The effect of ‘influencer’ food marketing on YouTube, and a ‘protective’ advertising disclosure, on children’s food intake

Anna Elizabeth Coates, Charlotte Alice Hardman, Jason Christian Grovenor Halford, Paul Christiansen, and Emma Jane Boyland

Department of Psychological Sciences, University of Liverpool, Liverpool, UK

Keywords:

Digital marketing; social media; food advertisement; influencer; food intake; disclosures

Running title:

Impact of food marketing on children’s intake

Corresponding author:

Miss Anna Coates
Department of Psychological Sciences

Room 2.18, Eleanor Rathbone Building
Bedford Street South
Liverpool
L69 7ZA

0151 794 1124

Anna.Coates@liverpool.ac.uk

**Abstract**

Background: Children are active on social media and consequently are exposed to new and subtle forms of food marketing.

Objectives: To examine whether exposure to a YouTube video featuring influencer marketing of an unhealthy snack affects children’s *ad libitum* snack intake, and whether inclusion of an advertising disclosure moderates this effect.

Methods: In a randomised between-subjects design, 151 children (aged 9-11 years, mean 10.32 years ± 0.6) were exposed to influencer marketing of a non-food product (n=51), or an unhealthy snack with (n=50) or without (n=50) an advertising disclosure. Participants’ *ad libitum* intake of the marketed snack and an alternative brand of the same snack was measured.

Results: Children exposed to influencer food marketing with (*p*<.001, *d*= 1.40) and without (*p*<.001, *d*= 1.07) a disclosure consumed more (kcals) of the marketed snack relative to the alternative, the control did not differ (*p*=.186, *d*= 0.45). Consumption of the alterative brand did not differ across conditions (*p*=.287, ηp2= .02). Children who viewed food marketing with a disclosure (and not those without) consumed 41% more of the marketed snack (*p*=.004, ηp2=.06), compared with control.

Conclusions: Influencer marketing increases children's immediate intake of the promoted snack relative to an alternative brand. Advertising disclosures may enhance the effect.

Abbreviations:

High fat, sugar, and/or salt, HFSS

Video blogger, Vlogger

Body mass index, BMI

Visual analog scale, VAS

Kilocalories, Kcal

**Introduction**

The well-documented global increases in childhood obesity prevalence 1,2 are likely to be driven by an obesogenic environment 3 including the excessive marketing of unhealthy foods, particularly to children.4 Substantial evidence illustrates the acute impact of marketing foods high in saturated fat, salt, and/or free sugars (HFSS) on children’s dietary health.5–7 While many studies have explored the effects of traditional television (TV) advertising, research on the impact of digital marketing on children’s eating behaviour is far more limited.8 Digital media are hugely popular with children 9 and so it is important that the impact of marketing exposure through this medium is further investigated and quantified.

Awareness of where children spend time online is critical to understanding the types of digital food marketing they may be exposed to and how this may affect their eating behaviours. It is thought that Internet locations most visited by children are not child-specific but are platforms that appeal to a range of ages, such as social media.10 Despite many social media platforms requiring users to be a minimum age of 13-years, younger children are active on these sites.8 The most popular is YouTube, with 80% of 5-15-year-olds in the UK reporting regular use.9 YouTube has enabled video bloggers (vloggers), to amass huge followings, and these individuals are often referred to as “influencers” due to the persuasive effect their opinions can have on their audiences.11 Children report trusting vloggers’ recommendations more than advertising directly from a brand 12 or celebrity.13 Accordingly, food brands pay or ‘gift’ products to influencers to feature on their social media channels. Social Learning Theory 14 claims that children's liking of a character increases the probability of imitating the character's action. Consistent with this, a previous study showed that exposure to Instagram posts of vloggers pictured with HFSS foods increased children’s (9-11 years) later consumption of HFSS products, compared with children in a control condition.15

 Studies exploring the effect of celebrity endorsements of HFSS foods show that they can increase children’s preferences, requests for, and intake of these products.16–18 One study looked at effects on children’s (aged 8-11 years) brand choice and intake by simultaneously offering children the endorsed brand and a perceived alternative brand and allowing them to choose the amount they consumed from each.16 The alternative brand was in fact the endorsed brand, but participants were led to believe it was an alternative to test the impact of advertising on brand choice while controlling for other potential differences, such as taste and texture. Children were exposed to a TV commercial featuring celebrity endorsement of a HFSS food, the same celebrity in a non-marketing context (presenting a TV show), a commercial for a different snack, or a non-food commercial (control). Results showed that children consumed significantly more of the endorsed brand compared with the alternative brand in the celebrity endorser conditions, but not in the control condition. Children also did not reduce their intake of the alternative brand to compensate for their increased intake of the endorsed brand. No research has explored whether promotion of a food brand by an influencer, such as a YouTube vlogger, affects children’s choice and intake of a branded product.

The Reactivity to Embedded Food Cues in Advertising Model (REFCAM) states that the level of processing influences the effect of food cue exposure.19 While TV advertising appears at recognisable intervals within and between programming,20 digital marketing is often embedded in the online content itself.21 Food cues that are integrated into media content are processed with minimal cognitive elaboration,19,22,23 diminishing children’s ability to recognise when they are being advertised to,24,25 and making this type of marketing more difficult for children to resist.19 Under the current self-regulatory codes for non-broadcast marketing in the UK, marketing of this nature should clearly indicate the commercial intent of the marketer.26 This guidance applies to influencer marketing on social media which is paid for and controlled by the advertiser. On YouTube this requires an advertising disclosure (e.g. “#ad”), to be displayed on screen during the marketing content and/or in the video title before viewer engagement.

Persuasion knowledge is a consumers’ understanding of the persuasive attempts of marketing.21 Although not tested in the context of YouTube videos, studies exploring the effectiveness of advertising disclosures in increasing persuasion knowledge have produced equivocal results. Research with adults shows that disclosures can correct for otherwise increased brand attitudes, by activating persuasion knowledge and mitigating persuasion.27,28 However similar research with adolescents finds no such effects 29. Persuasion knowledge is thought to develop in adolescence,21,30 therefore if not fully developed, disclosures may not be effective.31 In support of this, when children were informed of the persuasive intent of an advergame (a free online game characterised by extensive branded content 32), this did not affect children’s cognitive or affective responses to the promoted brand. In addition, children who played an advergame promoting branded HFSS foods increased their food intake, irrespective of whether an advertising disclosure was featured.33 The Food Marketing Defense Model 34 states that four conditions must be met in order for children to counter the effects of food marketing; *awareness* of advertising, *understanding* of its persuasive intent, and the *ability* and the *motivation* to resist. Therefore, if advertising disclosures do raise awareness of the persuasive intent of marketing, in order to resist its effect children must also be *motivated* to do so.25 Children describe enjoying engaging with digital marketing,35,36 are less likely than adults to have health concerns 37 and are more likely to make food choices based on taste.38 Therefore, they may not be motivated to resist HFSS digital food marketing even when they are aware of the exposure.

The aim of the current research was to examine the impact of influencer marketing of a branded unhealthy snack, featured in a YouTube video, on children’s *ad libitum* snack intake and brand choice; and to explore if the presence of an advertising disclosure moderates any effect. It was hypothesized that (1) children exposed to digital marketing of a branded unhealthy snack (with or without an advertising disclosure) would consume more of the marketed brand relative to a perceived alternative brand (marketed brand labelled as an alternative brand), than those in the control condition (exposure to digital marketing for a non-food item), (2) these children would not differ in consumption of a perceived alternative brand compared with children in the control condition, and (3) children exposed to marketing of a branded unhealthy snack with an advertising disclosure would not differ in their consumption of the marketed snack compared to children exposed to the same marketing without an advertising disclosure.

**Methods**

Participants

A convenience sample of 151 participants (80 female) aged 9-11 years were recruited via schools in the UK. The power calculation for the current study was based on 95% power and an alpha of .05 to find a large effect size (*d* = .67, based on a similar short-term advertising exposure study 16). This indicated a required sample size of 150 participants.

The current study was approved by the University of Liverpool Institute of Psychology, Health and Society Research Ethics Committee in September 2017. Parents and children were informed of the study via school distribution of written information. Parents were required to return opt-in consent forms, and children to assent, before participation. Children with a food allergy of any kind (as reported by parents on the consent form) were excluded from participation. The number of children with food allergies, and eligible parents who did not provide consent, were not recorded. Data were collected between January and June 2018 and no incentive was offered for taking part.

Design

Using a between-subjects design children were randomly assigned to one of three conditions; exposure to a YouTube video featuring influencer marketing of (i) a branded non-food product, or a branded unhealthy snack either with (ii), or without (iii), an advertising disclosure. Allocation of participants to condition was conducted using [www.randomizer.org](http://www.randomizer.org). Participants’ intake of the marketed snack and a perceived alternative brand of the same snack was measured and used to calculate overall intake (as detailed below).

Materials and measures

*Mock YouTube video blogs (vlogs)*

Two social media influencers, 26 year old female YouTube vlogger Zoella (<https://www.youtube.com/user/zoella280390>), and 23 year old male YouTube vlogger PointlessBlog (<https://www.youtube.com/user/PointlessBlog>), were selected on the basis of their popularity with children in the UK.12 At the time of testing Zoella had approximately 12.1 million subscribers and PointlessBlog 4.1 million. Children respond differently to male and female celebrity endorsers,39 and choose to watch YouTube vloggers who they view as being appropriate for their own gender.40 For these reasons girls were shown videos of the female influencer, and boys videos of the male. Videos were obtained from influencers’ YouTube channels using the download software KeepVid (<https://keepvid.com>) and edited using VideoPad video editor (<http://www.nchsoftware.com/videopad/index.html>). Editing ensured that each video was 5 minutes in duration and included a 1-minute marketing segment, which was identical for the two influencers across food marketing conditions. The influencers regularly feature in one another’s videos, therefore this remains ecologically valid. Editing also enabled an advertising disclosure message to be inserted into the advertising disclosure condition. An on-screen message “This is an advert” was displayed in the top left-hand corner of the screen for the duration of the marketed content (see **supporting information**). This message is more direct and prose-like than the suggested labelling of ‘#ad’ and was used so children of this age would be more likely to understand that the video featured a commercial.

In the control videos the marketed product was a branded non-food item (Apple iPhone 8), and in the test videos it was a branded unhealthy snack (McVitie’s chocolate digestives, approximate UK equivalent to graham crackers but with a thin chocolate coating). Snack foods are one of the most frequently marketed food categories to children.41

*Hunger*

Subjective measures of hunger were obtained using 100mm visual analog rating scales (VAS). This measure followed the format of the question “how hungry do you feel right now?” with the anchor points “not at all hungry” and “very hungry” to the left and right of the line, respectively. VAS are widely used and are reliable and valid rating scales for measuring children’s subjective experiences related to food intake.42

*Caloric intake*

To measure caloric intake, children were invited to eat *ad libitum* from two plates of cookies for a period of five minutes. Each plate contained 100 g of McVitie’s chocolate digestive cookies, but one was labelled “McVitie’s” and the other was falsely labelled “Tesco’s” (the largest food store chain in the UK). The children were also verbally informed of the brand difference. This approach, used in a similar study,16 enabled brand-specific intake effects to be disentangled from the general consumption effects of the marketing. Cookies were broken into small pieces to minimise the likelihood of children consciously choosing a particular amount to consume.43 Cookies were presented on white paper plates and were weighed post intake to the nearest 0.1 g (model BP8100, Sartorius, Epsom, United Kingdom), with data later converted into kilocalories (kcals) based on the manufacturer’s nutritional information.

*Questionnaire*

To control for potential effects on kcal food intake, a questionnaire designed specifically for this study assessed children’s liking of test foods (pre-marketing exposure), as well as liking of the YouTube video, average time spent on YouTube per week, prior familiarity with the influencers, and awareness of advertising (post-marketing exposure).

VAS were used to capture children’s liking of the test food and were embedded into a series of scales measuring liking of a variety of items (*n*=11). The measure followed the format of the question “how much do you like \_\_\_\_?” with the anchor points “really dislike” and “really like” to the left and right of the line, respectively. The order of the scales was counterbalanced across participants. Liking of the video used the same VAS format. Prior familiarity with the influencers was operationalised as the number of social media platforms a child reported following them on. Scores ranged from 0 (no social media sites) to 5 (follows on 5 social media sites). Awareness of advertising was measured with questions derived from Ofcom’s Children and parents: media use and attitudes report 2016.44 Children were asked ‘Did the YouTube video you watched today have an advert in it?’ with a yes/no response.

*Body Mass Index (BMI)*

Weight was measured to the nearest 0.1 kg with a calibrated weighing scale (Seca 770) and height was measured to the nearest 0.5 cm using a stadiometer (Leicester Portable Height Measure). BMI was later calculated as weight (kg)/height (m)2. Internationally recognised criteria for children were used to categorise children as healthy weight, overweight, or obese, based on age and sex specific BMI cut offs equivalent to adult BMI of 25–30kg/m2.45 BMI z-scores adjusted for age and sex were calculated using WHO AnthroPlus software (accessible at <http://www.who.int/growthref/tools/en>).

Procedure

The experiment was conducted in a quiet room at the children’s school. Participants were seated at a desk with a laptop computer, headphones and a questionnaire. Children firstly completed the VAS hunger rating and test food liking and then were told that they would be watching a YouTube video and that they should pay close attention as they would be asked about it afterwards. Immediately after viewing the video, participants were served two pre-weighed snacks (the branded marketed snack and the purported ‘alternative’ brand). Participants were told they had five minutes and could eat what they wished. Afterwards, remaining snacks were removed and weighed, and participants completed post-marketing exposure measures in their questionnaire. Participants were debriefed, asked about what they thought the purpose of the study was, and their weight and height measurements taken in private. Children were accompanied back to their classrooms and asked to refrain from discussing the experiment with their classmates.

Statistical analysis

Randomisation checks were conducted with a Welch’s one-way ANOVA and Chi-square analysis for test variables. The conditions did not differ on the variables measured (all *ps* > .07; **Table 1)**. Correlations with marketed, alternative and overall snack intake were calculated to determine possible covariates. Covariates that were related to kcal intake and included in the analyses were sex *F* (1, 131.61) = 4.20, *p*=.042, age (*r=*-.21,*p*=.011), hunger (*r=*.21,*p*=.010) and BMI corrected (*r=*-.20,*p*=.016). All other variables were not related to kcal intake (*ps*>.05).

[Table 1 here]

A 3 (condition: food marketing with disclosure, food marketing with no disclosure, non-food marketing with no disclosure [between group factor]) x 2 (snack intake: marketed snack *McVitie’s* versus a perceived alternative snack *Tesco’s* [within group factor]) mixed factor analysis of covariance (ANCOVA) was conducted to test hypothesis (1). A separate multivariate analysis of covariance (MANCOVA) measured the effect of food marketing condition (food marketing with a disclosure, food marketing with no disclosure, non-food marketing with no disclosure) on kcal intake of the marketed snack, a perceived alternative snack, and overall (combined snack intake) to test hypotheses (2) and (3). This MANCOVA also measured the interaction effect between food marketing condition and children’s awareness of advertising in the YouTube video (no awareness vs awareness), on kcal intake measures. Post hoc tests examined the differences between and within conditions with Bonferroni adjustments for multiple comparisons. A Chi-square analysis tested whether children’s advertising awareness (no awareness vs awareness) differed across conditions. All analyses were conducted using SPSS software (version 24 for Windows, SPSS Inc, Chicago, US) and significance was assessed using a two-tailed test at *p*< 0.05. Effect sizes were calculated using partial eta squared, with 0.01 indicating a small effect, 0.09 a medium effect, and 0.25 a large effect.

**Results**

The final sample consisted of 151 participants (80 female), aged 9-11 years (*M*=10.32 ± 0.6). One child was excluded from the analysis for not watching the video in full. Of the participants 60% were of a healthy weight, while 40% were of an unhealthy weight (32% with overweight, and 8% with obesity). The percentage of children with overweight or obesity was slightly higher than the national average 46 (34.3% for 10-11-year-olds in England at the most recent assessment). ﻿No differences were found in BMI distribution between sexes.

The mixed ANCOVA measured the effect of food marketing condition (food marketing with disclosure, food marketing with no disclosure, non-food marketing with no disclosure) on kcal intake of the marketed brand relative to the alternative brand. BMI had a significant effect on kcal intake (*F* (1, 144) = 6.53, *p*=.012, ηp2=.04) and therefore, means were adjusted and controlled for BMI. There was a significant main effect of snack type on kcal intake (*F* (1, 145) = 15.06, *p*<.001, ηp2=.09), with children across the group as a whole consuming more (kcals) of the marketed brand (180.51 ± 93.53) than the alternative brand (97.40 ± 75.09). There was no significant main effect of condition on snack type consumed (*F* (1, 148) = 2.46, *p*=.089, ηp2=.03). There was a significant interaction between snack type and food marketing condition on intake (*F* (2, 145) = 4.71, *p*=.01, ηp2=.06). Children who viewed food marketing with a disclosure showed increased intake of the marketed snack (211.5 ± 99.4) relative to the alternative snack (90.61 ± 71.37; *t*(49) = 6.24, *p*<.001, *d*= 1.40), as did children who viewed food marketing without a disclosure (181.36 ± 101.33 v 82.08 ± 82.91 respectively; *t*(49) = 4.58, *p*<.001, *d*= 1.07). There was no significant difference in marketed snack intake relative to alternative snack intake in the non-food marketing condition (*t*(50) = 1.91, *p*=.186, *d*= 0.45) (see **Figure 1**).

[Figure 1 here]

The MANCOVA measured the effect of food marketing condition (food marketing with disclosure, food marketing with no disclosure, non-food marketing with no disclosure) on kcal intake (marketed snack kcal consumed, alternative snack kcal consumed, and total snack kcal consumed). Hunger had a significant effect on kcal intake (*F* (3, 142) = 2.93, *p*=.036, ηp2=.06) and therefore, means were adjusted and controlled for hunger. Food marketing condition had a significant effect on kcal intake (*F* (6, 142) = 3.11, *p*=.006, ηp2=.06). Food marketing condition had a significant effect on marketed snack kcal intake (*F* (2, 144) = 6.40, *p*=.002, ηp2=.08), with children exposed to food marketing with a disclosure consuming 41% more kcals (214.40± 99.40)than children exposed to non-food marketing (149.61 ± 67.42, *p*=.002). The difference in marketed snack kcal intake between those exposed to food marketing with no advertising disclosure and non-food marketing (*p*=.521), and those exposed to food marketing with or without an advertising disclosure (*p*=.148) was not significant. There was no significant effect of food marketing condition on ‘alternative’ snack kcal intake (*F* (2, 144) = 1.26, *p*=.287, ηp2= .02). There was a significant effect of food marketing condition on total snack kcal intake (*F* (2, 144) = 4.28,*p=.*016, ηp2=.06). Children exposed to food marketing with an advertising disclosure consumed 12% more snack kcals overall (309.03 ± 105.65) than children exposed to non-food marketing (260.3 ± 71.86, *p*=.030). There was no significant difference in total snack kcals consumed between children exposed to food marketing with no advertising disclosure and non-food marketing (*p*=1), and between those exposed to food marketing with and without an advertising disclosure (*p*=.057). (see **Figure 2**).

[Figure 2 here]

There was no significant interaction between food marketing with an advertising disclosure and children’s awareness of advertising (no awareness vs awareness) on kcal intake (*F* (6, 280) = 1.55, *p*=.163, ηp2=.032). However, the results of a Chi-square analysis showed a significant difference in children’s awareness of advertising across all marketing conditions (χ2=53.43, *p*<.001). Specifically, 76% of participants exposed to food marketing with an advertising disclosure reported awareness, compared with 20% of those exposed to food marketing with no disclosure, and 12% exposed to non-food marketing with no disclosure. Analyses were rerun without the inclusion of the covariates and the effect of condition on marketed snack intake remained significant (see **supporting information**).

**Discussion**

This study quantifies the effect of influencer food marketing via YouTube on children’s brand choice and *ad libitum* intake and shows that including a ‘protective’ advertising disclosure does not reduce the effect. Children exposed to influencer marketing of a branded unhealthy snack (with and without an advertising disclosure) consumed more of the marketed snack relative to the alternative, whereas children exposed to non-food marketing did not, which supports hypothesis (1). Children exposed to influencer marketing of a branded unhealthy snack (with and without an advertising disclosure) did not differ in intake of an alternative snack, compared with children exposed to non-food marketing, which supports hypothesis (2). The results also support hypothesis (3), as including an advertising disclosure in influencer food marketing was not effective in reducing children’s kcal intake. In addition, relative to the non-food marketing condition, exposure to food marketing with an advertising disclosure actually increased marketed and overall snack intake.

The observed effects of food marketing on intake in the current study were brand specific. Children exposed to a branded unhealthy snack had greater consumption of the marketed snack relative to the perceived alternative brand, whereas those exposed to non-food marketing did not. In addition, intake of the alternative brand did not differ across all three conditions. Although food advertising has been suggested to operate at a category level, 5,47,48 brand specific effects on intake 16,49 and preference 50,51 have been observed in previous studies. In a similar study 16 children (8-11 years) were exposed to a TV commercial featuring celebrity endorsement of a HFSS food, the same celebrity in a non-marketing context, a commercial for a different snack or a non-food commercial. All groups except those exposed to non-food advertising subsequently consumed significantly more of the endorsed product relative to a perceived alternative brand. Those exposed to the commercial or the TV programming in which the endorser featured consumed significantly more of the endorsed branded snack than the other groups but did not reduce their intake of the perceived alternative branded snack to compensate. The findings of the current study are somewhat consistent with this, although there are clear methodological differences that make direct comparisons difficult.

Concerns have been raised over the potential for digital marketing to be even more impactful on eating behaviour than traditional forms of exposure.8,48 While children have been shown to recognise TV advertising from a relatively young age because of the presence of cues such as jingles or clear advert ‘breaks’, it is more challenging to identify when digital marketing is occurring because of the blurred boundaries between content and marketing.52 In order to support children to discern what digital content is actually marketing, current self-regulatory codes in the UK require that influencer marketing should be labelled with an advertising disclosure.26 In the current study there was no difference in intake of the marketed snack between children who viewed influencer marketing with or without an advertising disclosure. This is consistent with a recent study finding the same effects after exposure to a HFSS food advergame either with or without an advertising disclosure.33 Also supported by the literature,25,29,53,54 the current study found the presence of an advertising disclosure did increase children’s awareness of advertising, with 76% of children exposed to a disclosure, and 32% of those not, reporting awareness. However, increased awareness did not reduce kcal intake of the marketed snack, but actually increased intake, meaning marketing was *more* effective when a disclosure was present. Other studies too have found little evidence that awareness of advertising has a beneficial impact on children’s eating behaviour response.55,56 Even six-year-olds have been found to display knowledge of the persuasive intent of an advergame, but this knowledge did not impact brand preference, with children preferring the advertised product to an alternative.32 Media literacy programmes have been developed as strategies to increase persuasion knowledge e.g. industry funded MediaSmart in the UK (<http://www.mediasmart.org.uk>). However, if persuasion knowledge is not associated with increased resistance to advertising, it is not clear what benefit these programs could have in relation to helping children counter advertising’s influence. From the findings of the current study we might conclude that such programmes could unintentionally exacerbate the problem. It appears, based on these new data and the evidence cited, that more than advertising recognition is necessary for children to defend themselves against influential effects. This notion is supported by the Food Marketing Defence Model, which asserts that motivation and ability to resist are also essential.34 Future research could explore whether children who are more motivated to eat healthily (e.g. restrained eaters), and therefore more likely to resist HFSS food advertising, respond differently to advertising disclosures.

In the current study the advertising disclosure was made more explicit than in real life by using clear wording (“this is an advert”) that featured on screen for the duration of the marketed content. This was done intentionally to increase the likelihood of children noticing the warning and to ensure the study could explore any moderating effect of marketing awareness. Compared to the control condition, children had increased intake of the marketed snack when marketing featured an advertising disclosure. This effect was non-significant for those exposed to food marketing with no advertising disclosure. This latter finding is surprising and is not consistent with the REFCAM,19 which states that food cues embedded in marketing can increase children’s intake of these foods when they become available. It is also not consistent with the celebrity endorsement study that the current study was broadly based on 16 or with the many studies that demonstrate food marketing does increase children’s food intake.5,57 One potential explanation may be that advertising disclosures attract children’s attention to brands, and can actually increase brand awareness,28,54,55 thus children who saw the disclosure consumed more of the branded product when available *ad libitum*. In addition, without the ‘distraction’ of the disclosure, children in the non-disclosure condition may have been more engaged in the entertaining content 22 of the YouTube video and paid less attention to the brand compared to those in the disclosure condition. Children’s knowledge of the persuasive intent of advertising has previously been shown to increase children’s preference scores for advertised foods.32 The current findings are consistent with this, but the mechanism of effect warrants further exploration. Whilst in principle demand characteristics are another potential explanation for these findings, this is unlikely to be the case for the present study as the ‘manipulation check’ found that only two children correctly guessed the aims of the research. It is also important to note here that in both food marketing conditions, relative to the alternative brand, consumption of the marketed brand intake was greater (an effect not found in the non-marketing condition).

The literature indicates that when children consume a greater amount of snack food following acute food advertising exposure (via both TV and the Internet), this additional intake is not compensated for at a later lunch meal.58 Cohort studies indicate that an energy gap of 69-77 kcal per day is all that is required for a child to become overweight.59 In the current study, children exposed to influencer food marketing with an advertising disclosure consumed 41% kcal more of the marketed snack compared with the control. This is the effect after acute exposure to marketing of a single branded product in a YouTube video only. If food marketing exposure drives increased consumption of food that is not compensated for, over time, this would contribute to weight gain. A limitation of this study is that children viewed a YouTube video for only five minutes, which featured one minute of influencer food marketing. In reality these videos can feature more marketing 60 and children will watch for longer,44 and so the effects may well be amplified relative to those reported here. However, in real life children may be less likely to be invited to eat unhealthy food *ad libitum,* and parental mediation may moderate the effects of advertising.61 Additionally, all children were exposed to the same influencers, and individual differences that may moderate endorser effects (such as perceived similarity, familiarity, and likeability 62) were not measured.

This study confirms that engaging and entertaining digital marketing of unhealthy foods can increase children’s intake of the advertised brand relative to an alternative. Equally, it has been established that although an advertising disclosure increases advertising awareness, it does not protect children from the effects of influencer marketing. Disclosures may actually drive increased brand awareness and amplify intake effects in the marketed product specifically. In light of these findings advertising disclosures may be something of a counterproductive regulatory approach. Further research is needed to support development of policy options to reduce children’s exposure to digital advertising and its impact on their consumption of unhealthy foods.

Conflict of interest statement:

Dr. Hardman reports grants from American Beverage Association, personal fees from International Sweeteners Association, outside the submitted work; Dr. Boyland reports personal fees from Consultancy, grants from Consultancy, outside the submitted work; .Dr. Coates, Dr. Halford and Dr. Christiansen have nothing to disclose.

Acknowledgements:

AC designed and conducted the research, analysed the data, wrote the paper, had primary responsibility for the final content, approved the final manuscript as submitted and agree to be accountable for all aspects of the work.EB designed the research, interpreted the data, wrote the paper, approved the final manuscript as submitted and agree to be accountable for all aspects of the work.CAH, PC, and JH analysed and interpreted the data, revised the article for important intellectual content, approved the final manuscript as submitted, and agree to be accountable for all aspects of the work.

This work was conducted as part of Anna Coates’ PhD which is funded by the University of Liverpool. No external funding was received for this work. Paul Christiansen, Jason C. G. Halford, and Charlotte A. Hardman receive research funding to their institution from the American Beverage Association. The other authors have indicated they have no financial relationships relevant to this article to disclose.

References

1. Wang Y, Lim H. The global childhood obesity epidemic and the association between socio-economic status and childhood obesity. *Int Rev Psychiatry*. 2012;24(3):176-188. doi:10.3109/09540261.2012.688195.

2. Ng SH, Kelly B, Se CH, et al. Global Health Action Obesogenic television food advertising to children in Malaysia: sociocultural variations Obesogenic television food advertising to children in Malaysia: sociocultural variations. *Glob Health Action*. 2014;7(1):25169. doi:10.3402/gha.v7.25169org/10.3402/gha.v7.25169.

3. Swinburn BA, Sacks G, Hall KD, et al. Obesity 1 The global obesity pandemic: shaped by global drivers and local environments. *Lancet*. 2011;378:804-814. doi:10.1016/S0140-6736(11)60813-1.

4. WHO. *Report of the Commision on Ending Childhood Obesity. Implementation Plan: Executive Summary.* Geneva; 2017. http://apps.who.int/iris/bitstream/handle/10665/259349/WHO-NMH-PND-ECHO-17.1-eng.pdf;jsessionid=B243269A6BAD4EFC0D9BECF3CFF25EA7?sequence=1. Accessed September 24, 2018.

5. Boyland EJ, Nolan S, Kelly B, et al. Advertising as a cue to consume: A systematic review and meta-analysis of the effects of acute exposure to unhealthy food and nonalcoholic beverage advertising on intake in children and adults. *Am J Clin Nutr*. 2016;103(2):519-533. doi:10.3945/ajcn.115.120022.

6. Cancer Research UK. *10 Years on. New Evidence on TV Marketing and Junk Food Consumption amongst 11-19 10 Years Olds after Boradcast Regulations*.; 2018. https://www.cancerresearchuk.org/sites/default/files/10\_years\_on\_full\_report.pdf?utm\_source=t.co&utm\_medium=referral. Accessed January 17, 2018.

7. Norman J, Kelly B, Boyland E, McMahon AT. The Impact of Marketing and Advertising on Food Behaviours: Evaluating the Evidence for a Causal Relationship. *Curr Nutr Rep*. 2016;5(3):139-149. doi:10.1007/s13668-016-0166-6.

8. WHO. *Tackling Food Marketing to Children in a Digital World: Trans-Disciplinary Perspectives*.; 2016. http://www.euro.who.int/\_\_data/assets/pdf\_file/0017/322226/Tackling-food-marketing-children-digital-world-trans-disciplinary-perspectives-en.pdf.

9. Ofcom. *Children and Parents: Media Use and Attitudes Report*.; 2017. https://www.ofcom.org.uk/\_\_data/assets/pdf\_file/0020/108182/children-parents-media-use-attitudes-2017.pdf. Accessed November 29, 2017.

10. Livingstone S, Haddon L, Görzig A. *Risks and Safety on the Internet: The Perspective of European Children*.; 2011. doi:2045-256X.

11. Berryman R, Kavka M. ‘I Guess A Lot of People See Me as a Big Sister or a Friend’: the role of intimacy in the celebrification of beauty vloggers. *J Gend Stud*. 2017;26(3):307-320. doi:10.1080/09589236.2017.1288611.

12. Childwise. *New CHILDWISE Report Reveals Children’s Favourite Internet Vloggers*.; 2016.

13. Defy Media. *Acumen Report: Constant Content*.; 2015.

14. Bandura A. Social cognitive theory of mass communications. In: *Media Effects: Advances in Theory and Research*. ; 2001:121-153. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.200.9808&rep=rep1&type=pdf. Accessed August 3, 2018.

15. Coates AE, Hardman CA, Halford JCG, Christiansen P, Boyland EJ. Social Media Influencer Marketing and Children’s Food Intake: A Randomized Trial. *Pediatrics*. 2019. doi:10.1542/peds.2018-2554.

16. Boyland EJ, Harrold JA, Dovey TM, et al. Food choice and overconsumption: Effect of a premium sports celebrity endorser. *J Pediatr*. 2013;163(2):339-343. doi:10.1016/j.jpeds.2013.01.059.

17. Smits T, Vandebosch H, Neyens E, Boyland E. The Persuasiveness of Child-Targeted Endorsement Strategies: A Systematic Review. *Ann Int Commun Assoc*. 2015;39(1):311-337. doi:10.1080/23808985.2015.11679179.

18. Vassallo AJ, Kelly B, Zhang L, Wang Z, Young S, Freeman B. Junk Food Marketing on Instagram: Content Analysis. *JMIR public Heal Surveill*. 2018;4(2):e54. doi:10.2196/publichealth.9594.

19. Folkvord F, Anschütz DJ, Boyland E, Kelly B, Buijzen M. Food advertising and eating behavior in children. *Curr Opin Behav Sci*. 2016;9:26-31. doi:10.1016/j.cobeha.2015.11.016.

20. Owen L, Lewis C, Auty S, Buijzen M. Is Children’s Understanding of Nontraditional Advertising Comparable to Their Understanding of Television Advertising? *J Public Policy Mark*. 2013;32(2):195-206. doi:10.1509/jppm.09.003.

21. Wright P, Friestad M, Boush DM. The Development of Marketplace Persuasion Knowledge in Children, Adolescents, and Young Adults Peter. *J Public Policy Mark*. 2005;24(2):222-223.

22. Buijzen M, Van Reijmersdal EA, Owen LH. Introducing the PCMC model: An investigative framework for young people’s processing of commercialized media content. *Commun Theory*. 2010;20(4):427-450. doi:10.1111/j.1468-2885.2010.01370.x.

23. Cauberghe V, De Pelsmacker P. Advergames. The Impact of Brand Prominence and Game Repetition on Brand Responses. *J Advert*. 2010;39(1):5-18. doi:10.2753/JOA0091-3367390101.

24. Freeman B, Chapman S, Freeman MB. Is “‘YouTube’” telling or selling you something? Tobacco content on the YouTube video-sharing website. *Tob Control*. 2007;16:207-210. doi:10.1136/tc.2007.020024.

25. Rozendaal E, Lapierre MA, van Reijmersdal EA, Buijzen M. Reconsidering Advertising Literacy as a Defense Against Advertising Effects. *Media Psychol*. 2011;14(4):333-354. doi:10.1080/15213269.2011.620540.

26. Committee of Advertising Practice. Younger children and recognition of online advertising. https://www.asa.org.uk/news/younger-children-and-recognition-of-online-advertising.html. Published 2017. Accessed May 4, 2017.

27. Campbell MC, Mohr GS, Verlegh PWJ. Can disclosures lead consumers to resist covert persuasion? The important roles of disclosure timing and type of response ☆. *J Consum Psychol*. 2013;23:483-495. doi:10.1016/j.jcps.2012.10.012.

28. Boerman SC, van Reijmersdal EA, Neijens PC. Using Eye Tracking to Understand the Effects of Brand Placement Disclosure Types in Television Programs. *J Advert*. 2015;44(3):196-207. doi:10.1080/00913367.2014.967423.

29. van Reijmersdal EA, Boerman SC, Buijzen M, Rozendaal E. This is Advertising! Effects of Disclosing Television Brand Placement on Adolescents. *J Youth Adolesc*. 2017;46(2):328-342. doi:10.1007/s10964-016-0493-3.

30. Livingstone S, Helsper EJ. Does advertising literacy mediate the effects of advertising on children? A critical examination of two linked research literatures in relation to obesity and food choice. *J Commun*. 2006;56(3):560-584. doi:10.1111/j.1460-2466.2006.00301.x.

31. An S, Stern S. Mitigating the Effects of Advergames on Children. *J Advert*. 2011;40(1):43-56. doi:10.2753/JOA0091-3367400103.

32. Mallinckrodt V, Mizerski D. The Effects of Playing an Advergame on Young Children’s Perceptions, Preferences, and Requests. *J Advert*. 2007;36(2):87-100. doi:10.2753/JOA0091-3367360206.

33. Folkvord F, Lupiáñez-Villanueva F, Codagnone C, Bogliacino F, Veltri G, Gaskell G. Does a ‘protective’ message reduce the impact of an advergame promoting unhealthy foods to children? An experimental study in Spain and The Netherlands. *Appetite*. 2017;112:117-123. doi:10.1016/j.appet.2017.01.026.

34. Harris JL, Brownell KD, Bargh JA. The Food Marketing Defense Model: Integrating Psychological Research to Protect Youth and Inform Public Policy. *Soc Issues Policy Rev*. 2009;3(1):211-271. doi:10.1111/j.1751-2409.2009.01015.x.

35. Lawlor M-A, Dunne Á, Rowley J. Young consumers’ brand communications literacy in a social networking site context. *Eur J Mark*. 2016;50(11):2018-2040. doi:http://dx.doi.org/10.1108/MRR-09-2015-0216.

36. Logicalis. *Realtime Generation Report 2016. The Age of Digital Enlightenment*.; 2016. www.uk.logicalis.com/RTG. Accessed July 30, 2018.

37. Harris JL, Haraghey KS, Lodolce M, Semenza NL. Teaching children about good health? Halo effects in child-directed advertisements for unhealthy food. *Pediatr Obes*. 2018;13(4):256-264. doi:10.1111/ijpo.12257.

38. Bruce AS, Pruitt SW, Ha O-R, et al. The Influence of Televised Food Commercials on Children’s Food Choices: Evidence from Ventromedial Prefrontal Cortex Activations. *J Pediatr*. 2016;177:1-7. doi:10.1016/j.jpeds.2016.06.067.

39. Bergkvist L, Zhou KQ. Celebrity endorsements: A literature review and research agenda. *Int J Advert*. 2016;35(4):642-663. doi:10.1080/02650487.2015.1137537.

40. Martínez C, Olsson T. Making sense of YouTubers: how Swedish children construct and negotiate the YouTuber Misslisibell as a girl celebrity. *J Child Media*. 2018;00(00):1-17. doi:10.1080/17482798.2018.1517656.

41. Whalen R, Harrold J, Child S, Halford J, Boyland E. Children’s exposure to food advertising: the impact of statutory restrictions. *Health Promot Int*. 2017. doi:10.1093/heapro/dax044.

42. Laerhoven H van, Zaag-Loonen H van der, Derkx B. A comparison of Likert scale and visual analogue scales as response options in children’s questionnaires. *Acta Paediatr*. 2004;93(6):830-835. doi:10.1080/08035250410026572.

43. Oldham-Cooper RE, Hardman CA, Nicoll CE, Rogers PJ, Brunstrom JM. Playing a computer game during lunch affects fullness, memory for lunch, and later snack intake. *Am J Clin Nutr*. 2011;93(2):308-313. doi:10.3945/ajcn.110.004580.

44. Ofcom. Children and parents: media use and attitudes report. 2016:1-53. https://www.ofcom.org.uk/\_\_data/assets/pdf\_file/0034/93976/Children-Parents-Media-Use-Attitudes-Report-2016.pdf. Accessed March 23, 2017.

45. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. *Br Med J*. 2000;320(1):1-6. doi:10.1136/bmj.320.7244.1240.

46. Public Health England. National child measurement programme (NCMP): trends in child BMI. https://www.gov.uk/government/publications/national-child-measurement-programme-ncmp-trends-in-child-bmi. Published 2017. Accessed July 27, 2018.

47. Hastings G, Stead M, Mcdermott L, et al. *REVIEW OF RESEARCH ON THE EFFECTS OF FOOD PROMOTION TO CHILDREN*.; 2003. http://www.csm.strath.ac.uk.

48. Folkvord F, Anschütz DJ, Buijzen M, Valkenburg PM. The effect of playing advergames promoting healthy or unhealthy foods on actual food intake among children. *Am J Clin Nutr*. 2013;97:239-245. doi:10.1016/j.appet.2012.05.062.

49. Forman J, Halford JCG, Summe H, MacDougall M, Keller KL. Food branding influences ad libitum intake differently in children depending on weight status. Results of a pilot study. *Appetite*. 2009;53(1):76-83. doi:10.1016/j.appet.2009.05.015.

50. Robinson TN, Borzekowski DLG, Matheson DM, Kraemer HC. Effects of Fast Food Branding on Young Children’s Taste Preferences. *Arch Pediatr Adolesc Med*. 2007;161(8):792. doi:10.1001/archpedi.161.8.792.

51. Borzekowski DLG, Robinson TN. The 30-second effect: An experiment revealing the impact of television commercials on food preferences of preschoolers. *J Am Diet Assoc*. 2001;101(1):42-46. doi:10.1016/S0002-8223(01)00012-8.

52. Ali M, Blades M, Oates C, Blumberg F. Young children’s ability to recognize advertisements in web page designs. *Br J Dev Psychol*. 2009;27(Pt 1):71-83. doi:10.1348/026151008X388378.

53. Boerman SC, Van Reijmersdal EA, Neijens PC. How audience and disclosure characteristics influence memory of sponsorship disclosures. *Int J Advert*. 2015;34(4):576-592. doi:10.1080/02650487.2015.1009347.

54. Boerman SC, van Reijmersdal EA, Neijens PC. Sponsorship Disclosure: Effects of Duration on Persuasion Knowledge and Brand Responses. *J Commun*. 2012;62(6):1047-1064. doi:10.1111/j.1460-2466.2012.01677.x.

55. Van Reijmersdal EA, Rozendaal E, Buijzen M. Effects of Prominence, Involvement, and Persuasion Knowledge on Children’s Cognitive and Affective Responses to Advergames. *J Interact Mark*. 2012;26(1):33-42. doi:10.1016/j.intmar.2011.04.005.

56. Panic K, Cauberghe V, De Pelsmacker P. Comparing TV ads and advergames targeting children: The impact of persuasion knowledge on behavioral responses. *J Advert*. 2013;42(2-3):264-273. doi:10.1080/00913367.2013.774605.

57. Sadeghirad B, Duhaney T, Motaghipisheh S, Campbell NRC, Johnston BC. Influence of unhealthy food and beverage marketing on children’s dietary intake and preference: a systematic review and meta-analysis of randomized trials. *Obes Rev*. 2016;17(10):945-959. doi:10.1111/obr.12445.

58. Norman J, Kelly B, McMahon AT, et al. Sustained impact of energy-dense TV and online food advertising on children’s dietary intake: A within-subject, randomised, crossover, counter-balanced trial. *Int J Behav Nutr Phys Act*. 2018;15(1). doi:10.1186/s12966-018-0672-6.

59. Van Den Berg. Quantification Of the Energy Gap In Young Overweight Children. *Piama Bitth Cohort Study Blue Public Heal*. 2011:11.

60. Goldsmith RE. The Influentials: One American in Ten Tells the Other Nine How to Vote, Where to Eat, and What to Buy. *J Prod Brand Manag*. 2004;13(5):371-372. doi:10.1108/10610420410554449.

61. Naderer B, Matthes J, Marquart F, Mayrhofer M. Children’s attitudinal and behavioral reactions to product placements: investigating the role of placement frequency, placement integration, and parental mediation. *Int J Advert*. 2018;37(2):236-255. doi:10.1080/02650487.2016.1218672.

62. Kapitan S, Silvera DH. From digital media influencers to celebrity endorsers: attributions drive endorser effectiveness. *Mark Lett*. 2016;27:553-567. doi:10.1007/s11002-015-9363-0.