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Influencing children: food cues in YouTube content from child and youth influencers

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Abstract

Digital marketing of unhealthy foods is linked to childhood obesity. This study evaluated nutrient quality and creative strategies of food cues on social media, focusing on child/youth influencers, to inform the ongoing digital media regulatory debate. Using the WHO's Monitoring of Marketing of Unhealthy Products to Children and Adolescents protocol, 162 videos from seven child/youth influencers' YouTube accounts with German content (33.8 h) were analyzed, classifying foods and beverages as permitted or not based on the WHO Nutrient Profile Model. Two-thirds (67%) of the $n=901$ food cues analyzed were not permitted for marketing to children, 30.4% were permitted, and 2.6% were miscellaneous. Chocolate had the biggest proportion (19.8%). Child-appealing food cues were significantly more likely to feature not permitted foods than permitted foods (91.1% vs. 71.9%, $p<0.001$). Of branded foods, 46.5% were not permitted foods and 7.7% were permitted foods ($p<0.001$), and of those with positive verbal attributions/reactions, 36.9% were not permitted foods, and 28.1% were permitted foods ($p<0.001$). Similarly, compared to 36.9% of not permitted foods, only 28.1% of permitted foods were presented with positive verbal attributions/reactions ($p<0.001$). Children are exposed to extensive appealing presentations of food not permitted for marketing to children via influencers on digital media. Policy makers need to become more active in monitoring and regulating this content.

Keywords Children, Social media influencer, Digital marketing, Food and beverage cues, Child influencer

Introduction

YouTube is a highly popular platform among children including adolescents worldwide [1]. In Austria, 70% of those aged 11–17 years [2], and in Germany, 80% of those aged 12–19 years, use it several times a week [3]. While most social media platforms have an age requirement of 13, YouTube allows children of all ages to use its services with parental consent [4] and does not require sign-in for general channels, often used by children under 13 and widely used by those as young as three [5].

YouTube hosts a diverse range of content, including that from social media influencers. Influencers are defined by their reach and impact on their audience based on the para-social relationship their audiences build [6, 7], which in turn is generally linked to marketing opportunities [6]. They generate revenue through sponsored brand presentations, which must be disclosed in Germany and Austria [8–10]. However, monitoring reveals many undisclosed brand mentions, blurring lines between paid marketing, unpaid marketing, and other content [11]. Some influencers are themselves children/

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youth, known as 'child influencers' [12]. Children may particularly respond to peer content including that from older peers [13–15], which makes content and effect research on these content creators especially relevant.

One major concern is how food and non-alcoholic beverages (hereafter: food) are presented to children [16]. Food advertising influences children's eating habits, with meta-analyses linking exposure to high-fat, salt, and sugar food marketing to unhealthy diets and obesity [17, 18]. Although YouTube banned paid food advertising in and around content 'made for kids' in 2020 [19], an analysis in 2022 showed that influencers still frequently post about branded HFSS (high in fat, sugar and/or salt) products, generating millions of impressions [11]. Studies of child influencers to date show a bias towards unhealthy foods. In the U.S., a study [20] found that 90% of food cues by popular child influencers ($n=5$) were unhealthy, and in Germany [12], 66% of branded foods in child influencer content ($n=4$) were in the least healthy Nutri-Score categories (D-E).

These results have intensified the debate on regulating the exposure to HFSS food depiction in media in Germany and Austria. In 2023, the German Minister of Health proposed a full ban on unhealthy food promotions targeting children [21]. Similarly, the Austrian health minister has proposed stricter regulations [22]. The generation of new evidence may prompt regulators to give further consideration to the implementation of measures and the taking of action.

The degree of exposure, which includes the presentation of brand names, brand-only advertisement, showcasing the type of product, and giving detailed description of the product, is a significant factor that has the potential to influence the formation of children's food preferences. This is because food cues integrated in entertaining content, such as YouTube videos can only be processed with minimal cognitive elaboration, increasing their persuasive potential [23]. In addition, dominance predicts familiarity, which is a crucial element in the development of food preferences [24].

However, it is also important to examine how food cues are presented to children in order to gain insight into the persuasive power of these food cues. Power variables capture the type of marketing strategies used or the type of language and composition that make food cues more or less appealing. For example, emotional conditioning assumes that positive evaluations of food cues by presenters and positive feedback from the audience, expressed as likes or number of views, can influence the evaluation and preference of the respective audience member [13]. In contrast, strategies that aim to highlight the persuasive nature of a food cue and encourage critical reflection on the implementation of products might also occur. This for instance can be the use of disclosures [9]. Based on the persuasion knowledge model [25], it is assumed that such disclosures should be able to activate information processing appropriate for persuasive messages. However, a recent effect study has shown that such disclosures may be limited in their potential to influence children's critical reflection of food cues and do not necessarily protect against their harmful effects, and may even exacerbate them [26]. Thus, it is necessary in content analyses to go beyond the study of exposure to certain food cues alone and to also assess the potential persuasive power of these cues.

To date, two studies have examined the food cues by child influencers on YouTube. Our study aimed to assess the exposure and power of overall food cues, by investigating seven child/youth influencers with German content, focusing on the healthiness of the products featured and creative appeal strategies used.

Methods

Study design

This study presents a content analysis of food cues featured in YouTube content created by child/youth influencers popular in Germany and Austria. To ensure international comparability and clear determination of whether or not the food presented is allowed to be promoted to children we used the YouTube Social Media Influencer Marketing Protocol V3 2024, from a package of protocols and templates created by the World Health Organization's (WHO) Regional Office for Europe [27–29], as a part of the 'CLICK' monitoring framework [30]. This protocol provides guidance on study design and specific methods for classifying, describing, and analyzing the level of *exposure* to (communication channels, times and settings in which children see and experience marketing) and the *power* of (creative strategies used) in the food cues [31].

In addition, the study is exploratory in nature and adheres to the protocols established by the WHO [27–29], therefore no hypotheses were specified. The value of exploratory research as an underutilized source of insight is increasingly recognized in the field of marketing [32–34]. Research employing descriptive methods has the potential to influence a range of stakeholders, including those responsible for formulating public health policy [35].

Identifying child/youth influencer channels, number of videos and engagement

Popular child/youth influencer channels were identified in August 2022 via noxinfluencer.com, a social media analysis service [36, 37]. On this platform, the following criteria [38] were set as filters: (1) having more than 50,000 followers, (2) German content, in example Austrian and German child/youth influencers, and

(3) Made-for-Kids channels. From this list, all channels were evaluated and only real child/youth influencer were selected. In addition, the channels were also searched for the keywords 'family-friendly', or 'child-friendly' to ensure suitability for a young audience. Importantly, channels were selected where children under the age of 16 were clearly the main presenters, based on public profile information and content descriptions. In total, seven child/youth influencer channels met these inclusion criteria. Although some studies seek a gender balance in influencers studied, the influencers we identified were predominantly female.

The videos uploaded to these seven child/youth influencer channels over a 12-month period (July 1, 2021-June 31, 2022) totaled 162 videos (33.8 h). Systematic sampling with a random start was used to select two videos per month and per influencer to provide a random sample for the content analysis. Some accounts had fewer than 24 videos, so only the available videos were included. The videos on the channels were all publicly available.

Based on public profile information and the influencer's YouTube channel, the name and number of subscribers, total number of videos uploaded by the influencer, gender, location of the influencer and channel categories on YouTube were assessed. Additionally, the engagement metrics, defined as the number of likes and comments the video had received at the time of viewing, were documented where available.

Exposure and power of food cues

Food cues can be defined as visual (e.g. pictures and videos) or textual displays of food or beverage brands or products, in accordance with the WHO protocol [27–29] and with previous studies [26, 39]. These cues were coded for (1) *exposure* and (2) *power* [31] by using the WHO codebook [27–29] to capture the ways in which food cues are presented and appeal to young audiences. These variables were selected to reflect known mechanisms of marketing influence, to provide a structured assessment of marketing power, appeal to children, and the types of foods presented. Exposure variables include extensive information about the food cues (including the brand name, brand-only advertisement, type of product, detailed description of the product) as well as information about the influencer (e.g., social media handle, number of subscribers) and practical details in relation to the content (e.g., date the video was published). The power variables capture the type of marketing, strategies used and user responses. These include the context in which food cue is featured, interactions with the post (likes, views, shares), as well as its presentation and the rationale behind featuring the cue, links to other social media platforms. In addition, variables such as health or nutrition-related statements or claims, the presence of disclaimers, and instances of health washing are considered. Specifically, the variables consider if the video made health or nutrition-related claims (e.g., mentioning organic), contained verbal or textual disclaimers (e.g., suggesting the product is part of a balanced/healthy diet), or implied health benefits without explicit statements (e.g., prominently showing fruits or vegetables in a soda ad). The variables also include if the video contained elements that could potentially appeal to (a) children and/or (b) adolescents. As per the protocol, food cues were considered appealing to children if, for example, they used child-friendly language, drawings, magic, fantasy, animals, smiles or cartoons, or showed games, toys or film characters. They were considered appealing to adolescents if they showed celebrities, TV personalities and athletes, or had content (visual or audio) about adventure, fashion, popularity, friends, etc. Appeal to children and to adolescents was not mutually exclusive. Further, food cue brand (branded, unbranded, food retail establishment, supermarket own brand, miscellaneous), food cue display (eating-out meal, supermarket, home, event, outdoors, exercising context), language used in food cue description (positive, negative, neutral), and food cue presentation (consumed and referenced, consumed and not referenced, not consumed but referenced, neither consumed nor referenced) were coded in accordance with the WHO protocol [27–29]. Operationalization of each variable is available in Supplementary Material (Table S1).

Disclosure of brand presentation

We also examined if the video or its caption contained an advertisement disclosure, using terms such as '#advert', '#ad' (German '#Werbung', '#Anzeige'), 'product placement of company name', 'competition with company name' or affiliation links.

Nutrient profiling of food cues

The Nutrient Profile Model (NPM) of the WHO Regional Office for Europe (version 2, 2023) was used to analyze the nutritional quality of foods and beverages [40]. The WHO-NPM was developed specifically for the regulation and monitoring of food cues to children. Nutrient profiles distinguish between foods and beverages that are more and less healthy (e.g. HFSS products) and therefore whether they can be marketed to children.

It assigns food items to a specific food category [40]. Nutritional information was obtained from company websites where possible, or from the website of the largest supermarket chain in Austria and Germany, in order to classify foods and beverages using the NPM. If no nutritional information was available for the presented products, a similar product was identified using the food composition database, the German Nutrient

Database (German: 'Bundeslebensmittelschlüssel'; BLS, version 3.02, https://www.blsdb.de/). The nutritional inf ormation of the product is then compared with the category thresholds for total fat, saturated fat, total sugars, salt and/or energy per 100 g/ml food/beverage, and for added sugars and non-sugar sweeteners present. These thresholds are used to classify items as: (1) not permitted for marketing to children; (2) permitted for marketing; [40] or (3) miscellaneous (food or beverage could not be determined due to lack of relevant nutritional information, e.g. the product could not be identified from the video, nutritional information could not be accessed, or it did not fit into any of the food categories e.g., gingerbread spice), as done in previous studies [38, 41].

Coding reliability

To ensure coding reliability with three researchers, a randomly selected sub-sample (10%) of five videos were independently coded; interrater reliability was assessed using Krippendorff's alpha and Fleiss kappa analysis. Agreement was reached if a Krippendorff's alpha agreement was k>0.67 [42], and a Fleiss kappa agreement was k>0.21 [43]. The majority of exposure and power variables showed required level of agreement [42] (Kappa agreement between k=0.24 and k=1 for exposure variables; [43] and between k=0.23 and k=1 for power variables). Some of the power variables such as 'primary' and 'secondary persuasive appeal', 'brand equity characters' and 'celebrity endorsers' did not achieve satisfactory agreement and were therefore excluded from the analysis. (Note: following the piloting stage, to take account of this and similar challenges in reliability reported by other piloting researchers, the primary and secondary appeal variables, have since been amended to simpler binary variables in the updated 2024 WHO protocols [44]).

Statistical analysis

All variables were analyzed descriptively; categorical data frequencies and percentages are presented. To identify possible differences in frequencies between the cue categories Chi-squared tests were carried out. Cramer's V [45] was used to calculate effect sizes, where a small effect is represented by 0.04, a medium effect by 0.13 and a large effect by 0.22 [46].

Statistical significance was set at $p<0.05$, and the exact values to $p<0.001$ were reported. Statistics were computed using IBM® SPSS® Statistics Version 27 software (IBM Corp., Armonk, NY, U.S.).

Results

Child/youth influencer channels, number of videos and engagement

The final sample consisted of seven child/youth influencers (6 female, 1 male), with a median age of 12.5 years (range, 9–16 years). They were identified in four channel categories: 'YouTuber' ($n=4$), 'Sisterpower' ($n=1$), 'Horses' ($n=1$), and 'Food' ($n=1$). Two influencers were located in Austria and five in Germany. At the time of data collection, they had a total of 6.2 million followers on YouTube (median of 0.85 million followers [range, 0.1–2.6 million]), and had uploaded 6,158 videos (median, 520 [range, 224-1,883]) (Supplementary Material Table S2). Engagement metrics (likes and/or comments) were available for most videos (88%, $n=95$) with a median of 2,839 likes (range, 168−13,928) and 0 comments (range, 0–1,086). A total of 162 videos were analyzed, comprising 33.8 h of content. Food cues were present in 66.7% ($n=108$) of the videos, averaging 27 cues per hour. Two videos (1.2%) contained brand-only advertisements (i.e., no products) and 52 videos (32.1%) did not feature any food cues (Supplementary Material Table S3 and Table S4).

Food and beverage categories

A total of $n=901$ food cues (excluding brand-only advertisements) were identified. Chocolate and sugar confectionery made up the greatest proportion of cues (19.8%, $n=178$), followed by fruit, vegetables and legumes (17.1%, $n=154$), cakes, sweet biscuits and pastries (8.2%, $n=74$), and ready-made and convenience foods (8%, $n=72$) (Table 1).

Nutrient profiling

Two thirds (67%, $n=604$) of the food cues were not permitted for marketing to children according to the WHO NPM, with 30.4% ($n=274$) permitted, and 2.6% miscellaneous ($n=23$) cues (Fig. 1).

Most of the products had excessive sodium (66.6%, $n=267$), energy (63.8%, $n=44$), total fat (40.2%, $n=141$), saturated fat (27.8%, $n=27$), total sugars (27.7%, $n=56$), contained added sugars (62.1%, $n=311$) or non-sugar sweeteners (7.3%, $n=34$) (Fig. 2). Only 31.8% ($n=274$) did not exceed the cut-off point for any critical nutrient; 42.6% ($n=367$) exceeded the cut-off point for one and 25.7% ($n=221$) for two or more.

Power aspects

Appeal to children, use of brand logos, packaging, and claims

Most food cues were assessed as appealing to children (85%, $n=766$), to adolescents (81.8%, $n=737$) or to both (86.5%, $n=779$) (Table 2). Food cues classified as appealing to children and/or to adolescents were significantly more likely to feature products not permitted to be marketed to children than permitted: 91.1% vs. 71.9% for children ($p<0.001$), 88.4% vs. 67.2% for adolescents ($p<0.001$), and 92.4% vs. 73.7% for both children and adolescents ($p<0.001$) (Fig. 3).

Table 1 Food and Beverage categories based on WHO-NPM ordered by frequency of appearance in YouTube videos

	Frequency (*n* = 901)	%
Chocolate and sugar confectionery, energy bars, sweet toppings and desserts	178	19.8%
Fresh and frozen fruit, vegetables or legumes	154	17.1%
Cakes, sweet biscuits and pastries; other sweet bakery wares, and dry mixes for making such	74	8.2%
Ready-made and convenience foods and composite dishes	72	8%
Beverages - Other	71	7.9%
Savory snacks	65	7.2%
Processed fruit, vegetables and legumes (neither breaded nor deep-fried)	38	4.2%
Beverages - Juices	28	3.1%
Bread, bread products and crisp breads	24	2.7%
Sauces, dips and dressings	19	2.1%
Edible ices	18	2%
Fresh and frozen meat, poultry, fish and similar	18	2%
Breakfast cereals	15	1.7%
Yoghurts, sour milk, cream and other similar foods	15	1.7%
Aged cheese (hard, semi-hard, soft, sour milk cheese), firm mozzarella cheese	15	1.7%
Butter and other fats and oils	15	1.7%
Consumer milk, mixed milk products made from non-fermented milk	14	1.6%
Fresh or dried pasta, rice and grains	14	1.6%
Fried, breaded and pre-fried food	14	1.6%
Beverages - Water	10	1.1%
Processed meat, sausages, ham, bacon and similar	8	0.9%
Processed fish, crayfish, mollusks (neither breaded nor deep-fried)	6	0.7%

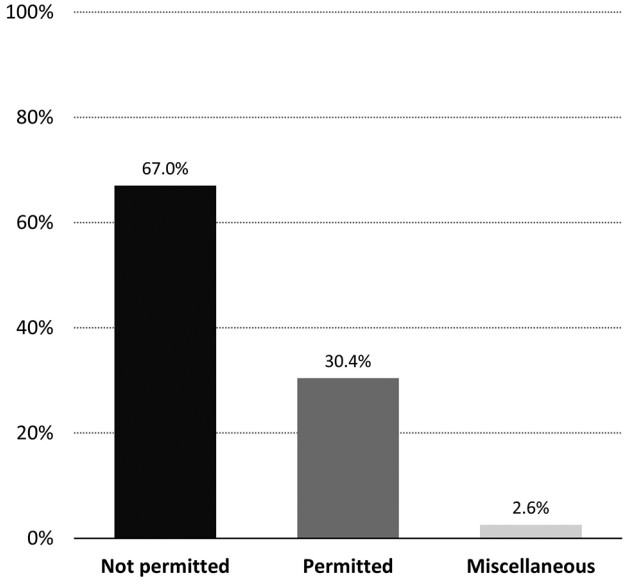

Fig. 1 Nutrient profiling of food cues (*n* = 901) posted on YouTube videos from child/youth influencers. Miscellaneous = nutritional content not available, e.g., product not identifiable from the video

In 36.8% (*n* = 332) of cases, the brand logo (only the brand logo is visible) was easily identifiable within the video itself; packaging was shown in 45.7% (*n* = 412); and an unpackaged, unbranded product, such as a bowl of crisps or a plate of pizza, was shown in 65.4% (*n* = 589) of cues. These categories are not exclusive, e.g., in some cues both branded packaging and the unbranded product was visible (Table 2). Health or nutrition-related claims were identified in 8.7% (*n* = 42) of food cues and physical activity claims in 9.6% (*n* = 43) of cases; 3.6% (*n* = 16) of food cues contained verbal or textual disclaimers, and 2% (*n* = 9) of these disclaimers indicated that the product presented was part of a balanced/healthy diet. Explicit health washing was found in 2.4% (*n* = 11) of food cues (Table 2).

Food cue brand, display, description, and presentation

Nearly half of food cues (48.7%, *n* = 439) were unbranded and 41.2% (*n* = 371) were branded (brand logo/name is visible or brand name is verbally stated; including food retail and supermarket own brands). Of foods permitted for marketing to children, only 7.7% (*n* = 21) were branded, whereas 46.5% (*n* = 281) of foods not permitted were branded ($p < 0.001$) (Table 3).

The vast majority of foods were presented in the context of the influencer's own home (81.1%, *n* = 731). Just over half were described in a neutral manner (58.5%, *n* = 527) and 34.6% (*n* = 312) were presented in a clearly positive manner. Only 6.9% (*n* = 62) of food cues were rated as negative. Only 28.1% (*n* = 77) of foods permitted for marketing to children were presented positively, whereas 36.9% (*n* = 223) of foods not permitted were associated with positive verbal attributions or reactions ($p = 0.012$). (Table 3). Nearly half of presentations showed actual consumption and a verbal reference to a food

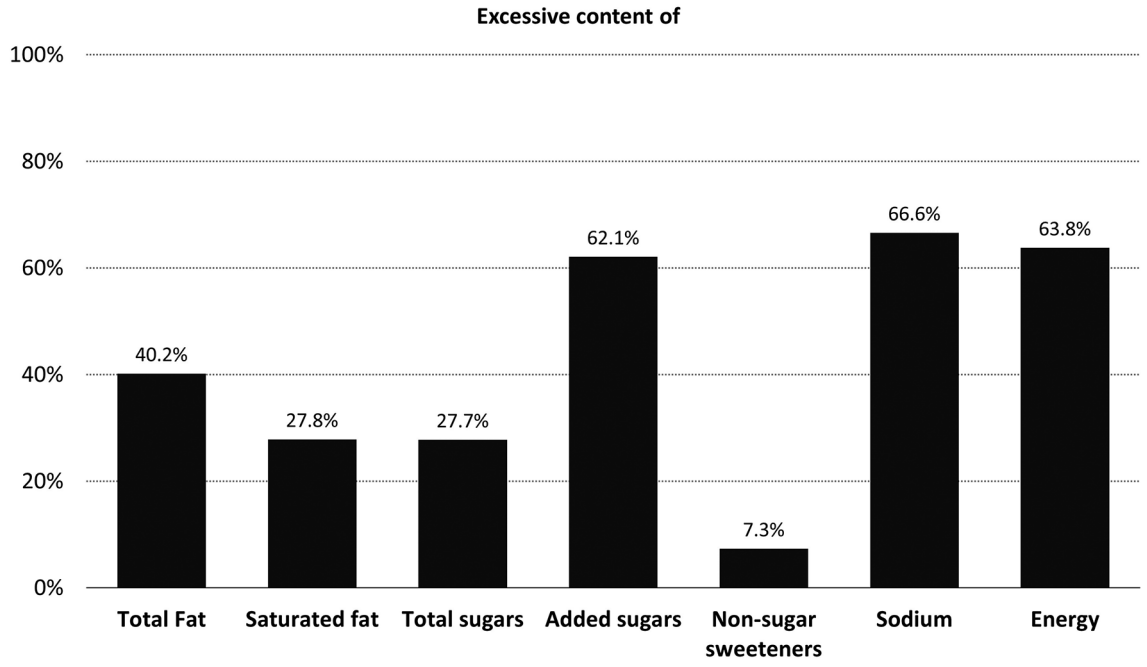

Fig. 2 Excessive content of different nutrients

Table 2 The power aspects of food cues posted on YouTube videos from child/youth influencers

	Frequency ($n=901$)	%
Food cue appeal to		
Children	766	85%
Adolescents	737	81.8%
Both children or adolescents	779	86.5%
Use of brand logos	332	36.8%
Packaging visible	412	45.7%
Product itself visible	589	65.4%
Health or nutrition claims	42	8.7%
Organic	31	6.4%
Natural ingredients/all natural/no preservatives/nothing artificial	1	0.2%
Whole grain/whole wheat	2	0.4%
Healthy food	8	1.6%
Physical activity depicted	43	9.6%
Disclaimers	16	3.6%
Suggests that the product is part of a balanced/healthy diet	9	2%
Suggests that the product should be enjoyed in moderation	7	1.6%
Health washing present	11	2.4%

(42.2%, $n=380$); 38.7% ($n=349$) give a verbal reference to a food without showing its consumption; 15.2% ($n=137$) showed no consumption and no verbal reference, and 3.9% ($n=35$) showed consumption but no verbal reference (Table 3).

Disclosure of brand presentation

None of the videos identified any content as advertising (e.g., with tags like #ad, etc.) (Table 3). The food cues were neither labeled as gifts, nor marked as sponsored products, or disclosed as advertisements. In only one instance, a link to a brand page was provided in the video description (for a product not permitted to be marketed to children).

Discussion

This study assessed the nutrient quality and creative strategies of food cues by YouTube child/youth influencers popular with children and with German content. We found that the majority of the food cues presented would not be permitted to be advertised to children according to the WHO NPM. Most of the presented food cues had an excessive content of salt, energy and contained added sugars. This finding aligns with previous analyses showcasing a dominance of candy, sweet and salty snacks, sugary drinks, and ice cream in YouTube food cues [12, 20, 47], with indications of slight increases in such portrayals over the past years [36].

To address the dominance of HFSS foods, content produced by influencers, especially when directed at children, should at the bare minimum be clearly identified as commercial if influencers receive monetary compensation, gifting or product sponsorship [8–10], as these subtle marketing forms in YouTube videos can mislead young viewers [14]. Still studies indicate that disclosures do not necessarily facilitate children's critical reflection of content or the impact of food cues [26, 48]. Notably,

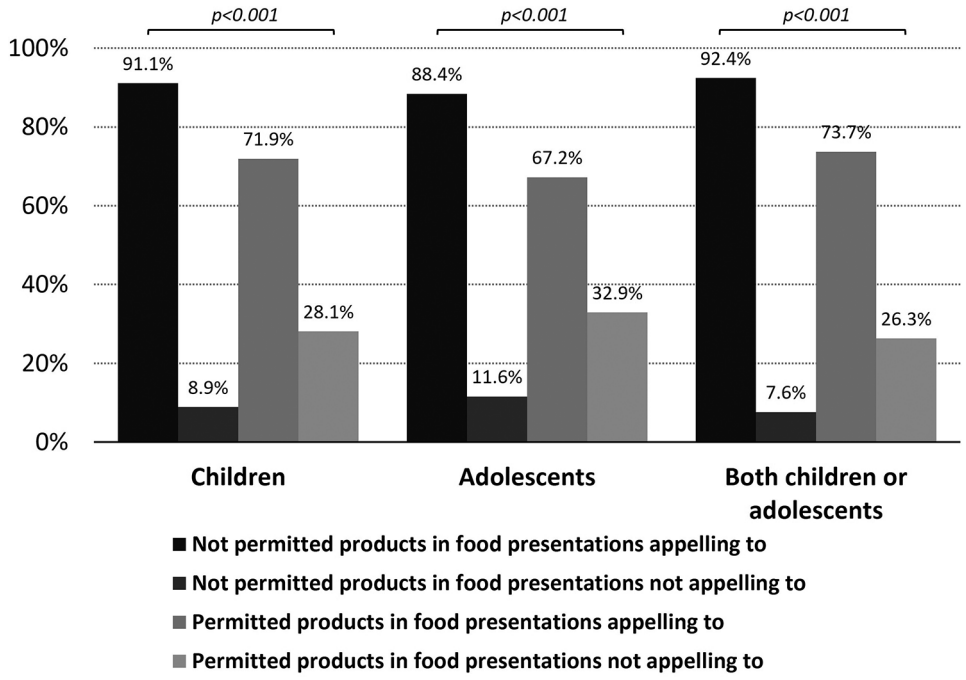

Fig. 3 Products classified as not permitted and permitted for marketing to children in food cues

nearly 40% of the food cues in our analysis were easily assignable to a brand, as the displayed a visible brand logo or name. However, these did not include any disclosure as sponsored content or compensation, except for one instance where a link to a brand page was provided in the video description. Thus, there were no disclosures about sponsorship or compensation, even though the type of presentation makes persuasive effects likely [13]: products were presented appealingly, with positive verbal references, visibly consumed in almost half of the presentations, potentially triggering eating behaviors among its audience [49, 50]. Furthermore, videos emphasized products' good taste, which may impact children's food choices and evaluations [51, 52]. This results indicate that YouTube's ban of paid food advertising in and around children's content [19] is insufficient to protect children from harmful exposure to food marketing due to a large number of persuasive presentations of such products within content generated by influencers. Children's interest in these products may increase influencers' reach and revenue, given that attracting and engaging an audience is crucial for influencers' income, which is not limited to direct remuneration from brands. Children form their dietary preferences based on familiar products [53] and those they associate with positive affective and emotional responses. If HFSS products are ubiquitous in entertainment content including from influencers who are viewed as role models [11], this will continue to shape their food preferences in ways that are detrimental to dietary health.

Consequently, it is imperative that regulations be enacted that directly impact influencers in their content production. This could entail enforcing stricter regulations for what food cues are showcased in influencer content. Thus, policymakers need to implement guidelines on the types of products showcased by influencers targeting young audiences and potentially even enforce a ban on certain products [21]. Discussions by regulators in Austria and Germany are already moving in this direction [21, 22], in line with the efforts of regulators in other countries, such as Chile, where the ban on the presentation of HFSS products has reduced children's exposure to unhealthy food marketing [54]. Currently, researchers are also developing Artificial Intelligence (AI) systems to monitor compliance with food marketing regulations and assess exposure to unhealthy food advertising. These systems use machine learning and image recognition to detect and classify instances of food marketing across different digital platforms, and even in non-digital environments. While these AI tools offer scalability and consistency in tracking marketing exposure, they require extensive training data to accurately identify techniques that target children [55].

Steps could also be considered to motivate content creators such as influencers to focus more on healthy products such as fruit, vegetables and unsweetened beverages. In this way, the positive role model effect and the existing relationship between followers and influencers could be used to promote healthy lifestyles and outbalance the current dominance of HFSS products [56].

Table 3 Food cue brand, display, description and presentation of products categorized according to WHO-NPM

	Overall (*n* = 901)		Not permitted (*n* = 604)		Permitted (*n* = 274)		*p* value[1]	Cramers' V	χ2
	n	%	*n*	%	*n*	%			
Brand									
Unbranded	439	48.7%	211	34.9%	224	81.8%	< 0.001	0.45	176.9
Branded	308	34.2%	281	46.5%	21	7.7%			
Food retail establishment	33	3.7%	30	5%	3	1.1%			
Supermarket own	30	3.3%	21	3.5%	9	3.3%			
Miscellaneous	91	10.1%	61	10.1%	17	6.2%			
Cue display									
Home	731	81.1%	493	81.6%	227	82.9%	0.560	0.08	4.9
Outdoors	103	11.4%	70	11.6%	29	10.6%			
Supermarket	31	3.4%	23	3.8%	8	2.9%			
In exercising context	15	1.7%	4	0.7%	3	1.1%			
Event	11	1.2%	9	1.5%	2	0.7%			
Eating-out meal	1	0.1%	1	0.2%	0	0%			
Not applicable	9	1%	4	0.7%	5	1.8%			
Cue description									
Neutral	527	58.5%	346	57.3%	171	62.4%	0.012	0.10	8.8
Positive	312	34.6%	223	36.9%	77	28.1%			
Negative	62	6.9%	35	5.8%	26	9.5%			
Cue presentation									
Consumed and verbal reference	380	42.2%	255	42.2%	121	44.2%	0.006	0.12	12.4
Not consumed and verbal reference	349	38.7%	257	42.6%	89	32.5%			
Not consumed, no verbal reference	137	15.2%	74	12.3%	49	17.9%			
Consumed, no verbal reference	35	3.9%	18	3%	15	5.5%			
Disclosure of brand presentation									
Not explicit marketing (campaign)	901	100%	604	100%	274	100%			
Paid or gifted by brand	0	0%	0	0%	0	0%			

[1]Significant differences were calculated using Chi-Square Test; Percentages in the overall column refer to the group% within each category. Percentages in the 'not permitted' and 'permitted' columns refers to the % within the group

Ongoing monitoring and research are also needed to assess regulation effectiveness and adapt as necessary. Longitudinal studies could provide insights into the long-term impact of embedded advertising on children's dietary habits and health outcomes [43]. Continuously evaluating and refining these strategies can create a media environment supporting healthier dietary choices among children and adolescents with fresh and frozen fruit, vegetables, and legumes being the second most presented food category [57, 58].

Our research has some limitations: Focusing on well-known German-speaking child/youth influencer channels on YouTube provides only a partial view of the broader content children consume, given data suggests the popularity of other platforms like Instagram [2] and the still high use of series and movies (~ 132 min) [3]. In addition, while our study used a codebook to analyze persuasion variables, providing insight into the potential persuasive power of different food cues, further research is needed to assess their behavioral impact. This should include effects studies that go beyond single-shot experimental investigations [17, 18, 59, 60] and utilize longitudinal designs to assess the lasting effects of food cues [61] on diet quality and health.

Child/youth influencers on YouTube feature extensive presentations of unhealthy foods in their content in ways that appeal to children and adolescents. Comprehensive policies and regulations that address marketing practices in the digital media environment are required to meaningfully reduce children's exposure and promote better dietary health. Through a multi-faceted approach that includes greater transparency and evidence-informed policymaking, we can work toward a future where the presence of HFSS products in content consumed by children and adolescents is significantly reduced.

Supplementary Information

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Supplementary Material 1

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Author contributions
EW and BN made significant contributions to the conception and design of the study, coordinated and supervised data collection, conducted the analyses and interpretation, and drafted the initial manuscript; MW, SH, MTG, EB, and MM made significant contributions to the conception and design of the study and critically reviewed and revised the manuscript for important intellectual content; and all authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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Data availability
The datasets during and/or analysed during the current study are available from the corresponding author on reasonable request.

Decleration

Ethics approval and consent to participate
No human participants were involved, so ethical approval was not required.

Competing interests
The authors declare no competing interests.

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