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Young children's food brand knowledge. Early development and associations with television viewing and parent's diet

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Abstract

Brand knowledge is a prerequisite of children's requests and choices for branded foods. We explored the development of young children's brand knowledge of foods highly advertised on television – both healthy and less healthy. Participants were 172 children aged 3 to 5 years in diverse socioeconomic settings, from two jurisdictions on the island of Ireland with different regulatory environments. Results indicated that food brand knowledge (i) did not differ across jurisdictions; (ii) increased significantly between 3 and 4 years; and (iii) children had significantly greater knowledge of unhealthy food brands, compared to similarly advertised healthy brands. In addition, (iv) children's *healthy* food brand knowledge was not related to their television viewing, their mother's education, or parent or child eating. However, (v) *unhealthy* brand knowledge was significantly related to all these factors, although only parent eating and children's age were independent predictors. Findings indicate that effects of food marketing for unhealthy foods take place through routes other than television advertising alone, and are present before pre-schoolers develop the concept of healthy eating. Implications are that marketing restrictions of unhealthy foods should extend beyond television advertising; and that family-focused obesity prevention programmes should begin before children are 3 years of age.

Introduction

Food is one of the most highly branded commodities (Story & French, 2004), and systematic reviews have found that food marketing significantly and independently determines children's food preferences, eating and health (Cairns, Angus & Hastings, 2009; Cairns, Angus, Hastings, & Caraher, 2013; IoM, 2005). Family decision-making research demonstrates that children have a strong influence on food and drink purchases when items are for their own consumption, with a particular influence on product type and brands (Boyland & Halford, 2013; Norgaard, Bruns, Christensen & Mikkelsen, 2007; Søndergaard & Edelenbos, 2007).

The World Health Organisation has called for reduced high fat, salt and sugar (HFSS) food marketing to children, and the World Health Assembly has urged implementation by member states (WHA, 2010). As brand preference precedes purchase requests, marketing aims to build young children's knowledge of food brands and desires for them (McNeal, 1999; Story & French, 2004). A large body of research has concluded that television advertising influences eating behaviours (Gibson et al, 2012), creates taste expectancies (Harris, Brownell & Bargh, 2009), and prompts children's food requests (Coon & Tucker, 2002). Television advertising implicitly develops emotional associations with food brands and brand exposure earlier in childhood may create stronger and longer-lasting attachments (Braun-LaTour, LaTour, & Zinkhan, 2010; Nairn & Fine, 2008). Despite growth of digital media, television remains the primary food marketing medium in the UK and Ireland (Boyland & Halford, 2013; Harper, 2010, Landon, 2013) as well as in the US, where television accounted for 35% youth-directed marketing expenditure compared to 7% on new media (FTC, 2012).

The majority of research on food marketing effects on children has focused on school-aged children (Harris et al, 2009). However, some studies indicate that advertising and branding effects develop earlier: preschool children aged 2-6 years preferred food items if they had seen advertisements for them embedded in videotaped programming (Borzekowski & Robinson, 2001); children's mental representations of fast food and soda brands at 3 to 5 years are positively related to their HFSS preferences (Cornwell & McAlister, 2011); and fast food brand knowledge at 4 to 8 years has been linked to higher body mass index (BMI) (Arredondo, Castaneda, Elder, Slyman & Dozier, 2009).

Research exploring factors influencing preschoolers' eating has focused on parenting styles and practices (Schwartz, Scholtens, Lalanne, Weenen & Nicklaus, 2011; Skouteris, 2012). Parents, the major socialisation agents in early childhood, have significant direct and

indirect impact on children's food knowledge and eating. This takes place through food provision; responses to children's requests; restriction and monitoring of eating; use of foods as rewards; and modelling of eating behaviours (Birch, 1999; Gibson et al, 2012; Skouteris, 2012; Slusser et al, 2012).

Both parents and marketing are therefore likely to have an effect on young children's food brand knowledge and preferences. However, understanding the interplay of influences is critical, as early food preferences strongly predict eating through life (Nicklaus, Boggio, Chabanet & Issanchou, 2004; Skouteris, 2012). One recent experiment explored the relative influences of parents and television advertising, finding that a few minutes after preschoolers viewed television advertisements, parental persuasion had little moderating effect on their children's choice of coupons for McDonald's Apple Dippers versus French fries (Ferguson, Muñoz & Medrano, 2012).

However, overall, the interplay of factors influencing early food brand knowledge and preferences is poorly understood (Jansen, Daniels & Nicholson, 2012; Skouteris, 2012).

Measuring young children's brand knowledge

Researching with pre-schoolers can be challenging, as they cannot always verbally communicate their knowledge, and so visual methods are often devised: for example, in brand research, preschool children's visual brand logo recognition is substantially better than their brand name recall, at least in part because recognition develops earlier than recall memory (Siegler & Alibali, 2005; Valkenburg & Buijzen, 2005).

Brand researchers have therefore usually employed visual recognition tasks, asking children to match logos to product images for brands such as cars, sportswear, petrol, washing products, toys, foods and fast food restaurants (Arredondo et al, 2009; Fischer, Schwartz, Richards, Goldstein & Rojas, 1991; Valkenburg & Buijzen, 2005). Valkenburg and Buijzen (2005) studied visual recognition and verbal brand name recall in children from 2 to 8 years of age, for 12 general consumer goods including HFSS foods. They found high visual brand logo recognition at 2-3 years (75% matching), but strikingly lower verbal brand name recall (8% recall); even by 8 years, children only knew the names for 42% logos. This suggests that verbal studies of brand knowledge may achieve floor effects in very young children. However, Valkenburg and Buijzen's study did not focus exclusively on food brands; children may have greater verbal recall of these, as they interact daily with food from an early age.

When exploring children's brand knowledge, studies to date have typically examined HFSS foods. However, in a shifting advertising landscape in the UK and Ireland, healthier

items are also frequently advertised when young children watch television. In 2010, TAM/Nielsen audience research data for the Republic of Ireland indicated that the top 20 food and drink advertisements seen by children aged 4-6 years included not only HFSS sugar-sweetened cereals, crisps and fast food items, but also many healthier items including milk, water, fruit smoothies, low sugar /low salt breakfast cereals, and yoghurt-based dairy products. It is important to understand the effects of marketing healthy food as well as HFSS food (IoM, 2005); for example, in school-aged children, healthy food advertising has been found to affect their preferences (Dixon, Scully, Wakefield, White, & Crawford, 2007). Therefore it is important to identify young children's knowledge of widely advertised healthy foods as well as HFSS ones.

Finally, a limitation of previous studies of young children's brand knowledge is that brands have not been selected systematically (e.g., Arredondo et al, 2009; Fischer et al, 1991; Valkenburg & Buijzen, 2005), with the result that relationships with young children's television viewing patterns are challenging to interpret. Selecting brands from those most advertised on television should ensure any relationships found are more robust.

Aims

In this study we sought to identify the development and determinants of children's early food brand knowledge, for brands highly advertised on television. We had two specific objectives: (i) to identify age-related brand knowledge, for both healthy and less healthy food items (ii) to explore mother's education, family eating and children's television viewing as predictors of children's food brand knowledge.

Method

The study was conducted in the Republic of Ireland and Northern Ireland. Advertising restrictions for HFSS foods have been in force in the UK (including Northern Ireland) since 2007 (Ofcom, 2007). However, no HFSS restrictions were in force in the Republic of Ireland at the time of conducting the study.

The study formed part of a larger project examining aspects of pre-schoolers' food, drink and advertising-related knowledge and practices across the island of Ireland. The preschool quota sampling procedure, sample, and measures completed by parents have been described in detail elsewhere (Tatlow-Golden, Hennessy, Hollywood & Dean, 2013); we therefore summarise them here before describing the development of the brand recognition stimuli.

Participants

Participating children ($n = 172$) were aged 3 to 5 years (see table 1); 48% were boys. They attended 11 preschools and 3 primary schools across the island of Ireland (25% Northern Ireland, 75% Republic of Ireland). Just over half ($n = 94$; 55%) attended preschool/school in disadvantaged communities, ascertained with Northern Ireland local government data and Republic of Ireland Department of Education data.

Table 1 Age ranges, means, standard deviations and percentages by gender, for each age group

	N		Age (months)	<i>M</i>	<i>SD</i>	males		females	
	%	n				%	n	%	n
Full sample	100	172	36 - 71	52.16	8.55	48	82	52	90
3 years	31	54	36 - 47	42.52	3.00	52	28	48	26
4 years	47	81	48 - 59	53.02	3.63	42	34	58	47
5 years	22	37	60 - 71	64.35	3.35	54	20	46	17

Parents gave information about family demographics, eating habits and children's television viewing. Of the 100 parents (58%) who returned completed questionnaires, significantly more did so in advantaged communities (68%) compared to disadvantaged communities (50%); $\chi^2 5.643$, $df = 1$, $p = .018$. We therefore examined the education levels mothers reported in returned parent questionnaires. One-third (32%) had completed secondary (high school) education; nearly a third (29%) had a diploma (post high school qualification, lower than degree level), and just over a third had a university degree (39% bachelor or higher degree), reflecting a spread across socio-economic levels. Finally, t-tests and chi-square analyses identified no significant differences in any of the study's dependent variables, depending on whether parents returned a questionnaire; we therefore believe that the 100 parent-child dyads sufficiently reflect the sample as a whole (for further details, see Tatlow-Golden et al, 2013).

Measures

Healthy eating: Children and parents This healthy eating scale (Tatlow-Golden et al, 2013), was developed from previous research and uses seven questions (scored 1-7) about the number of times per week healthy and less healthy foods are eaten. Two questions ask about fruit and vegetables and five ask about sweets/chocolate; crisps/snacks; sugared cereals; sugared soft drinks; and fast food/takeaways. After reverse coding for less healthy foods, higher scores indicate healthier eating. Parents completed one for themselves and

one for their preschool child (range = 7-49; Child $M = 35.80$, $SD = 6.17$; Parent $M = 37.81$, $SD = 5.94$). The internal reliability of the children's eating scale ($\alpha = .71$) was over the accepted level of .7; the parent eating scale approached this ($\alpha = .68$).

Television exposure To capture children's passive and active television viewing, parents reported on all times when their child watched television *alone, with others, and just being in a room when the TV is on*, for a typical weekday and weekend day. Almost all children (98%; $n = 98$) watched TV; mean daily TV viewing was 2 hours, 9 minutes (0 – 6 hours a day; 0 – 2700 minutes per week; $M = 909.07$ minutes, $SD = 581.38$).

Brand knowledge for healthy and unhealthy foods Verbal recall of brand names indicates a strong level of knowledge; visual logo recognition reflects early knowledge when recall memory is typically less developed (Fischer et al, 1991; Valkenburg & Buijzen, 2005). To achieve a graduated account of food brand knowledge development, we added a measure of intermediate difficulty: naming the product type, e.g. if children responded "cereal" when viewing a Coco Pops® logo or "drink" for a Coca-Cola® logo.

Brand selection To select brands, we applied two criteria: brands should be among those most viewed on television by preschool children, and should be advertised and available in both jurisdictions. To identify the most-advertised food and drink brands, the Broadcasting Authority of Ireland supplied the research team with most recent data for the top 20 food, soft drink, and fast food restaurant brands seen on live TV by 4-6 year old children in the Republic of Ireland (TAM Ireland Ltd/Nielsen Arianna). To ensure brands were widely advertised and marketed in Northern Ireland, we consulted the most recent Mintel UK reports on children's eating and drinking habits; kids' snacking; children's packed lunches; and healthy eating and drinking; and conducted on-the-ground checks in a range of supermarkets in study locations.

UK Nutrient Profiling (NP; Department of Health, 2011) was applied to identify both healthier and less healthy brands. The Food Safety Authority of Ireland considers cheese a valuable source of nutrition for young children and therefore supports its advertising during children's programming (FSAI, 2012), so we coded a cheese brand as healthy.

Brand logos and product images Brand logo images were printed on separate cards and laminated. A board of food/drink product images, each the same size as the brand logo card, was also created. We consulted in several iterations with nutritionists, parents and pre-schoolers in different communities, to ensure that brands were relevant and that the product images, which had been chosen to ensure that logos could not be seen, were still recognisable. On piloting the activity, using 12 logos with children aged 3 and 4 years, their

attention waned at the end, so we reduced the logos from 12 to 9. The final brands selected were: four 'healthy' items: Innocent® (smoothies and juices); Actimel® (yoghurt drink); Frube® (flavoured yoghurt in a tube); and Cheestring® (string cheese) and five 'less healthy' items: Pringles® (crisps/chips); Coco Pops® (chocolate-flavoured sweetened cereal); Cadbury's® (chocolate); McDonalds® (fast food) and Coca-cola® (sweetened carbonated soft drink).

Procedure

The study underwent full ethical review at both participating universities. A letter to parents/guardians outlined the study and the requirement for signed parent consent. We informed children about activities in the study in pictorial information booklets and sought their agreement when collecting data.

Children were interviewed individually in quiet corners of their playrooms or classrooms in their preschools/schools as part of their normal school morning with teachers and other children present in other parts of the room. Interviews were conducted by one of five researchers. All had experience with young children and had received training to ensure consistency in data collection.

As part of the overall project, a ten-minute activity incorporating an ice-breaker story was conducted first. Children were then asked *Would you like to play another game, this one is where we see if you know the names of some things to eat and drink?* Children were shown the laminated brand logo cards one at a time, and were asked: *This has a name - do you know what it's called?* Interviewers explored further with questions such as *What do you think? Have you ever seen this before? Do you know what it is?*, to elicit the greatest possible recall of food/drink brand names and product types. In their training they had been directed to probe gently and not to 'coach' or encourage children to give correct answers. Responses were noted verbatim on an answer sheet and children were thanked, but were not told whether answers were correct.

Finally, interviewers showed children the board of nine food/drink images, and handed children the brand logo cards one at a time, inviting them to match each to an image on the board. As children made each match, we noted it and then put the logo card aside, so nine product images were available for every match. We therefore tested brand knowledge with three tasks which became progressively easier:

- i. *Brand name*: Naming the brand, e.g., "Coco Pops®"
- ii. *Product type*: Naming the product type, e.g., "cereal"

- iii. *Visual recognition*: Matching the brand logo to product image, e.g., the Coco Pops® brand monkey and a picture of a bowl of Coco-Pops®.

Results

Brand knowledge across jurisdictions

Analyses first explored any systematic differences between the Republic of Ireland and Northern Ireland samples, examining (with t-tests and chi-square analyses as appropriate) participants' age; gender; community type; mothers' education levels; home eating habits and television viewing. No significant differences were found. T-tests then compared children across jurisdictions in all three types brand knowledge. There were no significant differences. Data across jurisdictions were therefore combined in subsequent analyses.

Children's knowledge of food and drink brands

For all three types of brand knowledge (total ranges 0-9), and for healthy (range 0-4) and unhealthy (range 0-5) sub-totals, children's mean scores are shown in table 2. To aid comparability across sub-totals, mean scores are also converted to percentages.

Table 2 Means, standard deviations and percentages of correct responses for all three brand knowledge tasks

	Full sample N = 172			3 years n = 54			4 years n = 81			5 years n = 37		
	M	SD	%	M	SD	%	M	SD	%	M	SD	%
All logos (n = 9)												
Brand naming	2.83	1.80	31	2.46	1.90	27	2.89	1.81	32	3.24	1.54	36
Product naming	4.78	2.23	53	3.98	2.06	44	5.04	2.18	56	5.41	2.31	60
Visual recognition (matching)	5.67	2.41	63	4.31	2.26	48	6.01	2.29	67	6.89	2.00	77
Unhealthy logos (n = 5)												
Brand naming	2.21	1.38	44	1.72	1.31	34	2.40	1.48	48	2.51	1.07	50
Product naming	3.40	1.59	68	2.56	1.49	51	3.72	1.53	74	3.92	1.38	78
Visual recognition (matching)	3.82	1.45	76	2.86	1.53	57	4.10	1.27	82	4.62	.79	92
Healthy logos (n = 4)												
Brand naming	.62	.88	16	.74	1.08	19	.49	.71	12	.73	.87	18
Product naming	1.39	1.18	35	1.43	1.21	36	1.32	1.12	33	1.49	1.30	37
Visual recognition (matching)	1.85	1.36	46	1.46	1.14	37	1.91	1.39	48	2.27	1.47	57

Three clear trends were evident in children's food/drink brand knowledge: (1) From 3 to 5 years, children's scores increased on all forms of brand knowledge; (2) Children's scores at all ages reflected the relative cognitive challenge of the tasks: they could *name* nearly a third of brands; *name the product type* of just over half the brands; and *visually*

recognise (*match images of*) nearly two-thirds of brands; and (3) across ages and task types, children recognised substantially fewer healthy items than unhealthy items.

Age differences Three one-way between-group ANOVAs explored age effects. No significant effect was found for *brand naming*, $F(2,169) = 2.18$, $p = .116$, but there was a significant age effect for *product naming*, $F(2,169) = 5.75$, $p = .004$; the effect size (eta squared) was medium, .06 (Cohen, 1988). Post-hoc Tukey HSD comparisons indicated that scores at 3 years ($M = 3.98$, $SD = 2.06$) differed significantly from those at 4 years ($M = 5.04$, $SD = 2.18$), but not between 4 and 5 years ($M = 5.41$, $SD = 2.32$). For *visual recognition (matching)*, there was also a statistically significant age difference, $F(2,169) = 16.76$, $p < .001$, for which the effect size (eta squared) was large, .16 (Cohen, 1988). Post-hoc Tukey HSD comparisons indicated that, again, 3 year olds' scores ($M = 4.31$, $SD = 2.26$) differed significantly from 4 year olds' ($M = 6.01$, $SD = 2.29$), but scores did not differ significantly between 4 and 5 years of age ($M = 6.89$, $SD = 2.00$). Therefore, children's food brand knowledge advanced significantly from 3 to 4 years.

Recognition of healthy and unhealthy brands Across tasks, children's scores were higher for *unhealthy*, compared to *healthy*, food brand logos (see table 2). To explore differences, subtotals were first converted to proportions of 1, dividing healthy subtotals by 4 and unhealthy subtotals by 5. Paired t-tests established that children had significantly higher brand knowledge of unhealthy foods than healthy ones, for name and product recall (brand names, $t(171) = 12.03$; $p < .001$; product types, $t(171) = 11.83$; $p < .001$; and visual recognition $t(171) = 12.12$; $p < .001$).

Relationships between brand knowledge and media use, family eating and SES As children had significantly greater unhealthy brand knowledge, separate tests were conducted to explore relationships of healthy and unhealthy brands with mothers' education, family eating and children's TV watching. For each form of brand knowledge, four correlations were conducted, so a Bonferroni correction was applied, and p values set at .013.

Table 3 TV viewing, family eating and mother's education as related to children's brand knowledge scores for healthy and unhealthy logos

	Healthy food logos (n = 4)		
	Brand name	Product type	Image matching
Child TV minutes (N = 97)	$r = .007$, $p = .474$	$r = -.049$, $p = .317$	$r = .046$, $p = .328$

Child healthy eating (N = 96)	$r = -.014, p = .445$	$r = .003, p = .489$	$r = -.058, p = .289$
Parent healthy eating (N = 96)	$r = -.037, p = .398$	$r = .002, p = .494$	$r = .012, p = .452$
Mother education (N = 97)	$r = .148, p = .074$	$r = .121, p = .118$	$r = -.079, p = .222$
Unhealthy food logos (n = 5)			
	Brand name	Product type	Image matching
Child TV minutes (N = 97)	$r = .255, p = .006^*$	$r = .368, p < .001^{**}$	$r = .298, p = .001^*$
Child healthy eating (N = 96)	$r = -.499, p < .001^{**}$	$r = -.452, p < .001^{**}$	$r = -.289, p = .002^*$
Parent healthy eating (N = 96)	$r = -.543, p < .001^{**}$	$r = -.481, p < .001^{**}$	$r = -.233, p = .011^*$
Mother education (N = 97)	$r = -.309, p = .001^{**}$	$r = -.389, p < .001^{**}$	$r = -.225, p = .013^*$

* = significant at .013; ** = significant at <.001

As can be seen in table 3, no significant relationships were found between these variables and children's *healthy* brand knowledge. However, children's *unhealthy* brand knowledge was significantly positively related to their TV viewing, and negatively related to their healthy eating; parents' healthy eating; and mothers' education. Thus, children with significantly more knowledge of widely advertised *unhealthy* food and drink brand logos watched more television; ate less healthy food; had parents who ate less healthy food; and their mothers had lower levels of education. Children's knowledge of widely advertised *healthy* brands was not related to these social/environmental variables.

Finally, we wished to assess how social/environmental variables and children's age predicted HFSS brand knowledge. As child and parent eating scores were strongly correlated ($r = .76, p < .001$), we selected parent eating for inclusion. We conducted three standard multiple regressions, with brand naming, product naming, and logo/image matching as dependent variables. Independent variables for all three regressions were age, parent healthy eating, child TV viewing and mother's education. For all three, scatterplots revealed no distinct patterns and there were strong linear trends in the normal probability plots of the regression standardised residuals, suggesting no major deviations from

normality. As parent healthy eating, child TV viewing and mother's education were moderately correlated with one another (r s .32 – .41), we checked regression models for tolerances and variance inflation factors (VIFs) for these variables. Tolerances were .77-.84; VIFs were 1.20 for child TV viewing, 1.27 for parent healthy eating and 1.30 for mother's education. As these figures indicate that multicollinearity is not present (Stevens, 2000; Tabachnik & Fidell, 2001), we retained all three variables in the regression analyses.

For *naming the brand* of unhealthy logos, 32% variance was explained by the model (adjusted $R^2 = .32$), $F(4,88) = 12.04$, $p < .001$. Statistically significant unique contributions were made by children's age, $\beta = .22$, $t(87) = 2.51$, $p = .014$ and parent's healthy eating $\beta = -.50$, $t(87) = -5.14$, $p < .001$; part correlations indicated that age contributed 5% variance and parent eating 20%. For *product recall* of unhealthy logos, 35% variance was explained by the model (adjusted $R^2 = .35$), $F(4,88) = 13.48$, $p < .001$. Children's age, $\beta = .28$, $t(87) = 3.21$, $p = .002$ and parent's healthy eating $\beta = -.36$, $t(87) = -3.80$, $p < .001$, made statistically significant unique contributions to the model; part correlations indicated that age contributed 7% variance and parent eating 10%. Finally, for *matching unhealthy food brand logos to product images*, 25% variance was explained by the model (adjusted $R^2 = .25$), $F(4,88) = 8.50$, $p < .001$. Children's age, $\beta = .28$, $t(87) = 3.21$, $p = .002$ made a statistically significant unique contribution to the model; part correlations indicated that it contributed 16% variance.

In sum, regression models that explored age, parent healthy eating, children's TV viewing and mother's education as predictors for three forms of children's unhealthy brand knowledge did not display multicollinearity and were significant in all cases. Young children's brand name and product *recall* of HFSS brands was, in both cases, most strongly independently predicted by less healthy parent eating; children's age made a significant but lesser (positive) contribution. Television viewing and mothers' education did not make unique significant contributions. Children's visual HFSS food brand knowledge was only significantly independently predicted by age.

Discussion

As food brand knowledge is the precursor for food requests and purchases, this study aimed to identify very young children's food brand knowledge and its social and environmental predictors. To our knowledge, this is the first comprehensive account of children's early food/drink brand knowledge development, and also the first with a clear rationale for brand

selection, having chosen from food and drink brands most advertised to children (aged 4 to 6 years) on live television. As previous studies examined general consumer brands and/or HFSS food items, here we focused on food brands, selecting both healthy and unhealthy items. We measured three forms of food brand recognition and recall: naming a brand, naming a product type, and matching a logo to an image of the product.

In line with previous research on early brand knowledge (e.g. Arredondo et al, 2009; Fischer et al, 1991; Valkenburg & Buijzen, 2005), this study found that young children had high levels of food brand *recognition* (image matching) but were less able to *recall* product types or brand names, most likely reflecting a well-established feature of cognitive development, that young children are better at recognition than recall tasks (Siegler & Alibali, 2005). However, it was notable that children's levels of free brand name recall in this study were greater than levels reported by Valkenburg and Buijzen (2005), who reported mean brand name recall of general consumer brands at 2-3 years of 8% (0.95 of 12 logos) and of 16% (1.86 of 12 logos) at 4-5 years. These compare to 31% brand name recall (2.83 of 9 food logos) in children aged 3-5 years in the present study. This suggests the interesting possibility that children's brand name recall for food may develop earlier than for other consumer goods. Researchers have noted that in the domain of food, children develop other cognitive abilities early (Nguyen & Murphy, 2003; Nguyen, 2007), most likely because they are exposed to food consistently from a very early age.

Several further novel results were found. First, the study identified 3 to 4 years of age as the time when food brand knowledge advances significantly. This is before young children's understanding of healthy foods advances (between 4 and 5 years), as we found in a companion study conducted with the same group of pre-schoolers (Tatlow-Golden et al, 2013), indicating that food brand knowledge develops before the concept of healthy eating does.

Second, young children's knowledge of unhealthy food brands was substantially greater than that of healthy brands – e.g., at 5 years, they could recognise nearly all unhealthy, but only just over half the healthy brands. Does this reflect greater television advertising exposure to unhealthy brands? We do not believe so: all brands in the study were among the top 20 food, drink and fast food restaurant brands viewed on television by children aged 4 to 6 years in the Republic of Ireland, and some healthy brands in this study had higher viewing levels (TVRs) than unhealthy brands.

Another possible source of this effect could be the used of more child-directed appeals in HFSS advertising than in healthier food advertising. Previously, research has

reported that HFSS advertising is designed to be attractive to children, employing animation, children, promotional characters; and focusing on fun and magic rather than on information (Boyland & Halford, 2013).

However, studies have generally been conducted in contexts where few healthy foods were advertised on television. A recent analysis of island of Ireland food advertising, broadcast at times when young children view television, designated advertisements as healthy or less healthy using UK Nutrient Profiling (Department of Health, 2011) and assessed advertising appeals employed in both categories (Tatlow-Golden et al, in press).

That study found few significant differences between appeals employed in healthy and less healthy food advertising. There was no difference in frequency of using brand logos in the advertisements. Nor did healthy/unhealthy advertisements differ in featuring adults, children, real or animated characters. *Less healthy* advertisements were significantly more likely to refer to the taste or aroma of the product; to employ humour, and to make reference to the item's novelty. Advertisements for *healthy foods* were significantly more likely to state or sing the brand name; to feature animals or promotional characters; and to refer to fun and play; magic and imagination; and physical activity (Tatlow-Golden et al, in press).

There are some challenges in interpreting these findings, as UK Nutrient profiling classifies substantially more foods as 'healthy' than other profiling systems (Scarborough et al, 2013). However, they are in line with Hebden, King and Kelly's (2011) analysis of Australian television food advertising on television, which suggested greater use in healthier advertisements of child actors, promotional characters and celebrities; and equal or near-equal use of fun/happiness and fantasy/imagination appeals, among many other techniques; Hebden et al concluded that advertisers' techniques did not discriminate by the type of food advertised. Such findings suggest that differences in children's recognition of less healthy food brands may not lie in the use of more attractive television advertising techniques.

These findings raise the possibility that television advertising alone does not drive children's food brand knowledge. Researchers have noted that other key marketing strategies are researched less than television advertising, and are not addressed by advertising restrictions, including food packaging; equity brand characters; child-directed colors, flavors and shapes; point of sale marketing, premiums and give-aways; program sponsorship; and digital media (Boyland & Halford, 2013; Landon, 2013).

A third novel finding was that children's food brand knowledge did not differ between the two jurisdictions in this study – even though statutory regulations limited HFSS

television advertising around children's programming in Northern Ireland, but not in the Republic. Reasons for this lack of an effect cannot be established by this study. It is possible to speculate that it may be because HFSS advertising restrictions do not target children's actual television viewing. As is increasingly noted by researchers in multiple jurisdictions (Boyland, Harrold, Kirkham & Halford, 2011; Harris, Sarda, Schwartz & Brownell, 2013), and as we also found from audience panel research used for this study, children view considerable amounts of television at times other than when children's programming is broadcast. Another possible cause for failing to find a difference between jurisdictions with different advertising regulations is that brand effects may take place, at least in part, through marketing routes other than television advertising.

A final novel finding from the study is that children's age, television viewing, parent's healthy eating, and mother's education were all significantly related to children's unhealthy brand knowledge, but the only unique independent predictors were children's age and parent eating. This suggests that, (a) children's cognitive level is, as one would anticipate, a factor in their brand knowledge; and (b) parent eating may be a stronger influence on children's unhealthy brand knowledge than children's television exposure.

A caveat regarding this finding is our use in this study of parent estimates of children's television viewing, which are not as reliable as, for example, diary data or audience panel data, so future research should explore its replicability with an independent measure. However, previous research suggests possible reasons for this finding. According to advertisers, parents' liking of a brand influences children's brand preference (McNeal, 1999; Story & French, 2004), and research on food choice finds that parent preference partially determines food availability (Søndergaard & Edelenbos, 2007). Harris et al (2009) propose that parent food choices for children are influenced by food marketing, because marketing leads them to form normative beliefs about taste, on which their decisions about how to feed children may be based.

Taken together, these findings have implications for policy and intervention design, which we address below, after considering strengths and limitations of the study.

Strengths and limitations This study considered the relative influence of several aspects of children's environments, but not all potential influences were included. Peers, older siblings, preschool/school and non-television forms of marketing may all affect children's food knowledge and preferences. Another limitation was that only nine brand logos were used, and for analytical purposes we would have preferred to have had more. However, we believe the limited logo set also reflects a strength of the study design, as

studies with very young children must attend to their attention span. During piloting, we found that having fewer logos ensured that children remained engaged, increasing the validity of the task as a measure of children's knowledge.

A further strength of the design was the consultation in several iterations with professionals, parents and children in different communities, to ensure that brands were relevant and recognisable. Particular strengths of the study, we believe, were the inclusion of healthy, as well as unhealthy, food brands; the fact that all brands had similar television viewing levels in the target population in the Republic of Ireland; and the fact that we sampled from two jurisdictions with different HFSS advertising regulations.

Implications In this study, we found that unhealthy brand knowledge (a precursor of food requests and purchase) was significantly positively related to children's television viewing, but was predicted more by parent unhealthy eating practices. In addition, children's knowledge of widely advertised unhealthy brands was greater than of similarly advertised healthy brands. Furthermore, this knowledge did not differ between two jurisdictions with different HFSS regulations regarding HFSS advertising around children's television programming.

These findings point to the likelihood that food branding effects in children, which subsequently influence purchase requests, purchasing and consumption, are not created by television advertising alone but rather by complex inter-relationships of multiple marketing, social and individual factors. For example, the failure to find a relationship between *healthy* brand knowledge and family eating patterns, despite finding such a link with *unhealthy* brand knowledge, requires further investigation.

The findings of this study support those who argue that, to promote healthy eating and achieve reductions in obesity, focusing on television advertising alone is not sufficient (Boyland & Halford, 2013; Lanford, 2013) and wider definitions of marketing is required, to protect children from marketing effects for unhealthy foods and to promote healthy eating as a cultural norm (Landon, 2013). In addition, the findings indicate that family-based healthy eating interventions should be designed. These should be aimed at children from 3 years of age at the latest, to reach children before brand effects increase – and they should address not only children, but parents as well.

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