peer influences, and limited exposure to practical nutrition education (3). Evidence suggests that these factors contribute to a dual burden of

undernutrition and emerging overweight and obesity, which together threaten the well-being of this population (4).

Studies conducted in Nigeria have consistently highlighted the prevalence of poor dietary habits among adolescents (5). Skipping breakfast, frequent consumption of fast foods, and inadequate intake of fruits, vegetables, and protein-rich foods are widely reported (5). Such habits increase the risk of micronutrient deficiencies, particularly iron, vitamin A, and zinc, which manifest in fatigue, poor academic performance, and susceptibility to illness (6). Urbanization has further reshaped food environments, making energy-dense processed foods more accessible and affordable compared to healthier options (7). This situation calls for urgent and innovative nutrition education strategies targeted at young people, particularly those in school settings where interventions can reach a large number of adolescents simultaneously.

Nutrition education is recognized as a cost-effective approach to promoting healthy eating behaviours and reducing nutrition-related health risks (8). However, the effectiveness of such education is strongly influenced by delivery methods. Conventional methods, including posters, lectures, and leaflets, have been widely used but are often criticized for being overly text-based and disconnected from the realities of adolescents' daily lives. Although leaflets are inexpensive and easy to distribute, their impact is limited by literacy demands and lack of interactivity. In many cases, adolescents regard them as uninteresting or irrelevant, leading to minimal long-term changes in dietary practices (9).

Recent advances in digital media and mobile technology have created new opportunities for interactive health communication. With increasing access to smartphones and internet services in Nigeria, nutrition education can now reach adolescents through platforms they already use and enjoy (10). Digital storytelling, which combines narration, visuals, sound, and animation, transforms health information into relatable, emotion-driven narratives. Unlike static materials, digital stories present health information through relatable characters and situations, making the content easier to understand, remember, and apply in real life (10).

Evidence from other fields of adolescent health supports the potential of digital storytelling (11). Digital stories improved HIV knowledge and reduced stigma among South African adolescents, while studies in the United States showed that digital storytelling increased fruit and vegetable intake among school-aged children (11). Narratives are particularly powerful because they evoke emotional engagement and foster identification with characters, which can influence beliefs and behaviors more effectively than factual messages alone (9). Social learning theory also reinforces this idea, proposing that individuals are more likely to adopt new behaviors when they observe relatable models practicing those behaviors (12).

In Nigeria, digital interventions in health education are still relatively new, and their application to adolescent nutrition remains underexplored. Most existing studies focus on conventional teaching methods, while those using digital tools have largely addressed areas such as reproductive health (9, 11). Yet, with young Nigerians among the most active users of digital platforms across Africa, digital storytelling represents an opportunity to align nutrition education with the lifestyles and preferences of today's adolescents (10).

This study, therefore, aimed to evaluate the effect of nutrition education delivered through digital storytelling and leaflets on the nutrition knowledge and dietary practices of in-school adolescents in Ibadan, Oyo State.

METHODS

Study design

A quasi-experimental study design with pre- and post-intervention assessments was employed to evaluate the effectiveness of nutrition education using digital storytelling (DI) and leaflets (LI) compared with a control group.

Study population and sampling

The study was conducted in three selected public secondary schools in Ibadan, Oyo State, Nigeria. The target population comprised in-school adolescents aged 10–19 years. The sample size was determined using standard power calculations for comparing mean differences in knowledge scores between groups, applying the formula for sample size estimation in clinical research. Parameters included a 95% confidence level ($Z\alpha = 1.96$), 80% power ($Z\beta = 0.84$), and a 10% attrition rate. The expected difference in nutrition knowledge scores between intervention and control groups was expressed as a standardized effect size ($E = 0.5$), representing a moderate difference, with the standard deviation of change

(S(Δ)) derived from a prior prevalence estimate of 59%. Based on these parameters, the calculated minimum sample size per group was approximately 115 participants, yielding a total of 345 participants after adjustment for attrition. However, a total of 343 participants were recruited across the three schools, with each school representing one of the intervention arms: digital storytelling (n = 115), leaflet (n = 115), and control (n = 113).

A multistage sampling technique was used. Three public secondary schools were purposively selected from different zones of Ibadan. Within each school, systematic random sampling was applied to select eligible students from class registers. The inclusion criteria required participants to be enrolled full-time in junior or senior secondary classes, within the defined age range, and willing to provide assent and parental consent to participate. Adolescents with any physical or cognitive limitations that could affect participation in the digital or printed interventions were excluded.

Research Instrument

Data were collected using a structured, pretested questionnaire developed from previous validated nutrition knowledge and dietary assessment tools (13). The instrument comprised sociodemographic characteristics (age, sex, class, parental education/occupation); nutrition knowledge scale – using 15 structured items covering food groups, nutrient functions, balanced diet, and consequences of deficiencies. Knowledge was scored as: poor (1–6 correct), fair (7–10), and adequate (11–15); and Dietary intake using a Food Frequency Questionnaire (FFQ) that assessed consumption of key food groups within the past seven days.

Intervention

Two nutrition education strategies were implemented over a six-week period to assess the effectiveness of digital storytelling and leaflets on adolescents' nutrition knowledge and dietary practices. Each intervention group received identical nutrition content, but through different instructional media, while a third group served as the control and received no intervention during the study period. The intervention process was integrated into the six-week data collection timeline, which included baseline assessment, a four-week behavioral change period, and endline reassessment.

Digital storytelling group (DI Group)

Participants in the digital storytelling group were exposed to a short-animated video developed using the Ed–W model, which unfolds learning through five narrative stages: Engage, Explore, Explain, Elaborate, and Evaluate. The animation, titled "The Nutri-Power," told the story of an adolescent girl, Sarah, who overcame poor dietary habits through guidance from her teachers, friends, and a school dietitian. The story featured familiar school settings, relatable dialogue, and culturally relevant foods to enhance engagement and comprehension.

At the baseline phase, participants viewed the animation in a multimedia classroom using a laptop, projector, and external speakers. To reinforce understanding, the video was played three times during the initial session, followed by a short group discussion led by the facilitator. No additional sessions were held afterward, but students were encouraged to apply the lessons during the four-week behavioral change period. Researcher and trained research assistants monitored engagement informally during routine school activities to maintain message retention.

Leaflet education group (LI Group)

The leaflet education group received printed educational materials containing the same nutrition content as the animated video. The leaflet was designed using simple, age-appropriate language and included colorful illustrations of food groups, the food pyramid, and examples of balanced meals. The content structure paralleled that of "The Nutri-Power" story, moving from common dietary problems to improved eating behaviors. Each student was given a personal copy of the leaflet at the start of the intervention for use during the session; however, the leaflets were collected afterward, and students were not allowed to take them home. During the baseline week, leaflets were distributed, and the facilitator conducted a guided 30-minute reading session, explaining key concepts and encouraging brief discussions.

Control group

The control group consisted of students who did not receive any form of nutrition education during the intervention period. They continued with their normal school activities without exposure to either the digital storytelling video or the printed leaflet. This group served as a baseline comparator to assess the true effect of the interventions on nutrition knowledge and dietary behavior. As an ethical consideration, following the completion of the endline assessment, participants in the control

group were provided with both the digital storytelling video and the educational leaflet to ensure equal access to the learning materials and to prevent informational disadvantage.

Method of data collection

Data collection commenced in March 2025 and spanned approximately six weeks, involving three structured phases. During the baseline assessment phase, a letter of introduction from the university was submitted to the Oyo State Ministry of Education and subsequently to school principals. Approval was obtained before commencement. The purpose of the study was explained to students, and verbal informed assent was obtained alongside parental consent. The baseline questionnaire was administered in all three schools over one week. Questionnaires were explained and completed under supervision and collected the same day. A four-week behavioral change period was allowed after the intervention. The same questionnaire used at baseline was re-administered to participants across the three groups over one week, and responses were collected on the spot. To assess the effect of the interventions, a knowledge scoring system was applied to participants' responses to the nutrition knowledge questionnaire. Each correct response was awarded one point, with a maximum possible score of 15. Scores between 1–6 were classified as poor knowledge, 7–10 as fair knowledge, and 11–15 as adequate knowledge.

Data analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 25. Descriptive statistics were employed to summarize the socio-demographic characteristics of respondents as well as their baseline and endline dietary intake patterns. The Chi-square test was used to examine differences between the control, digital storytelling, and leaflet groups with respect to dietary intake patterns and nutrition knowledge levels. Statistical significance was determined at $p < 0.05$.

Ethical considerations

Ethical approval for the study was obtained from the Ethical Review Committee of Lead City University, Ibadan (LCU-REC/25/095). Permissions were also obtained from the school principals. Written informed consent was secured from parents/guardians, while assent was obtained from adolescents. Confidentiality was maintained by anonymizing participant responses, and participants in the control group received the educational material after the study.

RESULTS

Sociodemographic status of the in-school adolescents

At baseline, there was no significant difference in age and gender distribution (44.6% male, 55.4% female), with no significant differences. Significant variations were observed in religion, ethnicity, living arrangements, and parental occupations. The majority were Yoruba (94.2%) and lived with both parents (60.1%), while most of their mothers (76.1%) and fathers (43.7%) were traders. (Table 1).

Dietary intake pattern among the in-school adolescents

At baseline, most adolescents reported eating three meals per day (63.6%), although a notable proportion skipped meals (49.3%), mainly due to religious fasting (59.2%). By endline, meal frequency improved, with 65.4% consuming three meals daily, while meal skipping decreased slightly to 45.5%. (Table 2).

Level of nutritional knowledge among in-school adolescents

At baseline, 19.0% of the digital storytelling group, 13.1% of the control, and 24.8% of the leaflet group demonstrated fair knowledge. Adequate knowledge was highest in the control group (15.5%) compared to 12.0% in the digital group and only 3.79% in the leaflet group. Poor knowledge was reported by 2.62% (digital), 4.37% (control), and 4.96% (leaflet), showing no major differences at baseline. Following the intervention, adequate knowledge rose dramatically to 32.94%, with poor knowledge eliminated and only 0.58% remaining at a fair level. Similarly, the leaflet group recorded a sharp increase in adequate knowledge to 31.20%, with no participants remaining in the poor category and only 2.33% at the fair level. In contrast, the control group showed minimal change, with adequate knowledge increasing only slightly to 16.62%, while poor and fair knowledge levels persisted at 4.37% and 11.95%, respectively (Figure 1).

Table 1: Sociodemographic status of the in-school adolescents (N = 343)

Variables	Control Group 113(%)	DI Group 115(%)	LI Group 115(%)	Total 343(%)	p-value
Age(years)					0.112
10 - 13	32 (28.3)	25 (21.7)	43 (37.4)	100 (29.2)	
14 - 16	65 (57.5)	71 (61.7)	54 (47.0)	190 (55.4)	
17 - 19	16 (14.2)	19 (16.5)	18 (15.7)	53 (15.5)	
Gender					
Male	56 (49.6)	50 (43.5)	47 (40.9)	153 (44.6)	
Female	57 (50.4)	65 (56.5)	68 (59.1)	190 (55.4)	0.400
Living with					
Mother	20 (17.7)	31 (27.0)	46 (40.0)	97 (28.3)	
Father	9 (8.0)	3 (2.6)	7 (6.1)	19 (5.5)	
Both	76 (67.3)	73 (63.5)	57 (49.6)	206 (60.1)	0.008**
Others	8 (7.1)	8 (7.0)	5 (4.3)	21 (6.1)	
Mother's occupation					
Trader	75 (66.4)	94 (81.7)	92 (80.0)	261 (76.1)	
Artisan	9 (8.0)	7 (6.1)	6 (5.2)	22 (6.4)	
Civil Servant	18 (15.9)	5 (4.3)	6 (5.2)	29 (8.5)	0.027*
Others	11 (9.7)	9 (7.8)	11 (9.6)	31 (9.0)	
Father's occupation					
Trader	43 (38.1)	49 (42.6)	58 (50.4)	150 (43.7)	
Artisan	13 (11.5)	24 (20.9)	20 (17.4)	57 (16.6)	
Civil Servant	33 (29.2)	14 (12.2)	9 (7.8)	56 (16.3)	0.001**
Others	24 (21.2)	28 (24.3)	28 (24.3)	80 (23.3)	

*Statistically significant (p<0.05) **Statistically significant (p<0.01), DI Group – digital intervention group, LI Group – Leaflet intervention group Chi-Square Test

Table 2: Dietary intake pattern among the in-school adolescents

Variables	Baseline					Endline				
	Control Group 113(%)	DI Group 115(%)	LI Group 115(%)	Total 343(%)	p-value	Control Group (113%)	DI Group 115(%)	LI Group 115(%)	Total 343(%)	p-value
Number of meals per day										
Once	3 (2.7)	2 (1.7)	0 (0.0)	5 (1.5)		5 (4.4)	2 (1.7)	2 (1.8)	9 (2.7)	
Twice	31 (27.4)	17 (14.8)	16 (13.9)	64 (18.7)		33 (29.2)	14 (12.2)	9 (8.2)	56 (16.6)	
Thrice	70 (61.9)	85 (73.9)	63 (54.8)	218(63.6)	0.000**	69 (61.1)	83 (72.2)	69 (62.7)	221 (65.4)	0.000**
More than 3 times	9 (8.0)	11 (9.6)	36 (31.3)	56 (16.3)		6 (5.3)	16 (13.9)	30 (27.3)	52 (15.4)	
Skips meals										
Yes	42 (37.2)	77 (67.0)	50 (43.5)	169(49.3)	0.000**	41 (36.3)	58 (50.4)	57 (49.6)	156 (45.5)	0.001**
No	71 (62.8)	38 (33.0)	65 (56.5)	174(50.7)		72 (63.7)	57 (49.6)	58 (50.4)	187 (54.5)	
Type of meal skipped										
Breakfast	28 (24.8)	11 (9.6)	14 (12.2)	53 (15.5)	0.030*	22 (19.5)	16 (13.9)	29 (25.2)	67 (19.5)	0.002**
Lunch	67 (59.3)	83 (72.2)	80 (69.6)	230(67.1)		73 (64.6)	77 (67.0)	48 (41.7)	198(57.7)	
Dinner	4 (3.5)	11 (9.6)	7 (6.1)	22 (6.4)		6 (5.3)	13 (11.3)	14 (12.2)	33 (9.6)	
Breakfast and lunch	9 (8.0)	6 (5.2)	6 (5.2)	21 (6.1)		8 (7.1)	6 (5.2)	20 (17.4)	34 (9.9)	
Lunch and dinner	5 (4.4)	4 (3.5)	8 (7.0)	17 (5.0)		4 (3.5)	3 (2.6)	4 (3.5)	11 (3.2)	

*Statistically significant (p<0.05), **Statistically significant (p<0.01), DI Group – digital intervention group, LI Group – Leaflet intervention group

Table 2 contd

Variables	Baseline					Endline				
	Control Group 113(%)	DI Group 115(%)	LI Group 115(%)	Total 343(%)	p-value	Control Group (113%)	DI Group 115(%)	LI Group 115(%)	Total 343(%)	p-value
Frequency of eating variety of foods										
Always	46 (40.7)	68 (59.1)	80 (69.6)	194 (56.6)	0.000**	46 (40.7)	71 (61.7)	50 (43.5)	167 (48.7)	0.000**
Often	21 (18.6)	6 (5.2)	19 (16.5)	46 (13.4)		30 (26.5)	8 (7.0)	11 (9.6)	49 (14.3)	
Sometimes	46 (40.7)	41 (35.7)	16 (13.9)	103 (30.0)		37 (32.8)	36 (31.3)	54 (46.9)	126 (36.7)	
Servings of fruits consumed daily										
3 or more	18 (15.9)	34 (29.6)	38 (33.0)	90 (26.2)	0.000**	19 (16.8)	35 (30.4)	43 (37.4)	97 (28.3)	0.000**
1–2 servings	47 (41.6)	63 (54.8)	58 (50.4)	168 (49.0)		49 (43.4)	61 (53.0)	38 (33.0)	148 (43.1)	
Rarely	39 (34.5)	11 (9.6)	15 (13.0)	65 (19.0)		35 (31.0)	10 (8.7)	18 (15.7)	63 (18.4)	
None	9 (8.0)	7 (6.1)	4 (3.5)	20 (5.8)		10 (8.8)	9 (7.8)	16 (13.9)	35 (10.2)	
Limit intake of sugary or processed foods										
Yes	38 (33.6)	87 (75.7)	57 (49.6)	182 (53.1)	0.000**	35 (31.0)	89 (77.4)	69 (60.0)	193 (56.3)	0.000**
No	11 (9.7)	7 (6.1)	32 (27.8)	50 (14.6)		8 (7.1)	10 (8.7)	7 (6.1)	25 (7.3)	
Sometimes	42 (37.2)	14 (12.2)	21 (18.3)	77 (22.4)		48 (42.5)	9 (7.8)	26 (22.6)	83 (24.2)	
I don't think about it	22 (19.5)	7 (6.1)	5 (4.3)	34 (9.9)		22 (19.5)	7 (6.1)	13 (11.3)	42 (12.2)	

*Statistically significant (p<0.05), **Statistically significant (p<0.01), DI Group – digital intervention group, LI Group – Leaflet intervention group

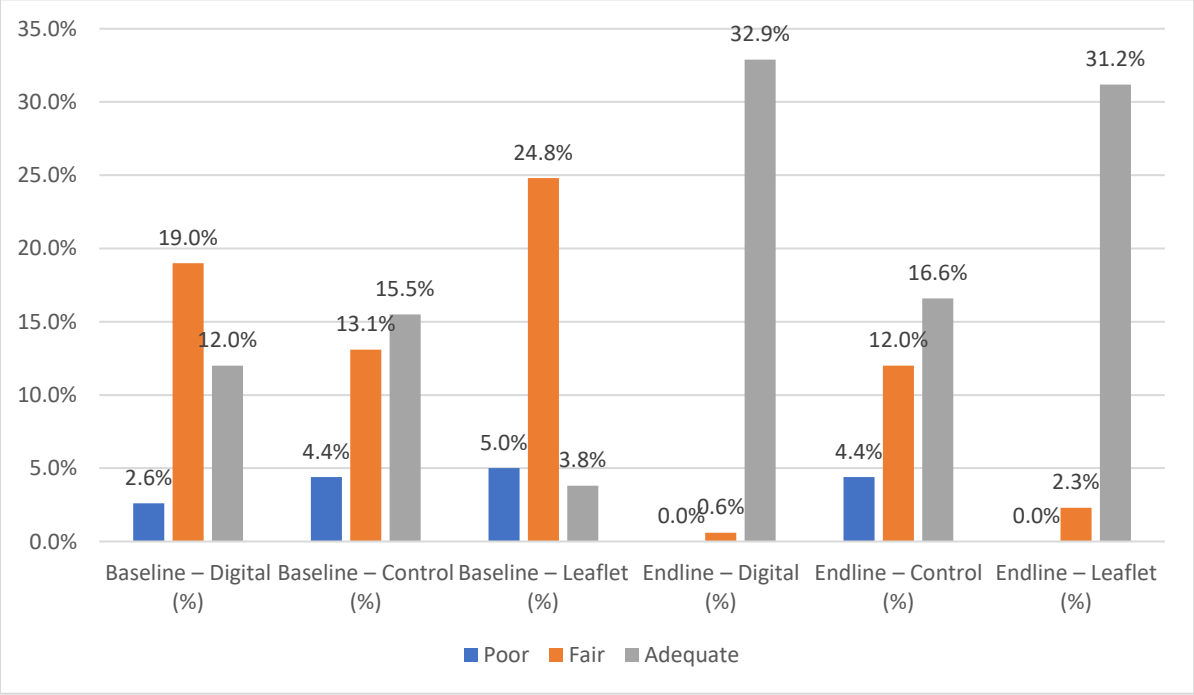

Figure 1: Baseline and endline level of nutritional knowledge among in-school adolescents

Comparison between the effectiveness of digital storytelling and leaflets on nutrition knowledge among in-school adolescents

Overall, the mean score increased from 8.98 ± 2.77 at baseline to 12.57 ± 3.02 at endline, showing a mean difference of 3.58 points ($t(684) = -16.18$, $p < 0.001$) (Table 3).

Table 3: Comparison between the effectiveness of digital storytelling and leaflets on nutrition knowledge among in-school adolescents (N =343)

Variables	Baseline				Endline			
	Control Group (%)	DI Group (%)	LI Group (%)	p-value	Control Group (%)	DI Group (%)	LI Group (%)	p-value
Meaning of adequate nutrition								
Eating only fruits and vegetables	22 (19.5)	2 (1.7)	1 (0.9)		22 (19.5)	2 (1.7)	1 (0.9)	
Eating a variety of foods in the right proportions	76 (67.3)	112 (97.4)	114 (99.1)	0.000**	76 (67.3)	112 (97.4)	114 (99.1)	
Eating as much as possible	10 (8.8)	0 (0.0)	0 (0.0)		10 (8.8)	0 (0.0)	0 (0.0)	0.000**
Eating fast foods regularly	5 (4.4)	1 (0.9)	0 (0.0)		5 (4.4)	1 (0.9)	0 (0.0)	
Nutrient essential for building and repairing tissue including muscles and skin								
Carbohydrate	4 (3.5)	1 (0.9)	5 (4.3)		4 (3.5)	1 (0.9)	5 (4.3)	0.000**
Protein	81 (71.7)	109 (94.8)	19 (16.5)	0.000**	81 (71.7)	109 (94.8)	19 (16.5)	
Water	14 (12.4)	1 (0.9)	9 (7.8)		14 (12.4)	1 (0.9)	9 (7.8)	
Vitamins	14 (12.4)	4 (3.5)	82 (71.3)		14 (12.4)	4 (3.5)	82 (71.3)	
Main role of water in the body								
To provide calories for energy	10 (8.8)	2 (1.7)	1 (0.9)		10 (8.8)	10 (8.8)	1 (0.9)	
To protect the organs from damage	5 (4.4)	3 (2.6)	1 (0.9)	0.007**	5 (4.4)	5 (4.4)	1 (0.9)	0.000**
To help with digestion and transport nutrients	91 (80.5)	108 (93.9)	113 (98.3)		91 (80.5)	91 (80.5)	113 (98.3)	
To provide fat for brain function	7 (6.2)	2 (1.7)	0 (0.0)		7 (6.2)	7 (6.2)	0 (0.0)	
Meat, fish, and eggs are rich in								
Carbohydrates	23 (20.4)	9 (7.8)	18 (15.7)		26 (23.0)	0 (0.0)	6 (5.2)	
Fats	11 (9.7)	18 (15.7)	21 (18.3)	0.017*	19 (16.8)	3 (2.6)	0 (0.0)	0.000**
Protein	73 (64.6)	87 (75.7)	74 (64.3)		65 (57.5)	111 (96.5)	109 (94.8)	
No idea	6 (5.3)	1 (0.9)	2 (1.7)		3 (2.7)	1 (0.9)	0 (0.0)	
Symptoms caused by iron deficiency								
Increased concentration	32 (28.3)	16 (13.9)	26 (22.6)		14 (12.4)	0 (0.0)	0 (0.0)	
Quick wound healing	14 (12.4)	7 (6.1)	12 (10.4)	0.000**	14 (12.4)	0 (0.0)	1 (0.9)	0.000**
Fatigue and dizziness	50 (44.2)	42 (36.5)	47 (40.9)		69 (61.1)	112 (97.4)	110 (95.7)	
Stronger bones	17 (15.0)	50 (43.5)	30 (26.1)		16 (14.2)	3 (2.6)	4 (3.5)	

*Statistically significant ($p<0.05$) **Statistically significant ($p<0.01$) DI Group – digital intervention group LI Group – Leaflet intervention group. SE = Standard error, SD = Standard Deviation

Table 3 contd.

Variables	Baseline				Endline			
	Control Group (%)	DI Group (%)	LI Group (%)	p-value	Control Group (%)	DI Group (%)	LI Group (%)	p-value
This is not considered a nutrient								
Protein	15 (13.3)	2 (1.7)	11 (9.6)		10 (8.8)	0 (0.0)	0 (0.0)	
Carbohydrates	30 (26.5)	8 (7.0)	13 (11.3)	0.000**	12 (10.6)	1 (0.9)	7 (6.1)	
Vitamins	2 (1.8)	7 (6.1)	6 (5.2)		13 (11.5)	1 (0.9)	4 (3.5)	0.000**
Fiber	66 (58.4)	98 (85.2)	85 (73.9)		78 (69.0)	113 (98.3)	104 (90.4)	
Main source of energy for the body								
Protein	20 (17.7)	35 (30.4)	35 (30.4)		19 (16.8)	1 (0.9)	3 (2.6)	
Carbohydrate	70 (61.9)	53 (46.1)	54 (47.0)	0.145	74 (65.5)	112 (97.4)	110 (95.7)	0.000**
Vitamin	14 (12.4)	15 (13.0)	18 (15.7)		9 (8.0)	1 (0.9)	1 (0.9)	
Fats	9 (8.0)	12 (10.4)	8 (7.0)		11 (9.7)	1 (0.9)	1 (0.9)	
Good sources of vitamins & minerals								
Soft drinks and candy	9 (8.0)	22 (19.1)	28 (24.3)		20 (17.7)	1 (0.9)	2 (1.7)	
Fruits and vegetables	84 (74.3)	85 (73.9)	68 (59.1)	0.000**	73 (64.6)	113 (98.3)	105 (91.3)	0.000**
Processed foods	6 (5.3)	4 (3.5)	13 (11.3)		7 (6.2)	1 (0.9)	4 (3.5)	
Fried snacks	14 (12.4)	4 (3.5)	6 (5.2)		13 (11.5)	0 (0.0)	4 (3.5)	
This is an unhealthy eating habit								
Eating balanced meals regularly	11 (9.7)	26 (22.6)	22 (19.1)		20 (17.7)	2 (1.7)	4 (3.5)	
Skipping meals frequently	79 (69.9)	65 (56.5)	56 (48.7)	0.013*	66 (58.4)	112 (97.4)	102 (88.7)	0.000**
Drinking plenty of water	14 (12.4)	19 (16.5)	27 (23.5)		15 (13.3)	0 (0.0)	6 (5.2)	
Eating fruits and vegetables	9 (8.0)	5 (4.3)	10 (8.7)		12 (10.6)	1 (0.9)	3 (2.6)	
This is not a benefit of eating a balanced diet								
Feeling stronger and more energetic	7 (6.2)	15 (13.0)	31 (27.0)		17 (15.0)	4 (3.5)	6 (5.2)	
Supporting growth and repair	23 (20.4)	9 (7.8)	38 (33.0)		19 (16.8)	0 (0.0)	2 (1.7)	0.000**
Gaining weight rapidly	47 (41.6)	29 (25.2)	24 (20.9)	0.000**	64 (56.6)	111 (96.5)	107 (93.0)	
Improving concentration and focus	36 (31.9)	62 (53.9)	22 (19.1)		13 (11.5)	0 (0.0)	0 (0.0)	
Eating too much fat can lead to health problems								
True	102 (90.3)	110 (95.7)	82 (71.3)		101(89.4)	115 (100)	106 (92.2)	
False	11 (9.7)	5 (4.3)	33 (28.7)	0.000**	12 (10.6)	0 (0.0)	9 (7.8)	0.010*

*Statistically significant (p<0.05) **Statistically significant (p<0.01) DI Group – digital intervention group LI Group – Leaflet intervention group. SE = Standard error, SD = Standard Deviation

Table 3 contd

Variables	Baseline				Endline			
	Control Group (%)	DI Group (%)	LI Group (%)	p-value	Control Group (%)	DI Group (%)	LI Group (%)	p-value
Skipping meals is a healthy way to lose weight								
True	59 (52.2)	103 (89.6)	83 (72.2)		39 (34.5)	3 (2.6)	5 (4.3)	
False	54 (47.8)	12 (10.4)	32 (27.8)	0.000**	74 (65.5)	112 (97.4)	110 (95.7)	0.000**
Proteins are only found in animal products								
True	30 (26.5)	33 (28.7)	85 (73.9)		41 (36.3)	10 (8.7)	4 (3.5)	
False	83 (73.5)	82 (71.3)	30 (26.1)	0.000**	72 (63.7)	105 (91.3)	111 (96.5)	0.000**
Eating only snacks and fast foods provides all nutrients								
True	35 (31.0)	10 (8.7)	30 (26.1)		49 (43.4)	1 (0.9)	3 (2.6)	
False	78 (69.0)	105 (91.3)	85 (73.9)	0.000**	64 (56.6)	114 (99.1)	112 (97.4)	0.000**
Not all nutrition trends on social media are safe or healthy								
True	97 (85.8)	60 (52.2)	78 (67.8)		106 (93.8)	111 (96.5)	54 (47.0)	
False	16 (14.2)	55 (47.8)	37 (32.2)	0.000**	7 (6.2)	4 (3.5)	61 (53.0)	0.000**
	Mean ± SD		**SE**	**Mean Difference**	**t (df)**	**p-value**	**95% CI of Difference**	
Knowledge score								
Baseline	8.98 ± 2.77		0.15					
Endline	12.57 ± 3.02		0.16	-3.58	-16.18 (684)	0.000**	–4.02, 3.15	

*Statistically significant (p<0.05) **Statistically significant (p<0.01) DI Group – digital intervention group LI Group – Leaflet intervention group. SE = Standard error, SD = Standard Deviation

DISCUSSION

The selection of effective communication tools has become critical in health promotion, particularly among adolescents who are increasingly immersed in technology-mediated environments. This study assessed the effectiveness of digital storytelling compared with printed leaflets in improving nutrition knowledge and dietary intake among in-school adolescents in Ibadan. At baseline, adolescents demonstrated a limited understanding of adequate nutrition, consistent with previous Nigerian studies that identified persistent challenges in health communication with this population (14). Earlier research has shown that adolescents often struggle not only with conceptual clarity, such as defining a balanced diet or classifying food groups correctly, but also with interpreting and trusting the sources of information they encounter (15). Misconceptions were widespread, including beliefs that "eating fruits and vegetables alone ensures good nutrition" or that "skipping meals aids weight loss (16)." These misconceptions reveal more than just a lack of knowledge; they underscore the limitations of traditional, text-based communication methods in engaging and effectively educating young audiences. The fact that many participants expressed confidence in information obtained from social media platforms illustrates how digital tools now dominate their information ecosystems, as also noted in prior studies (17).

Following the interventions, significant improvements were observed in both the digital storytelling and leaflet groups, with the greatest gains in the digital storytelling group. Nearly all participants exposed to digital storytelling were able to correctly identify the meaning of adequate nutrition, the role of proteins, and the symptoms of iron deficiency, while misconceptions such as "skipping meals to lose weight" sharply declined. These findings are consistent with previous research demonstrating that narrative-based, multimedia interventions can improve comprehension and retention of health-related information by making concepts more relatable and memorable (18, 19). The advantage of digital

storytelling in countering misinformation is particularly important given the influence of social media on adolescent food choice (17). The interactive and narrative features of digital storytelling may explain its superior performance. The integration of visual, auditory, and emotional cues, digital storytelling sustains attention, stimulates reflection, and personalizes learning experiences in ways that static materials cannot. In contrast, printed leaflets, while familiar and low-cost, rely heavily on text and self-directed reading formats that demand sustained concentration and motivation, both of which are often limited among adolescent learners.

Dietary behavior changes observed in both groups offer additional insight into tool effectiveness. Although improvements were noted — including reduced meal skipping and increased fruit consumption — these shifts were less pronounced than knowledge gains, echoing previous research that demonstrates the persistent gap between awareness and behavior (5, 19). However, participants in the digital storytelling group reported higher self-efficacy in applying what they learned, suggesting that the delivery tool itself may influence motivation and confidence which are key precursors to behavior change. This implies that the medium of delivery does not merely transmit information but also shapes learners' emotional engagement and their perceived ability to act on what they know.

These findings have significant implications for adolescent health communication strategies in Nigeria and beyond. The superior performance of digital storytelling underscores its potential as an effective, technology-driven tool for youth education. It demonstrates that learning outcomes are not solely determined by the content of the message, but by the medium through which it is delivered. As adolescents increasingly inhabit digital spaces, interventions that leverage multimedia narratives may be more successful in capturing attention, fostering understanding, and correcting misinformation than traditional print materials (20).

Despite its strengths, this study has limitations. First, the quasi-experimental design without long-term follow-up limits the ability to assess sustained behavioral change. Second, dietary practices were self-reported, which may have introduced recall or social desirability bias. Third, the interventions were tested in selected urban schools, and findings may not be generalizable to rural populations with different socioeconomic contexts.

ACKNOWLEDGEMENTS

The authors are grateful to the principals, teachers, and staff of the participating secondary schools for their cooperation and support throughout the data collection process. Special thanks go to the students who took part in the study for their time and willingness to share their experiences. The authors also acknowledge the contributions of colleagues in the Department of Nutrition and Dietetics, Lead City University, for their valuable guidance during the development of the research instruments and intervention materials.

REFERENCES

1. Chaudhary, A., Sudzina, F., & Mikkelsen, B. E. (2020). Promoting healthy eating among young people: A review of the evidence of the impact of school-based interventions. *Nutrients, 12*(9), 2894. https://doi.org/10.3390/nu12092894
2. Parajuli, J., & Prangthip, P. (2025). Adolescent nutrition and health: A critical period for nutritional intervention to prevent long-term health consequences. *Current Nutrition Reports, 14*(1), 116. https://doi.org/10.1007/s13668-025-00706-4
3. Ariyo, O., Oladipo, F. S., Alimi, E. J., & Atojoko, M. A. (2023). Access to nutrition information, dietary diversity, and shortfall food groups among Nigerian in-school adolescents. *Annals of Health Research, 9*(4), 279–289.
4. Alamu, E. O., Eyinla, T. E., Sanusi, R. A., & Maziya-Dixon, B. (2020). Double burden of malnutrition: Evidence from a selected Nigerian population. *Journal of Nutrition and Metabolism, 2020,* 5674279. https://doi.org/10.1155/2020/5674279
5. Gabriel, T. S., Kasim, M., Oluma, F. A., Muka, T., & Llanaj, E. (2024). Adolescent nutrition in Nigeria: A systematic review. *Journal of Nutritional Science, 13,* e38. https://doi.org/10.1017/jns.2024.34
6. Chitekwe, S., Parajuli, K. R., Paudyal, N., Haag, K. C., Renzaho, A., Issaka, A., & Agho, K. (2022). Individual, household, and national factors associated with iron, vitamin A, and zinc deficiencies among children aged 6–59 months in Nepal. *Maternal & Child Nutrition, 18*(Suppl 1), e13305. https://doi.org/10.1111/mcn.13305
7. Ren, Y., Castro Campos, B., Peng, Y., & Glauben, T. (2021). Nutrition transition with

accelerating urbanization? Empirical evidence from rural China. *Nutrients, 13*(3), 921. https://doi.org/10.3390/nu13030921
8. Adeoya, A. A., Akinwusi, A. T., & Nagatomi, R. (2023). Effectiveness of nutrition education in enhancing knowledge and attitude of pupils on choice of school mid-day meal in Ibadan, Nigeria. *Food Science & Nutrition, 11*(7), 3758–3766. https://doi.org/10.1002/fsn3.3359
9. Hasanica, N., Ramic-Catak, A., Mujezinovic, A., Begagic, S., Galijasevic, K., & Oruc, M. (2020). The effectiveness of leaflets and posters as a health education method. *Materia Socio-Medica, 32*(2), 135–139. https://doi.org/10.5455/msm.2020.32.135-139
10. Babatunde, A. O., Abdulkareem, A. A., Akinwande, F. O., Adebayo, A. O., Omenogor, E. T., Adebisi, Y. A., & Ilesanmi, E. B. (2021). Leveraging mobile health technology towards achieving universal health coverage in Nigeria. *Public Health in Practice, 2,* 100120. https://doi.org/10.1016/j.puhip.2021.100120
11. Maragh-Bass, A. C., Dinh, N., Cooney, G., Aikhuele, E., Chandler, R., Hughes, R., Jones, Z., Thomas, S., Soberano, Z. R., Stocks, J. B., Budhwani, H., Hightow-Weidman, L. B., & Lorenzetti, L. (2025). The role of digital storytelling methods in promoting health-related outcomes among young adults of color: A systematic review. *mHealth, 11,* 42. https://doi.org/10.21037/mhealth-24-65
12. Mukhalalati, B., Elshami, S., Eljaam, M., Hussain, F. N., & Bishawi, A. H. (2022). Applications of social theories of learning in health professions education programs: A scoping review. *Frontiers in Medicine, 9,* 912751. https://doi.org/10.3389/fmed.2022.912751
13. Adepoju, O. T., & Bright, O. A. (2021). Nutrition knowledge, dietary diversity, and nutritional status of adolescents in three selected local government areas of Ibadan municipality, Nigeria. *Biomedical Journal of Scientific & Technical Research, 37*(3), 28811–28820. https://doi.org/10.26717/BJSTR.2021.37.005999
14. Lassi, Z. S., Moin, A., & Bhutta, Z. A. (2017). Nutrition in middle childhood and adolescence. In D. A. P. Bundy, N. de Silva, & S. Horton (Eds.), *Child and adolescent health and development* (3rd ed., Ch. 11). The World Bank. https://www.ncbi.nlm.nih.gov/books/NBK525242/
15. Dada, S., Oyewole, O., & Desmennu, A. (2020). Knowledge as a determinant of healthy eating among male postgraduate public health students in a Nigerian tertiary institution. *International Quarterly of Community Health Education, 42*(3), 219–227. https://doi.org/10.1177/0272684X20972895
16. Feye, D., Gobena, T., Brewis, A., & Roba, K. T. (2023). Adolescent breakfast skipping is associated with poorer academic performance: A school-based study from Hidhabu Abote District, Ethiopia. *Journal of Health, Population, and Nutrition, 42*(1), 79. https://doi.org/10.1186/s41043-023-00424-z
17. Freeman, J. L., Caldwell, P. H. Y., & Scott, K. M. (2023). How adolescents trust health information on social media: A systematic review. *Academic Pediatrics, 23*(4), 703–719. https://doi.org/10.1016/j.acap.2022.12.011
18. Nouri, M., Shahmoradi, L., Mohammadi, A., Soleimani, H. O., & Mojtahedzadeh, R. (2023). The effectiveness of digital storytelling in teaching medical information searching. *Journal of Education and Health Promotion, 12,* 167. https://doi.org/10.4103/jehp.jehp_686_22
19. Li, L., Sun, N., Zhang, L., Xu, G., Liu, J., Hu, J., Zhang, Z., Lou, J., Deng, H., Shen, Z., & Han, L. (2020). Fast food consumption among young adolescents aged 12–15 years in 54 low- and middle-income countries. *Global Health Action, 13*(1), 1795438. https://doi.org/10.1080/16549716.2020.1795438
20. Tugume, P., Mustafa, A. S., Walusansa, A., Ojelel, S., Nyachwo, E. B., Muhumuza, E., Nampeera, M., Kabbale, F., & Ssenku, J. E. (2024). Unravelling taboos and cultural beliefs associated with hidden hunger among pregnant and breastfeeding women in Buyende District, Eastern Uganda. *Journal of Ethnobiology and Ethnomedicine, 20,* 46. https://doi.org/10.1186/s13002-024-00682