

Contact:

Prof. Dr. Lucia Reisch  
Copenhagen Business School  
Porcelaenshaven 18  
DK – 2000 Frederiksberg  
lr.ikl@cbs.dk

## **Childhood Obesity, Sustainable Development, and Behavioral Economics**

**Lucia A. Reisch & Wencke Gwozdz, Copenhagen Business School (Denmark)**

### **ABSTRACT**

To understand the rising prevalence of obesity in affluent societies, it is necessary to take into account the growing obesity infrastructure, which over past decades has developed into an obesogenic environment. This infrastructure is a direct reflection of the mainstream economic growth paradigm that the literature on consumer culture characterizes as chronic overconsumption. This study examines the effects of one of the constituent factors of consumer societies and a key contributory factor to childhood obesity: commercial food communication targeted to children and its impact on their food knowledge and food preferences. Because evaluations of traditional information- and education-based interventions suggest that they may not sustainably change food patterns, we combine insights from behavioral economics and traditional consumer behavior theory to formulate seven hypotheses, which we then test using a subsample from the IDEFICS study. The results reveal not only that advertising has divergent effects on children's food knowledge and preferences but that food knowledge is *unrelated* to food preferences, a finding that has important implications for future research and public policy.

**Keywords:** advertising exposure, childhood obesity, obesogenic environment, behavioral economics, food preferences, food knowledge

## **Background and Aim of the Study**

Only recently have the policy realms of sustainable development and public health promotion made an effort to move from a “silo” to a “systems” approach (Kickbusch 2010). From an ecological perspective, sustainable development and public health promotion share important similarities in their normative and conceptual bases, as well as their governance approaches. Such similarities are expressed in a gradual convergence and overlapping of agendas, with sustainability being the “larger” agenda. The resulting challenges for health promotion and sustainable development are succinctly expressed in a recent white paper from Switzerland: “The priority goal of health promotion with regards to healthy food must be to contribute to the establishment of a more sustainable, healthier, and more equitable food system in which choices for health are also the best choices for the planet and to support ethical and environmental choices that are also good for health” (Kickbusch 2010, pp. 14–18).

In consumer societies—as well as in the upper income levels of developing countries (Wittkowski 2007)—the spread of modern diets based on unhealthy fast foods, convenience foods, energy dense snacks, and soft drinks and the abundance and omnipresence of food, combined with sedentary lifestyles and electronic recreation that minimizes physical activity have lead to weight control problems. The resulting obesity does not simply impair individuals’ well-being; it jeopardizes societies’ sustainability (Reisch and Gwozdz 2011) through the erosion of social cohesion, equity, and fairness. In the developed world, obesity is closely connected with low socioeconomic status; that is, membership in groups for whom access to and availability and affordability of healthier food choices and physical activity is particularly limited. Nor are the economic consequences of obesity severe for the healthcare systems alone: obesity is responsible for high costs in the labor market. Ecologically, the modern diets in consumer societies, being high in processed foods and animal protein, have a particularly negative footprint—a long neglected fact that has given rise to a debate on “globesity.” Halting obesity has thus become an explicit goal in political sustainability strategies worldwide (Reisch, Lorek, and Bietz 2011).

To understand the rising prevalence of obesity in affluent societies, it is necessary to take into account the growing infrastructure of obesity, which has developed over past decades into an “obesogenic environment.” This infrastructure is a direct reflection of the mainstream economic growth paradigm that the literature on consumer cultures characterizes as “consumerism” or “chronic overconsumption.” In a human ecological approach, this infrastructure includes different influential factors operating on different levels: the influence of families, peer groups, and wider social networks (i.e., their social norms and attitudes, consumption practices, habits, and food styles) and the influences from the nearer (e.g., neighborhood bikeability and walkability; accessibility and availability of healthy food) and wider environments (e.g., commercial food messages in old and new media) that shape these food practices and provide the context of choices. Empirical data suggest that those groups in society with the least human capital resources (i.e., social, personal, and health capital) are most vulnerable: People who are poor not only in income but also in social relationships and personal skills like self-control or self-efficacy, as well as being low in competencies, are particularly prone to become obese (Reisch, Gwozdz, and Beckmann 2011).

One major cause of obesity and children’s unhealthy dietary choices is an obesogenic food environment characterized by a wealth of highly sophisticated *advertising messages* and ubiquitous food availability that encourages the consumption of calorie-dense food products with low nutritional value (IOM 2006). Yet, even though public policy efforts to strengthen children’s ability to resist food industry lures have been debated since the 1970s, any effective “food marketing defense model” (Harris et al. 2009) is still in its infancy, and regulation protecting children from overexposure has barely improved since the 1980s.

Moreover, despite claims that effectively countering harmful food marketing practices requires child awareness and understanding, together with the ability and motivation to resist (Harris et al. 2009), most empirical research, as well as evaluations of health intervention programs, shows that providing information and education—the major policy strategy of recent decades—fails to

decrease advertising's effects on children. Thus, to explain this influence more effectively, consumer research has turned to social and cognitive models that predict a direct influence of commercial cues on consumers' immediate and broad environment. Behavioral economics, another stream of research, has also gained momentum as a new approach to exploring policies that effectively change food choices by going beyond either information and education provision or rigid command and control (see, e.g., the 2010 USDA conference on "Incorporating Behavioral Economics into Federal Food and Nutrition Policy"). According to behavioral economics, consumer behavior is guided largely by individual heuristics and biases and is heavily dependent on the decision context. For instance, the way that food is displayed and the creation of healthy or sustainable "defaults" (e.g., in cafeterias) impacts consumer choices (OIRA 2010; Wansink et al. 2009).

Specifically, behavioral economics proposes that consumers are less "rational" and involved in their decision-making processes than traditional models assume; in fact, they rely strongly on simplifying heuristics, are influenced by systematic biases, and have preferences that are less stable than assumed (Thaler and Sunstein 2008). Hence, social regulation should be made "for Humans, not Econs; *'homo sapiens* rather than *homo oeconomicus*.'"<sup>1</sup> Although such findings stem from research that focuses primarily on adults, children may be even more susceptible to the power of context and social norms and more prone to make decisions based on biases and heuristics. In fact, public health research provides convincing empirical evidence of the *direct* causal effects of exposure to food advertising on children's diet and health (e.g., Epstein et al. 2008). Therefore, the question is not *whether* food marketing to children works, but *how* it affects them. A better understanding of this process is thus a precondition for developing effective consumer policy tools to protect children from overexposure and imprinting.

To enhance such understanding, this paper analyzes the effects of food advertising on children's food knowledge and food preferences. In doing so, it must take two issues into consideration: First,

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<sup>1</sup> Cass Sunstein, Head of OIRA ([nudges.wordpress.com/2010/02/18/oiras-goal-regulation-for-humans-not-econs/](http://nudges.wordpress.com/2010/02/18/oiras-goal-regulation-for-humans-not-econs/)).

to develop a genuine understanding of advertising's effects on knowledge and preferences, researchers must address a wider advertising context than is customary in the vast literature on advertising and children, including, for example, the family as a potential "communication buffer" for mass mediated commercial communication. Second, to investigate why enhancing knowledge does not necessarily lead to healthier preferences and food choices, researchers should relate them to both advertising and advertising contexts. The paper draws on data from an ongoing European intervention study on childhood obesity ([www.idefics.eu](http://www.idefics.eu)).<sup>2</sup>

### **Advertising Exposure, Food Knowledge, Food Preferences, and the Power of Context**

Children in Europe and the U.S. are heavily exposed to mass media, watching over two and a half hours of television daily on average (Holt et al. 2007). Because ad-free children's channels (like those in Germany and Sweden and PBS in the U.S.) are still exceptions, these hours of viewing bombard children with advertising (OFCOM 2004). As a result, in the U.S., foods consumed in front of the TV account for about 20–25% of children's daily energy intake (Matheson et al. 2004). In the EU, the Television Without Frontiers Directive limits product placement and commercial sponsoring during children's programs, while still leaving member states enough leeway in audiovisual media regulation that limits are even stricter in some EU countries than in others (Hawkes 2007). No such regulation exists in the U.S., however, where children aged between 2 and 11 are exposed to about 25,000 commercials per year, some during adult programming like soap operas or cooking shows (Desrochers and Holt 2007). In the U.S., 20% of these commercials are for food products, 98% of them high in sugar, fat, and/or sodium (Hawkes 2007). The "big five" of these products—sugared breakfast cereals, soft drinks, confectionary, savory snacks, and fast food outlets—also represent the majority of advertised food in Europe (Cairns et al. 2009), and there is ample empirical evidence that

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<sup>2</sup> The empirical data presented in this paper were retrieved from the IDEFICS study led by Gianvincenzo Barba (Institute of Food Science & Technology, National Research Council, Italy), Stefaan DeHenauw (Department of Public Health, Ghent University, Belgium), Natalia Lascorz (GENUD (Growth, Exercise, Nutrition and Development) Research Group, Universidad de Zaragoza, Spain), and Iris Pigeot-Kübler (Bremer Institut für Präventionsforschung und Sozialmedizin (BIPS), Germany). In case of publication, their contribution will be acknowledged accordingly.

such unhealthy advertising content often leads to unhealthier food choices (Taveras et al. 2006). In fact, research identifies a direct causal effect of exposure to food advertising on children's diet; in particular, an increase in snack consumption (Harris et al. 2009) and overall calorie consumption (Epstein et al. 2008), an immediately lower intake of fruits and vegetables (Livingstone and Helsper 2004), and higher rates of obesity (Chou et al. 2008).

There is also empirical evidence that food advertising affects knowledge about (un)healthy nutrition: commercials for unhealthy foods relate directly to lower levels of nutrition knowledge (e.g., Harrison and Marske 2005). Advertising, therefore, seemingly overrides knowledge already acquired from other sources that promote healthier choices. Hence, effective advertising messages, rather than requiring active processing and understanding, imprint positive associations on children's brains that can be triggered in decision situations (Urbick 2008). Nonetheless, evaluations of the effect of advertising on children's food knowledge rate it modest rather than strong (Cairns et al. 2009).

Empirical consumer research also shows that consumer knowledge does not necessarily lead to corresponding preferences and that even if specific preferences develop, they do not automatically guide behavior. Thus, although most children and their families generally know what a healthy diet involves, their food choices are inconsistent with their knowledge (Kopelman et al. 2007). In fact, research indicates that accurate beliefs about food healthiness are not associated with food preferences or consumption in children (Harris and Bargh 2009). It also provides evidence that the food choices of both children and their families are determined far more by attitudes and preferences than by acquired knowledge and that children are highly susceptible to the influence of peers in other social contexts (Taras et al. 1989). Nonetheless, despite such evidence, prevention and intervention programs usually take the educational approach (Kennedy 2000).

Children's food preferences are also greatly influenced by environmental factors, particularly familiarity, social modeling, and frequency of exposure (Kennedy 2000). Yet, according to the empirical literature (Chernin 2008), food advertising can influence children's preferences either

way: toward healthier or unhealthier preferences (Norton et al. 2000). Children also imitate their parents' (and other adult caretakers') food styles and learn by observation, meaning that they prefer eating fruits and vegetables if their parents do so. Their food preferences are thus influenced by sheer exposure to specific foods (the "I like what I know" phenomenon) (Cullen et al. 2000). In fact, based on comprehensive literature reviews on the direct effect of television advertising on children's food preferences, both Livingstone (2005) and Cairns et al. (2009) conclude cautiously that advertising does have a moderate direct effect on children's preferences.

Given the above, neither parents nor the media apparently offer good role models for healthy eating: despite widespread knowledge about how—and why—healthy living is better, people fail to live up to their best intentions, such as eating vegetables and fruits regularly (Prendergrast et al. 2008). Thus, both behavioral economics (e.g., Thaler and Sunstein 2008) and the psychology of consumer behavior stress the power of "default options" for consumer decisions in the consumption context. That is, since consumers tend to minimize decision costs for low-involvement decisions, they systematically follow their habits, use heuristics and rules of thumb, are influenced by emotional stimuli, and make—mostly unintentionally—use of defaults (Verbeke 2008). In addition, practically all consumers are subject to behavioral biases such as hyperbolic discounting (Scharff 2009).

All too often, decisions on food provision for children are made "upstream" by parents, school principals, ministries of health, and/or leading retailers, who through editing, pricing, framing, and presentation, create a "choice architecture" in which available choices and choice defaults may range from the relatively healthy to the relatively obesogenic. In general, such choices are strongly affected by the "triple A" of food items—availability, affordability, and accessibility—particularly if paired with and supported by social norms (Elinder and Janssen 2008). Children, therefore, depending on their stage of development, can only partly assume responsibility for their own food behavior. They are most certainly affected by subtle cues in the (non)obesogenic environment, the same "direct perception-behavior link" identified in adults (see Harris et al. 2009, p. 233). Young

children particularly are susceptible to external influences because their consumer competence and food literacy is just developing, family guidance is gradually losing its predominance, and the external consumption environment is gaining importance.

## **Analysis**

This study investigates three primary issues: the influence of advertising on children's food knowledge, the effects of advertising on children's food preferences, and the influence of children's food knowledge on preferences. Specifically, we address the extent of advertising's influence on knowledge and preferences and how these factors influence each other.

Methodologically, acknowledging the power of context, and drawing on an ecological human development model (Story et al. 2002), we differentiate between two different types of advertising contexts: direct and indirect. The *direct advertising context*, of primary interest, involves children's advertising literacy, as well as their exposure to TV advertising. The *indirect advertising context* reflects the effects of advertising on children's behavior (e.g., pestering, enacting consumed advertising) and reflects the influence of the "setting," children's institutional embeddedness, food styles at home, and general parental attitudes toward advertising (i.e., general norms, values, and habits).

### *Direct Advertising Context*

The direct advertising context is determined by children's access to advertising, penchants for TV programs that carry more or less advertising, and children's knowledge about and attitudes toward advertising. Knowledge refers to children's perceptions, including suspiciousness, of advertising's credibility and usefulness; attitudes reflect the advertisement's entertainment value for children (Diehl 2005). We therefore formulate the following hypothesis:

*H1: The better the advertising knowledge and the more critical the attitude, the better children's food knowledge and the healthier their preferences.*

If this hypothesis is true, then increasing advertising literacy in children should have a positive impact on their food knowledge and preferences (cf. Livingstone and Helsper 2006).

Exposure to advertising, however, is also influenced by access to media: unrestricted access increases hours of media exposure and influences time of exposure to advertising. We therefore measure access by the media equipment in children's bedrooms (Adachi-Mejia et al. 2006) and exposure by viewing times and penchants for specific TV programs. Hence, both the country of residence and the type of program watched also influence exposure to advertising. Given the so-called mere exposure effect—that mere (and also incidental) exposure to advertising affects children's food knowledge and preferences—and the assumption that advertising has the power to shape preferences (Chernin 2008), food knowledge should be less clear (and thus lower) (Harrison and Marske 2005) and preferences should be unhealthier:

*H2: Unrestricted access and thus more exposure to advertising leads to lower food knowledge and unhealthier preferences.*

### *Indirect Advertising Context*

The indirect advertising context—specifically, institutional embeddedness and the food and media setting at home—comprises the effect of setting on children's food knowledge and preferences. One useful measure of advertising influence is pester power, a strategy by which children try to acquire products by nagging their parents. On the one hand, when children ask for items seen on TV, parents have an opportunity to discuss food-related issues with them and thus enhance their food knowledge; on the other, pestering reflects how advertising can influence children's preferences (McDermott et al. 2006). We therefore hypothesize the following:

*H3: Children's behavior in response to advertising influences food knowledge and preferences.*

Another important influence on children's advertising competence is exerted by children's institutional embeddedness. Whenever children are watching TV or playing on the computer without parental supervision, they have no opportunity to discuss their experiences with and ask questions of their parents. Children's institutional embeddedness in the form of after-school clubs

can also help build their “TV and advertising smartness” using corresponding educational elements. Presumably, exposure to advertising is also lower in controlled settings like child care institutions or during after-school supervision. Hence, we hypothesize that when children spend most of their day in institutionalized settings, food knowledge and preferences are healthier, while being left home alone has the opposite effect:

*H4: Children’s (non)supervision significantly influences food knowledge and preferences.*

We measure the food and media setting at home by parents’ general attitude toward advertising (Ip et al. 2007) and food styles at home (Kennedy 2000). For the first, the underlying hypothesis is that the more critical parents are about food advertising, the less susceptible their children to the effects of advertising on food knowledge and preferences:

*H5: The more critical the parents’ attitude toward advertising, the better their children’s food knowledge and the healthier their food preferences.*

Through food styles and consumption practices, parents determine which foods will be offered at home and thus their children’s access and exposure to food (Kennedy 2000). Increasing children’s involvement in meals by having them assist in food preparation may also improve their food knowledge and shape their preferences:

*H6: Exposure to food at home shapes children’s food knowledge and preferences.*

#### *Impact of Knowledge on Preferences*

Our final hypothesis addresses the influence of food knowledge on preferences given the empirical evidence that accurate beliefs about food healthiness are not associated with food preferences or consumption in children (Harris and Bargh 2009). Obviously, in the light of this finding, the widely held assumption that increased knowledge of healthy nutrition leads to healthier choices is a “misperception” (Harris et al. 2009, p. 223). We therefore assume that good knowledge of what is healthy does not make children’s preferences healthier:

*H7: Food knowledge does not affect food preferences.*

## **Data and Methodology**

Our analysis, which is part of the IDEFICS study on the identification and prevention of dietary- and lifestyle-induced health effects in children and infants (cf. Ahrens et al. 2010), is based on data collected between April and June 2009 using a convenience sampling technique. The overall sample size is 219 children aged between 6 and 10 years (average age = 8.07;  $SD = .85$ ), 111 (53.6%) of whom are female. The participants are almost equally distributed over four countries: Belgium, 60 (27.4%); Germany, 60 (27.4%); Italy, 48 (21.9%); and Spain 51 (23.3%).

For this paper, we focus on two major aspects of the data: children's food knowledge and preferences and children's knowledge about and attitudes toward advertising. We then relate our findings to data on the advertising-related behaviors and sociodemographics of children and their parents taken from the 2007/08 IDEFICS baseline survey of 16,224 children aged 2 to 10 from eight European countries.

### *Study Instruments*

The data on children's food knowledge and preferences—the variables of interest—are gathered via a choice experiment (for detailed information, see Gwozdz and Reisch 2011) based on Kopelman et al. (2007) but adapted to our research question and settings. The primary stimuli are two brochures showing 10 matched pairs of food cards; one picturing a relatively healthy food, the other a relatively unhealthy food. These matched pairs always fall into the same food category (e.g., “juice”), and the order of presentation is always chosen to reduce framing effects. The two-step experimental procedure includes a preference test and a knowledge test. In the preference test, the children are asked, “Which food or drinks do you like best?” They then draw a smile (for “true”) or a frown (for “false”) for each matched pair according to their (forced-choice) preference. The knowledge test proceeds in a similar way. Again, children draw a smile or a frown for each matched pair in reaction to the following question: “What do you think: Which food or drink is the healthier one?”

The children's knowledge about and attitudes toward advertising are measured using a questionnaire. The original instrument, developed and validated by Diehl (2005), covers three

dimensions: credibility, children's perception of TV advertisement as a useful source of information; suspiciousness, their questioning of commercial messages; and entertainment, the fun factor of watching commercials. We incorporate an additional dimension, social desirability. Responses are measured on a four-point scale: -2 *disagree fully*, -1 *disagree*, +1 *agree*, and +2 *agree fully*.

We then relate these findings to the IDEFICS baseline survey data on the following:

- *Direct advertising context*: TV viewing-related data such as time spent weekly using audiovisual media; daily frequency of TV viewing; equipment in bedroom, such as TV or computer; and preferred TV program type, such as cartoons, children's programming, soap operas, or advertisements.
- *Indirect advertising context*: TV-related family behavior (whether parents discuss TV contents with their children, children's pester power); children's institutional embeddedness (after-school or similar supervision or whether children are home alone before or after (pre)school); food and media setting at home (parents' attitudes toward TV food advertisement and parents' food-related lifestyles).
- *Control variables*: Sociodemographic variables, such as age of both parents and net household income.

### *Statistical Analysis*

To meet the three study goals, we estimate a set of OLS regressions in which food knowledge and food preferences are the dependent variables. Based on the children's choice experiment scores (i.e., choosing healthier or unhealthier foods and drinks from the 10 matched pairs), we build one indicator for food knowledge and another for food preferences. Both indicators range between 0 (no healthy food chosen) and 10 (only healthy food chosen).

We assess the effects of advertising on knowledge versus preferences using different sets of variables that represent the direct and indirect viewing contexts. First, to test H1, we draw on information from our questionnaire and, as suggested by the instrument's developer (Diehl 2005),

construct an indicator for each dimension: credibility, suspiciousness, and entertainment factor. As there are three questions per dimension, the totaled responses result in a scale from -6 to +6, in which a higher value indicates, for example, more credibility in advertising while a negative one indicates more incredibility. To test H2 on access and exposure to advertising, we include dummy variables for whether children have a computer and/or television in their bedroom and for preferred television programs (e.g., children's programs, cartoons, soap operas, advertisements), as well as measures of the average time spent using audiovisual media (hours per week) and frequency of TV viewing (times per day).

To measure the indirect advertising context, we first scale the presence or absence of discussion on TV contents from 1 *never* to 4 *often* and children's effort to pester from 1 *never* to 3 *often*. We then use both variables to test H3 (children's behavior in response to advertising). We test H4 (children's institutional embeddedness) using two dummy variables: usage of daycare and whether children are left home alone. We then test H5 (parental attitudes toward TV food advertising) based on responses to three statements included in the baseline survey for their explanatory power on food knowledge and preferences: "TV food advertising assists parents in their efforts to feed their child a healthy and balanced diet," "A child clearly understands just how good the product presented in TV advertising is," and "TV food advertising informs children and parents about things they would otherwise never learn about." These variables are scaled from 1 *disagree* to 4 *agree*. To test H6 (food styles), we use responses to three statements selected on the same criterion: "I try to avoid food products with additives," "I prefer to buy meat and vegetables fresh rather than prepacked," and "We use a lot of ready-to-eat foods in our household." These responses are scaled from 1 *disagree* to 5 *agree*. Finally, we add in controls that reflect country dummies (with Belgium as a reference category) and sociodemographics, including parents' and child's ages and child's sex, as well as monthly household net income and mother's occupational status to control for parental influence on children's knowledge and preferences (Chou et al. 2008).

To explain the effects of advertising on food knowledge, we estimate several OLS regression models by stepwise inclusion of different variable sets, first from the direct advertising context, then from the indirect advertising context, and finally the country dummies and sociodemographics as controls. This stepwise progression results in four models. We follow the same procedure to explain the effects of advertising on food preferences; however, we also estimate a fifth model by including food knowledge to test H7.

## **Results**

### *Descriptive Statistics*

Among the 219 children that participated in the choice experiment and filled out the questionnaire, the average score for food knowledge is 7.65 ( $SD = 1.27$ ), higher than the average score of 4.73 ( $SD = 2.04$ ) for food preferences. Although no differences emerge between girls and boys, we find a positive correlation between knowledge and age ( $r = .179, p = .009$ ), which indicates that the older the child, the better the food knowledge. Food preferences, on the other hand, with a mean of 4.73 ( $SD = 2.04$ ), are far healthier than food knowledge, as was hypothesized.

### *Role of Commercials in Food Knowledge*

Table 1 presents the estimations of the food knowledge regressions, in which Model 1 is a parsimonious model that includes only the direct advertising context, Model 2 represents the indirect advertising context, Model 3 contains the country dummies, and Model 4 expands the regression by incorporating the sociodemographics.

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Insert Table 1 about here  
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In terms of direct advertising context, the robust effect of advertising's entertainment factor is especially noteworthy: Independent of added controls, we find a highly significant negative effect of advertising's entertainment factor on food knowledge, meaning that children who are less critical of advertising know less about food healthiness. Once sociodemographics are added in, suspiciousness also plays a role: the more suspicious children, the better their food knowledge. Hence, we can confirm H1: the better the knowledge about and the greater the criticism of advertising, the better the food knowledge. Regarding access to media, only in the full model is food knowledge influenced by time spent using audiovisual media or access to a computer in the bedroom: although the use of audiovisual media increases food knowledge slightly, a computer reduces scores by only half a point. H2 is therefore minimally supported.

In the indirect advertising context, child care plays a definite role: children left home alone score nearly one point less in food knowledge than children who are never home alone. Thus, although we find no support for H3, we can confirm H4. Also important are parents' advertising attitudes: the more critical the parent toward advertising, the better the child's food knowledge. In terms of food styles, although a parental preference for fresh meat and vegetables increases a child's food knowledge, the extensive use of ready-to-eat food decreases it. This finding suggests that regular exposure to healthy/unhealthy food has a particular influence on food knowledge. Hence, we confirm H5 and H6.

#### *Role of Commercials in Food Preferences*

Table 2 shows the results for the four regression models on food preferences, as well as the fifth model (to test H7) that includes food knowledge as an independent variable.

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Insert Table 2 about here  
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In the direct advertising context, only two variables have a strong and robust significant effect on food preferences. The preferences of children with a computer in their bedroom are about 1.5 times healthier than those of children without. This finding is indeed remarkable given that our results for knowledge indicate that a computer can have a negative effect on children's healthy food knowledge. Another interesting finding is that the preferences of children who prefer watching soap operas are approximately 1.4 times unhealthier than those of children who prefer children's programs. However, because more advertising is aired during soap operas than during children's programs, we cannot distinguish between the effects of the advertising versus the soap opera content. We can therefore neither reject nor confirm H2. Because H1 is not confirmed, advertising knowledge and attitudes are irrelevant for food preferences.

In the indirect advertising context, children's pestering (i.e., asking for items seen on TV) results in unhealthier preferences than those produced by its absence. Because this negative effect is weakly but steadily significant for food preferences, we use it to support H3 that observed advertising-related behavior influences food preferences. As with food knowledge, parental attitudes toward food advertising and food styles at home play an important role in food preferences. In terms of parental attitudes, however, the results are divergent and hence do not allow any claim about H5. Food styles do matter, however: a higher parental preference for fresh meat and vegetables leads to unhealthier food preferences in their children but (as shown previously) to better food knowledge. We can thus confirm H6—that mere exposure to foods shapes children's preferences—even if in the opposite direction. On the other hand, as hypothesized in H7, food knowledge exerts no influence over preference.

Although we can support the claim that advertising-related factors influence food knowledge, this is hardly true for the effects of advertising on preferences. That is, not only are preferences unhealthy, but better food knowledge itself does not guide them in a healthier direction. Our results also show that knowledge and preferences are shaped not only by the direct influence of advertising but also by advertising's indirect context.

## Discussion

This analysis, based on a subsample of the IDEFICS study, examines the effects of advertising on children's food knowledge and preferences. Recognizing that consumer behavior frequently fails to follow the traditional assumption that better knowledge leads to healthier preferences, intentions, and food choices (which underlies classical intervention programs), we attempt to paint a broader picture by focusing on the role of wider advertising contexts. Specifically, we adopt the assumption, taken from behavioral economics, that both direct and indirect advertising contexts influence children's advertising-related attitudes and behaviors.

Although our analysis of both types of context provides evidence for the effects of food advertising on food knowledge (i.e., confirms many of our related hypotheses), the situation becomes more blurred for food preferences. That is, the *direct advertising context*—including advertising literacy and access to, availability of, and exposure to advertising—plays an important role in children's food knowledge but not necessarily in their preferences. For example, although a better understanding of advertising implies better food knowledge, we find no relationship between children's advertising literacy and their food preferences. In fact, the results for media access and exposure reveal opposite effects: a computer in the bedroom is associated with lower food knowledge but healthier preferences.

The role of *indirect advertising context* in knowledge and preferences is also contradictory. Although pestering children have unhealthier preferences, they do not have lower food knowledge. Rather, such knowledge is shaped far more by child care settings, from which preferences are independent. Parental attitudes toward advertising and food styles at home, however, are important indicators for both knowledge and preferences. Nonetheless, even though more critical parental attitudes and healthier food styles may enhance children's food knowledge, they do not steer children's preferences in a healthier direction. This finding is especially interesting when the path dependence from exposure to knowledge to preferences is interrupted: whereas exposure to healthy foods increases children's knowledge, it signals unhealthier preferences—exactly the opposite of

the intended outcome. Our results therefore support the findings of previous studies (e.g., Harris et al. 2009).

Also in line with earlier research (e.g., Harrison and Marske 2005), we find evidence that advertising generally leads to lower food knowledge. However, our results also indicate a blurred effect of advertising/media exposure on knowledge (see Stead et al. 2007): although food knowledge is generally good, there seems to be no direct relationship between knowledge and preferences (see Kopelman et al. 2007). Moreover, the effects of advertising on knowledge and preferences do not go hand in hand. That is, although the contexts we defined seem to be decisive for both knowledge and preferences, they play different roles in each. Hence, it seems reasonable to argue that increasing knowledge by adapting influential factors does not necessarily lead to healthier preferences. This argument is supported particularly by the finding that food knowledge exerts no significant effect on food preferences.

Overall, these findings imply that identifying preference factors alone is not sufficient for developing effective policy strategies and intervention programs. Rather, there is an urgent need for empirical evidence on causality, a dynamic that the present study has no power to determine statistically. Longitudinal or experimental approaches, in contrast, could throw useful light on this causality issue. Our study is also limited by the exclusion of food choice, meaning that it does not follow the entire path from knowledge to preferences to actual food choice. Rather, we assume that preferences are tightly connected to food choices. Further empirical evidence is needed, however, to clarify this relationship.

In sum, this study supports the contention that traditional policy strategies, based primarily on informational and educational goals, are insufficient to decrease the effects of advertising on children. That is, although knowledge about good health remains an unquestioned goal, it cannot adequately guide behavior in a healthier direction (Shepherd and Towler 1992). Rather, given the complexity of advertising's effects, such strategies should consider the broader advertising context and attend more to influencing preferences and making the healthy choice the easy choice.

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Table 1: Role of commercials on food knowledge: OLS

	Model 1	Model 2	Model 3	Model 4
a) Direct advertising context				
H1: Credibility dimension	-.038 [.03]	-.046 [.03]	-.044* [.03]	-.026 [.03]
H1: Suspiciousness dimension	.038 [.04]	.043 [.03]	.025 [.03]	.074** [.03]
H1: Entertainment dimension	-.100*** [.03]	-.102*** [.03]	-.088*** [.03]	-.080** [.03]
H2: Time spent using audiovisual media [hours per week]	.015 [.01]	.011 [.01]	.021 [.01]	.035** [.01]
H2: Frequency of TV viewing [times per day]	.036 [.16]	.054 [.17]	.091 [.16]	.100 [.16]
H2: TV in bedroom [dummy]	-.181 [.21]	-.086 [.24]	-.357 [.24]	-.134 [.27]
H2: Computer in bedroom [dummy]	-.230 [.25]	-.190 [.27]	-.305 [.25]	-.568** [.27]
H2: Preferred program: cartoon [dummy]	-.331* [.24]	-.357* [.25]	-.209 [.23]	-.211 [.25]
H2: Preferred program: soap opera [dummy]	-.059 [.28]	-.131 [.32]	-.230 [.29]	-.337 [.30]
H2: Preferred program: advertisement [dummy]	-.108 [.38]	.016 [.41]	-.152 [.38]	-.504 [.37]
b) Indirect advertising context				
H3: Discussion of and reflection on TV contents with children		.032 [.14]	-.160 [.14]	-.044 [.14]
H3: Children's spending—child asks for item seen on TV		.050 [.16]	.131 [.15]	.135 [.16]
H4: Child left home alone [dummy]		-1.020** [.52]	-.852* [.47]	-.907* [.49]
H4: Use of daycare service or babysitter [dummy]		-.167 [.19]	.059 [.18]	.260 [.20]
H5: TV advertisement: helps parents to offer a healthy and balanced diet		.096 [.11]	.095 [.10]	.142 [.11]
H5: TV advertisement: child understands how good presented product is		-.228** [.10]	-.224** [.10]	-.228** [.10]
H5: TV food advertisement: informs children and parents about new things		.012 [.11]	-.059 [.10]	-.063 [.10]
H6: Food style: avoid food products with additives		-.081 [.07]	-.094 [.07]	-.086 [.07]
H5: TV advertisement: helps parents to offer a healthy and balanced diet		-.039 [.09]	.145* [.09]	.204** [.10]
H6: Food style: use lots of ready-to-eat foods		-.342*** [.12]	-.414*** [.12]	-.389*** [.12]
Country dummies			X	X
Sociodemographics				X
Observations	184	168	168	146
F-value	2.98	2.42	5.24	4.12
R <sup>2</sup>	.113	.226	.388	.461

*Note:* Standard errors in parentheses; \*  $p < .1$ ; \*\*  $p < .05$ ; \*\*\*  $p < .01$

Table 2: Role of commercials on food preferences: OLS

	Model 1	Model 2	Model 3	Model 4	Model 5
a) Direct advertising context					
H1: Credibility dimension	-.031 [.05]	-.015 [.05]	-.036 [.05]	-.078 [.06]	-.073 [.06]
H1: Suspiciousness dimension	.041 [.06]	.112* [.06]	.089 [.06]	.022 [.07]	.010 [.07]
H1: Entertainment dimension	-.095* [.06]	-.048 [.06]	-.052 [.06]	-.061 [.06]	-.048 [.06]
H2: Time spent using audiovisual media [hours per week]	.010 [.02]	-.011 [.03]	-.017 [.03]	-.001 [.03]	-.007 [.03]
H2: Frequency of TV viewing [times per day]	-.362 [.29]	-.281 [.29]	-.278 [.30]	-.256 [.32]	-.272 [.32]
H2: TV in bedroom [dummy]	-.309 [.38]	-.372 [.42]	-.346 [.46]	-.604 [.53]	-.583 [.53]
H2: Computer in bedroom [dummy]	1.400*** [.46]	1.600*** [.48]	1.450*** [.48]	1.430*** [.53]	1.530*** [.54]
H2: Preferred program: cartoon [dummy]	-.055 [.43]	.107 [.44]	.063 [.44]	-.051 [.49]	-.018 [.49]
H2: Preferred program: soap opera [dummy]	-1.130** [.52]	-1.330** [.55]	-1.430** [.56]	-1.410** [.60]	-1.360** [.61]
H2: Preferred program: advertisement [dummy]	-.525 [.70]	-.570 [.72]	-.638 [.72]	-.439 [.74]	-.359 [.75]
b) Indirect advertising context					
H3: Discussion of and reflection on TV contents with children		-.206 [.25]	-.222 [.26]	-.316 [.27]	-.309 [.27]
H3: Children's spending: child asks for item seen on TV		-.493* [.28]	-.542* [.29]	-.591* [.32]	-.613* [.32]
H4: Child left home alone [dummy]		-1.940** [.90]	-2.000** [.90]	-1.560 [.97]	-1.410 [.98]
H4: Use of day care service or babysitter [dummy]		.639** [.32]	.814** [.35]	.565 [.40]	.523 [.40]
H5: TV advertisement: helps parents to offer a healthy and balanced diet		.431** [.20]	.413** [.20]	.507** [.21]	.484** [.21]
H5: TV advertisement: child understands how good presented product is		.084 [.18]	-.014 [.19]	.009 [.19]	.046 [.20]
H5: TV food advertisement: informs children and parents about new things		-.525*** [.19]	-.415** [.20]	-.593*** [.21]	-.583*** [.21]
H6: Food style: avoid food products with additives		-.237* [.13]	-.167 [.14]	-.245* [.15]	-.232 [.15]
H6: Food style: prefer to buy fresh meat and vegetables		-.313* [.16]	-.399** [.18]	-.322* [.19]	-.354* [.20]
H6: Food style: use lots of ready-to-eat foods		-.494** [.21]	-.276 [.23]	-.240 [.24]	-.178 [.25]
Knowledge					
H7: Food knowledge					.159 [.19]
Country dummies			X	X	X
Sociodemographics				X	X
Observations	184	168	168	146	146
F-value	2.89	4.28	4.14	4.43	4.07
R <sup>2</sup>	.106	.278	.302	.387	.391

Note: Standard errors in parentheses; \*  $p < .1$ ; \*\*  $p < .05$ ; \*\*\*  $p < .01$