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Educational Animation on Ultra-Processed Food Effects to Children Cognitive Function: A Systematic Literature Review

Muhammad Reyhan Ramadhan Al-Aqil*, Agus Juhana**
* Multimedia Education, Universitas Pendidikan Indonesia
** Multimedia Education, Universitas Pendidikan Indonesia

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ABSTRACT

The consumption of ultra-processed food (UPF) poses a serious risk of cognitive impairment to children during their critical brain development phase. Effective educational media is crucial, as animation is a highly engaging and proven medium for children, with 90% of them choosing animation for education in previous research. This study, therefore, aims to systematically review the topic by addressing three key research questions (RQs): (1) To what extent does UPF consumption affect children's cognitive function and health? (2) Why are animations the most effective media for transferring nutritional knowledge? (3) How effective is animation-based educational media in raising children's awareness regarding UPF risks? This study adopts a Systematic Literature Review (SLR) methodology, adhering to the PRISMA guidelines. The systematic literature search gathered scientific articles from reputable world libraries. The results confirm that UPF consumption is a significant factor contributing to cognitive decline and obesity due to its high sugar and low micronutrient content. Conversely, animation is proven effective as it significantly increases children's focus and comprehension. The core conclusion is that educational animation media serves as a strategic and highly effective tool for fostering children's awareness of the dangers of consuming UPF and promoting preventative behavior.

1. INTRODUCTION

Modern movement requires us to keep moving quickly and as efficiently as possible in all activities. In this regard, Ultra-processed food is made to address all that practicality without sacrificing the deliciousness of the food [1]. Besides that answer, the content of addictive ingredients that makes ultra-processed food an instant meal and a very durable food becomes a new problem for health [2]. Health problems that arise from the consumption of Ultra-processed food include overweight, obesity, inflammation, diet problems, and cognitive impairment resulting from long-term consumption [3]. Among these health problems, cognitive impairment becomes a serious threat, especially to children who are undergoing the brain development phase.

The threat of cognitive impairment requires special attention, because the developmental period in children is a critical period for brain development. This finding is supported by the fact that Ultra-processed Food products are generally high in free sugar and low in essential nutrients such as micronutrients and fiber, with these contents being associated with impaired micronutrient status in schoolchildren, which indicates a potential decline in children's academic and cognitive abilities [4]. In addition, the consumption of Ultra-processed Foods from an early age can lead to an addictive and hard-to-control eating pattern, thereby disrupting cognitive function through energy metabolism instability, a mechanism supported by evidence linking high dietary sugar intake (a characteristic of UPFs) to functional alterations in the children's hippocampus [5].

Therefore, educational media is needed to reduce this concern. Media often used for the education process are Video, Animation, Interactive Media, Games, VR/AR Technology, Mobile base content, and communication platforms [6]. In addition to educational media for education, effective media is also needed to discuss health, including Animated video, Video, Static image, Print material, Written messages, Verbal consultation, and Oral messages [7]. The previous literature underlines the fact that animation presents its

unique advantages as an educational medium, because it can simplify complex information through engaging visual elements, characters, and narrative flow. This goes hand in hand with findings that animated content is more effective in catching children's attention, improving their retention of the message, and presenting abstract health concepts in a form which is easier to understand. These strengths reinforce the urgency of using animation as a tool in health-related education in a strategic way, particularly when presenting topics which are difficult to explain using conventional text-based or verbal approaches [8].

Furthermore, previous systematic studies on animated media indicate that animation could simplify complex messages and enhance the attention and comprehension of children. These findings underscore how important it is to adopt a systematic review method in this study for determining how animation supports knowledge transfer and awareness building regarding Ultra-processed Foods [9].Through various purposes, Animation media becomes one of the media that is often and effectively used in terms of education and health. Therefore, animation is chosen as a medium for education to raise children's awareness regarding the impact of Ultra-processed food. Animation media is proven to increase motivation, and through previous research, 90% of children chose animation as an educational medium [10].

There is no systematic literature review research that discusses Educational Animation Media on the Effects of Ultra-Processed Foods to Children's Cognitive Function, so a special study is needed regarding this :

1. To what extent does the consumption of ultra-processed food (UPF) affect the development of cognitive function and children's health?
2. Why are animation the most effective educational media for transferring nutritional knowledge?
3. How effective is animation-based educational media in raising children's awareness regarding the risks of consuming ultra-processed food?

2. RESEARCH METHOD

This literature review adopts a systematic review approach to analyze previous studies relevant to the 'Development of an Educational Animation Media on the Effects of Ultra-Processed Foods to Children's Cognitive Function'. This method is essential for collecting and evaluating primary sources (such as scientific journals) regarding the effectiveness of animated videos as a health information tool. The systematic review provides a structured framework for a deep understanding of the potential of educational animation and helps identify knowledge gaps [11]. Research methods are defined as systematic reviews employing explicit and reproducible methods to identify, critically evaluate, and summarise the results of primary research as an endeavour to gather evidence addressing specific research questions [12]. That is, it constitutes a literature survey conducted using a structured, systematic approach to ensure the accuracy and precision of the collected materials.

The operational procedures applied in this literature survey are systematised and divided into multiple sequential stages. The process begins by formulating the research problem which is the main focus of this study, followed by the formulation of keywords for the search guide (namely Animation, Cognitive, Children, Real Food, and Ultra Processed Food). The next step is data mining, which is searching for scientific articles related to the topic using the Publish or Perish software. During this step, Publish or Perish is a retrieval tool that collects bibliographic information from the Google Scholar database, the main source of indexed academic literature for this review. Then, the research questions (RQ) are formulated as follows: (1) To what extent does the consumption of ultra-processed food (UPF) affect the development of cognitive function and children's health? (2) What are the most effective educational animation design principles for transferring complex nutritional knowledge? (3) How effective is animation-based edAfter all the literature has been collected, strict data screening is carried out using inclusion and exclusion criteria presented in Functional Media in raising children's awareness regarding the risks of consuming ultra-processed food on Table 1.

Table 1. Table Inclusion and Exclusion

Criterion	Inclusion (Accepted)	Exclusion (Rejected)	Remarks
Publication Type	**Scientific journal article**	Non-article (book chapter, reports, policy papers)	Avoids the use of **grey literature** or book chapters which generally do not undergo a peer-review process as rigorous as journal articles.

Keywords	**Relevant to the research keywords**	Non-keyword / irrelevant	Serves as the primary filter to ensure the research content remains focused on the variables and concepts being studied.
Topic	**Specific to the research topic**	Non-specific topic	Limits the scope of discussion to prevent broadening into other related themes that are not the direct focus of the study.
Language	**English**	Non-English	Chosen so that all studies can be **consistently understood and analyzed** by the researcher, and because English is the primary language of international scholarly publication.
Academic Publication Type	**Peer-reviewed article**	Proceedings, thesis, dissertation, book	Validates that all studies can be understood and analyzed by the research team, and is often used because English is the **dominant language** in global scientific publication.

Data from the studies that passed are then processed through data extraction to obtain key information, which concludes with analysis and synthesis of evidence.

To ensure the transparency and reliability of every step of the process above, this systematic literature review (SLR) methodology strictly follows the PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) guidelines. PRISMA is a reporting guide formed to address transparency issues in systematic review reports, ensuring authors are able to document every research stage accurately and comprehensively [13]. The application of this framework, particularly in the study selection phase, covers three key phases: identification, screening, and included presented in Figure 1.

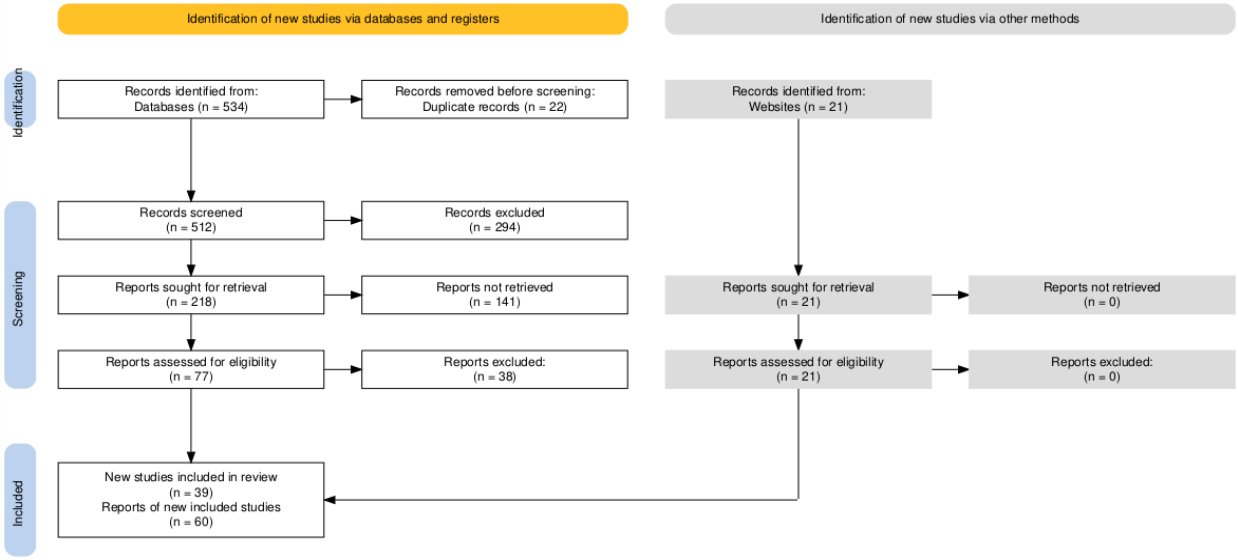

Figure 1. PRISMA Framework

2.1. Identification

This phase began by collecting a paper database using the Publish or Perish software. On October 16, 2025, a search was conducted using the keywords "Children AND ANIMATION AND ULTRA-PROCESSED FOOD." This initial search found a total of 534 papers as a broad initial record.

2.2. Screening

Filtering is conducted in three steps to narrow down the original dataset to highly relevant, high-quality research. Title Filtering: Initial filtering was performed based on the relevance of paper titles from the 512 basic data points collected. A total of 294 articles were excluded because their titles were irrelevant, leaving 218 articles. Abstract Screening: Next, the 218 articles with relevant titles underwent screening through reading the abstract. In this stage, 141 articles were excluded because their abstract content did not support the research topic, leaving 77 articles. Full-Text Screening: Finally, the remaining 77 articles were tested for eligibility by reading the entire (full-text) article. In this stage, 38 articles were excluded because they did not fully meet the inclusion criteria, resulting in 39 articles that fully matched the topic. Next, the authors performed file screening by carefully reviewing the eligibility of the articles based on the inclusion and exclusion criteria.

2.3. Included

In this final stage, the authors observed that the 39 articles obtained from the systematic search were still insufficient to complete the answers to all Research Questions (RQs). Therefore, an additional 21 articles were added through a manual search, specifically by performing snowballing on the references of the initially selected 39 articles, choosing only those articles that could help complete the research process. Thus, the total number of articles used for this SLR process is 60 articles.

3. RESULTS AND DISCUSSION

In order to provide a detailed and systematic overview, the characteristics of the selected literature were grouped according to their publication year and study design. These groupings offer a better insight into the distribution and methodological trends of the 60 studies reviewed here. The following tables summarize the study characteristics which passed the strict screening and systematic evaluation process presented in Table 2.

Table 2. Table Publication Year and Study Design

Year	Number of Studies	Study Design
2025	9	Cross-sectional Experimental / RCT
2024	10	
2023	7	
2022	8	Cohort
2021	9	
2020	4	
2019	3	Qualitative
2018	3	
2017	2	
2016	2	Mixed-method
2015	1	
2011	2	

3.1. To what extent does the consumption of ultra-processed food (UPF) affect the development of cognitive function and children's health?

Research evidence demonstrates that ultra-processed foods (UPF) substantially contribute to declining cognitive function in children, primarily through their elevated sugar levels and insufficient micronutrient composition, which negatively affect academic performance and cognitive capabilities [14]. UPF's nutritional profile harms child development beyond cognition, promoting obesity, dual malnutrition, and metabolic

disorders requiring early intervention. Childhood UPF consumption establishes irregular, addictive dietary patterns that disrupt bodily energy regulation. These preferences dominate children's eating behaviors, creating persistent choices favoring highly appealing foods that produce nutritionally inadequate diets and impair growth. Research confirms strong continuity between childhood UPF intake and adult eating patterns. Since early childhood represents a critical period for developing food preferences that resist later modification, early UPF exposure likely establishes unhealthy lifelong eating behaviors. Given that UPFs may comprise over 60% of children's energy consumption, excessive early intake severely compromises metabolic function and cognitive performance [16]. Monitoring children's diets becomes essential to prevent early patterns from determining future behaviors. This concern intensifies considering that 70% of UPF advertisements employ attractive marketing specifically targeting infants and young children [17]. These findings emphasize the critical need for awareness regarding young children's eating behaviors, as patterns established during this developmental stage produce significant, enduring effects on future quality of life.

Chemical additives and inadequate nutritional composition represent the primary mechanisms through which UPF damages health [18]. Non-natural ingredients produce gradual side effects including chronic diseases when consumed regularly. Nutritional claims on UPF packaging often constitute misleading marketing strategies rather than representing genuinely healthier products, particularly targeting parents purchasing children's food [19]. Listed content frequently serves as consumer bait, highlighting ingredient benefits while concealing concerning elements like excessive sugar or insufficient sodium. Research reveals that 42% of product formulations claim "no added sugar" despite containing high sugar levels and concentrated chemicals, even in products marketed for babies or children [20]. Consumers must carefully examine packaging labels to identify deceptive claims. Additionally, studies show that 59.26% of products employ promotional strategies directly targeting underage consumers without implementing warning labels, despite containing excessive sugar, sodium, or saturated fat [21]. Warning labels remain necessary as marketing regulations for children's food products lack optimal enforcement. Beyond regulations like warning labels providing honest nutritional information, successfully reducing UPF consumption requires addressing children's external environment and digital exposure.

Contemporary factors increasingly influence UPF consumption, with aggressive advertising particularly targeting children, encouraging product preferences without nutritional consideration. Restricting unhealthy food advertising becomes necessary to reduce ultra-processed food dominance among children [22]. Industry protection appears to exceed food protection itself [23]. Insufficient regulation permits continuous UPF exposure to children. Research demonstrates that nutritional claims on UPF products often inadequately offset high sugar and fat content, revealing discrepancies between perceived health benefits and actual nutritional reality [24].

Filmic research approaches reveal individual desire as part of contemporary lifestyles normalizing UPF promotion [25]. Only 18% of advertised UPF products meet nutritional standards among thousands available [26]. Children's cereals contain double the sugar of regular cereals [27]. Excessive energy intake high in sugar potentially damages neurocognitive pathways affecting self-regulation and working memory, reducing children's attentional focus [28]. These pattern is further demonstrated in Table 3, which illustrates the proportional distribution of cognitive domains most frequently reported to be impaired by UPF consumption.

Table 3. Summary of Cognitive Domains Affected by High Consumption of Ultra-Processed Foods

Cognitive Domain	Effect of High UPF Consumption	Type of Effect
Working Memory	↓ 12–18%	Decrease in working memory test performance
Attention	↓ 18–25%	Reduction in focus and sustained attention
Executive Function	OR 1.6–2.1	Increased risk of executive dysfunction (self-control, inhibition, planning)
Processing Speed	↓ 10–15%	Slower cognitive processing speed

3.2. Why are animation the most effective educational media for transferring nutritional knowledge?

Animation represents a medium implementing moving visual simulation that has increasingly influenced the development of engaging, interactive, and comprehensible teaching materials [33]. Analysis of collected findings regarding animation's educational effectiveness reveals that videos, including animation formats, prove highly effective for learning due to enhanced children's focus [34]. Video media, particularly animation, increases children's attention as digital media usage has become routine in contemporary life. An experiment involving 88 students comparing static images with animation demonstrated that animation facilitated more effective comprehension during learning processes [35]. Static media lacking movement no longer suits contemporary education, as modern children require interactive media stimulation. Research examining various animation types identified slow-paced animation as particularly suitable for preschool children [36]. Selecting appropriate animation categories requires careful evaluation for proper orientation application.

Creating effective animation demands suitability across multiple aspects, including visual appropriateness. Research analyzing Instagram posts targeting adolescents found that visuals featuring striking styles, slang language, humor, and teenage-oriented product associations successfully attracted adolescent attention [37]. Matching these aspects ensures successful educational animation output. Evaluation of children's market products containing harmful health content revealed their use of cartoon characters for marketing purposes [38]. Visual aspects require careful consideration in media design from comprehensive perspectives. Visual elements can enhance learning effectiveness; animated media applied to Taiwanese primary school students demonstrated increased understanding and confidence, with students desiring home viewing [39]. Implementing animation in learning requires appropriate contextual adaptation.

Multimedia principles, including animation implementation, enhance comprehension by over 100% compared to plain text [40]. Animation's effectiveness proves essential for contemporary teaching materials. Supporting research shows that incorporating animation into children's stories significantly improves comprehension by directing visual focus toward important story elements [41]. However, visual movements must align with narrative content to prevent cognitive overload disrupting learning focus. Animation-based instructional videos increase student engagement and conceptual understanding compared to conventional methods [42]. Animation effectively simplifies learning, particularly for children.

Research demonstrating positive effects of animated educational media on children's attention, comprehension, and memory retention faces methodological limitations including small samples, inadequate controls, insufficient randomization, and short-term measurement without follow-up. These limitations increase internal validity bias risks and problematize long-term outcome generalization. Despite limitations, cross-study alignment with multimedia learning theoretical principles positions animation as a promising educational tool requiring more rigorous experimental designs with stronger controls to establish effect durability and generalizability.

3.3. How effective is animation-based educational media in raising children's awareness regarding the risks of consuming ultra-processed food?

A series of studies has shown that animation, because of its powerful visual attraction, influences children's perceptions of food [43]. The use of vivid colors, cartoon characters, and dynamic movements makes even nutrient-poor foods are attractive. This can be used to one's advantage in educational settings to capture the students' Attention [44]. Other studies indicate that children tend to find foods decorated with cartoon characters more appealing than plain, unadorned foods [45]. It, therefore, follows that using cartoon characters into teaching aids allows children to associate and remember provided information more effectively. information by using visual imagery. Repeated exposure to animated advertisements on digital channels for instance, YouTube has also demonstrated to encourage children to choose items featuring characters they know.and love [46]. In the meantime, cartoon-style mascots create a sense of familiarity and trust, which eventually and increases children's interest in purchasing ultra-processed food [UPF-19]. In addition, the combination of bright colors and dynamic movements in advertising is proven to strengthen the intention to purchase products high in sugar and fat [47]. All these findings confirm that animation possesses extraordinary persuasive power; therefore, the same visual approach can be transferred for educational purposes in instilling children's awareness of the dangers of consuming ultra-processed food [43].

Educational animation media is proven to be effective in increasing children's understanding of the risks of ultra-processed food as well as fostering awareness of the importance of balanced nutrition [48]. In a number of experimental studies, children who learned nutritional topics through animation showed a more significant increase in knowledge compared to participants who learned through static visual media such as

posters or comics [49].The narrative and storyline in animation play the major role in explaining the Explain the cause-and-effect relationship between eating habits and health in a way that is enjoyable and easy to understand [50]. By using animated media, the learning process in children would become more interactive and participatory and more effective than conventional pedagogies [51]. In the domain of educating about the dangers of unhealthy diets, animation has been shown to help children recognize unhealthy eating. habits and understand the adverse effects of excessive consumption of ultra-processed foods (UPFs) [52]. This will also involve incorporating local cultural elements in designing animation characters and backgrounds. It enhances the emotional bond of children with the learning material and hence makes the process of learning quite engaging. meaningful and relevant to their own environment [53]. In this way, animation plays a dual role: not only passing on knowledge but also teaching good eating habits and healthy nutritional behavior from an early age.

A series of studies has confirmed the effectiveness of adopting visual and interactive strategies in order to raise children's awareness of healthy eating. Observational studies indicate that collaboration between teachers and parents make nutrition education much more effective, besides combining it with visual strategies designed for children [54]. Separate research on nutrition education has shown that using
visual media significantly enhances children's nutrition knowledge compared to that by traditional text-based methods [55]. A comparative media study conducted in Brazil found that using visual characters combined with emotional storytelling has remained the most frequent strategy deployed on both television and social media. supporting the effectiveness of visual approaches to change children's behaviors [(56)]. Among the educational field, interdisciplinary collaboration between teachers, nutritionists, and psychologists has revealed that This is inclusive of animations and interactively simulated activities in schools, enabling children to get a deeper understanding of nutrition labeling [(57)]. Moreover, intentional use of visual, textual, and auditory elements in multimedia educational programs has been shown to increase children's motivation to learn and their awareness of healthy eating [35].

These findings support the constructive use of animation and visual integration-not only in commercial advertising contexts but also in children's nutrition education-to raise awareness about the risks of ultra-processed foods. The success of animation in nutrition education can be examined from the perspective of cognitive theories regarding multimedia instructional design [58]. It is well documented that visually dynamic elements relevant to learning content are capable of drawing children's attention and enhancing their comprehension of the material [37]. Eye-tracking technology has also been used to confirm findings indicating that contextually relevant animated movements can orient children's attention toward displayed key nutritional information [59]. Moreover, applying Meyer's principles of coherence, marking, and segmentation can help reduce gratuitous cognitive load and enhance the speed with which children process information [60]. These principles emphasize that an animation's mere appearance is not the key to its success; rather, educational animations succeed to the extent to which they are congruent with the cognitive mechanisms children use to process visual and verbal information [60]. By incorporating learning theory-based design, educational animation holds significant potential as a strategic tool to deepen children's understanding of the risks associated with ultra-processed foods and encourage them to adopt preventive behaviors at the earliest possible age.

Evidence of how children process animated content points to some key visual and cognitive mechanisms; however, findings are weakened due to methodological inconsistencies and fragmented approaches. Several of the studies have focused on advertising rather than educational animation, and therefore applicability is uneven. Constructs like attention, engagement, and media literacy are measured through diverse and sometimes unstandardized tools, which enhance the possibility of measurement bias. Small sample sizes and qualitative or observational designs further set limitations on generalisability. Despite these weaknesses, combined results suggest that animation is effective in drawing attention and in supporting comprehension if designed with appropriate visual cues. More systematic and standardized research is needed to strengthen the interpretation of how children process and learn from animated media.

4. CONCLUSION

This systematic review of literature was conducted to study the impact of UPF on the cognitive capabilities of children and the role of animation as a medium for education. RQ1: All findings typically indicate that high UPF intake is related to reduced attention, impaired working memory, slower processing speed, and increased risk of executive dysfunction. While the trend is apparent, the predominance of cross-sectional studies and self-reported dietary measurements limits the strength of causal interpretation.

Literature review for RQ2 shows that animation is an effective educational medium, as it simplifies complex information, enhances focus, and improves children's retention of health-related messages. Its visual clarity, narrative structure, and emotional appeal make animation particularly suitable for nutritional education.

For RQ3, animation-based interventions have showed an enhancement in the awareness of dietary risks and more informed decision-making regarding food choices among children. These findings, however, remain limited to small sample sizes, short-term evaluations, and a lack of experimental validations.

On the whole, animation is a promising educational medium for conveying messages regarding UPF consumption risks; however, the evidence to date is limited by methodological weaknesses. Therefore, future researchers are encouraged to design and develop animation-based educational media that closely aligns with the findings of this SLR, embedding validated storytelling principles, age-appropriate visual elements, and evaluation via pre–post cognitive assessments. More rigorous experimental or longitudinal approaches will be required to conclusively establish the potential long-term impacts of animation on improving children's dietary awareness and fostering cognitive development.

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