

## Obesity Etiology/Pediatric Obesity

# Influence of food companies' brand mascots and entertainment companies' cartoon media characters on children's diet and health: a systematic review and research needs

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### Summary

Reducing the extent and persuasive power of marketing unhealthy foods to children worldwide are important obesity prevention goals. Research is limited to understand how brand mascots and cartoon media characters influence children's diet. We conducted a systematic review of five electronic databases (2000–2014) to identify experimental studies that measured how food companies' mascots and entertainment companies' media characters influence up to 12 diet-related cognitive, behavioural and health outcomes for children under 12 years. Eleven studies met the inclusion criteria. Studies used 21 unique popular media characters, but no brand mascots. Results suggest that cartoon media character branding can positively increase children's fruit or vegetable intake compared with no character branding. However, familiar media character branding is a more powerful influence on children's food preferences, choices and intake, especially for energy-dense and nutrient-poor foods (e.g. cookies, candy or chocolate) compared with fruits or vegetables. Future research should use a theoretically grounded conceptual model and larger and more diverse samples across settings to produce stronger findings for mediating and moderating factors. Future research can be used to inform the deliberations of policymakers, practitioners and advocates regarding how media character marketing should be used to support healthy food environments for children.

**Keywords:** Brand mascots, children, diet, food marketing, media characters.

**Abbreviations:** ANOVA, analysis of variance; BMI, body mass index; CINAHL, Cumulative Index to Nursing and Allied Health Literature; IOM, Institute of Medicine; RTE, ready-to-eat; US/USA, United States of America; WHO, World Health Organization; WHTF, White House Task Force.

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### Introduction

In 2013, 2.1 billion people worldwide were overweight or obese (1). One in five children and adolescents aged 5–17 years in several high- and middle-income countries were overweight or obese (2). The World Health Organization

(WHO) estimated that more than 40 million children under the age of 5 years were overweight or obese in 2012, which may reach 70 million by 2025 with current trends (3). Nearly one-third (31.8%) of American children and adolescents aged 2–19 years are overweight (14.9%) or obese (16.9%) in the United States (4).

Two important obesity prevention goals are to (i) reduce the *extent* of children's exposure to all forms of marketing of unhealthy foods and beverages and (ii) reduce the *persuasive power* of these promotions worldwide (5). Numerous systematic evidence reviews have documented that food marketing practices strongly influence children's food preferences and purchase requests (6–11). A rigorous review conducted by an expert committee of the US Institute of Medicine (IOM) of the National Academies concluded that food marketing also influences children's eating behaviours, contributes to an energy-dense and nutrient-poor diet, increases their risk of unhealthy weight gain, and may contribute to negative diet-related health outcomes (8).

The IOM committee concluded that '*even a small influence, aggregated over the entire population of American children and youth, would be consequential in impact*' (pp. 9 and 13; (8)).

Children are especially vulnerable to current food environments because they have a biological preference for salty and sweet foods (12). Children's recognition of food brand logos increases with age (13), and overweight children are more likely to recognize fast food restaurant logos compared with other food logos (14). Children who recall details about their exposure to fast food and soda brands have greater preferences for salt, sugar and fat (15); and their knowledge of fast food and sugar-sweetened beverage brands is a predictor of body mass index (BMI) (16).

The IOM (2006) (8) and US White House Task Force (WHTF) to Prevent Childhood Obesity (2010) (17) recommended that licensed cartoon characters should be used only to promote healthy foods to children. Collective insights are lacking from experimental studies with children that have examined the persuasive power of food companies' brand-equity mascots (e.g. Kellogg's *Tony the Tiger* and General Mills Inc.'s *Buzz Bee*) and entertainment companies' cartoon media characters (e.g. Nickelodeon's *SpongeBob SquarePants*, DreamWorks Animation's *Shrek*, Walt Disney's *Nemo* and Warner Brothers Entertainments' *Scooby Doo*) to influence children's diet and health.

Some have advocated that media characters should not be used to market to children who are cognitively immature and vulnerable to target marketing because of their limited ability to differentiate between facts and persuasive marketing communications (18). Nevertheless, many popular cartoon brand mascots and media characters are used to promote products high in added sugars, salt and fat, which contribute to unhealthy weight gain and poor diet quality for children. It is unclear whether the IOM and WHTF recommendations are politically feasible, economically viable and socially acceptable. Addressing this research gap could inform effective obesity prevention policies, programmes and advocacy efforts worldwide.

## Purpose

This paper had four purposes that include: (i) provide an overview of the global policy context of food marketing to children; (ii) describe how brand mascots and licensed media characters are used to market food products to children; (iii) examine the persuasive power of character marketing through a systematic review of experimental studies that evaluated the influence of cartoon brand mascots or media characters on children's diet-related cognitive, behavioural and health outcomes; and (iv) identify future research needs to inform the deliberations of policymakers, practitioners, researchers and advocates regarding how mascots and media characters should be used to support healthy food environments for children.

A companion paper (19) examines trends in American children's exposure to mascots and licensed media characters in the United States from 2000 to 2014, identifies accountability gaps, and suggests how stakeholders can use mascots and licensed characters to encourage healthy dietary choices. Therefore, an in-depth analysis of policies and actions to address industry's use of mascots and media characters are beyond the scope of this paper.

## Global policy context of food marketing to children

Major transnational food, beverage and quick-serve chain restaurant companies that use brand mascots and licensed media characters to market food products to children operate in many countries worldwide. The Hershey Company and Mars, Inc. operate in 50 to 56 countries; Nestlé S.A. operates in over 80 countries; General Mills and McDonald's Corporation operate in over 100 countries; Kraft Foods in over 160 countries; and PepsiCo and The Coca-Cola Company conduct businesses in over 200 countries worldwide (20). Media and entertainment companies operate many business segments including cable and satellite television, magazines, music, videogames, and Internet advertising (21). The Walt Disney Company operates in over 40 countries (22), Sesame Workshop in 150 countries (23) and Nickelodeon conducts businesses in over 160 countries worldwide (24).

The type of cartoon mascots and licensed media characters used in food promotions varies across countries and global regions. Descriptive research on popular food-product characters used in Australia (25,26); Brazil, India and Russia (27); Guatemala (28); European Union (11); New Zealand (29); Taiwan (30); and the United Kingdom (31,32) and the United States (33–37). have documented the extensive use of culturally tailored mascots and cartoon media characters licensed by major food, beverage and restaurant companies to market primarily energy-dense and nutrient-poor food products to children in various settings.

In May 2010, the World Health Assembly adopted a landmark resolution to restrict the advertising and marketing of unhealthy foods and non-alcoholic beverages to children globally (38). In December 2010, the WHO released recommendations for Member States to reduce unhealthy food marketing to children for products high in saturated fats, *trans* fats, added sugars and salt (5). An in-depth evaluation framework was developed for governments to implement these recommendations (39). The reduction of unhealthy food and non-alcoholic beverage marketing is also one of 25 core indicators in the WHO's 2013 Action Plan and Global Monitoring Framework to Prevent and Control Non-Communicable Diseases (40). The WHO recommended that national governments restrict the promotion of unhealthy foods to children including brand-equity mascots, licensed characters and celebrities; sales promotions; and premiums used across diverse media platforms and settings (39).

### Policy relevance of mascot and character marketing to promote foods to children

The use of brand mascots and licensed characters is policy relevant for many reasons. First, companies and marketers use them to build an emotional relationship with children and cultivate brand loyalty for products that persists into adulthood (41–44). Second, children worldwide are targeted by companies that use mascots and media characters to promote branded food products to maximize sales and market share (45) even though many of these products are high in added sugars, salt and fat that contribute a poor diet quality and unhealthy weight gain (19).

In 2009, \$1.8 US billion dollars was spent by 48 companies on child- and adolescent-targeted US food marketing. Half of all child-marketing dollars (\$530.7 million) involved cross-promotions including: media character merchandising and tie-ins with movies, television programmes, videogames and social media (46). Nickelodeon's *Dora the Explorer* has generated nearly \$11 billion US dollars in worldwide sales since 2002 through character merchandising (47). Finally, this is an evolving policy issue with some positive steps taken by certain US companies (19), but may not apply to other countries.

### How brand mascots and media characters are used to market to children

*Brand mascots* (also called advertising ambassadors, brand icons, brand-equity or trade characters and non-celebrity spokes-characters) and *cartoon media characters* (also called celebrity spokes-characters) represent a broad range of human or fictional anthropomorphic beings or animated objects (43,44,48–51). Brand mascots are used to promote a product, service or idea, and cartoon media characters are





















used to entertain (51). Mascots and media characters are the intellectual property of companies and used in commercial licensing, franchising and merchandising activities to build the antecedents for customer brand loyalty (e.g. brand awareness, trust, association and preference) to purchase products (42–44,48–51).

Brand mascots are used by food and restaurant companies to create a product identity, promote brand personality and continuity across integrated marketing communications (51). Companies that use mascots retain 100% of the revenues generated in retail transactions, and mascots can be used for decades in promotions. In contrast, cartoon media characters (47,52) owned by entertainment companies are licensed through contractual agreements that allow characters to be used in cross-promotions (e.g. television programmes and movie tie-ins such as *SpongeBob SquarePants* cereal) and merchandising opportunities (e.g. displays and premiums such as toy replicas of media characters, prizes or giveaways) (46,47). Entertainment companies receive royalties from other companies in exchange for using one or more characters in advertising campaigns that may last for several days or years.

The 1950s Baby Boom era brought television to households and food companies marketed their products directly to children through mascots and characters to differentiate their company's products from the competition (52–54). Mascots and characters are deeply embedded in American culture where many of them were created (49–55). Marketers can control the messaging for fictional mascots and characters more effectively than human celebrities to maintain or defend a positive brand reputation to promote product sales and brand equity (43,49,56). Companies have visually transformed mascots over decades to appear healthier and physically fit as social norms change, to stay competitive against other brands in similar product categories, and to adapt them to international markets (49,57).

Figure 1 provides examples of more than 40 brand mascots used by 15 food and restaurant companies (58–72) that participate in the US Children's Food and Beverage Advertising Initiative (CFBAI) (73). The figure is based on an extensive search of published articles, industry trade literature, books (53–55) and companies' websites. The figure does not include mascots owned by companies that do not voluntarily participate in the CFBAI, such as Chuck E. Cheese's *Mr. Cheese Mouse* (33). Figure 2 provides examples of more than 55 cartoon media characters that are owned and licensed by five major entertainment and media companies (74–78) to promote food products to children. The figure is based on characters identified through several resources (33,46) supplemented by an extensive search of companies' websites.

A trademark is a 'word, phrase, symbol or design, or a combination of these elements, that identifies and distinguishes the source of one party's goods from those of

Beverages & Dairy	Candy	Children's Meals	Ready-to-Eat, Instant and Hot Cereals	Snack Foods		
 <p><b>Polar Bears</b> Coca Cola The Coca-Cola Company (1920s)</p>  <p><b>Punchy</b> Hawaiian Punch The Coca-Cola Company (1970s)</p>  <p><b>Bongo the Monkey</b> Dannals The Dannon Company (2000s)</p>  <p><b>Dino Danonino</b> The Dannon Company (2000s)</p>  <p><b>Safari Animals</b> Yoplait Go-Gurt General Mills, Inc. (2000s)</p>  <p><b>Kool-Aid Man</b> Kool-Aid Kraft Foods Group, Inc. (1950s)</p>  <p><b>Nesquik Bunny</b> Nesquik Nestlé USA (1940s)</p>	 <p><b>Kinder Pilot</b> Ferrero U.S.A., Inc. (2013)</p>  <p><b>Hershey Kiss</b> The Hershey Company. (Unknown)</p>  <p><b>M&amp;M characters</b> M&amp;M's Mars, Incorporated (1940s–2000s)</p>	 <p><b>Campbell's Soup Kids</b> Campbell Soup Company (1900s)</p>  <p><b>K.C. Penguin</b> Kid Cuisine ConAgra Foods, Inc. (2000s)</p>  <p><b>Ronald McDonald</b> Happy Meal McDonald's USA, LLC (1960s)</p>  <p><b>Farris and the Goat</b> Happy Meal McDonald's USA, LLC (2012)</p>  <p><b>Happy Meal</b> McDonald's USA, LLC (2014)</p>  <p><b>Cheesassaurus Rex</b> Macaroni &amp; Cheese Kraft Foods Group, Inc. (2000s)</p>	 <p><b>Trix Rabbit</b> Trix General Mills, Inc. (1960s)</p>  <p><b>Sunny the Cuckoo Bird</b> Cocoa Puffs General Mills, Inc. (1960s)</p>  <p><b>Lucky the Leprechaun</b> Lucky Charms General Mills, Inc. (1960s)</p>  <p><b>Buzz Bee</b> Honey Nut Cheerios General Mills, Inc. (1970s)</p>  <p><b>Chef Wendell</b> Cinnamon Toast Crunch General Mills, Inc. (1990s)</p>  <p><b>Chip the Wolf</b> Cookie Crisp General Mills, Inc. (2005)</p>	 <p><b>Snap, Crackle and Pop</b> Rice Krispies Kellogg Company (1930s–1940s)</p>  <p><b>Tony the Tiger</b> Frosted Flakes Kellogg Company (1950s)</p>  <p><b>Toucan Sam</b> Froot Loops Kellogg Company (1960s)</p>  <p><b>Cinnamon &amp; Bad Apple</b> Apple Jacks Kellogg Company (2004)</p>  <p><b>Boo Berry Ghost, Count Chocula Vampire, Franken Berry Frankenstein</b> General Mills, Inc. (1970s)</p>	 <p><b>Cornelius (Corny) Rooster</b> Kellogg Company (1950s)</p>  <p><b>Sunny Raisin Bran</b> Kellogg Company (1960s)</p>  <p><b>Dig Em' Frog</b> Honey Smacks Kellogg Company (1970s)</p>  <p><b>Quaker Oats Man</b> PepsiCo, Inc. (1870s)</p>  <p><b>Cap'n Crunch</b> PepsiCo, Inc. (1960s)</p>  <p><b>Sugar Bear</b> Golden Crisp Post Foods, LLC (1980s)</p>  <p><b>Crazy Craving Craver</b> Honeycomb Post Foods, LLC (1990s)</p>	 <p><b>Ernie Keebler and the Keebler Elves</b> Kellogg Company (1960s)</p>  <p><b>Pillsbury Doughboy</b> Pop 'n Fresh General Mills, Inc. (1960s)</p>  <p><b>Teddy Bear</b> Teddy Grahams Mondeléz Global, LLC (1960s)</p>  <p><b>Chester Cheetah</b> Cheetos PepsiCo, Inc. (1950s)</p>  <p><b>Fino the Goldfish</b> Pepperidge Farm crackers Campbell Soup Company (1990s)</p>  <p><b>Pop-Tarts</b> Kraft Foods Group, Inc. (2000s)</p>  <p><b>Cookie Guy</b> Chips Ahoy! Kraft Foods Group, Inc. (2000s)</p>

**Figure 1** Examples of brand mascots used by companies participating in the US Children's Food and Beverage Advertising Initiative to promote food products to American children by specific food categories of nutritional concern. As of October 2014, the 17 CFBAI members are: Campbell Soup Company, ConAgra Foods, Inc., The Dannon Co., Inc., Ferrero USA, Inc., General Mills, Inc., The Hershey Company, Kellogg Company, Kraft Foods Group, Inc., Mars, Inc., Mondeléz Global LLC, Nestlé USA, PepsiCo, Inc., Post Foods, LLC, The Coca-Cola Co., Unilever United States, Burger King Corp. and McDonald's USA. Italicize texts are brand mascot names. Texts in purple are brands that the mascots represent. Texts in red are the companies that own the copyright and/or trademark for the mascot. Number in parentheses is the decade or the year that the mascot was created. The trademarked images used in this figure are intended for educational purposes only. Their use is allowed for non-commercial purposes through the US 'nominative fair use' doctrine that protects free speech over trademark infringement. Sources: references (49,53–55,58–72).

another' used in the commercial marketplace (79). The trademarked images used in Figs 1 and 2 are reproduced for educational purposes only. The US 'nominative fair use' doctrine allows their use for non-commercial purposes, which protects an individual's free speech over trademark infringement (80).

### Children's relationships with mascots and characters

Children learn about mascots and characters through social, media and marketing environments including their parents, television, movies, the Internet and food packaging (81). Children develop 'parasocial relationships' with favourite characters, representing emotionally infused friendships based on characters' attractiveness and the messages they convey (82) that can influence their diet-related outcomes. Mascots and characters are associated with

memorable slogans, jingles, taglines, musical themes and stories (49,50,83,84); and market nostalgia through trans-generational, parent-child interactions that generate fun, humour, emotional appeals and positive feelings towards company brands and products (49,51,52,83).

Figure 3 provides a conceptual model grounded in socioecological and socio-cognitive theories adapted from a causal model developed by the IOM Food Marketing Committee (8) and a parasocial interactions model developed by child development and psychology researchers (82).

The figure shows that companies use cartoon mascots and media characters through merchandizing, franchising and licensing strategies to market food products and messages to children to influence their diet-related outcomes. Figure 3 only describes mediating factors that may promote or reinforce parasocial interactions and relationships and moderating factors (e.g. age, gender, race and ethnicity) that may influence children's diet-related outcomes.

DreamWorks Animation, SKG	Sesame Workshop	Viacom International	Walt Disney Company	Warner Brothers Entertainment, Inc.
<p><b>Kung Fu Panda</b> (2000s) was licensed to <b>McDonald's Corp.</b> to promote Happy Meals</p> <p><b>MADAGASCAR</b></p> <p><b>Madagascar characters</b> (2000s) were licensed to <b>McDonald's Corp.</b> to promote Happy Meals</p> <p><b>Shrek</b> (2000s) was licensed to <b>McDonald's Corp.</b> to promote Happy Meals</p> <p><b>How to Train Your Dragon characters</b> (2000s) was licensed to <b>General Mills, Inc.</b> to promote YoPlait Go-Gurt yogurt</p>	<p><b>Cookie Monster, Grover and Elmo</b> (1960s) were licensed to <b>Post Foods, LLC</b> to promote Alpha Bits cereal</p> <p><b>Super WHY! characters</b> (2000s) were licensed to <b>Post Foods, LLC</b> to promote Alpha Bits cereal</p>	<p><b>Teenage Mutant Ninja Turtles</b> (1980s) were licensed to <b>General Mills, Inc.</b> to promote assorted fruit-flavored snacks</p> <p><b>SpongeBob SquarePants</b> (1990s) licensed to many companies such as <b>Kraft Foods</b> to promote Mac and Cheese, <b>General Mills, Inc.</b> to promote assorted fruit-flavored snacks and YoPlait Go-Gurt yogurt, and the <b>Kellogg Company</b> to promote Cheez-it Crackers and Pop-tarts</p> <p><b>Dora the Explorer</b> (2000s) was licensed to <b>General Mills, Inc.</b> to promote cereals and YoPlait Go-Gurt yogurt</p> <p><b>Jimmy Neutron</b> (2000s) was licensed to <b>Kraft Foods</b> to promote assorted fruit-flavored snacks and the <b>Kellogg Company</b> to promote cereals</p>	<p><b>Mickey and Minnie Mouse</b> (1980s) were licensed to <b>General Mills, Inc.</b> to promote YoPlait yogurt</p> <p><b>Spider Man</b> (1960s) was licensed to the <b>Kellogg Company</b> to promote cereals and <b>General Mills, Inc.</b> to promote assorted fruit-flavored snacks</p> <p><b>Marvel Superhero characters</b> (1960s) were licensed to <b>Unilever U.S.</b> to promote popsicle treats</p> <p><b>Chocolate Cheerios</b></p> <p><b>Miss Piggy</b> (1960s) was licensed to <b>General Mills, Inc.</b> to promote Chocolate Cheerios cereal</p> <p><b>Kermit the Frog</b> (1960s) was licensed to <b>General Mills, Inc.</b> to promote Apple Cinnamon Cheerios cereal</p> <p><b>Disney Princesses</b> (1960s to present) licensed to the <b>Kellogg Company</b> to promote cereals and assorted fruit-flavored snacks</p> <p><b>Masters characters</b> (2000s) were licensed to the <b>Kellogg Company</b> to promote assorted fruit-flavored snacks</p> <p><b>Finding Nemo characters</b> (2000s) were licensed to the <b>Kellogg Company</b> to promote assorted fruit-flavored snacks and <b>McDonald's Corp.</b> to promote Happy Meals</p>	<p><b>Popeye the Sailor Man</b> (1920s) was used not only to promote spinach but also was licensed to <b>Pez Candy, Inc.</b> to promote candy and <b>Popeye's restaurant</b> to promote fast foods</p> <p><b>Bugs Bunny</b> (1930s) was licensed to <b>Kraft Foods</b> to promote Mac and Cheese and Kool-Aid, and with other Looney Tunes characters was licensed to the <b>Kellogg Company</b> and <b>General Mills, Inc.</b> to promote assorted fruit-flavored snacks and <b>Pez Candy, Inc.</b> to promote candy</p> <p><b>Flintstones</b> (1960s) were licensed to <b>Post Foods, LLC</b> to promote Fruity and Cocoa Pebbles cereals</p> <p><b>Scooby-Doo</b> (1960s) was licensed to <b>General Mills, Inc.</b> to promote cereals and assorted fruit-flavored snacks</p> <p><b>Batman, Superman and other superheroes</b> (1980s) were licensed to <b>General Mills, Inc.</b> to promote cereals</p> <p><b>Cartoon Network characters</b> (2000s) were licensed to the <b>Kellogg Company</b> to promote snack foods such as Pop-Tarts</p>

**Figure 2** Examples of entertainment companies' popular media characters that have been licensed to food and restaurant companies to promote food products to American children. Related business may include television; animated motion pictures, movies, and films; videos and DVDs; books and comics; radio; music; interactive digital media including advergaming and online virtual worlds; theme parks and resorts; and merchandizing, franchising, and licensing. Texts in purple italics are media character names. Texts in roman purple are the parent companies that own the copyright and/or trademark for the character. Texts in green are the companies or networks. Texts in red are the food or restaurant companies that have licensed the media character to promote food products to children. Number in parentheses is the decade or the year that the mascot was created. The trademarked images used in this figure are intended for educational purposes only. Their use is allowed for non-commercial purposes through the US 'nominative fair use' doctrine that protects free speech over trademark infringement. Sources: references (74–78).

However, it does not describe the specific mechanisms by which the mascots and characters influence children.

Figure 3 offers a continuum of outcomes, including cognitive outcomes (e.g. character and brand recognition; character trust; character, food brand or marketing message recall; and character, taste or snack preference); behavioural outcomes (e.g. purchase request, food choice and food intake); and health outcomes (e.g. BMI). The model excludes business-related outcomes, such as media impressions and food product sales, which are beyond the scope of this paper.

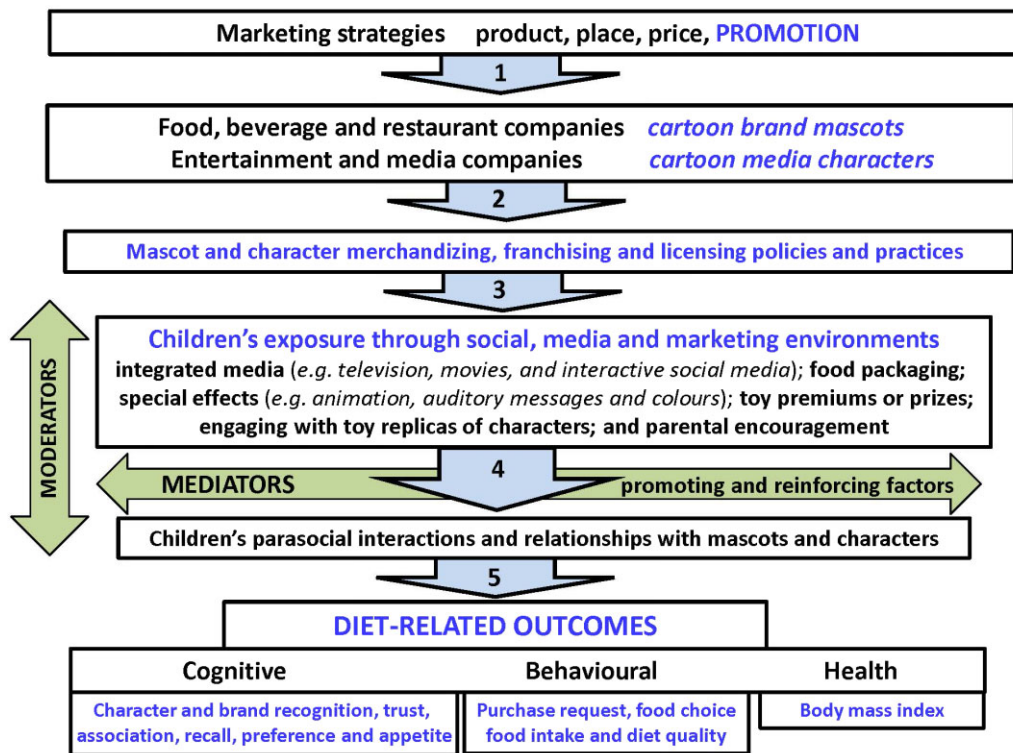
**Methods**

The research question that guided this systematic review was 'What do experimental studies show about the influence of cartoon brand mascots and media characters on

children's diet-related cognitive, behavioural and health outcomes?' We developed a protocol to guide the search strategy described below.

**Search strategy**

The causal model described in Figure 3 was used to guide the search strategy and analysis. To identify search terms, we reviewed resources from the business and marketing, child development and communication literature published during the 1990s (51,52,84,85) and the non-experimental and industry trade literature published after 2000. A third independent researcher conducted the search using subject headings and text terms (i.e. brand mascot or cartoon spokes-character or character or licensed or anthropomorphic and advertising or marketing and child and food



**Figure 3** Conceptual model of the influence of cartoon brand mascots and media characters on children's diet and health. Sources: references (8,82).

or beverage or cereal or restaurant or food retail or nutrition).

Five English databases (i.e. Academic Search Premier, Business Source Premier, CINAHL, Health Source and Medline via PubMed) were searched between 1 January 2000 and 31 May 2014 to examine trends in American children's exposure to mascots and licensed characters within the context of the evolving US regulatory, food marketing and children's digital media landscapes during this time frame. The search was supplemented by a review of the bibliographies of both the experimental and non-experimental studies collected.

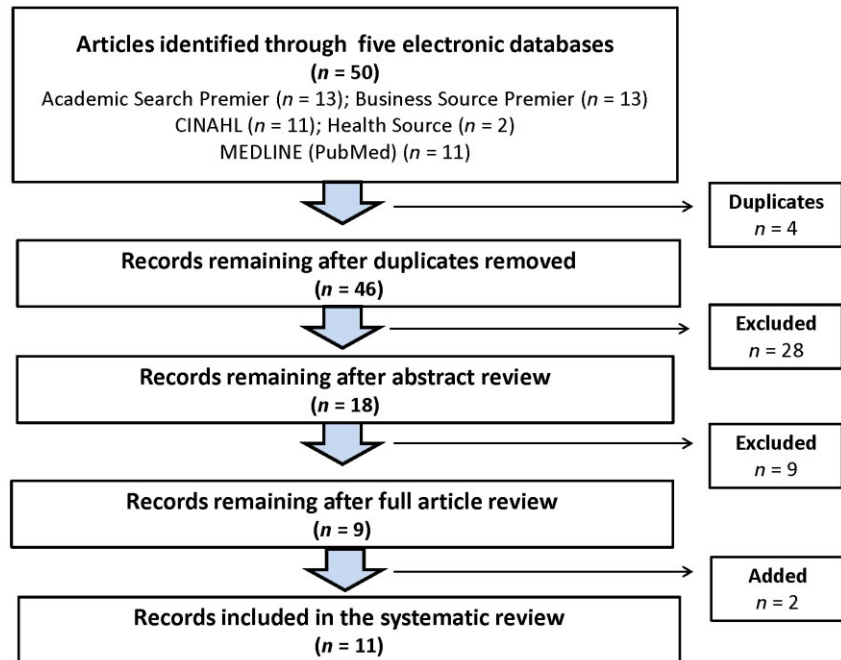
### Inclusion and exclusion criteria

The *a priori* inclusion search criteria included: (i) any experimental study involving children ages 2 through 12 years; (ii) use of one or more visual cartoon mascots and/or licensed characters; (iii) measurement of one or more diet-related cognitive, behavioural or health outcomes and (iv) English-language paper published between January 2000 and May 2014. Exclusion criteria were: (i) experimental studies involving adults and adolescents; (ii) experimental studies that examined children's response to food packaging, but measured other types of exposures (e.g. nutrient-content

claims, sports celebrity endorsement or premiums) and did not measure outcomes of interest related to mascot and/or media character exposure; (iii) non-experimental descriptive studies that assessed the nature, prevalence or frequency of mascot or character use on television, the Internet or in food-retail settings and (iv) studies that used mascots or characters to promote non-food products (i.e. tobacco, alcohol and medications) or athletic events.

### Study selection

The co-investigators independently reviewed the abstracts and full papers for the final selection. As shown in Fig. 4, 50 studies were initially identified, but were reduced to 46 studies after removing duplicates. After reviewing the abstracts, 28 records were excluded leaving 18 records. An additional nine records were excluded after reading the full papers because they were descriptive or did not report relevant outcomes. The reference lists of the remaining nine papers were reviewed for any records that met the inclusion criteria. Two additional papers that met the inclusion criteria were identified and included in the final systematic review ( $n = 11$ ). The co-investigator independently reviewed the papers and reached consensus with the lead investigator on the records retained. We independently



**Figure 4** Process used for the systematic review to identify experimental studies that examined the influence of brand mascots and cartoon media characters on the diet-related outcomes of children <12 years.

reviewed the evidence to reach consensus on their contents. The analysis was conducted between 1 June and 15 July 2014.

## Results

Eleven experimental studies were identified that were published between 2004 and 2014. Table 1 provides an overview of the 11 studies and lists the primary author, year the study was conducted and published, age range, sample size and sex, race or ethnicity, and diet-related outcomes measured. Table 2 describes the study design, characters used and results. Table 3 lists four quality assessment criteria used to evaluate the studies including: (i) use of a theoretically grounded, conceptual framework to guide the research; (ii) number and type of outcomes measured; (iii) causal inference validity (e.g. strength of the evidence to support an associative or causal inference between media character exposure and outcomes measured) and (iv) ecological validity (e.g. degree to which the study results can be generalized to daily life).

The research was conducted in five countries: the United States, Netherlands, Belgium, Guatemala and Turkey. The age range of children was 2–11 years. Nine studies involved children aged 2–6 years with a sample size ranging from  $n = 16$ –343 (86–94); one study involved children aged 4–11 years ( $n = 121$ ) (95), and one study included children aged 8–11 years ( $n = 208$ ) (96) (Table 1). Only two studies (89,92) reported details of ethnic and racial diversity, and the study conducted in Guatemala included only Latino children (95). Three studies measured sex differences

(86,92,93), but noted no differences in the response of boys and girls to the characters used on the food products.

No study tested children's response to a brand mascot owned by a food, beverage or restaurant company. A total of 21 unique popular cartoon media characters owned by five leading entertainment companies were used across 11 studies (Table 2). Culturally specific media characters, including *Chavo* in Guatemala (95) and *Kabouters Plop* (a popular gnome) in Belgium (94) were also used. Several studies included unknown animal characters (e.g. monkey, mouse, penguin, rabbit and dinosaur); and the Flemish study included an unknown gnome.

## Quality assessment

Neely and Schumann (91) was the only study that reported using a theoretically grounded causal model to guide the design and analysis (Table 3). These investigators examined seven outcomes compared with the remaining 10 studies, which measured only between two and four cognitive or behavioural outcomes. The causal inference validity was rated medium for the randomized controlled studies and low for non-randomized study designs. No study received a high rating of causal inference validity because of the small sample sizes. Ecological validity was rated medium for all studies because they were conducted in real-life settings.

## Outcomes measured

There was wide heterogeneity in how the outcomes were measured and reported across each study. Therefore, they

**Table 1** Description of the experimental studies and outcomes measured in the systematic review, 2004–2014

Author year published Country	Study dates	Age range years	Sample size (n =) Sex: M/F	Race or ethnicity %	Diet-related outcomes							Health (n = 1)			
					Cognitive (n = 7)			Behavioural (n = 4)							
					Character or brand recognition	Character trust	Character and brand association	Character, brand or message recall	Character preference	Taste or snack preference and appetite	Purchase request	Food choice	Food intake	Diet quality	Body mass index
de Droog <i>et al.</i> , 2011 Netherlands	2008	4–6	216 M:108 F:108	Dutch Race NR	N	N	N	N	Y	Y	Y	N	N	N	N
de Droog <i>et al.</i> , 2012 Netherlands	2009	4–6	166 M:85 F:81	Dutch Race NR	Y character	N	Y character and product	N	N	N	N	N	N	N	N
Keller <i>et al.</i> , 2012 USA	NR	4–5	16 M:NR F:NR	Ethnically diverse NR	N	N	N	N	N	N	N	N	Y	N	Y
Koiler <i>et al.</i> , 2012 USA	NR	Study 1 2–6 Study 2 3–6	343 M:168 F:175 207 NR	Ethnically diverse Caucasian: 42% African-American: 35% Latino: 11% Asian: 5% Other: 7%	Y character	N	N	N	Y	Y	N	Y	N	N	N
Lapierre <i>et al.</i> , 2011 USA	2007	4–6	80 M:38 F:42	American Race NR	N	N	Y character and brand	N	Y	Y	N	N	N	N	N
Letona <i>et al.</i> , 2014 Guatemala	NR	4–11	121 M:54 F:67	Latino	Y character	N	N	N	N	Y	N	N	N	N	N
Neeley & Schumann, 2004 (91) USA	NR	Study 1 2–5 Study 2 2–5	66 M:33 F:33 37	American Caucasian: 85–89% African-American: 1% Latino: 0–1.3% Asian: 4.5–6% Mixed: 1.5–2.7%	Y character vs. product	N	Y character and brand	Y	Y	Y	Y	Y	N	N	N
Roberto <i>et al.</i> , 2010 USA	NR	4–6	40 M:26 F:14	American Caucasian: 50% African-American: 20% Latino: 12.5% Asian: 17.5%	Y character	N	N	N	N	Y	N	Y	N	N	N
Smits & Vanderbosch, 2012 (94) Belgium	NR	6–7	57 M:27 F:30	Flemish Race NR	N	N	N	N	N	Y	Y	Y	N	N	N
Ülger, 2009 (93) Turkey	NR	6	144 M:72 F:72	Turkish Race NR	N	N	N	Y	N	N	N	Y	N	N	N
Wansink <i>et al.</i> , 20125 USA	NR	8–11	208 M:109 F:99	Ethnically diverse Race NR	N	N	N	N	N	N	N	Y	Y	N	N

N, no; NR, not reported; Y, yes.



**Table 2** Description of the study design, media characters used, and results of experimental studies included in the systematic review, 2004–2014

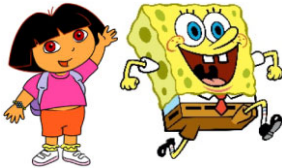


Author year published	Study design	Media characters used	Results
de Droog <i>et al.</i> , 2011 (86) Netherlands	<p><i>Randomized controlled trial</i></p> <p>A 4-point scale was used to test nine experimental conditions among children (<math>n = 216</math>; 4–6 years) asked to select chopped bananas versus banana candy that had either one of two familiar media characters versus an unfamiliar character (monkey) versus no character.</p> <p>ANOVA was used to measure significance for three cognitive outcomes:</p> <ol style="list-style-type: none"> <li>1. character preference</li> <li>2. snack preference</li> <li>3. purchase request</li> </ol>	 <p>Nickelodeon's <i>Dora the Explorer</i> for girls and <i>SpongeBob SquarePants</i> for boys were the familiar characters used</p>	<p>Both familiar and unfamiliar cartoon media characters increased young children's preference and purchase request for fruit compared with candy.</p> <p>Preschool children's preference for and purchase request for fruit did not differ between a familiar versus unfamiliar character.</p> <p>No character reduced preference for and purchase request for fruit.</p> <p>No difference was observed between boys and girls.</p>
de Droog <i>et al.</i> , 2012 (87) Netherlands	<p><i>Within subjects repeated measure design</i></p> <p>Children (<math>n = 166</math>; 4–6 years) were exposed to five different, randomly selected character–product picture combinations:</p> <ul style="list-style-type: none"> <li>• familiar character versus unfamiliar character and a carrot</li> <li>• conceptually and perceptually congruent character (orange rabbit and a carrot)</li> <li>• conceptually congruent (gray rabbit and a carrot)</li> <li>• perceptually congruent (orange rhino and a carrot)</li> <li>• incongruent (gray rhino and a carrot)</li> </ul> <p>ANOVA was used to measure the significance for three cognitive outcomes:</p> <ol style="list-style-type: none"> <li>1. Familiar character recognition</li> <li>2. Character and product preference</li> <li>3. Character preference (familiar versus unfamiliar)</li> </ol>	 <p>Nickelodeon's <i>Dora the Explorer</i> and <i>Diego</i> were the familiar characters used</p>	<p>91% of the children were able to identify <i>Dora</i> and <i>Diego</i>.</p> <p>Children preferred a familiar character and conceptually congruent character–product pair (e.g. gray rabbit and a carrot) linked to a product by a story compared with an incongruent character–product pair (e.g. gray rhino and a carrot).</p> <p>Children preferred a familiar character–product combination (<i>Dora</i> or <i>Diego</i> and a carrot) more than an unfamiliar character–product combination (rabbit or rhino and a carrot).</p>
Keller <i>et al.</i> , 2012 (88) USA	<p><i>Randomized controlled trial × 7 weeks</i></p> <p>This study was one of three branding experiments that involved parents and their children (<math>n = 16</math>; 4–5 years).</p> <p>Parents in the intervention group offered their child a colourful package of fresh fruits and vegetables + familiar character + premium (redeemable sticker for a prize) + nutritional counselling versus parents in the control group who offered their child fruit and vegetables in a plain package.</p> <p>ANOVA was used to measure two outcomes:</p> <ol style="list-style-type: none"> <li>1. food intake</li> <li>2. body mass index</li> </ol>	 <p>Sesame Workshop's <i>Elmo</i> was the familiar characters used</p>	<p>Familiar character branding using <i>Elmo</i> significantly increased children's fruit and vegetable intake compared with a control group that showed no change.</p> <p>Children in the intervention group decreased their BMI z-score compared with children in the control group who increased their BMI z-score.</p>

Table 2 Continued

Author year published	Study design	Media characters used	Results
Kotler <i>et al.</i> , 2012 (89) USA	<p><i>Randomized controlled trial</i></p> <p>Study 1 assessed the effect of branding on children (<math>n = 343</math>; 2–6 years) using three familiar cartoon media characters (<i>Elmo</i>, <i>Bert</i> and <i>Ernie</i>) versus three unfamiliar cartoon anthropomorphic characters (e.g. dinosaur) versus no character on children's food preference by selecting one out of nine sets of selected food photos for zucchini versus celery, mushrooms versus peas, grapes versus bananas, donut versus Cheerios, potato chips versus apple, chocolate versus broccoli, star fruit versus melon, cherry tomato versus cauliflower, and Saltines versus pumpernickel crackers.</p> <p>A third of the children were asked to select their favourite foods from the pairs with no characters (control group); a third selected their preferred food with a Sesame character on targeted foods and a third selected their preferred food with an unknown character (intervention groups).</p> <p>Study 2 assessed the effect of branding on children (<math>n = 207</math>; 3–6 years) using <i>Elmo</i> versus an unknown character versus no character on their willingness to taste and eat food (outcome = food intake) via selected photos for three sets of food.</p>	 <p>Sesame Workshop's <i>Elmo</i>, <i>Grover</i> and <i>Oscar</i> were the familiar characters used</p>	<p>Branding with a familiar character increased children's preference for and willingness to taste and eat both healthy and unhealthy foods.</p> <p>Branding was strong when a familiar character was used on an unhealthy branded snack food compared with an unfamiliar character on a healthy branded snack food versus no character.</p> <p>Children were more willing to try a healthy food (fruit or vegetable) with a favourite brand character compared with an unknown character.</p> <p>When a healthy food branded by a popular character competed against a branded unhealthy food, the popular character did not increase children's preference for the healthy food.</p> <p>When two foods in the same category (i.e. 2 vegetables, 2 fruits or 2 grains) competed against each other, character branding strongly influenced children's food choice compared with no character.</p>
Lapierre <i>et al.</i> , 2011 (90) USA	<p><i>Between-subjects study design</i></p> <p>A 5-point smile scale was used to test the preference of children (<math>n = 80</math>; 4–6 years) for ready-to-eat cereals under four conditions:</p> <ul style="list-style-type: none"> <li>• healthy bits cereal versus sugar bits cereal</li> <li>• character preference (penguin versus no character)</li> </ul>	 <p>Warner Brothers Entertainment's <i>Mumble</i> and <i>Gloria</i> from the movie, <i>Happy Feet</i>, were the familiar cartoon media characters used</p>	<p>Children who saw a popular media character on the box preferred the cereal with the character versus no character.</p> <p>Children who were told the cereal was called Healthy Bits liked the taste more than children who were told it was called Sugar Bits.</p> <p>Children preferred the character on Sugar Bits compared with Healthy Bits suggesting that the character is a more powerful influence than the nutritional merits of the cereal.</p>
Letona <i>et al.</i> , 2014 (95) Guatemala	<p><i>Between-subjects study design</i></p> <p>Three cartoon media characters were used to assess three outcomes for children (<math>n = 121</math>; 4–11 years) including:</p> <ul style="list-style-type: none"> <li>• recognition of popular characters</li> <li>• taste preference and snack preference for three foods: potato chips, crackers and baby carrots.</li> </ul>	 <p>Nickelodeon's <i>SpongeBob SquarePants</i>, Warner Brothers Entertainment's <i>Pink Panther</i> and <i>El Chavo</i> were the familiar characters used</p>	<p>Children showed a high recognition of familiar media characters (92–98%).</p> <p>The use of a familiar licensed character on food packaging increased children's taste and snack preferences.</p> <p>Younger children (4–6 years) were more likely to prefer a food with a licensed media character compared with older children (7–11 years).</p>

Table 2 Continued


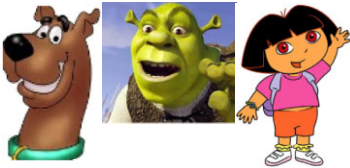




Author year published	Study design	Media characters used	Results
Neeley & Schumann, 2004 (91) USA	<p><i>Post-test, between-subjects factorial designs</i></p> <p>Study 1 exposed children (<math>n = 66</math>; 2–5 years) to an animated mock commercial showing an unfamiliar cartoon character paired with a product (mouse eating cheese). The commercial was embedded into a television programme and shown three times to children. Other commercials for food ads (e.g. Cheerios, Cap'n Crunch and a toy tea set) were also shown to children. Each child was randomly assigned to the experimental or control group. Children in the experimental group were shown three sets of flashcards and pointed to the animal they saw in the commercial and the food that the animal was eating. Statistical tests were used to measure seven outcomes:</p> <ol style="list-style-type: none"> <li>1. Character versus brand recognition (to assess attention to commercial)</li> <li>2. Character and brand association</li> <li>3. Character and product recall</li> <li>4. Character preference</li> <li>5. Food preference (fruit versus chips or cookie)</li> <li>6. Purchase request (intention to eat)</li> <li>7. Food choice</li> </ol> <p>Study 2 used statistical tests to examine the significant influence of auditory messages on children (<math>n = 37</math>; 2–5 years) who were either exposed to two character voices or no voices in commercials to assess their attention and retention of information from an animated commercial for fruit snacks.</p>	 <p>A cartoon mouse was the non-celebrity character used</p>	<p>Children had a higher recall for the animated mouse (78%) compared with fewer children (52%) who recalled the food product (cheese) advertised.</p> <p>Children's exposure to the cartoon mouse was statistically significant only for the food product preference (cheese) but not the other variables.</p> <p>Children's exposure to auditory messages with animated characters (bear and dog) did not positively influence the seven variables measured.</p> <p>Children's attention, recognition and preference for cartoon characters was not significantly related to high levels of food product preference, intention to eat, and food product choice.</p>
Roberto <i>et al.</i> , 2010 (92) USA	<p><i>Between-subjects study design</i></p> <p>Children (<math>n = 40</math>; 4–6 years) were exposed to three study foods (e.g. graham crackers, gummy fruit snacks and baby carrots) that were branded with three different popular licensed cartoon media characters to examine three outcomes:</p> <ol style="list-style-type: none"> <li>1. character recognition</li> <li>2. character influence on taste preference</li> <li>3. character influence on food choice.</li> </ol> <p>A 5-point Likert scale was used to assess children's character recognition. Statistical tests were used to determine children's taste preference versus snack choice.</p>	 <p>Warner Brothers Entertainment's <i>Scooby Doo</i>, Nickelodeon's <i>Dora the Explorer</i> and DreamWorks Animation, SKG's <i>Shrek</i> were the familiar characters used</p>	<p>Children's recognition of popular characters ranged from 60 to 90%.</p> <p>A majority of children preferred the taste of foods and selected snacks with a licensed character versus no character, especially for gummy fruit candy and graham crackers compared with baby carrots.</p> <p>No differences were observed based on children's age, ethnicity or race and sex.</p>
Smits & Vanderbosch, 2012 (94) Belgium	<p><i>Between-subjects study design</i></p> <p>Baseline measures were obtained for children (<math>n = 57</math>; 6–7 years) on a 5-point appetite scale and 10-point scale for children's self-reported frequency of intake and frequency of parental purchase of grapes, apples, chocolate and cookies.</p> <p>A questionnaire was used to assess children's reported intended frequency of intake, appetite for and purchase request for each food that was endorsed either by a familiar celebrity media character (<i>Kabouter Plop</i> gnome) or an unknown gnome.</p> <p>Three outcomes were measured:</p> <ol style="list-style-type: none"> <li>1. increased appetite</li> <li>2. intent to consume</li> <li>3. purchase request</li> </ol>	 <p>Studio 100's <i>Kabouter Plop</i> was the familiar media character used</p>	<p>Children's self-reported appetite, intention to consume and frequency of parental purchase requests increased when either a familiar media character gnome or an unfamiliar gnome was used on foods.</p> <p>The familiar media character gnome had a stronger effect on the three outcomes measured compared with the unknown gnome, especially for chocolate.</p> <p>The unfamiliar gnome had a smaller positive effect on the three outcomes measured compared with baseline.</p>

Table 2 Continued

Author year published	Study design	Media characters used	Results
Ülger, 2009 (93) Turkey	<p><i>Randomized controlled trial</i></p> <p>Children (<math>n = 144</math>; 6 years) in the experimental group were shown a 50-minute cartoon show on a compact disc with Warner Brothers' Looney Tunes cartoon characters (e.g. <i>Bugs Bunny</i>) that showed two embedded commercials for a chocolate wafer (product 1) (experimental group) compared with children who watched the cartoon without the commercials (control group). Two outcomes were measured:</p> <ol style="list-style-type: none"> <li>1. message recall</li> <li>2. product choice</li> </ol> <p>Children in the experimental group described the advertising content of the commercials. Chi-squared test was used to assess one of two food products that was most appealing to children: either the chocolate wafer shown on the commercials (product 1) or a chocolate wafer with an appealing package branded with one of five Walt Disney characters (product 2) that was not shown in the commercial.</p>		<p>Children who watched the cartoon show with the embedded commercials demonstrated good recall of the content of the chocolate wafer advertisements.</p> <p>Children who viewed the cartoon show with or without the embedded commercials chose the chocolate wafer with the packaging branded with the Walt Disney characters (74%) rather than the wafer advertised in the cartoon programme with the Warner Brothers media characters (26%)</p> <p>No significant differences were observed for product choices made by boys versus girls.</p>
Wansink <i>et al.</i> , 2012 (96) USA	<p><i>Cross-over study design</i></p> <p>Over the course of five days, children (<math>n = 208</math>; 8–11 years) from seven schools were given an apple or cookie without a branded character (days 1 and 5).</p> <p>Children were given a choice of an apple and cookie branded with <i>Elmo</i> (day 2).</p> <p>Children were given a choice of an apple branded with <i>Elmo</i> and an unbranded cookie (day 3).</p> <p>Children were given a choice of an unbranded cookie and an unknown cartoon character (day 4).</p> <p>Chi-squared test was used to assess the statistical significance for two behavioural outcomes:</p> <ol style="list-style-type: none"> <li>1. food choice</li> <li>2. food intake</li> </ol>		<p>Given a choice between the unbranded apple and cookie, about 90% of children chose the cookie.</p> <p>Children were more likely to choose an apple branded with an Elmo sticker compared with the pre-test control.</p> <p>A branded mascot sticker with Elmo had no effect on children's cookie consumption.</p>
		 <p>Sesame Workshop's <i>Elmo</i> was the familiar characters used</p>	

ANOVA, analysis of variance; BMI, body mass index.

**Table 3** Assessment criteria used to evaluate the experimental studies in the systematic review

Author, year country	1	2	3	4
de Droog <i>et al.</i> , 2011 (86) Netherlands	N	3/12	M	M
de Droog <i>et al.</i> , 2012 (87) Netherlands	N	2/12	L	M
Keller <i>et al.</i> , 2012 (88) United States	N	2/12	M	M
Kotler <i>et al.</i> , 2012 (89) United States	N	4/12	M	M
Lapierre <i>et al.</i> , 2011 (90) United States	N	3/12	L	M
Letona <i>et al.</i> , 2014 (95) Guatemala	N	2/12	L	M
Neeley & Schumann, 2004 (91) United States	Y	7/12	M	M
Roberto <i>et al.</i> , 2010 (92) United States	N	3/12	L	M
Smits & Vanderbosch, 2012 (94) Belgium	N	3/12	L	M
Ülger, 2009 (93) Turkey	N	2/12	M	M
Wansink <i>et al.</i> , 2012 (96) United States	N	2/12	L	M

1. Did the investigators use a theoretically grounded conceptual model or analytic framework to guide the research design and analysis, and to interpret the results? (Y, yes, N, no, NR, not reported.)

2. How many outcomes were measured for each study?<sup>†</sup>  
(x/12 = number of outcomes measured out of 12 potential outcomes identified in Figure 3.)

3. What is the level of causal inference validity for each study?<sup>†‡§</sup> (H, high, M, medium, L, low. *Casual inference validity* is the strength of the evidence for the investigator to make an associative or casual inference between a marketing variable [media character exposure] and a diet-related cognitive [ $n = 7$ ], behavioural [ $n = 4$ ] and health [ $n = 1$ ] outcome. The measures [H, M or L] take into consideration three dimensions: validity, reliability and precision.)

4. What is the level of ecological validity for each study?<sup>†‡§</sup> (H, high, M, medium, L, low. *Ecological validity* is the degree to which the investigator can generalize the study results to daily life.)

Criteria 3 and 4 were adapted from the IOM Food Marketing to Children and Youth report (8).

were categorized into one of 12 outcomes including: seven *cognitive outcomes* (e.g. character or brand recognition; character trust; character and brand association; character, brand or message recall; character preference; and taste or snack preference and appetite); four *behavioural outcomes* (e.g. purchase request, food choice, food or product intake, and diet quality); and one *health outcome* (e.g. BMI) (Table 1).

### Character recognition, trust, recall and brand association

Five studies measured children's recognition of popular characters at baseline and found a high recognition ranging

from 60 to 90% (87,89,91,92,95). No study examined children's trust of characters. One study measured children's recall of an animated mouse (78%), but fewer children (52%) recalled correctly the food product (cheese) (91). A second study measured children's recall of advertising content with media characters and found a high degree of message recall for age-appropriate content (93).

Three studies measured children's character and brand association (87,90,91). Of these, de Droog *et al.* (87) found that younger children preferred a familiar and conceptually congruent character-product pair (e.g. gray rabbit and a carrot) linked to a story compared with an incongruent character-product pair (e.g. gray rhino and a carrot). LaPierre *et al.* (90) found that children preferred the familiar penguin characters on the Sugar Bits versus Healthy Bits cereal; and Neeley and Schumann (91) found a high degree of congruent character and food product association (e.g. mouse and cheese).

### Character preference or taste or snack preference

Several studies examined the influence of media characters on children's character preference (familiar versus unfamiliar versus none) (86,90,91) or taste and snack preference, and one study examined character influence on children's appetite (94). Two studies (89,90) documented that children prefer a character over no character on a product package. Two studies also found that children are more likely to try and prefer fruits when endorsed by a media character (89,90). When given a choice between a familiar versus unfamiliar character, only one study (86) found no statistically significant differences between younger children's preference for fruit versus candy when endorsed by a familiar character (e.g. *Dora* or *SpongeBob SquarePants*) versus an unfamiliar monkey character.

Three studies (89–91) found that children liked or preferred a familiar media character used to promote energy-dense foods such as sugary cereal, potato chips, crackers and candy compared with fruits or vegetables. Thus, when a fruit or vegetable with a branded character competed against energy-dense foods using the same character, children preferred the energy-dense food. Only one study (94) showed the presence of a media character on a package increased children's self-reported appetite for grapes, apples, cookies or chocolate compared with no character.

### Behavioural and health outcomes: purchase request, food choice or intake and BMI

Of the three studies (86,91,94) that examined character influence on children's purchase request or intention to eat, children were more likely to request foods (e.g. fruit versus candy, or fruit versus chocolate or cookies) with the presence of either a familiar or unfamiliar media character. The

familiar media celebrity gnome had a stronger effect on children's purchase request for chocolate over fruit versus an unknown gnome (94). Six studies examined media character influence on children's food choices (89,91–94,96). Four of these studies found that the effect of character branding was stronger for a familiar character on an unhealthy food versus the same character used to promote fruit or vegetables. A familiar media character on a package was also more influential on children's food choice than a television commercial with different cartoon media characters with embedded advertisements for a chocolate wafer (93).

Two studies examined character influence on children's willingness to consume or actual food intake (88,96). Wansink *et al.* (96) uniquely found that *Elmo* branding of apples significantly increased children's intake over 3 days compared with *Elmo* branding of a cookie in a school setting. Keller *et al.* (88) was the only study to measure children's BMI and found that *Elmo*'s character branding significantly increased children's fruit and vegetable intake and decreased their BMI *z*-score over 7 weeks compared with the control subjects.

Keller *et al.* (88) was one of two studies that examined several combined factors. *Elmo* was combined with colourful packaging and a prize (stickers) and nutritional counselling. Neeley and Schumann (91) examined the influence of both visual action and auditory messages on children's attention and retention of information, but were unable to draw a definitive conclusion about character exposure and children's food choice.

## Discussion

This systematic review compiled evidence from 11 published experimental studies involving children aged 2–11 years to evaluate collective insights about the influence of brand mascots and cartoon media characters on children's diet-related cognitive, behavioural and health outcomes. While it is difficult to draw firm conclusions because of methodological heterogeneity, the most salient results from the studies are summarized later:

1. Media character branding *may* be a promising strategy to increase children's preference for, purchase request, choice and intake of fruits and vegetables compared with no character branding.
2. An unfamiliar cartoon media character may increase children's appetite, preference for, choice and intake of healthy foods compared with no character branding.
3. When healthy foods compete against energy-dense foods (e.g. fruit or vegetables versus cookies, candy or chocolate), familiar media character branding is a more powerful influence that increases children's appetite, preference for, choice and intake of less healthy foods.

## Study strengths and limitations

One strength of this systematic review was the use of four quality assessment criteria to evaluate the studies. Two of these evidence quality grading criteria (e.g. causal inference validity and ecological validity) were used in the IOM systematic review (8).

A second strength was our use of a theoretically grounded, conceptual framework to assess whether and how the studies measured up to 12 diet-related outcomes. Collectively, the studies had several limitations including: small and heterogeneous sample sizes; several that did not report or analyse moderating factors including race, ethnic or gender differences; and most studies measured only two to four of 12 possible dietary outcomes. These limitations made it difficult to compare the results across the studies and limit the use of evidence to support definitive conclusions.

## Future research implications

Several research gaps are discussed later, including: (i) the importance of theory-grounded experimental research; (ii) children's parasocial relationships with mascots and media characters; (iii) children's associative learning and dietary outcomes; (iv) disentangling the influence of several mediating factors and (v) food-retail settings. Proposed questions for future research are summarized in Table 4.

## Importance of theory-grounded research

Theoretically grounded conceptual models can help to design relevant studies to inform future research, policies and practice. A theory provides justification for one's actions whereas a conceptual framework allows investigators to reflect systematically on complex factors that influence children's diet and health. Only one study used a theoretically grounded conceptual model to guide the study design and interpretation of the results. Neeley and Schumann (91) used a modified hierarchy of effects model (97) that measured children's awareness and knowledge, liking and preferences, and purchasing behaviours. While this model has been critiqued for a simplistic conceptualization of children's information processing (98), it suggests the need to examine and understand how mascot and media character exposure influences many interrelated cognitive, behavioural and health outcomes.

One might postulate that using popular and familiar media characters may encourage children's preference for, choice, and intake of fruits and vegetables to improve their diet and health. Empirical research is lacking to support this proposition, especially given the international research showing that media characters are used to promote foods with excessive amounts of fat, added

**Table 4** Proposed future research questions regarding brand mascot and media character influence on children's diet and health

Thematic topic	Future research questions
Theoretical framework	What are the theoretical underpinnings and specific mechanisms used by marketers to encourage children to develop parasocial relationships with popular mascots and cartoon media character that promote food products?
Moderating factors	How does a child's age, sex, race and ethnicity influence his/her diet-related cognitive, behavioural and health outcomes related to food products promoted by popular brand mascots and cartoon media characters? How does a child's obesity status (e.g. healthy weight versus overweight or obese) influence his/her preference for and response to foods that are branded with popular mascots or cartoon media characters?
Mediating factors	How does a child's cognitive development stage influence his/her preference for certain brand mascots and media characters? Are there any measurable differences in how children respond to brand mascots versus cartoon media characters? How do the design characteristics of mascots or characters (e.g. colour, shape, animation and eye contact with young consumers) appeal to children to promote product awareness, character and product association, character recognition, food or character recall, food preference, purchase request, food choice, food intake and brand loyalty? What are effective auditory cues (e.g. music, jingle and message content) and visual cues (e.g. packaging, labelling, composition and positioning in food-retail outlets and restaurants) used with mascots or media characters to influence children's food brand recall, product or brand association, food preferences and choices? How do children interpret promotional messages in a food-retail setting when they see certain media characters (e.g. Sesame Workshop's <i>Elmo</i> promoting apples in the produce aisle) promote messages about a healthy diet and other characters (e.g. Walt Disney Company's <i>Miss Piggy</i> endorsing Chocolate Honey Nut Cheerios in the RTE cereal aisle) promote foods that do not support a healthy diet? What are appealing and effective auditory or visual messages that can accompany mascots and characters viewed by children to increase their preference, selection and intake of healthy foods? Under what circumstances could mascot or character branding have a long-term influence to improve children's diet quality to reduce their obesity risk? What actions can parents take to encourage the use of mascots and media characters to promote healthy dietary choices (e.g. fruits, vegetables, whole grains, low-fat dairy products and water) and healthy food environments for their children?

sugars and salt (25,26,28,29,31–35). An unpublished study not included in this systematic review tested the effect of four familiar cartoon media characters versus unknown animal characters versus no characters on the food choices of 6–7-year-old children ( $n = 164$ ) in Arkansas. This study found that using unfamiliar media characters unexpectedly reduced children's choice of both fruit and unhealthy foods (99).

To ensure ecological validity, future research should use a theoretically grounded conceptual model to acknowledge the complexity and diversity of real-world conditions that influence whether and how children will choose healthy-profile foods over energy-dense and nutrient-poor foods. Additionally, quasi-experimental and longitudinal research designs are needed to evaluate large-scale natural experiments, such as the short- and long-term effects of Sesame Workshop's decision to implement a royalty-free, character-licensing fee waiver between 2014 and 2016 for produce companies to use its media characters to promote fruit and vegetables to children between 2014 and 2016 (100–102).

### Children's relationship with mascots and characters

A clearer understanding is needed for how children develop parasocial relationships with mascots and media characters

(82) to influence their diet-related outcomes. Traditional models have used an information-processing approach to understand how food marketing practices influence children's diet and health. Harris *et al.* (103) suggest that psychological models based on social-cognitive theory and knowledge persuasion show that the effects of marketing exposure occur without children's conscious awareness of marketing cues and represents implicit learning.

This is relevant to how companies use nostalgic mascots and popular media characters to market to children with their parents. Moreover, marketers use animal mascots (e.g. *Tony the Tiger* and *Buzz Bee*) and media characters (e.g. *Kung Fu Panda*, *Big Bird*, *Miss Piggy* and *the Lion King*) that tap into shared and socially learned cultural meanings to design successful advertising campaigns (50) through various settings and media platforms that appeal to children and their parents. Future research should examine familial interactions related to intergenerational loyalty marketing that uses nostalgic mascots and characters in various settings. Research could also empirically test a food marketing defence model (103) to help older children and their parents resist food marketing stimuli.

No study reviewed tested the influence of food companies' mascots on children's diet-related outcomes, which is a remarkable finding given these mascots' lucrative value to sell branded foods in categories of concern that impact children's diet and health. Public health advocates often

claim that certain mascots (e.g. PepsiCo's *Chester Cheetah*, Mars, Inc.'s *M&M characters* and Coca Cola's *Polar Bears*) target children. However, food and beverage companies have claimed these mascots are intended only to target adults. There is no empirical evidence to support either position. But evidence suggests that brand mascots are used to build an emotional relationship to cultivate brand loyalty for products that persist into adulthood (41–44).

Future research should test the appeal of a broader and more diverse selection of cartoon brand mascots and media characters to influence a continuum of children's diet-related outcomes.

### Children's associative learning and dietary outcomes

Experimental research on the psychology of marketing emphasizes that children's implicit learning and memory of branded products require previous and new exposures to influence their food choices (13,14,16,104). Empirical research shows that children's associative learning can influence their palate preferences and choices (105). Enthusiasm for using cartoon media characters, along with children's repeated exposure to and associative conditioning to increase vegetable preferences and consumption (106), should be tempered by the reality of food companies and marketers continuing to cultivate children's association of mascot and media character images with memorable auditory slogans, jingles, taglines, musical themes and stories to promote primarily unhealthy foods. Therefore, future research is needed to strengthen policies that support children's healthy food preference learning through their early formative years.

### Disentangling the influence of several mediating factors

Only two of the 11 studies (88,91) examined several factors concurrently, but were unable to identify the most influential mediating factors (e.g. visual animation, auditory messages, special effects, bright colours, familiarity, receiving a premium with food products and food package attractiveness) to facilitate children's attention, character recognition, trust, brand association, character and product preferences that link to their diet-related behavioural and health outcomes. Future research should examine the appeal and effectiveness of auditory and visual cues and messages conveyed by mascots and characters to children. This research will require interdisciplinary collaboration among experts in business, food marketing, child psychology, consumer behaviour and public health nutrition.

### Food-retail settings

Supermarket aisles and other retail settings are a 'visual collage of competing brands, multi-colored shapes, spokes-characters, and incentives to influence children's food choices' (107).

Product placement on grocery store shelves and even the angle of a mascot's eye contact with children may influence their brand awareness and preference while shopping (108). Future research is needed to understand how a child interprets promotional messages in a food-retail setting when he or she sees Sesame Workshop's characters, including *Elmo*, *Bert* and *Ernie*, promote apples in the produce aisle while The Walt Disney's *Miss Piggy* character endorses Chocolate Honey Nut Cheerios in the cereal aisle.

Eye-tracking technology is a novel way that some researchers are using to assess children's attention to media characters and advertising messages. A recent study did not find a significant association between older children's exposure to cartoon characters in advertisements and their choice of unhealthy food and beverage products at McDonald's Corporation (109). A second study of preschoolers' exposure to foods with collectible toys found that the toys influenced children's preferences for both healthy and unhealthy foods, suggesting that a healthy meal paired with a collectible toy might be more preferable than an unhealthy meal without a toy (110).

A third study involving toddlers under 2 years of age found that familiar media characters can convey personalized messages to promote early learning experiences compared with non-personalized messages or no characters (111). Future research is needed to understand the shopping and eating experiences of children in food-retail and restaurant settings.

Evaluations are also needed to assess the effectiveness of communicating visual and auditory messages used to influence children's diet-related outcomes, especially purchase influence, dietary intake and health. One study that used cartoon characters in comics (print media) suggested that they could be used to build racially and ethnically diverse children's self-efficacy to encourage fruit consumption (112). It is unclear how culturally diverse children process conflicting messages when they see media characters promoting both unhealthy and healthy foods integrated across print, broadcast and digital media.

### Conclusions

Brand mascots and cartoon media characters represent a broad range of human or fictional anthropomorphic beings or animated objects used by food, restaurant and entertainment companies to sell food products to children. The experimental studies reviewed suggest that cartoon media character branding can positively increase children's fruit



or vegetable intake compared with no character branding use. However, familiar media character branding appears to be a more powerful influence on children's preferences, choices and intake of less healthy foods compared with fruits or vegetables. Future research should use a theory-grounded conceptual model, and larger and more racially and ethnically diverse samples of children in various marketplace settings to produce stronger findings for influential mediating and moderating factors. Finally, future research can be used to inform the deliberations of policymakers, practitioners and advocates at national, regional and global levels regarding how cartoon brand mascots and media characters should be used to create healthy food environments to reduce children's risk of obesity and diet-related non-communicable diseases.

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No conflict of interest was declared.

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