Exposure to ‘healthy’ fast food meal bundles in television advertisements promotes liking for fast food but not healthier choices in children.

Emma J. Boyland\*, Melissa Kavanagh-Safran, Jason C.G. Halford

Department of Psychological Sciences, University of Liverpool, Eleanor Rathbone Building, Bedford Street South, Liverpool, L69 7ZA, UK.

Author email addresses:

Dr Emma J. Boyland [e.boyland@liverpool.ac.uk](mailto:e.boyland@liverpool.ac.uk)

Melissa Kavanagh-Safran [melissasafran@hotmail.com](mailto:melissasafran@hotmail.com)

Jason C.G. Halford [j.c.g.halford@liverpool.ac.uk](mailto:j.c.g.halford@liverpool.ac.uk)

\*Corresponding author:

Dr Emma J. Boyland

Department of Psychological Sciences, University of Liverpool, Eleanor Rathbone Building, Bedford Street South, Liverpool, L69 7ZA

Email: [e.boyland@liverpool.ac.uk](mailto:e.boyland@liverpool.ac.uk)

Tel.: +44 (0) 151 794 1137

Running title: ‘Healthy’ fast food advertising to children.

Keywords: fast food, advertising, food choice, children.

**Abstract**

Due to regulatory changes, fast food companies often depict healthy foods in their television advertising to children. This study examined how exposure to advertising for ‘healthy’ children’s meal bundles influenced children’s food selection. 59 children (37 male), aged 7–10 years (8.8 ± 0.9y) took part. The within-participant, counterbalanced design had two conditions: control (exposure to ten toy adverts across two breaks of five adverts each) and experimental (the middle advert in each break replaced with one for a McDonalds’s Happy Meal® depicting the meal bundle as consisting of fish fingers, a fruit bag and a bottle of mineral water). Following viewing of the adverts embedded in a cartoon, children completed a hypothetical menu task and reported liking for McDonald’s food and fast food in general. Nutritional knowledge, height, and weight were measured. There was no significant difference between the two advert conditions for the nutritional content of the meal bundles selected. However, children’s liking for fast food in general increased after exposure to the food adverts, relative to control (*p*=0.004). Compared to children with high nutritional knowledge, those with low scores selected meals of greater energy content (305kJ) after the food adverts (*p*=0.016). Exposure to adverts for ‘healthy’ meal bundles did not drive healthier choices in children but did promote liking for fast food. These findings contribute to debates surrounding food advertising to children and the effectiveness of related policies.

**Introduction**

In the context of a global obesity epidemic, concerns have been raised about the marketing of unhealthy foods to children on television(1-5). In their large scale systematic review, Hastings et al., stated that the emphasis on the promotion of high fat, sugar and/or salt (HFSS) foods on television constitutes a major barrier to instilling healthy food choices in children(1). In support of this, an increasing body of scientific evidence exists to demonstrate the direct causal effects of exposure to food advertising on children’s food preferences(6, 7), brand preferences(8), product requests(9), snack food consumption(10, 11), and overall caloric intake(12), with data also showing that it leads to reduced intake of fruits and vegetables longitudinally(13).

Fast food advertising in particular has been shown to be highly prevalent on television(14, 15) and not only associated with normalising and increasing fast food consumption(16), but also with increased body fat(17), body mass index (BMI)(18) and rates of obesity(19) in youth, particularly in those who are receptive to its promotional messages(20). To increase this receptivity in the profitable youth market(21), fast food advertising often directly targets a young audience with techniques of particular appeal to that age group such as the inclusion of premiums (such as toy giveaways) and movie tie-ins(22, 23), and strong brand imagery. These elements are far less apparent when the companies are advertising to adults(23). It is notable that in the last few decades levels of fast food consumption in childhood have increased substantially(24, 25), consistent with rising saturation of restaurants(26), and in parallel with rising pediatric obesity prevalence. In the UK alone, the fast food and takeaway market was estimated to be worth £8.9 billion in 2005, a figure that was predicted to rise by 5% each year(27).

Regulations were introduced in the UK in 2007 to govern the promotion of HFSS foods in and around television programming deemed to be ‘of particular appeal to children’(28). These regulations use a nutrient profiling (NP) scheme to determine those foods (and beverages) that should (or should not) be advertised to children(28, 29), such that the promotion of healthy items is not restricted.

As a result of these rules, although fast food advertising on television has not reduced (14, 30) it now increasingly depicts healthier items (e.g. fruit and water alongside the main item, as opposed to fries and a soft drink; EB unpublished results) that ‘pass’ the NP thresholds and therefore can be advertised to children. A similar trend has been observed in the US in response to food industry self-regulatory pledges (31). Importantly, the effects of this type of advertising on children’s eating behaviours are so far unknown.

Given the financial power of the food industry relative to the public health sector, combining the known appeal of highly familiar(32), liked brands and their persuasive marketing techniques with healthier foods has oft been suggested as a potentially promising public health approach(33-37). However, a recent study by Bernhardt et al., found that when healthy foods were depicted in fast food advertising the items were often not recognised by children, or the manner of their presentation caused confusion (e.g. apple pieces shaped like French fries)(31). Understanding how factors such as food advertising affect children’s food choices is crucial, as even young children are often somewhat autonomous in their diet-related decision making, and parental intervention alone is seemingly not sufficient to ensure healthy choices will be made (38).

One factor that may influence children’s dietary selections is nutritional knowledge. Although some studies have not shown an association between good nutritional knowledge and healthy food choice in children(39, 40), others have found a positive relationship(41), and furthermore, exposure to nutrition education campaigns has been demonstrated to positively influence the selection of healthy snack foods in children(42). Similarly, researchers exploring the effects of television advertising for healthy foods have found that this can promote positive attitudes and beliefs about these foods (43, 44) and even alter food choice in some children, although this was a reduction in consumption of unhealthy foods rather than increased intake of healthier options(45).

This study is the first to experimentally test the impact of fast food advertising where healthier items are depicted (hereafter ‘healthy’ fast food advertising) on fast food liking and choice in children with varying levels of nutritional knowledge.

**Methods**

*Participants*

59 children (37 male, 11 overweight or obese), aged 7 – 10 years (8.8 ± 0.9y) took part in the study between March and May 2014. Participants were recruited from 3 primary schools in northwest England using opportunistic sampling. Information sheets and consent forms were sent by the school to parents with children in the desired age range, a range that is similar to previously published studies demonstrating the impact of television food advertising on children’s food choices and intake (6, 11). No incentive for participation was offered. Due to the novel nature of the study equivalent data were not available for a power analysis. Therefore the sample size is based on a similar published study of food marketing effects on children(11).

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the University of Liverpool’s Institute of Psychology, Health and Society Research Ethics committee, under a generic approval for studies of this nature provided by the University’s Research Ethics Sub-Committee for Non-invasive Procedures. Written informed consent was obtained from all gatekeepers (school head teachers and parents). Children whose parents had provided consent for participation were given child-appropriate study information to read, this information was also read out loud to the group by the researcher. Children were given the opportunity to ask the researcher questions about the study in private, after which verbal consent from children was witnessed and formally recorded by the researcher or class teacher.

*Design*

This study was a within-participant, counterbalanced design with two conditions: control (exposure to ten toy advertisements(adverts)) across two breaks of five adverts each) and experimental (the middle advert in each break replaced with an advert for a McDonalds’s Happy Meal (a fast food meal bundle aimed at children) depicting the meal bundle as consisting of fish fingers, a fruit bag and a bottle of mineral water). The toy adverts promoted an approximately equal mix of female and male-targeted items and all advert breaks were of similar duration (approximately 3.5 minutes). Adverts were embedded within the same episode of an age-appropriate, gender-neutral cartoon (Phineas and Ferb) which included no reference to or depiction of food or eating. At least a week interval between conditions was enforced to minimise the likelihood that children would recall responses from the previous session.

All television adverts and the cartoon were recorded from children’s and family programming broadcast on popular UK channels during 2012, three years after the full implementation of the Ofcom regulations(28). McDonalds adverts were chosen because McDonalds have the largest UK market share with over one-third of the fast food sales in 2012(46) and a Happy Meal advert was selected due to the child-targeted nature of this product. The adverts used were shown during peak children’s viewing hours (after school period).

*Procedure*

On test days, children were shown a DVD (control or experimental, in accordance with a randomisation schedule prepared via www.randomizer.org) in small groups of 6 in a private room within the school. Following viewing, children completed some paper-based measures (detailed below). On the second (final) study day only, participants’ height was measured to the nearest 0.1cm using a stadiometer (SECA Leicester Portable Height Measure; Birmingham, UK) and weight using recently calibrated weighing scales (SECA 770; Birmingham, UK) to the nearest 0.1kg in light clothing with no shoes. Testing was carried out at the same time of day on both occasions to minimise variation in levels of hunger between the two conditions.

*Measures*

*Meal Bundle Food and Drink Item Selection (hereafter ‘food selection’)*

Children were presented with labelled colour images (all equal size) of all choices of ‘main’ foods (Cheeseburger, Chicken McNuggets, Fish Fingers and Hamburger) on a single sheet of paper. The images used were those from the official McDonald’s website and appeared in the same order as they did online at the time of testing. Participants were asked to circle or mark the one item they would choose if they were constructing a McDonald’s Happy Meal at that moment. This was then repeated for ‘side’ items (Carrot sticks, Fruit bag, French fries) and drinks (Fruitizz, Robinson’s Fruit Shoot, Organic milk, Buxtons Mineral Water, Tropicana Orange juice, Diet coke, Fanta orange, Sprite zero, Coca-Cola, and milkshakes in four possible flavours – banana, vanilla, chocolate and strawberry). A similar ‘hypothetical menu’ approach has been used successfully in a recently published study(47).

*Hunger and fast food liking*

Further 5-point Likert scales were used to assess hunger, liking for the food at McDonalds and liking for fast food in general (1 “not at all”, 5 “very much”).

*Nutritional Knowledge*

This was measured using the Child’s Nutritional Knowledge Assessment(40). This checklist assesses knowledge of the nutrient content of 15 common foods and drinks (such as whole milk, skimmed milk, apples, and chocolate), by asking children to “tick which of the following describes each food: has lots of sugar; has lots of fat; has lots of fibre”. Correct selection of a food high in the nutrient is scored 1, while incorrect selection of foods not high in the nutrient is scored -1, summed for a total score which theoretically could range from -16 to +16.

*Statistical Analysis*

BMI was calculated as weight (kg)/height (m2). Using internationally recognised criteria for children(48), healthy weight (HW) overweight (OW) and obesity (OB) were defined based on age- and gender-specific BMI cut-off points equivalent to adult BMIs of 25 kg/m2 and 30 kg/m2 respectively. BMI z-scores adjusted for age and gender were calculated using WHO AnthroPlus software (accessible at http://www.who.int/growthref/tools/en).

Nutritional information from the McDonalds’s website was used to calculate energy (kJ) and fat, carbohydrate, sugar, and salt content (all grams, g) of all individual items and meal bundles overall in each condition. A mean nutritional knowledge score was generated from the scores in both conditions, and a median split was used to categorise children as having low (score <8, n = 31) or high (score >8, n = 28) nutritional knowledge.

Data met the assumptions for parametric analysis and so t-tests and bivariate Pearson correlations were used. All comparisons were two-tailed and significance was taken at p < 0.05, with Bonferroni adjustments for multiple comparisons. Analyses were completed using IBM SPSS Statistics Version 20.0 for Windows (Armonk, NY: IBM Corp). Results are reported as mean (± SD).

**Results**

48 participants were a healthy weight (81.4%, 31 male), 6 were overweight (10.2%, 3 male) and 5 obese (8.5%, 3 male). With 18.7% of children in this sample overweight or obese, this indicates a lower prevalence of overweight and obesity than the national average of 28% in children aged 2-15 years(49), although it must be taken into account that the Health Survey for England used different reference standards than the current study. Self-reported hunger was not significantly different between the two conditions (t(58) = 0.194, *p* = 0.846). There were no differences between girls and boys on any food selection outcome in either condition [results not reported] and therefore analyses are based on the entire sample unless otherwise stated.

*Food selection*

There was no significant difference between the two advert exposure conditions (control v experimental) on the content of the meal bundle selected in terms of energy, fat, carbohydrate (CHO), sugars, or salt (see Table 1, all comparisons *p* > 0.05). Chi square analyses indicated no difference in the frequency of selection of any items in the main (χ2(3, *n* = 113) = 0.294, *p* = 0.961), side (χ2(2, *n* = 118) = 1.043, *p* = 0.593) or drink (χ2(11, *n* = 118) = 4.391, *p* = 0.957) categories across the two conditions.

[TABLE 1 ABOUT HERE]

There were significant, but very weak, positive correlations between BMI z-score and total grams of sugar in the meal bundles chosen in the control (r = 0.286, *p* = 0.028) and experimental conditions (r = 0.258, *p* = 0.048), but r2 values indicate that BMI only explains 0.07% and 0.08% of variance in this relationship.

*Nutritional knowledge and food selection*

The mean score for nutritional knowledge across the sample was 7.68 ± 2.9. The low (n = 31) and high (n = 28) nutritional knowledge groups did not differ significantly on mean BMI z-score (low 0.772 ± 1.2 v high 0.838 ± 1.1; t(57) = 0.211, *p* = 0.834) or gender distribution (low: 18 male, 13 female; high: 19 male, 9 female; χ2(1, *n* = 59) = 0.603, *p* = 0.591).

Independent t-tests showed no difference between high and low nutritional knowledge groups on total energy content of meal bundle in the control condition (see Table 2; *p* = 0.150). A significant difference was found after viewing the food adverts, whereby children with low nutritional knowledge selected a meal bundle with a significantly greater energy content than those with higher nutritional knowledge (*p* = 0.016). This was driven largely by the greater fat content of the meal bundle selected by the children with low (versus high) nutritional knowledge after seeing the food adverts (*p* = 0.045) as significant differences were not seen for CHO (*p* = 0.132), sugars (*p* = 0.0661), or salt (*p* = 0.271). However, when the energy content of the meal bundle selected in the experimental condition was baseline-adjusted (control condition value subtracted from that of the selection following food adverts) there was no significant difference between the two nutritional knowledge groups (t(57) = 0.829, *p* = 0.136).

[TABLE 2 ABOUT HERE]

*Fast food liking*

There was no significant difference between the children’s rating of liking of McDonald’s food between the control and experimental conditions, with mean scores equally high (4.3 ± 1.0 v 4.3 ± 1.1; t(58) = 0.000, *p* > 0.999). However, after viewing the food adverts, children reported a greater liking for fast food in general relative to after the control adverts (4.2 ± 1.1 v 3.8 ± 1.2; t(57) = 2.962, *p* = 0.004).

**Discussion**

This study is the first to demonstrate the impact of exposure to ‘healthy’ fast food advertising on children’s hypothetical food selection. Following exposure to television adverts for McDonald’s Happy Meals® in which healthier options were depicted, children did not select a significantly healthier meal bundle for themselves from a hypothetical menu relative to their choices after control adverts. In addition, after seeing the McDonald’s adverts children’s reported liking for fast food increased. Therefore, this kind of food promotion, which is permitted on television within the current regulatory regime in the UK and many other territories, seemingly does not drive healthier food choice, but simply promotes a liking of fast food more generally.

These findings are a concern as although there is always a clear and strong argument for the role of parental responsibility in determining children’s diets, Wellard et al. found that in reality, a majority of parents (60%) reported sharing responsibility for fast food meal selection with their children(38). In 27% of cases the child was said to be solely responsible for the choice, and for children older than 5 years, only 7% of parents fully dictated the meal selection. Crucially, when children chose their own meals, the energy content of the meal was significantly higher than when their parents chose but when responsibility was shared, the energy content of the meal was not significantly lower than that chosen by children alone(38). A further study suggests that parents do not choose healthier fast food meal bundles for their children even when menu labelling is provided(47). Therefore, it is not sufficient to assume that parental involvement will ensure healthy choices are made, and it is clear that factors influencing children’s food choices are likely to be important determinants of their actual intake.

Although the current study is novel with no directly comparable data available, these findings are also broadly consistent with those of Dovey et al., in which many children failed to respond to the specific content of food advertising (i.e. whether the foods represented were healthy or not), instead had a similar appetitive response to both healthy and unhealthy food adverts(45). These findings also concur with the assertion of Hastings et al.(1), that food promotion works at a category level (driving liking for a food type), although interestingly in the current study this difference in liking was not also shown at a brand level as would be anticipated. It is probable that this was due to a ceiling effect, as liking for McDonald’s food was particularly high across the sample (mean of 4.3 on a scale with a maximum of 5) regardless of condition. This universal liking is not unexpected, given that this brand’s advertising was chosen for use in the current study because of its notable familiarity and popularity with the UK market(46). Given the inter-play between hedonic liking and motivational wanting in our reward responses to food(50), these adverts could act as a reminder to children that they like the foods represented which may then also trigger wanting and actual choice of those items in the real world food environment.

Although these findings are limited by the scale of the study and the use of hypothetical food selection rather than a real-world eating opportunity, there are some potential implications for the debate around food marketing regulation and the proposed use of well-known brands to promote healthier food choices in children(33-37).

Firstly, these findings provide initial empirical evidence that policies which permit highly familiar fast food brands to continue to advertise their products to children on television provided they depict a healthier profile of foods and beverages are potentially detrimental to child health as they act to increase liking of fast food and don’t improve food choice. Research also suggests that children are often confused by this type of marketing(31). Similar questions must be raised about the advertising of diet versions of carbonated beverages, also permitted within the UK regulatory approach and that of most countries. More studies are needed to explore whether this type of marketing actually promotes consumption of the diet version or whether it is in line with the findings of the current study in that it drives liking for the carbonated beverage category, with consumers often continuing to select the full sugar version. Further confusion for consumers, particularly children and specifically those with lower nutritional knowledge, may also result from some foods (such as sandwiches and salads) being considered as, and often advertised as, ‘healthy options’ but containing similar levels of sugar, sodium and saturated fat as the traditional menu items such as burgers(51).

In addition, with regard to fast food brands, as well as amendments to policy to restrict their marketing more comprehensively (including brand advertising where no food is shown at all, just powerful food brand imagery which alters taste preferences(52) and has even been shown to affect children at a neurological level(53)), other useful avenues for policy deliberation would be enforced changes to the default meal bundle offered. In US restaurants, this has been shown to reduce calories purchased(54), but to the authors’ knowledge this change has not yet occurred in UK outlets and it is also not yet clear whether this is sufficient to affect actual consumption.

As mentioned previously, there are limitations to the current study which must be taken into account when interpreting the findings. The sample size is relatively small, but nevertheless the study was sufficiently powered to detect this effect and the *n* of 59 is consistent with other published studies of food marketing effects on children(11). The lower than anticipated rate of overweight and obesity in this sample may have affected the results. The use of a hypothetical menu task rather than providing an actual eating opportunity is another limitation, as is the lack of data on the participants’ exposure to advertising for this brand and its products outside of the testing sessions. Future studies should seek to improve upon the external validity of the experiment, perhaps by incorporating a visit to an actual fast food outlet after the advert exposure. It should also be taken into consideration that these effects were found after exposure to only two McDonald’s adverts, therefore given the known high prevalence of fast food advertising on television(14, 30) the current study may actually underestimate the impact of this exposure on children’s food selections.

*Conclusion*

Food advertising on television has been demonstrated as one of the key factors contributing to unhealthy diets and overconsumption in children (1-5). Recent regulatory changes in the UK have sought to reduce children’s exposure to promotions for unhealthy foods, but some of the consequences of these rules have raised further questions. This study has shown that there is cause for concern over the practice of fast food brands continuing to market to children on television, albeit showing foods with a healthier profile, as this increases children’s liking for fast food and does not lead to healthier choices being made. Given that levels of pediatric obesity remain critically high, particularly in low SES groups, further efforts should be made to ensure that elements within our current obesogenic environment that do not enhance, and may even hinder, children’s likelihood of making healthy dietary choices are adequately tackled. Food advertising is one such element. Parental responsibility alone cannot be expected to override the power of ubiquitous food industry marketing and children’s hedonic preferences for HFSS foods, and policymakers should strongly consider strengthening regulations to address the issues raised here.

**Acknowledgements**

None

**Financial Support**

This research received no specific grant from any funding agency, commercial or not-for-profit sectors.

**Conflict of Interest**

EJB and MKS – none.

JCGH - Professor Halford’s research is funded through grants by: MRC, EUFW7, BBSRC, ERSC, California Prune Board and Ingredion. The University is paid for consultancy on health, weight management and appetite control expertise by the food and beverage, pharmaceutical, commercial weight management and ingredients sectors. No personal consultancies are taken. The laboratory has studentships funded through BBSRC and ESRC with Unilever, Coca-Cola and Tate and Lyle. Those related to eating behaviour focus on the potential benefits of dietary fibre in appetite and weight control. There has been and is no industry involvement in any of the public health related research the laboratory has conducted over the past 12 years.

**Authorship**

EJB formulated the research question, designed the study, analysed the data, wrote the article and had primary responsibility for the final manuscript.

MKS carried out the study, assisted with data analysis and reviewed the article drafts.

JCGH advised on study design and contributed to the writing of the article.

**References**

1. Hastings G, Stead M, McDermott L, et al. Review of research on the effects of food promotion to children. Centre for Social Marketing, The University of Strathclyde, 2003.

2. Cairns G, Angus K, Hastings G. The extent, nature and effects of food promotion to children: A review of the evidence to December 2008. Prepared for the World Health Organisation. Institute for Social Marketing, University of Stirling & the Open University. Geneva, Switzerland.: WHO Press, 2009.

3. Kunkel D, Wilcox BL, Cantor J, et al. Report of the APA task force on advertising and children. 2004. Retrieved from [www.apa.org/releases/childrenads.pdf](http://www.apa.org/releases/childrenads.pdf) on 17/01/05. 2004.

4. Institute of Medicine. Food Marketing to Children and Youth: Threat or Opportunity? Washington D.C.: The National Academies Press; 2006.

5. Story M, French S. Food advertising and marketing directed at children and adolescents in the US. Int. J. Behav. Nutr. Phys. Act. 2004;1:3-19.

6. Boyland EJ, Harrold JA, Kirkham TC, et al. Food commercials increase preference for energy-dense foods, particularly in children who watch more television. Pediatrics. 2011;128(1):e93-e100.

7. Halford JCG, Boyland EJ, Cooper GD, et al. Children's food preferences: Effects of weight status, food type, branding and television food advertisements (commercials). Int. J. Pediatr. Obes. 2008;3:31-8.

8. Borzekowski DLG, Robinson TN. The 30-second effect: an experiment revealing the impact of television commercials on food preferences of pre-schoolers. J. Am. Diet. Assoc. 2001;101:42-6.

9. Buijzen M, Valkenburg PM. The effects of television advertising on materialism, parent–child conflict and unhappiness: A review of research. J. App. Dev. Psychol. 2003;24:437-56.

10. Halford JCG, Gillespie J, Brown V, et al. Effect of television advertisements for foods on food consumption in children. Appetite 2004;42:221-5.

11. Halford JCG, Boyland EJ, Hughes GM, et al. Beyond-brand effect of television food advertisements on food choice in children: The effects of weight status. Pub. Health Nutr. 2008;11(9):897-904.

12. Epstein LH, Roemmich JN, Robinson JL, et al. A randomized trial of the effects of reducing television viewing and computer use on body mass index in young children. Archiv. Pediatr. Adolescent Med. 2008;162:239-45.

13. Barr-Anderson DJ, Larson NI, Nelson MC, et al. Does television viewing predict dietary intake five years later in high school students and young adults? Int. J. Behav. Nutr. Phys. Act. 2009;6:7.

14. Boyland EJ, Harrold JA, Kirkham TC, et al. The extent of food advertising to children on UK television in 2008. Int. J. Pediatr. Obes. 2011;6(5-6):455-61.

15. Kelly B, Halford JCG, Boyland EJ, et al. Television food advertising to children: a global perspective. Am. J. Pub. Health. 2010;100:1730-6.

16. Grier SA, Mensinger J, Huang SH, et al. Fast-food marketing and children's fast-food consumption: Exploring parents' influence in an ethnically diverse sample. J. Pub. Policy Market. 2007;26(2):221-35.

17. Grossman M, Tekin E, Wada R. Fast-food restaurant advertising on television and its influence on youth body composition. NBER Working paper. 2012; No. 18640.

18. Andreyeva T, Kelly IR, Harris JL. Exposure to food advertising on television: Associations with children's fast food and soft drink consumption and obesity. Econ. Human Biol. 2011;9(3):221-33.

19. Chou SY, Rashad I, Grossman M. Fast-food restaurant advertising on television and its influence on childhood obesity. J. Law Econ. 2008;51:599-618.

20. McClure AC, Tanski SE, Gilbert-Diamond D, et al. Receptivity to television fast-food restaurant marketing and obesity among U.S. youth. Am. J. Prev. Med. 2013;45(5):560-8.

21. McNeal JU. The Kids Market: Myths and Realities. Ithaca, NY.: Paramount Market Publishing. 1999.

22. Sahud HB, Binns HJ, Meadow WL, et al. Marketing fast food: Impact of fast food restaurants in children's hospitals. Pediatrics. 2006;118:2290-7.

23. Bernhardt AM, Wilking C, Adachi-Mejia AM, et al. How television fast food marketing aimed at children compares with adult advertisements. PLoS One. 2013;8(8):e72479.

24. St-Onge M-P, Keller K, Heymsfield S. Changes in childhood food consumption patterns: a cause for concern in light of increasing body weights. Am. J. Clin. Nutr. 2003;78:1068-73.

25. Bauer K, Larson N, Nelson M, et al. Fast food intake among adolescents: secular and longitudinal trends from 1999 to 2004. Prev. Med. 2009;48:284-7.

26. Newman CL, Howlett E, Burton S. Implications of fast food restaurant concentration for preschool-aged childhood obesity. J. Bus. Res. 2014;67:1573-80.

27. Patterson R, Risby A, Chan M-Y. Consumption of takeaway and fast food in a deprived inner London Borough: are they associated with childhood obesity? BMJ Open. 2012;2:e000402.

28. Ofcom. Television advertising of food and drink products to children: Final statement. <http://stakeholders.ofcom.org.uk/consultations/foodads_new/statement>. 2007.

29. Rayner M, Scarborough P, Stockley L. Nutrient profiles. Options for definitions for use in relation to food promotion and children's diets.: UK: Food Standards Agency.; 2004.

30. Galbraith-Emami S, Lobstein T. The impact of initiatives to limit the advertising of food and beverage products to children: A systematic review. Obes. Rev. 2013;14:960-74.

31. Bernhardt AM, Wilking C, Gottlieb M, et al. Children's reaction to depictions of healthy foods in fast-food television advertisements. JAMA Pediatrics. 2014.

32. Arredondo E, Castaneda D, Elder JP, et al. Brand name logo recognition of fast food and healthy food among children. J. Community Health. 2009;34:73-8.

33. Gunnarsdottir I, Thorsdottir I. Should we use popular brands to promote healthy eating among children? Pub. Health Nutr. 2010;13(12):2064-7.

34. Keller KL, Kuilema LG, Lee N, et al. The impact of food branding on children's eating behaviour and obesity. Physiol. Behav. 2012;106:379-86.

35. Batada A, Bruening M, Marchlewicz EH, et al. Poor nutrition on the menu: Children's meals at America's top chain restaurants. Child. Obes. 2012;8(3):251-2.

36. McAlister AR, Cornwell BT. Collectible toys as marketing tools: understanding preschool children's responses to foods paired with premiums. J. Pub. Pol. Market. 2012;31(2):195-205.

37. Kirkpatrick SI, Reedy J, Kahle LL, et al. Fast-food menu offerings vary in dietary quality, but are consistently poor. Pub. Health Nutr. 2013;17(4):924-31.

38. Wellard L, Chapman K, Wolfenden L, et al. Who is responsible for selecting children's fast food meals, and what impact does this have on energy content of the selected meals? Nutr. Diet. 2014.

39. Murphy AS, Youatt JP, Hoerr SL, et al. Kindergarten students' food preferences are not consistent with their knowledge of the Dietary Guidelines. J. Am. Diet. Ass. 1995;95:219-23.

40. Gibson EL, Wardle J, Watts CJ. Fruit and vegetable consumption, nutritional knowledge and beliefs in mothers and children. Appetite. 1998; 31:205-28.

41. Pirouznia M. The influence of nutrition knowledge on eating behavior - the role of grade level. Nutr. Food Sci. 2001;31(2):62-6.

42. Bannon K, Schwartz MB. Impact of nutrition messages on children's food choice: Pilot study. Appetite 2006; 46:124-9.

43. Dixon HG, Scully ML, Wakefield MA, et al. The effects of television advertisements for junk food versus nutritious food on children's food attitudes and preferences. Soc. Sci. Med. 2007;65:1311-23.

44. Beaudoin CE, Fernandez C, Wall JL, et al. Promoting healthy eating and physical activity: Short-term effects of a mass media campaign. Am. J. Prev. Med. 2007;32:217-23.

45. Dovey TM, Taylor L, Stow R, et al. Responsiveness to healthy television (TV) food advertisements/commercials is only evident in children under the age of seven with low food neophobia. Appetite 2011;56:440-6.

46. King M. UK fast food market led by McDonald's with over one-third of value sales in 2012. https://uk.finance.yahoo.com/news/uk-fast-food-market-led-000000574.html2013.

47. Dodds P, Wolfenden L, Chapman K, et al. The effect of energy and traffic light labelling on parent and child fast food selection: a randomised controlled trial. Appetite. 2014;73:23-30.

48. Cole TJ, Bellizi MC, Flegal KM, et al. Establishing a standard definition for child overweight and obesity worldwide: international survey. Br. Med. J. 2000;320:1240-3.

49. Craig R, Mindell J. Health Survey for England. London: The Health and Social Care Information Centre; 2012.

50. Berridge KC. 'Liking' and 'wanting' food rewards: Brain substrates and roles in eating disorders. Physiol. Behav. 2009;97(5):537-50.

51. Dunford E, Webster J, Barzi F, et al. Nutrient content of products served by leading Australian fast food chains. Appetite. 2010;55:484-9.

52. Robinson TN, Borzekowski DLG, Matheson DM, et al. Effects of fast food branding on young children's taste preferences. Archiv. Pediatr. Adolescent Med. 2007;161:792-7.

53. Bruce AS, Bruce JM, Black WR, et al. Branding and a child's brain: an fMRI study of neural responses to logos. Soc. Cog. Affect. Neurosci. 2013.

54. Wansink B, Hanks AS. Calorie reductions and within-meal calorie compensation in children's meal combos. Obesity. 2014;22:630-2.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Condition | Meal bundle contents |  |  |  |  |  |  |  |  |  |
|  | Energy (kJ) | ± sd | Fat (g) | ± sd | CHO (g) | ± sd | Sugars (g) | ± sd | Salt (g) | ± sd |
| Experimental (food ad) | 2292.8 | 495.0 | 20.4 | 5.3 | 72.1 | 17.7 | 28.5 | 11.9 | 1.4 | 0.6 |
| Control | 2262.3 | 443.5 | 20.1 | 5.0 | 71.8 | 15.2 | 28.2 | 11.9 | 1.4 | 0.6 |

Table 1 - Nutritional contents of hypothetical meal selection in each condition (entire sample, *n* = 58)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Experimental |  |  |  | Control |  |  |  |
|  | High NK | ± sd | Low NK | ± sd | High NK | ± sd | Low NK | ± sd |
| Energy (kJ) | 2131.3a | 471.5 | 2438.4 | 477.0 | 2174.8 | 469.0 | 2341.8 | 410.9 |
| Fat (g) | 18.9a | 5.7 | 21.7 | 4.5 | 19.1 | 5.5 | 21.1 | 4.3 |
| CHO (g) | 68.4 | 16.9 | 75.4 | 18.1 | 67.9 | 15.4 | 75.3 | 14.4 |
| Sugars (g) | 29.2 | 11.7 | 27.8 | 12.2 | 27.6 | 13.9 | 28.8 | 10.9 |
| Salt (g) | 1.3 | 0.6 | 1.5 | 0.6 | 1.4 | 0.6 | 1.4 | 0.5 |

Table 2 – Nutritional contents of hypothetical meal selection in each condition by nutritional knowledge groups.

a = significantly different from low nutritional knowledge group in same condition.