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**Is it ever Enough? Food Consumption,
Satiation and Obesity**

by

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Is it ever Enough? Food Consumption, Satiation and Obesity*

Corinna Manig[†]

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Abstract

In order to explain the growth of obesity in industrialized and transition economies, a behavioral approach to food intake and overconsumption of calories is presented. It is argued that changes in food consumption patterns are one of the main drivers behind the imbalance of calories consumed and calories spent. The inclusion of new types of food in the regular diet of individuals led to changes in the motives for eating. While the intake of nutrients has always been and still is a prime motive of food consumption, it will be argued that with a growing variety of food items other motives increasingly take over as major drivers of the expanding food intake. These other motives also cause that the internal signals indicating to the body when to close a consumption act now occur with delay. The interrelation of biological and psychological factors and changes in the composition of diet therefore forms the basis for weight gain and, in the long run, obesity.

Keywords: Consumer behaviour, obesity, food consumption, needs, satiation processes

JEL Codes: I19, D11, D83

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1 Introduction

The eating behavior of individuals is in the center of a debate both in science and in public discourse. The discussion is driven by the numerous empirical observations indicating a growing number of overweight and obese people in industrialized and transition economies. This emphasizes that obesity has become a major public health problem (WHO, 2006; Cawley and Burkhauser, 2006; Bolin and Cawley, 2007; Sassi, 2010). The Centers for Disease Control and Prevention (CDS) found that in 2005/2006 33.3% of men and 35% of women in the US have been classified as obese. According to Rashad (2006), the percentage of obese people in the United States increased by 67% between 1971 and 1994 and most of this increase occurred during the 1980s. Obesity on this scale has implications for all parts of society, among which are an increased personal risk of illness, higher costs for social security systems and lower productivity in certain sectors followed by low wages (Colditz, 1995; Brown et al., 2000; Cawley, 2004; Finkelstein et al., 2004, 2005; Popkin et al., 2006).

These alarming empirical facts have caused several attempts by policy makers to change eating habits, for instance mandatory calorie information on menus and information campaigns (Downs et al., 2009). While the effects of these instruments have to be investigated in the future, the theoretical approach behind them assumes that individuals do not have enough information to make a proper choice about their eating habits. But as several studies have shown, individuals usually know about the possible bad health effects (Wansink, 2004b). This raises the question why do individuals obviously eat more than they need?

The purpose of this paper is to explain changes of consumption patterns by applying a behavioral approach to food consumption based on insights from behavioral sciences. It will be argued that eating is increasingly instrumentalized for satisfying needs other than, and in addition to, that of the intake of nutrients. I suggest in particular that the need for sensory and cognitive arousal increasingly influences patterns of food consumption. With a growing variety of food items

available, some of the main features of food products seem to get associated with consumption activities for which the need for calories is not the main motivation to start the consumption act. In these cases food can be seen as a combination good, i.e., food appeals to two or more needs simultaneously. If in these cases the need for calories is not the main motivation underlying the consumption act, consumers tend to underrate or ignore the nutrition effect and even seem to sense a feeling of satiation much later than in cases where food intake is the main motivation to act. Due to the resulting higher frequency and larger amount of calorie intake, the balance between calories consumed and burnt is distorted. In the longer run the effect cumulates and leads to overweight. Although the most immediate focus is on the way food satiates different needs simultaneously and thus results in a too high calorie intake; we also describe the circumstances that made food a combination good in the first place.

The remainder of the paper is organized as follows. In section 2 we give a short review of the literature dealing with the economics of obesity. Section 3 introduces the theoretical background on which the main argument is built, namely the learning theory of consumption. In section 4 the biological foundations of food consumption are presented, including basic mechanisms concerning food selection and satiation processes. These insights are applied to give an overview of how consumers choose their diet today, what kind of knowledge is applied in the selection of food, and how new types of food find their way into the regular diet of the consumer (section 5 and 6). Section 7 then shows the relation between consumption of new types of food, overconsumption of calories and respective satiation patterns. Section 8 gives a number of policy implications and concludes.

2 Economics of obesity: Empirical and theoretical contributions

A growing literature in economics and neighboring sciences addresses the recent growth in obesity rates and emphasizes the importance of both supply of food and the relation of calories consumed and calories spent. In particular, special atten-

tion is given to the influence of decreasing prices of food but also to other factors, among them technological progress and socio-economic factors like education, income, and ethnic background (for an overview see, e.g., Bolin and Cawley, 2007; Rosin, 2008). Lakdawalla and Philipson (2002) present empirical evidence for decreasing costs for most categories of food. Monsivais and Drewnowski (2007) show that high-energy-density foods provide the most dietary energy at least cost.¹ Putnam et al. (2002) show that in the U.S. the average number of calories consumed per person per day has increased during the last 30 years up to 30%. With regard to the influencing factors of obesity Baum II and Ruhm (2007) show that weight and BMI rise with age but are inversely related to socio-economic status at given ages. Lakdawalla and Philipson (2002) estimate that about 40% of weight gains can be explained by agricultural innovation and the remaining 60% are due to demand factors, among which is declining physical activity caused by technological progress in home and market production.

Theoretical approaches include among others capital investment models of weight and models of rational addiction. In capital investment models of weight individuals compare life time costs of weight gain and the respective benefits. Since eating provides utility immediately, reductions in the price for food provide an incentive for higher calorie consumption and weight gain with simultaneously declining incentives for exercising because of its comparatively higher costs. In view of these assumptions, economic progress leads to weight gain if people behave efficiently, i.e., obesity is a side effect of welfare-enhancing progress (Lakdawalla et al., 2005; Lakdawalla and Philipson, 2009). Other models focus on the effects of decreasing real prices of food and lower levels of physical work (Philipson and Posner, 1999) as an explanation for the overconsumption of calories.²

¹According to the authors, between 2004-2006 the price change for the most energy dense food was -1.8% whereas the 2-years price change for the least energy dense food was + 19.5%. The authors conclude that prices of non-processed food such as raw meat, fruits and vegetables have been rising while prices for highly-processed foods have been substantially decreasing (Monsivais and Drewnowski, 2007).

²These models are based on the seminal work by Grossman (1972), who states that health is demanded by individuals for two reasons: on the one hand to maximize their own utility and on the other hand as an investment in their own productivity because a

Ruhm (2010), in contrast, enlarges this argument by including scientific evidence from neuroscience on the determinants of eating behavior. In his dual decision model, individuals maximize utility according to the capital investment model, but their eating behavior is on a second stage determined by the affective system of the brain. As a result, calorie consumption exceeds utility maximizing levels.

Rational addiction models of weight state that calories are potentially addictive and therefore consumers' expectations about the decline of food prices lead to large increases in the consumption of food (Cawley, 1999, 2002). Related to that argument is the work by Cutler et al. (2003), who are suggesting that a lack of self control leads to overconsumption. They argue that in an environment where food is always available consumers are animated to consume much more food than they would in absence of these signals. This is in line with the work by Scharff (2009), who presents evidence for hyperbolic discounting in the behavior of obese consumers.

3 Needs, satiation and consumption knowledge

The approach presented here differs from the above mentioned approaches in several ways. First, instead of using the notion of utility maximizing behavior the focus is on consumer needs understood as genetic predispositions that motivate actions. Second, even if a lack of self-control can be found in many eating situations, it is still open to debate how large this effect is and why individuals start these repeated consumption acts at all. That is why the motives and the incentives to include and consume new types of food are emphasized. Third, while the price of food plays a role in the above mentioned approaches, the quality of food consumed, which is reflected in the price, is not treated as an important factor.

The theoretical framework for the approach is the learning theory of consumption (LTC) by Witt (2001). This is a behavioral theory emphasizing the role of cognitive and non-cognitive learning patterns for individual consumption. Con-

healthy body is necessary both for market and non-market activities.

sumers are assumed to be motivated to satisfy needs that, in part, belong to their genetic endowment including both physiological and psychological needs among them the need for air, for aqueous solutions to drink, sleep, calories, keeping body heat, physical activity, sex, and arousal. These needs, Witt claims, differ with regard to their satiability so that with rising income consumption patterns tend to change. In addition, learning mechanisms that also contribute to changes in individual consumption patterns are taken into consideration.

The interplay between deprivation and satiation determines the underlying motivation for consumption. Deprivation causes an unpleasant sensory experience which motivates actions known to be capable of reducing deprivation - in many cases consumption activities. The removal of deprivation (i.e., satisfaction of a deprived need) is considered a rewarding experience and, as such, assumed to be reinforced. Every need is characterized by its own unique patterns of deprivation and satiation with regard to time, strength and speed of satiation. While for physiological needs there is an upper limit where further consumption would lead to a state of aversion, this does not necessarily hold for a psychological need, implying that the satiation level may be quite different.

Which means or, for that matter, consumption activities, are used to satiate a need is highly determined by former experiences and is therefore learned behavior. During every consumption act individuals build up comprehensive consumption knowledge that includes means-end-relationships to satisfy different needs, i.e., modes of insightful learning about the way goods and services can be directed toward satiation processes. Additionally, individuals also acquire information about novel means to satisfy their needs. Other ways of need satisfaction may then not be applied any more as better alternatives became available.

The means-end relationships collected in the consumption knowledge are not necessarily associating needs and available goods and services one-to-one. Books, for example, may be used as means to satisfy the need for arousal while reading. If these books are seen as collectibles, in contrast, they may serve the need for status

as well. If the individual also reads them, books serve both needs simultaneously. In this case, the book becomes a combination good. Whether a new connection between a good and the satisfaction of a need is established depends on learning processes. No good has to be considered as a combination good from the beginning of its use and the individual does not have to be aware of this relation all the time the good is consumed. Depending on the needs to be satisfied, the individual applies different parts of her consumption knowledge when considering the same good as a means to satiate a need.

Witt's approach to explaining consumer behavior will be used here as a basis for the analysis of changing patterns of food consumption. In the following we present relevant facts about food and food consumption to demonstrate how it can be utilized to explain observable food consumption patterns. Special attention will be given to biological predispositions, patterns of deprivation and satiation and the relevant parts of the consumption knowledge with respect to food, eating and nutrition.

4 Food Consumption - Biological background

Due to the importance of a stable nutrition, a number of genetic predispositions ensure that humans as omnivores select a nutritious combination of food. Among these predispositions are the "omnivores paradox" (Rozin, 1976, 1982) and the basic tastes. The omnivore's paradox states that humans are equipped with two tendencies: neophobia and neophilia. Neophobia (the fear for novelty expressed as culinary conservatism) guarantees a certain degree of cautiousness with respect to new types of food. Neophilia (the urge toward novelty and aversion to monotony) on the other hand, ensures that omnivores are continuously searching for new sources of food. While food has to be sampled to guarantee a certain variety in the diet, this is in conflict with the respective preference for familiarity. Both tendencies have to be balanced by the individual, implying that every type of food has to be evaluated with respect to both a potential danger and an opportunity

for dietary diversification.

The selection of food takes place mainly by evaluating appearance and taste. Tastes are used to form expectations about the nutritional values of food, i.e., whether the food may be poisonous or not. From birth on, individuals are endowed with four basic tastes: sweet, bitter, sour and salty. Sweet taste is preferred from birth onwards, because it signals calories in form of carbohydrates (Desor et al., 1973). Hearty taste indicates protein. Other tastes have the function of a warning system. For instance, salt is a dietary essential but it is harmful at high levels and the avoidance of bitter taste is helpful as it can signal poison (Shallenberger and Acree, 1971). Individuals show a clear preference for a combination of sweet taste and fatty texture, but an optimal combination does not contain maximum levels of each ingredient Drenowski and Greenwood (1983). Besides these innate preferences, the cultural environment plays an important role for food choices (Fiddes, 1995) and individuals start to consume an initially non-pleasing substance as long until they like it if cultural influences motivate this behavior (Farb and Armelogas, 1980). For instance, a number of foods and beverages like coffee, black tea, but also chili or cheese, need repeated consumption until consumers start liking them (Ruprecht, 2005).

Eating and the need for nutrition respectively are, like all needs, subject to processes of deprivation and satiation. In order to describe the physiological satiation process of the need for nutrition in detail, general approach to satiation is needed. The concept of the satiety cascade by Blundell (1990) defines different stages or phases of satiation and connects them to the psychological and physiological factors influencing the satiation process. In this framework it is important to define the terms hunger, satiation, and satiety as these terms refer to different stages of the cascade. Hunger is the motivation to start an act of food consumption. According to Blundell (1990) "...satiation is a process which brings a period of eating to a close, whereas satiety is the state of inhibition over further eating once a period of eating has ended." (Blundell, 1990, p.6). This implies that satiation is a gradual process that ends in a state of satiety. In this regard, Dye and

Blundell (2002) state that deprivation of the need for calories is linked to the satiating power, or satiating efficiency, of food defined as the capacity of a food to suppress and inhibit further eating (p. S188). Food causes this effect by a number of mediating processes or phases that are linked to its nutritional characteristics.

How these mediating processes form satiation and consequently lead to the state of satiety is not answered completely both in medical and nutrition science (for an overview of existing theories see Eastwood, 1997).³ Most of the theories concentrate on a single factor and its role in the satiation process. In contrast, Blundell's four-phase model does not exclude existing studies and theories but integrates both physiological and psychological processes that lead to satiety.

The first phase, sensory satiety, is related to sensory characteristics, such as smell, taste, temperature, texture or color of the food consumed. Its occurrence is linked to the variety of food presented during a consumption act. The more variety is available during a meal, the higher is the amount of food actually consumed because then sensory satiety occurs with delay (Rolls, 1986; Rolls et al., 1988; Rolls and McDermott, 1991). A pertinent example is the everyday observation that while having dinner people reject a second portion of the main course but ask for a dessert. In this case the main course in comparison to the dessert is completely different in terms of texture and taste, i.e., eating the dessert causes another specific sensory effect.⁴

The second phase, cognitive satiety, is associated with the cognitive effects of food intake. These include expectations and beliefs concerning portion size in terms of calories and characteristics of food like nutritional values or its perceived fillingness. A broad literature deals with the factors influencing the individual per-

³The medical literature on this topic provides a number of complementary theories. For instance, the amino static theory of satiety states that the combination of amino acids in the food item has an influence on the selection of food. To give another example, the glycogen static theory claims that the regulation of caloric intake depends on changes of the aerobiosis of the liver (Bender, 2007).

⁴For a discussion of sensory specific satiety see Rolls (2000).

ception of eating behavior (for an overview see Wansink, 2004a). For instance, Brunstrom et al. (2008) show that expectations about the fullness of food are positively correlated with the familiarity of food but it is not correlated with the actual calorie content. Furthermore, participants expected sweets and processed food to be much less filling than unprocessed food. This implies that cognitive satiety is subject to learning processes but also highly susceptible to misinterpretation.

The third phase, postingestive satiety, is connected to effects such as gastric distension and the rate of gastric emptying. Furthermore, the release of hormones and the stimulation of physiochemical-specific receptors along the gastrointestinal tract play a role. Finally, the post-absorptive phase of satiety includes: "... those mechanisms arising from the action of metabolites after their absorption across the intestine and into the blood system. This category includes the actions of chemicals such as glucose and the amino acids which may act directly upon the brain after crossing the blood-brain barrier or which may influence the brain directly via neural inputs after stimulation of peripheral chemoreceptor." (Blundell, 1990, p. 8). After the individual's metabolism went through all four phases, the state of satiety is reached and further food consumption would lead to a state of aversion.

Blundell (1990) states that the four phases are overlapping and will cause a combined effect. This is obvious in the sense that the metabolism reacts immediately when food consumption takes place to avoid possible negative effects (Rozin, 1989; Shepherd, 1989). Furthermore, learning mechanisms enable the metabolism to form associations between the sensory and post absorptive properties of food. Different kinds of food and their corresponding nutritional characteristics engage differently with the mediating processes and consequently, exert differing effects on satiation and satiety. Since all foods consist basically of macronutrients like protein, carbohydrate and fat, these inherent elements determine the satiety efficiency of food. Stubbs (1996) presents experimental evidence for a hierarchy of satiety power among the macronutrients. According to his con-

cept, the hierarchy of satiating power is protein > carbohydrate > fats.⁵ However, further research on this topic is needed.

The satiety cascade is an adequate and valuable approach to describe the process that brings eating to an end. In the following we will concentrate on the first two phases, sensory and cognitive satiety, because both are directly influenced by the individual since they can be monitored by individuals (in contrast to the last two phases that cannot be influenced any more because they strongly depend on the first two phases).⁶

5 Consumption knowledge in the case of nutrition

After having described the biological foundations of eating behavior, we move on to the second important part, the role of knowledge and learning. Consumers living in modern societies today have a detailed knowledge about diet and nutrition, differences in the quality of food, and special kinds of diets (Brownell and Battle Horgan, 2004; Brunello et al., 2009). This kind of knowledge, nutrition knowledge, includes all types of information related to the nutritional values of food and the physiological aspects of food consumption, i.e., the different ingredients of types of food or complete meals and their effects on health. Nutrition knowledge is therefore part of the individual's consumption knowledge and is applied in all situations where food is consumed to satisfy the need for nutrition.

Nutritional knowledge also includes information from advertisement and nutritional labels provided by the suppliers. In practically every modern market the seller's own information is one of the primary sources used by potential customers to make choices (for an overview see Golan et al., 2001). A number of studies

⁵For a discussion on further experimental evidence of the satiety efficiency of macronutrients see Dye and Blundell (2002).

⁶Since the satiety cascade illustrates a succession of processes only, it provides no evidence that would allow to make approximations about the length of the satiation process.

support the hypotheses of a correlation or even causal relationship between advertisement and aggregate food consumption (Brownell and Battle Horgan, 2004). Empirical evidence suggests that advertisement affects primary demand and several studies found weak evidence of brand switching but stronger evidence for increased demand (Garde, 2008; Richards and Padilla, 2009).⁷ Concerning nutritional labels and health claims two different effects are discussed in the literature. First, the information hypothesis suggests that consumers choose healthy (or avoid unhealthy) food if food manufactures are allowed to link consumption of particular types of food to disease risk. Second, the consumer confusion hypothesis states that consumers are so confused by too much information that improvement in diet, that would occur otherwise, is decreasing. Many studies arise from the empirical and experimental study of these two hypotheses but the evidence provided is mixed (Drichoutis et al., 2007). Furthermore, even the framing and content of the labeling itself seems to have an effect on consumers' perception of health claims (Grunert et al., 2009).

Quality of food is a crucial part of consumption knowledge because the quality of food determines whether the product may be consumed at all or whether it may become part of the regular diet. The consumer's perception of quality is a large field of research in psychology, marketing, and management, including both theoretical approaches and empirical and experimental evidence (for an overview see, e.g., Grunert, 2005). In this literature, special attention is given to the relation between the perception of quality and the actual consumption decision. Food quality is decomposed into an objective and a subjective part. Objective quality refers to physical characteristics and measurable and verifiable superiority compared to some predetermined ideal standard or standards (Zeithaml, 1988). For example, nutritional quality, microbiological quality, or chemical stability are standards in-

⁷In contrast, other studies criticize the missing evidence on the causality of advertisements for highly processed food and increasing consumption of these kinds of food. It is argued that advertising changes brand preferences within mature markets but does little to generate primary demand (Duffy, 1995; Nelson, 1999; Duffy, 2003). Since the results of the studies appears to depend on the statistical methods applied, this debate is clearly a field for further research.

dicating objective quality. Subjective quality, on the contrary, can be defined as “the customer’s perception of the overall quality or superiority of a product or service with respect to its intended purpose, relative to alternatives.” (Aaker, 1991, p.85). Quality is consequently a multidimensional concept and accordingly the consumer cannot completely evaluate all dimensions simultaneously but only in relation to available alternatives (Oude Ophuis and van Trijp, 1995).

An analysis of quality perception includes at least two different facets, the time dimension and the role of indicators signaling a certain quality. The time dimension of quality is related to the differences in quality perception before and after consumption (Oliver, 1980). The indicator dimension, in comparison, deals with different types of signals or indicators and their influence on quality perception before purchase and consumption. One of the most important indicators is the price of a product. In absence of other indicators, consumers who have to choose between two similar products expect that the higher price alternative is also the alternative with higher quality (Oude Ophuis and van Trijp, 1995). Consumers prefer indicators that are easy to recognize. For example, color and fat content of meat are perceived as indicators of its taste and tenderness, while organic production is applied as an indicator for the superior taste of fruits and vegetables.⁸ The literature furthermore discusses three other quality indicators: brands, signals related to food origin and quality labels (for a discussion on the three indicators see, e.g., Keller, 1993; van der Lans et al., 2001; Johansson, 1989)

6 The inclusion of new types of food

Whether a new food product will be included in the regular food consumption or not is determined by the already mentioned biological predispositions but also by quality expectations and quality perception of the individual. But variety, similar to quality, may have different implications in different contexts. For example, eat-

⁸Bredahl et al. (1998) present experimental evidence that consumers often misinterpret those indicators, because they relate the wrong characteristics with high quality.

ing different types of breakfast cereals every morning may create dietary variety in the view of the consumer. From the viewpoint of nutritional science, however, most breakfast cereals contain an almost identical composition of macronutrients, minerals and vitamins and thus dietary variety may not be affected. That consumers nonetheless prefer a variety of cereals is a signal for the subjective dimension of variety. In order to take this subjective component into account between nutritional variety and the consumers perceived variety, and in analogy to the separation of quality, we distinguish between variety from a nutritional science point of view (objective variety) and variety from the consumer's point of view (subjective variety). Objective variety can be defined with regard to the nutritional aspects of the diet, i.e., composition of macro-nutrients such as protein, fat and carbohydrates in connection with the intake of vitamins and minerals.⁹ Subjective variety, in comparison, depends on the subjective evaluation of the diet with regard to the number of food items consumed and the perception and taste of these food items.

The main indicator for the perception of variety is the sensory experience caused by food consumption. If these sensory experiences are sufficiently different from each other, the individual considers the single experiences as adding to her subjective variety. This also holds when different food products consumed seem to be very similar on the first view. For instance, consuming different food products belonging to the same kind of cheese is not adding to dietary variety from the nutritional science point of view. But empirical evidence shows that individuals consume different types of cheese and also different brands of one type of cheese (Arnade et al., 2008).

How can several brands of the same type of cheese add to the perceived variety of an individual's diet? The crucial point here is the way expectations about quality of a product are built by the individual. Consider again the time dimen-

⁹Nutritional science provides a number of guidelines for the optimal composition of the diet that ensures an appropriate functioning of the metabolism (Eastwood, 1997). However, most people in industrialized countries consume a diet that consists of the necessary objective variety that prevents consumers from effects of deprivation.

sion of quality perception. Before purchasing, individuals use indicators to build quality expectations about a product. When these expectations meet a certain standard, the product will be purchased and consumed. During and after (repeated) consumption, the sensory experience causes either pleasure or it creates a non-pleasurable experience that may range up to a feeling of disgust. If the perceived quality is consistent with experienced quality the first condition for further consumption is fulfilled. In order to be integrated into the regular diet, the food product additionally has to add to the consumer's subjective variety. As consumers are searching for ways of getting many different pleasurable experiences, they may want to include also different kinds of a type of food if each of them is adding to the perceived variety in their diet. In order to stay with the example of cheese, the consumer may buy cheese from a brand and additionally cheese that is labeled as coming directly from the France. Food products that add not much to the variety of the diet from a nutritional point of view are regularly consumed, because they are subjectively perceived as adding to variety by the consumer.

7 Food as combination good

The acceptance and inclusion of new types of food is a necessary condition for changes of eating habits but it cannot explain why people consume even more calories than necessary to keep the metabolism work properly. In order to explain this behavior it is necessary to take a closer look at the motives that drive eating and the role of combination goods in the satiation process. Since the consumption of combination goods satisfies at least two different needs simultaneously, the consumption act is subject to more than one satiation process. It is suggested that, in the case of eating, the need for nutrition and the psychological need for arousal together determine duration and amount of food intake.

Food became a combination good for several reasons, among them increases in disposable income that made it possible to consume new types of food and a change in need satiation patterns for the need for arousal. The need for arousal

and the means of satiating this need have changed tremendously during the last decades. The role of the need for arousal for consumption behavior has been emphasized first by Scitovsky (1976). Arousal has motivational value independently from other needs such as hunger or thirst, as was shown by a number of studies (Steenkamp et al., 1996). Most individuals tend to seek an Intermediate State of Arousal (ISA), which is, following Scitovsky, between strain and boredom (Scitovsky, 1976, p. 15). Individuals try to reduce arousal, if its level is above the ISA (for instance, relaxing after a day full of work) and when it is too low they try to increase their arousal level (for example, eating snacks). Therefore the need for arousal can be defined as the motivation to act which results from the comparison of the negative/positive difference between the ISA and the individual's actual arousal level (Chai, 2007). Scitovsky suggests that technological progress supports a situation where consumers are less and less deprived of their physiological needs (such as the need for calories or keeping a certain level of body temperature) but this causes a deprivation of the need for arousal. Since today's daily life is much more secure than it used to be, a positive need for excitement is inherent to most individuals. In order to avoid boredom as a source of unpleasant experiences, individuals have to find ways to increase their level of arousal including mental and physical stimulation. Different sources of entertainment are becoming, as a result, more important for individuals. Indeed, the reiterated use of convenient forms of entertainment like watching TV or reading a book leads to habituation effects that result in a situation where the means are no more a source of novelty or only in a limited way (Scitovsky, 1976). As novelty is used up during the consumption process (i.e. the act of enjoyment), individuals become less responsive to the stimulus after prolonged exposure. It follows, therefore, that another stimulus is needed, either instead of the existing stimulus or in addition to it.

Reasons to prefer food to other ways of satiating the need may include its easy accessibility, its price, or that it can be consumed easily and fast, implying an easy way of reaching satiation. Considering the example of an interaction between the need for nutrition and the need for arousal, the following picture emerges. The in-

dividual realizes deprivation with respect to the need for arousal. Simultaneously, the need for nutrition does not necessarily have to be deprived but it cannot be in a state of satiety. As the main goal of the consumption act is the satisfaction of the psychological need, consumption knowledge is applied to select consumption activities. The respective means-end relationships contain a certain number of consumption possibilities, among them several types of food, including sweets, salty snacks, and similar products.

When the consumption act starts both satiation patterns - satiation with respect to the need for nutrition and the need for arousal - play a role with respect to the amount of food consumed and the duration of the consumption act. But, due to the underlying motive of the consumption act, the satiation patterns of the need for nutrition are of minor importance. Consequently the main goal of food consumption here is to reach the ISA level.

Since the consumption act itself will be closed only when the ISA level is reached again, key determinants are the characteristics of the food chosen. The stronger the sensory experience caused by the food, the faster the ISA level of arousal may be reached again. Here, several factors influence the consumption process in different directions. On the one hand, food products which are characterized by a strong taste or which offer a multitude of sensory stimulations have the potential to satisfy the need for arousal in an effective way (in contrast to other types of food such as bread). But, on the other hand, exactly these characteristics stimulate food consumption. It is, therefore, very likely that the satiation patterns with respect to the need for nutrition are affected in a different way.

In principle, there is the possibility that the consumer would have to stop the consumption act before reaching the preferred ISA level because of reaching satiety with respect to the need for nutrition. Since this seems to happen rather seldom during such consumption acts, the question arises how this is possible. In order to answer this question it is useful to take into account the different phases of the satiety cascade and how the phases occur during the consumption act considered.

The characteristics of the food lead to a situation where the different phases occur with delay. Sensory satiety is delayed due to the variety of food consumed, since it will not occur as long as different sensory stimuli are provided by the consumption act. Here, the subjective variety of the food consumed is the crucial factor and not the objective variety. It is therefore very likely that the subjective variety is high (due to the number of sensory experiences or expectations that are formed), while the objective variety is rather low. For the second phase, sensory satiety, the process is more difficult since the two needs satiated by the consumption act interact. First, cognitive satiety can hardly occur when sensory satiety is not reached. Second, cognitive satiety strongly depends on the degree of monitoring that is devoted to the consumption act. The higher the degree of monitoring, the higher the probability that cognitive satiety will occur according to the experience and knowledge about the satiating characteristics of food. This monitoring does not take place since the main motivation for the consumption act is not related to nutrition and the respective knowledge is therefore not applied. Expectations about the satiating characteristics or the fillingness of these food products are not related to the concrete consumption situation and cognitive satiety is delayed.

The delay of cognitive satiety, then, also influences the two remaining phases, as connections between cognitive and postabsorptive satiety that have been formed in the past are not applied. All these processes add to the case that, since satiation with respect to the need for nutrition is delayed, the complete consumption act is closed when the preferred level of ISA is reached. Since this is independent from the amount of calories consumed, such a behavior implies overconsumption of food and calorie intake that is far beyond the necessary amount.

At least two consequences occur from the satisfaction of psychological needs by consuming food. First, food consumption triggers a rewarding experience that occurs when the need is satisfied. Second, food intake without being hungry leads to an additional calorie intake that is not needed from a physiological point of view. From the individual's point of view, the consumption behavior does not

obtain any inconsistency. Eating fruits and yogurt for breakfast and eating crisps while watching TV is related to the satiation of different needs, even if the respective calorie intake seems to be the connecting factor. It is important, therefore, to take into account the special characteristics of a situation to acquire information about the underlying needs that will be satiated. Depending on the situation, the need for nutrition motivates a behavior influenced explicitly by nutritional knowledge while a need like arousal motivates behavior that, accordingly, is influenced by other parts of an individual's consumption knowledge.

8 Concluding remarks

In this paper, a behavioral explanation for increases in calorie intake and resulting growing rates of obesity has been presented. One of the reasons for the overconsumption of calories is founded in the possibility to satisfy different needs with food simultaneously. Besides the need for nutrition, individuals also satisfy psychological needs by consuming food; thus, food can be seen as a combination good. Furthermore, the role of consumption knowledge has been analyzed. If the daily routine of the individual consists of many situations where food is consumed to satisfy a psychological need, the resulting higher frequency of food consumption leads to overconsumption of calories and consequently to increasing rates of overweight or obese people. The underestimation of calorie consumption is strengthening this behavior.

The argument explains the weak effect of additional nutritional information on dieting decisions (Downs et al., 2009). Many policy interventions are based on the provision of information (e.g., European Charter on counteracting obesity,¹⁰ In-Form,¹¹ and calorie postings regulation for food service establishments

¹⁰Charter adopted by the Ministers and delegates attending the WHO European Ministerial Conference on Counteracting Obesity in 2006. For more information see <http://www.euro.who.int/document/e89567.pdf>

¹¹Program of the German Ministry of Health and the German Ministry of Nutrition, Agriculture and Consumer Affairs. For further information see <http://www.in-form.de/>

in New York City¹²). Depending on the consumption situation, the individual applies different parts of her consumption knowledge. Consequently, even the best information provided is not taken into account as long as the individual is in a situation where the satisfaction of the need for nutrition is not the main aim of the consumption act. It follows from this argument that the provision of additional information as a policy response to increasing rates of obese people may have only limited effects as long as the majority of consumption acts is only subordinately related to the need for nutrition.

Another policy intervention targets the availability of food and especially the availability of different types of food. Two possible points are crucial in this context: First, what kind of food is available to consumers? Second, what kind of offers would be desirable? Concerning the first point, a number of empirical studies present evidence for an effect of social and physical surroundings on individuals' health and behavior. Curtis and McCellan (1995) show that the sharp decline of supermarkets in low-income areas in the U.S. lead to a dependence on small stores with limited selection of food and higher prices. They reason that people in such areas consume a comparatively poor diet. In response to those findings policy makers are trying to stop further openings of fast-food outlets in poor city areas. In July 2008, the City Council of Los Angeles, California, passed a law that bans new fast food outlets in South Los Angeles. Simultaneously, the city offers financial incentives for prospective owners of grocery stores and non-fast-food restaurants to open new shops in the respective area. An evaluation of the resulting effects is, to my knowledge, not available yet. But the general attempt to change the consumption possibilities may have an effect on food consumption behavior. A larger number of supermarkets and the respective variety in products improve the chance of choosing healthier food products. This may have an effect on food consumption decisions even in situations where the nutritional values of food play a minor role for the consumption act. Strong stimulating sensory experiences are often, but not only, created by the consumption of highly processed food.

¹²For further information see <http://www.nyc.gov/html/doh/html/inspect/insp-calorie-posting.shtml>

As many people do not want to spend too much time on shopping, a mixture of different offerings for food shopping and food away from home consumption may provide a basis for healthier eating habits in all situations of food consumption. An effective way to change consumers' eating habits is to increase the availability of healthy food and to limit the availability of unhealthy food.

Changing food consumption behavior is a complicated task because most consumers try to reduce the effort that deciding what and how much to eat takes. Consuming a healthy diet is both a question of income and a question of cognitive effort. Furthermore, many people think that it takes too much time to change eating habits, including changes in the way how and where to buy food and how to prepare it. It remains a question for further research what factors are necessary to motivate people to give their nutritional knowledge a higher weight in their consumption behavior.

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