Understanding behavioural pathways in WhatsApp-based video nutrition extension for child feeding practices

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Abstract. Stunting is still a major public health issue in Indonesia, affecting 19.8% of children under five. To remedy it, we need nutrition programs that focus on behaviour. A primary reason for chronic undernutrition is that carers often feed children in ways that are not good for them, depending on what they think they can accomplish instead of what they know. This study examined a WhatsApp-based nutrition extension strategy that draws on the Technology Acceptance Model and the Theory of Planned Behaviour. A non-randomized quasi-experimental pre–post design with a control group of 128 parents or carers of PAUD students in East Lombok, Indonesia (July–October 2025). The intervention group (n = 64) received brief educational and recipe-based films over 10 weeks, whereas the control group received brochures. There were no significant differences in feeding behaviour among the groups; however, the intervention groups showed a slight improvement in attitudes. PLS-SEM showed that the features of a message affected how easy it seemed ($\beta = 0.457$; $p = 0.004$), which in turn, affected how people ate ($\beta = 0.587$; $p < 0.001$; $R^2 = 0.392$). These findings indicate indirect behavioural effects, underscoring the need for ongoing, interactive support.

1 Introduction

Stunting remains a major public health concern in Indonesia. It is characterized by impaired child growth resulting from chronic and recurrent malnutrition over extended periods [1]. In 2024, the prevalence of stunting was reported at 19.8% in the Indonesian Nutritional Status Survey (SSGI) [2], indicating ongoing challenges despite mitigation efforts. Suboptimal infant and young child feeding practices, particularly inadequate dietary diversity, including insufficient consumption of nutrient-dense foods, such as eggs, milk, fruits, and vegetables, are recognized contributors to stunting [3]. Deficiencies in essential micronutrients, such as iron, zinc, calcium, and niacin, remain prevalent, particularly among children aged 6–23

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months, and are closely linked to limited dietary diversity [4]. Stunting is associated with increased morbidity and mortality risks, suboptimal brain development, and delays in motor and cognitive functions, which may affect an individual's quality of life and broader human capital [5, 6].

Inadequate feeding practices are often shaped by parent's limited nutritional knowledge, low self-efficacy in preparing diverse meals, and entrenched cultural habits and social norms that influence children's diets [7, 8]. The persistent gap between knowledge and practice underscores the need for educational interventions that facilitate meaningful behavioural change. Globally, WHO and UNICEF have developed Infant and Young Child Feeding (IYCF) indicators to assess feeding practices. In Indonesia, these principles are operationalized through the Balanced Nutrition Guidelines, the Isi Piringku campaign, the Diverse, Nutritious, Balanced, and Safe (B2SA) framework, and the Local Food-based Balanced Nutrition Guidelines (PGS-PL), emphasizing alignment with Local Food contexts.

In recent years, digital platforms have emerged as promising channels for community-based nutrition education. Based on data from We Are Social (2024), WhatsApp, in particular, is widely used in Indonesia with 116 million users, representing 45,2 % of the national population. Its high penetration, low cost, familiarity among parents, and suitability for asynchronous communication within community groups make it strategic channel for delivering nutrition education interventions. Its group-based structure enables repeated exposure to educational content and peer interaction. However, challenges include message overload, limited engagement, forward-based information culture, and the risk of passive consumption without behavioural follow-through. Despite increasing digital initiatives, research on systematically developed stunting-related educational videos grounded in behavioural theory and technology adoption remains limited. Integrating the Theory of Planned Behaviour (TPB) to identify determinants of child feeding behaviour and the Technology Acceptance Model (TAM) to explain caregivers' acceptance of video-based educational media warrants further empirical investigation. This study therefore examines a WhatsApp-based video nutrition extension model integrating TPB and TAM to understand behavioural pathways in child feeding practices.

2 Methods

A non-randomized quasi-experimental design with pre–post testing and a control group was employed, combined with a video-based educational media development approach. The study was conducted in three sub-districts of the East Lombok Regency from July to October 2025. Ethical approval was obtained from the Social and Humanities Ethics Committee of the National Research and Innovation Agency (BRIN) (No. 088/KE.01/SK/02/2025), and all participants provided written informed consent.

2.1 Video series development

A needs assessment was conducted in September 2024 through in-depth interviews with key stakeholders, including PAUD school principals, teachers, and parents, to identify nutrition education needs, barriers to child- feeding practices, and media preferences. The assessment revealed a demand for practical, locally based child- feeding guidance to support stunting prevention. The video series was developed based on the SEAMEO RECFON module *"Memenuhi Gizi Anak yang Optimal"* or Fulfilling Optimal Child Nutrition, which aligns with the B2SA and PGS-PL frameworks. The videos ranged from 1 min to 3 min. Stakeholder input informed the content design, which was grounded in these frameworks.

The scripts were developed using module materials and delivered in an informative, practical format with a warm communication style to encourage engagement. Accessible languages, local community leaders, and nutritionists from primary health centres (Puskesmas) were featured. Emphasis was placed on audience awareness, simple language, clear on-screen text, appropriate spokespersons, and concise durations [9]. The content focused on practical "how-to" guidance relevant to participants' daily experiences. Local languages were used to enhance the acceptability and relevance [10, 11, [12]. Background music complemented the narration, with key concepts highlighted via on-screen text, and subtitles.

2.2 Intervention procedures

The video series was disseminated weekly via WhatsApp groups comprising parents or caregivers, PAUD teachers, and nutrition facilitators from local Puskesmas over 10 weeks, including an introductory week, eight weeks of video dissemination, and an evaluation week. The control group received no intervention during the study period. The study population included 29 PAUD institutions across three sub-districts participating in the ECCNE program, with 1,628 enrolled students. The sample size was calculated using G*Power at 5% significance, 80% power, and an effect size of 0.494, yielding 64 respondents per group (total 128). Participants were recruited from six PAUD institutions in East Lombok. The surveys involved 128 parents from six PAUD institutions across the three sub-districts. The study applied TPB and TAM to examine the factors influencing child-feeding behaviour and to test the relationships among constructs.

Baseline data collection was conducted in mid-July 2025, with brochures distributed to both groups. The intervention group received weekly videos using WhatsApp. The control group received no intervention. The intervention included an introductory week, eight weeks of video dissemination, and a final evaluation week with a quiz. Data were collected using a structured questionnaire based on the TPB and TAM constructs, comprising seven variables, 27 indicators, and 123 items on a four-point Likert scale. Variables included source characteristics, message characteristics, participant characteristics, environmental characteristics, perceived ease of B2SA and PGS-PL child-feeding innovation, perceived WhatsApp message diffusion channels, and child-feeding behaviour.

Perceptions of B2SA and PGS-PL innovation (Y1) included relative advantage, compatibility, complexity, trialability, and observability. Perceptions of WhatsApp as a diffusion channel (Y2) included the perceived ease of use and usefulness. Child feeding behaviour (Y3) was assessed using knowledge, attitudes, loyalty, and practices. The data were transformed and normalized prior to analysis. Pre–post differences were analyzed using t-tests. The relationships between TPB and TAM constructs and child feeding behaviour were analyzed using Partial Least Squares–Structural Equation Modeling (PLS-SEM) with SmartPLS 4.0. Descriptive statistics and group comparisons were conducted using SPSS software.

3. Results and discussion

A total of 128 parents and caregivers participated, with equal numbers in the intervention and control groups. Most respondents were female (control: 96.9%; intervention: 98.4%) or married (control: 98.4%; intervention: 89.1%). The majority reported that at least one household member smoked (control: 70.3%; intervention: 65.6%). Most of the respondents were aged 19–44 years (control: 90.6%; intervention: 89.1%). Educational attainment was predominantly senior high school or equivalent (control: 48.4%; intervention: 62.5%). Housewives without a fixed income comprised the largest occupational group (control:

59.4%; intervention: 73.4%). Most reported monthly household incomes were below the IDR 2,500,000 (control: 84.4%; intervention: 76.6%). Health professionals were the primary source of information on stunting (95.3% in both groups).

Stakeholder interviews indicated the need for practical, context-specific, and easily applicable nutrition education materials focusing on balanced, locally based foods. Participants reported limited nutritional knowledge, frequent consumption of fast food, and a lack of sustained health professional support. Preference was expressed for materials that were short, accessible repeatedly, and delivered in simple ways. Nutrition facilitators from Puskesmas and Posyandu (integrated health service posts) have tried to educate parents how to feed their children properly, but their efforts are too generic, not into the real problems, and do not address the problems they do face. Parents and caregivers, who are the decision-makers, also have to deal with several problems, such as not having enough time or money and having with picky eaters problem. Because of these things, they choose the simplest and quickest answers instead of the healthiest. When providing an extension, most of the health workers focus on programs rather than the problems they face. The extension is mostly one-way, making it difficult for parents and caregivers to ask questions when faced with real problems.

Eight nutrition education videos were developed and adapted from the SEAMEO RECFON module. The series included five core educational videos and three recipe videos, each 1–3 minutes long. The core content covered the introduction to balanced nutrition, parental accompaniment during meals, food purchasing and planning, dietary pattern documentation, and nutrient-dense food preparation. The recipe videos featured affordable local foods aligned with the B2SA and PGS-PL principles.

The videos employed an informative, practical approach emphasizing "how-to" guidance relevant to parents' daily experiences. The content used local languages, warm narration, and featured community leaders and nutritionists to enhance credibility. Visual support includes key on-screen text, simple illustrations, and background music. Baseline analysis showed no significant differences between the groups in child feeding behaviour variables (Mann–Whitney p-values 0.313–0.658), indicating comparable baseline conditions. Information about baseline characteristics between groups is shown in Table 1.

Table 1. Comparison of baseline characteristics between groups

Variable	U	p-value
Y3.1 (Knowledge)	1987	0.658
Y3.2 (Attitude)	1931	0.449
Y3.3 (Loyalty)	1894	0.426
Y3.4 (Practice)	1856	0.313

Pre–post analyses revealed no significant changes in the control group across aspects of child feeding behaviour (all $p > 0.05$), reflecting the absence of behavioural dynamics with brochure-only education. In the intervention group, Wilcoxon tests indicated a significant improvement only in feeding attitudes ($p = 0.043$), while knowledge, loyalty, and practice showed no significant changes ($p > 0.05$). A high proportion of unchanged scores suggests a potential ceiling effect due to relatively high baseline scores.

Between-group comparisons of change scores (Mann–Whitney U test) showed no significant differences in any aspect of child feeding behaviour (all $p > 0.05$), with very small effect sizes ($r = 0.069–0.094$), indicating a limited practical impact of the 10-week video intervention on behaviour. The comparison is shown in Table 2.

Table 2. Comparison of score changes between groups

Variable	Mean Rank control	Mean Rank Intervention	U	z	p-value
ΔY3.1 (Knowledge)	62.45	66.55	1917.00	−0.781	435
ΔY3.2 Attitude	61.96	67.04	1885.50	−0.963	335
ΔY3.3 Loyalty	65.49	63.51	1984.50	−0.318	751
ΔY3.4 Practice	61.23	67.77	1838.50	−1.067	286

SEM-PLS analysis of the intervention group's endline data demonstrated acceptable measurement model reliability and validity (CR > 0.70; AVE > 0.50). Discriminant validity was generally achieved, with conceptual proximity observed between environmental characteristics and perceptions of WhatsApp channels, which was theoretically explained by social context. The Measurement Model Evaluation is shown in Table 3.

Table 3. Measurement model evaluation (SEM-PLS)

Construct	Indicator	Outer Loading	Composite Reliability (CR)	AVE
X1	X1.1	0.756	0.819	0.601
	X1.2	0.814		
	X1.3	0.755		
X2	X2.1	0.817	0.882	0.714
	X2.2	0.876		
	X2.4	0.841		
X3	X3.4	1	—	—
X4	X4.2	0.789	0.742	0.59
	X4.3	0.746		
Y1	Y1.1	0.838	0.867	0.57
	Y1.2	0.87		
	Y1.3	0.701		
	Y1.4	0.605		
	Y1.5	0.731		
Y2	Y2.1	0.72	0.81	0.684
	Y2.2	0.921		
Y3	Y3.1	0.648	0.831	0.558
	Y3.2	0.571		
	Y3.3	0.888		
	Y3.4	0.837		

Structural model evaluation identified two significant paths: message characteristics positively influenced perceived ease of child feeding (β = 0.457; p = 0.004), and perceived ease significantly influenced child feeding behaviour (β = 0.587; p < 0.001). Other paths were nonsignificant but directionally consistent with the theory. The coefficients of determination indicated moderate explanatory power ($R^2 = 0.511$ for perceived ease; $R^2 = 0.392$ for feeding behaviour). The SEM-PLS structural model results is shown in Table 4.

Table 4. SEM-PLS structural model results

Structural Path	β	t-value	p-value	Result
X1 → Y1	0.12	0.652	0.514	Not supported
X1 → Y2	0.338	1.508	0.132	Not supported
X2 → Y1	0.457	2.874	0.004	Supported
X2 → Y2	−0.073	0.346	0.729	Not supported
X3 → Y1	0.192	1.617	0.106	Not supported
X3 → Y2	−0.029	0.169	0.866	Not supported
X4 → Y1	0.188	1.674	0.094	Not supported
X4 → Y2	0.203	1.093	0.275	Not supported
Y1 → Y2	0.31	1.637	0.102	Not supported
Y1 → Y3	0.587	3.677	< 0.001	Supported
Y2 → Y3	0.07	0.335	0.738	Not supported

These findings suggest that the WhatsApp-based video intervention did not yield statistically significant direct behavioural changes in the short term; however, the behavioural mechanisms identified by TPB and TAM were operative. This finding is consistent with prior research suggesting that short-term digital interventions tend to facilitate cognitive shifts more quickly than they translate into observable behavioural changes [13, 14]. The intervention primarily influenced behaviour indirectly by enhancing perceived ease and by strengthening beliefs about the feasibility of feeding practices.

TAM constructs related to perceptions of the WhatsApp channel did not significantly affect feeding behaviour, indicating that technology acceptance alone may be insufficient to drive behaviour change without enhancing perceptions of capability and feasibility. This supports the integration of TPB and TAM frameworks, emphasizing content and practical ease over platform acceptance in social media–based public health interventions. This finding is consistent with prior research that one-way, media-based interventions implemented without intensive support exhibit clear limitations in promoting sustainable behavioural change, particularly when compared with approaches that incorporate interactivity, social engagement, and strategically repeated messaging [15].

This study provides empirical evidence that WhatsApp-based educational videos can influence behavioural mechanisms, even in the absence of immediate, measurable behavioural changes. The integration of the TPB–TAM approach offers a comprehensive understanding of media-based interventions for child feeding and stunting prevention. Practically, these results underscore the need to complement video education with offline extension, facilitated discussions, personalized feedback, and sustained engagement by

health professionals and educators to translate perceptual changes into consistent behavioural practices.

Limitations include the nonrandomized design, the short intervention duration, and reliance on self-reported behaviour, which is subject to social desirability bias. Future research should explore longer interventions with robust designs and interactive components to support sustained behavioural change.

4. Conclusion

The WhatsApp-based educational video intervention did not produce statistically significant short-term changes in child- feeding behaviour. Nonetheless, the analysis indicates that the intervention strengthened behavioural mechanisms by enhancing caregivers' perceived ease in implementing feeding practices aligned with the B2SA and PGS-PL principles. Perceived ease emerged as a key mediator linking message characteristics to feeding behaviour. WhatsApp functioned as a mediator in the behavioural change process, rather than as a standalone determinant. Nutritional extension agents remain critical in supporting behavioural changes through sustained community facilitation.

Integrating the TPB and TAM provides a comprehensive framework for understanding digitally delivered extension interventions. Effectiveness depends not only on technology acceptance but also on the practical design and relevance of messages to target populations. Video interventions are likely to be more effective when structured to bolster caregivers' confidence and capability, rather than merely transmitting information. These findings highlight the importance of combining video-based education with interactive, sustained accompaniment strategies to facilitate stronger transitions from perceptual to behavioural change. Future studies should investigate more intensive, longer-duration interventions with robust designs to assess their long-term impacts on child feeding and stunting reduction.

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