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The Effect of Calorie Information on Consumers' Food Choice: Sources of Observed Gender Heterogeneity

by

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The Effect of Calorie Information on Consumers' Food Choices:

Sources of Observed Gender Heterogeneity

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Abstract

A lower proportion of females are overweight than is males. Females' food choices in comparison to those of males reflect the higher importance they attribute to health and physical appearance, more complex attitude toward risk, greater esteem for home-cooked food, and sociological factors. This paper explores the variables that affect consumers' final food choices, shedding light specifically on the choice process and analyzing whether gender affects predispositions toward foods, perceptions, choice processes, or both. Perceptions and choice processes based on memory judgments serve only as a benchmark used to compare choices made with calorie information.

In two experiments wherein subjects were exposed to two forms of calorie information on three fast food items, we show that that differences in perceptions of healthfulness and tastiness of foods account for gender differences in memory-based choices; while calorie information affected both perceptions and choice processes for females, it changed only the perceptions of food for males.

We show that differing calorie presentations affected males and females differently.

1. Introduction

Females' food choices are healthier than those of males (CDC 2008), and their likelihood of being overweight is less overall (*NIH 2010*[3]). Females are more conscientious than are males about their own diets and health (Wyant and Mislead 1984; Roininen et al. 1999; Gerend 2009), consume healthier foods, and rate such foods as tastier (Rappoport et al. 1993; Digby and Stewart 1996).

Zooming in and observing overweight figures in ethnographic populations complexifies the picture: The odds of African-American females or Latinas of being overweight are greater than those of African-American males or Latinos (AHA, 2008); and the proportion of obese females is larger than that of males in the US adult population (Ogden, Carroll, McDowell, and Flegal 2007).

Since overweight is a major risk factor increasing the likelihood of diabetes, heart attacks, and strokes; and affects mortality rate as well as quality of life, then it is no wonder that understanding the factors that have led females to adopt healthier lifestyles has inspired many studies. The academic literature suggests that socio-cultural variables, genetics, evolution, importance attributed to health and looks, and economic variables such as differences in income and price sensitivity account for the observed gender differences in food choices.

Consumers of both genders are largely affected by social factors, e.g., social desirability and social acceptance, also termed *sociopolitical factors* (Herbert et al. 1997; Miller et al. 2008). Females' sense of social acceptance is more strongly bound up in physical appearance (look) than is that of males (Feingold 1990). Since in the West, "thin look" is the ideal of many females, while "strong build" is the ideal of

[3] http://www.win.niddk.nih.gov/statistics/index.htm Weight Control Information Network

many males, then eating has much to do with body shape, image, and social acceptance.

Aside from the sociopolitical variables, the literature explains gender differences in food choices by referring to genetic differences in sensory systems that affect taste (Fisher et al. 1961); differing metabolism resulting in differing energy needs (Lovejoy 1998); taking health hazards more seriously (Finucane et al. 2000); and attributing higher importance to looks and health relative to taste (Roininen et al. 1999; Gerend 2009). Naturally, some of these constructs are related. The judgment of one's self (and others') body image (look) depends on the "ideal look", which is culturally derived (Beardsworth et al. 2002). Likewise, culture affects taste in food (Zellner et al. 2004), as well as risk perceptions (Kahan et al. 2005).

While studying the reasons for gender differences in food choices is of great importance, as it can aid in influencing consumers to make healthier food choices, additional insight is provided by revealing that the sources for gender differences in memory-based choices serve in a benchmark case only. This study focused on studying the effect of calorie information on consumers' choice processes between food items, and whether such information widened or narrowed the gap between the genders therein.

Previous literature suggested that calorie information affects females' choices, shifting their selections toward lower-calorie foods, while it did not change males' choices (Milch et. al 1976; Driskell et al. 2008; Gerend 2009). By analyzing both perceptions and choice processes, we are able to both better understand the effect of information on final choices, and identify the sources of gender differences in response to calorie information.

We found that differences in perceptions of healthfulness and tastiness of foods account for gender differences in memory-based choices. Provision of calorie information affected both perceptions and choice processes for females, while it changed perceptions only for males. We also found that males and females responded differently to various forms of calorie presentation.

2. Literature review

When it comes to what we eat, men and women behave differently: Men consume more beef, eggs, and poultry; while women eat more fruits and vegetables and consume less fat than do men (Johansson and Andersen 1998; CDC 2008[4]). Consumption of fruits and vegetables is considered an efficient strategy in balancing diet, fighting obesity, and maintaining health. The gender differences in preferences for healthier foods begin in childhood. Previous literature has found that girls choose healthier food and are fonder of fruits and vegetables than are boys (Le Bigot Macaux 2001; Wardle et al. 2004). Boys rated beef, processed meat, and eggs as more desirable than did girls. Wardle et al. (2004), however, worded their findings cautiously, suggesting that their findings may have physiological origins (higher energy requirements for boys) or lie in social desirability, which has a stronger impact on girls' behavior.

The literature provides several explanations for the difference in choices and higher (lower) preferences for healthier foods. Among others are informational gaps, i.e., females are more aware of and have better knowledge of nutrition than do males (Johansson and Andersen 1998). Nutrient knowledge is a necessary, though not by itself sufficient condition, for making wise food choices. The state of being more

[4] http://www.eurekalert.org/pub_releases/2008-03/asfm-tdi031408.php EurekAlert

knowledgeable results from differing media exposure, where media sectors that target women place higher emphasis on health, style, education, and other topics that are believed to arouse their audience's interest.

Sensory (taste) differences between the genders are the second most widely ventured explanation for the differences in food choices, although it is not clear that such genetic differences actually exist. While the popular media argue that females prefer sweetness and dislike bitterness, while males may enjoy bitterness (Shah 2010), academic literature on this matter is less conclusive. The bitter taste receptor, gene TAS2R38, has been associated with the ability to taste PROP (6-n-propylthiouracil), one source of genetic variation in PROP and PTC taste. Individuals who experience bitterness strongly are assumed to also experience sweetness strongly relative to those who experience PROP as only slightly bitter (Reed, Tanaka, and McDaniel 2006). While previous studies found that inherited taste-blindness to bitter compounds such as PROP may be a risk factor for obesity, this literature has been hotly disputed (Keller et al. 2010).

The distribution of perceived bitterness of PROP differs among women and men, as does the correlation between genetic taste measures and acceptance of sweetness (Duffy and Bartoshuk 2000). A higher percentage of women are PROP and PTC tasters, sensing bitterness above threshold (Bartoshuk, Duffy, and Miller 1994). It has been suggested that women are more likely to be *supertasters*, or those who taste with far greater intensity than average. PROP and PTC sensitivity, however, does not fully explain the supertaster phenomenon (Bartoshuk, Duffy, and Miller 1994).

The correlation between PROP sensitivity and vegetable consumption appears mixed: Early studies suggested that consumers who are sensitive to bitterness (PROP

sensitivity) are more likely to dislike foods that contain coffee, beer, and bitter vegetables, e.g., cabbage and spinach (Fisher et al. 1961). Yet later studies reported only minimal effects of PTC taster status on the consumption of bitter vegetables (Niewind et al. 1988; Jerzsa-Latta et al. 1990). More recently, Dinehart, Hayes, Bartoshuk, Lanier, and Duffy (2006) showed that that the stronger the perceptions of vegetables' bitterness, the lower the preference ratings, and the lower the likelihood that such foods would be chosen. The correlation between strong ability to sense bitterness and lower odds of choosing vegetables begins at an early age: In a study conducted among children, only 8% of the nontaster children declined vegetables in a free-choice test, compared with 32% of taster children. Gender was not correlated to tasters or nontasters / PROP sensitivity (Bell and Tepper 2006).

Accepting the idea that more women than men are supertasters, and therefore are more sensitive to bitterness, might suggest that the likelihood of women's choosing green salad is lower than that of men, yet literature suggests that the reverse holds, i.e., women are by far greater salad eaters. Rejecting the genetic explanation, as it does not (yet) provide conclusive and comprehensive explanations, provides backwind to the idea of biological gender differences that seek causality by suggesting that differences in hormone composition are responsible for differences in food preferences and choices (Bierma 2005). For example, during pregnancy, women desire (and need) salty food, and the threshold for bitterness increases (see Faas, Melgert, and de Vos 2010 for review). It is not clear, however, that on average there is a genetic explanation for preferences of sweetness and fat and avoidance of bitterness and tart tastes that while indeed are the outcome of genetics, are not necessarily distributed differently in males and females (Keller et al. 2010). Evolution has always been used as argumentation for gender differences in preferences, as it was used by

Faas, Melgert, and de Vos (2010) to support the idea that bitterness avoidance results from mothers' need to protect their infants from poisonous plants.

While evolution and differences in genetics may create predispositions toward certain foods, the choice of whether to consume foods with greater (less) relish is socially and culturally dependent (Zellner et al. 2004[5]) and related to the importance one places on healthfulness and physical appeal, as well as on foods' availability (Birch 1999).

Wansink et al. (2003) found that while men rated steak, casserole, pizza, and pasta as being sources of pleasure (comfort food[6]), females rated candy, chocolate, salad, and soup as comfort foods. This finding raises thoughts about the role of sociopolitical factors in shaping taste and the perceptual correlations between tastiness and healthfulness. While males perceived steak and casserole as healthy, females experienced guilt after eating chocolate, indicating that there are some perceived undesirable attributes to certain foods, e.g., healthfulness, or calorie density. While gender differences in preference for chocolate over steak is consistent with culture, evolution, chromosomes, metabolism, and motivational system theories, it is still not obvious why American Style salad is regarded as comfort food by females. It appears safe to assume that salad's taste is ranked lower than, say, that of fries or hamburger. If salad is chosen by consumers, it is probably due to a tradeoff between pleasure, health, and danger of weight gain that consumers are considering.

Following the aforementioned discussion, we hypothesize that if genetics and evolution create gender differences in sensual interpretation of taste:

[5] In the US, a significantly larger proportion of females than males reported that they crave chocolate, whereas in Spain, the proportion of males and females who crave chocolate was similar (Zellner 1999).
[6] *Comfort food* is defined by Wansink et al. (2003) as a food that is tasty and is perceived as a source of pleasure.

H1: *Gender differences will be reflected in perceptual differences in the taste of food in general and vegetables (salads) in particular.*

The literature suggests that females are more conscientious than are males regarding their own diet and health (Roininen et al. 1999; Gerend 2009); and have stronger preferences for healthier Roininen and Tuorila, 1999) and organic foods (Lookie et al. 2002; Dreezens et al. 2005). Despite the importance of a particular food's healthfullness and its contribution to weight (gain) control, which is more important to women (Hawkins et al. 1983; Turrell 1998), taste is the most important variable in consumers' food choices (Holm and Kildevang 1996; Koivisto and Sjóden 1996; Moskovich, German, and Saguy 2005). A food's tastiness generates pleasure; it is a more observable attribute (at least in the short run) than is the health attribute; and therefore, it can provide a greater distinctive value in evaluating alternative food products (Bryant 2007). Choices of food products are affected largely by experience through sensory attributes, in particular taste (Shepherd and Stokly 1985; Shepherd and Towler 1992). Therefore, following Heiman and Lowengart (2010), we hypothesize that:

H2: *The choice of fast food items with no additional information will be based on taste only. We do not expect to see gender differences in the choice process.*

If females are more willing to trade taste for weight maintenance, appealing looks, and health, then we may conjecture that provision of calorie information that implies that the calorie gap between a salad and a juicy double hamburger (for example) is not wide, then females should reverse their preferences and switch to the tastier choice. The calorie difference between an entrée-size salad and a hamburger or a chicken sandwich is not always in the direction of the hamburger having more calories. For example, McDonald's Big Mac contains 590 calories, while McDonald's

Premium Southwest Salad with Grilled Chicken delivers 360 calories[7]. This gap validates our beliefs that salads have fewer calories than do hamburgers. If, however, the salad is accompanied by two slices of bread, and dressing is added (on average, 200 calorie per 2 OZ. / 4 Tbsp.), then the salad meal surpasses the hamburger in calories. The popular press reports[8] that some salads are actually "calorie traps", as they contain more calories than a regular entree. For example, MSN's Health & Fitness column tells readers about "America's worst salads", saying (referring to Applebee's Oriental Chicken Salad with Oriental Vinaigrette), "This Asian-themed salad starts out with a bed of 'Fresh Asian greens', according to the menu. Unfortunately, these greens serve as a bed for deep-fried chicken tenders and carbohydrate-heavy crispy noodles. Without dressing, this dish rings in at 840 calories—already more than in an Applebee's hamburger".

Even if the calorie contents of the lighter salads on fast food chains' menu are compared with the calorie contents of a hamburger or chicken sandwich, the surprisingly small gap between the two may give rise to second thoughts about the tradeoff between taste, healthfulness, and fitness — unless of course, females actually prefer the taste of salad. Next, we build our model of perceptions, choice processes, and choices given that calorie information has been provided to consumers.

2.1 The effect of calorie information on perceptions and choices

Females and males obtain information from differing media sources respectively (d'Haenens, Jankowski, and Heuvelman 2004). Media sources that target females assign more space to health and diet (Wade and Schramm 1969).

[7] The calorie gaps in the Israeli menu, which is used in our study is smaller. Hamburger McRoyal contains 386 calories, chicken sandwich contains 318 calories and the salad with dressing but without bread delivers 218 calories.

8 "The Worst Salads in America": If you're looking to eat healthfully at your favorite restaurant, don't automatically turn to the salad menu. David Zinczenko and Matt Goulding, *Men's Health*http://health.msn.com/nutrition/articlepage.aspx?cp-documentid=100255651.

Furthermore, the information is framed in a differing manner and in differing sections of the print media; this framing affects perceptions (Nisbet and Huge 2000), including those of foods. Since women are more interested in health and physical attractiveness than are men (Feingold 1990, 1992a), it is likely that the female-targeted media sections will provide their readers with more nutrient information than do the male-targeted sections. Since information increases the quality of food selection, women's food choices should be more consistent with nutrient guidelines.

Perceived importance of health and nutrition among females increases their attention to and allocation of resources (including cognitive) to the task of food selection. More attention results, for example, in females referring to nutrition labeling more frequently than males (Neuhouser, Kristal, and Patterson 1999). In addition to females' greater attention to and their being more informed on nutrition, the greater importance that they place on health and physical attractiveness increases their utilization of nutrient information that includes calorie information (Harnack et al. 2008). Calorie information therefore affects females' food choices by shifting their selections toward lower-calorie foods, while it does not significantly shift males' choices (Driskell et al. 2008; Gerend 2009). Further, 10-15% of males responded to calorie information by choosing a higher-calorie meal. Harnack et al. (2008) explained this finding thusly: "Conversely, this result could reflect a desire among males for an energy-dense meal."

Harnack et al.'s (2008) findings suggests that there is a segment of males does not perceive a negative correlation between calories and health or physical appearance, but rather a positive relationship. Females, in contrast, are socially conditioned to avoid calorie-dense foods, and therefore, are expected to perceive a

stronger negative relationship between calories, health, and potential weight gain than are males.

Gender differences in perceptions of the positive (subsection of male population) in contrast to negative (the vast majority of females) consequences of calorie consumption on physical appeal are reflected in the following quote by Loder (2010): "While males try to build their bodies (getting larger) by lifting weights, females are trying to get rid of their butts and waists by targeting their physical workout efforts on aerobics."

The psychology literature links weight to perceptions of body image, which both affects and is affected by self-esteem (e.g., Feingold and Mazzella 1998). The correlation between self-esteem and body image, holds for both genders but with different strength (Silberstein et al. 1988). Since physical attractiveness is a stronger determinant of desirability by the opposite sex for women than for men, then its importance is commensurately greater for women (e.g., Feingold 1990, 1992a). Furthermore, body weight affects body image of males and females differently: While females associate their body image with their body weight, males associate their body image with their physical strength, muscles, and attractiveness, i.e., being tall, hairy in the right places, and other physical qualities unrelated to body weight (Franzoi et al. 1984).

Women are more likely than men to describe themselves as fat, to weigh themselves often, and to diet frequently, and on average are less satisfied with their physical appearance than are men (Cooper and Fairburn 1983; Furnham and Calnan 1998). For many males, the ideal image of a body is a V-shape, which means higher body mass and muscle-building, while the ideal body shape of women is thin (Anderson and DiDomenico 1992). The desire to enhance masculinity by building a

V-shaped body results in a sub-group of males who desire to gain weight and become heavier, while almost no women expressed the desire to gain weight (Silberstein 1988; Frunham et al. 2002). The aforementioned discussion can be summarized in Hypothesis (3):

a. *The likelihood that males will perceive calories as a positive trait of a product is stronger than that of females doing so.*
b. *Males will not perceive a negative relationship between calories and physical attractiveness or health, while females are expected to perceive a negative relationship between physical attractiveness, health, and calories content.*

Heiman and Lowengart (2008) found that information on health hazards may change perceptions, attributes, and importance weights; and both attribute perception and importance weights, i.e., if perception of calories is negatively associated with health, we should expect the importance weight of the health attribute to increase ex-post calorie information. An incline in the importance of the health attribute increases the likelihood that consumers will now consider a tradeoff between health and taste (Heiman and Lowengart 2010). The direction of changes in perceptions and the corresponding changes in the importance weights depends on the opinion as to whether calories are good (bad) for health and physical attractiveness. Following the aforementioned discussion on gender differences in perceptions of weight and physical attractiveness, we hypothesize that calorie information will affect the choice processes of males and females differently. Furthermore, if calorie information is linked to fitness and body-building activities (burn), then males will not perceive it negatively, while women will. Following the above discussion, we hypothesize that:

H4: *Calorie information will affect perceptions such that the health attribute will be salient for women in the food choice process, while males' choice processes will remain unaffected.*

Table (1) summarizes our research hypotheses.

Table 1 here.

3. Survey and Data

The research design in this study is a between-subject one that enables detecting variations in consumers' evaluations of products' characteristics, as well as their purchasing behaviors under differing levels of information on calories. Three groups of respondents were used in this study: The first was a control group, the second underwent calorie content manipulation, and the third underwent calorie manipulation and manipulation on the amount of workout needed to burn a certain number of calories (hereinafter: "burn time"). In Group 1 (control), respondents were shown a menu of fast food items that included a hamburger, a chicken sandwich, a green salad, French fries, and a soft drink, along with the price of each. The first manipulation (Manipulation 1) included the same menu, but with each item's calorie content alongside its price. The second manipulation (Manipulation 2) included the same menu (price and calorie content) as for Group 2 (Manipulation 1), as well as a short description of a physical activity and the time it takes engaging therein to burn the calories contained in each of the five products (burn time).

3.1 Data

We used a descriptive research, survey-based approach based on field work aimed at collecting relevant data from potential respondents, and utilized a closed-ended questionnaire to obtain consumers' preferences and perceptions of three food

items: a hamburger, a chicken sandwich, and a green salad. After being exposed to the three above-described menus, respondents were asked to rate the three food items on several product attributes using an eleven-item Likert-type scale. For instance, a respondent would be asked: “On the scale below (of -5 to +5), how would you rate the tastiness of this hamburger?” Other attributes rated were healthfulness, price, calorie content, and satiation. These attributes were used as they represent the main characteristics and benefits of food consumption decisions as revealed in an exploratory study.

In addition, respondents were asked to choose one product (the hamburger, the chicken sandwich, or the green salad) of the three as their preferred main dish. An initial exploratory study we conducted indicated that these three products are the main items consumers choose in fast food outlets, and the other two items (fries and soft drink) are used as complementary items. All five items — not just the three being studied — were used in the experiment in order to create the common task with which fast food patrons are usually faced.

Prior to answering the questionnaire, respondents were asked whether they had ever consumed the three food items. After verifying that they had, we found that nearly all had consumed each product multiple times. Hence there should be few confounding effects of product familiarity and use in our results.

Overall the sample included 511 Israeli respondents that were drawn using a stratified sampling-type procedure that allowed us to capture heterogeneity of respondents with respect to their demographics.

Each respondent was randomly assigned to one of the three groups. The sample contained 186 males and 325 females. Responders’ educations ranged from high school level (24.7%), vocational training (non-university or -college higher education

- 40%), to college degree (35.3%). 19.3% were below 20 years of age, 22.7% between 20 and 30 years of age, 16.6% between 31 and 40 years, and 41.4% over 40 years of age. With respect to income, 36.3% earned an income that fell below the national average, 15.7% at the average level, and 48% earned above-average income.

3.2 The econometric model

We utilized a multinomial Logit (MNL) multi-attribute model to analyze the data as follows:

Let $U_{ij} = V_{ij} + \varepsilon_{ij}$ denote individual *i*'s (*I* = 1, 2,…*n*) utility from choosing alternative *j* (*j* = 1, 2, 3), where V_{ij} is the deterministic component of utility, and ε_{ijt} is the random component of utility. Thus, the probability P_{ij} that an alternative food *j* will be chosen depends on the deterministic component of the utility function only, such that $P_{ij} = \Pr[U_{ij=J} \geq U_{ij \neq J}, \forall, \in C_j]$ and

$$P_{ij} = \frac{\exp^{(V_{ij})}}{\sum j=m \exp^{(V_{ij})}} \quad (1)$$

where $V_{ij} = \sum_{k=1}^{K} \beta_k x_{ijk}$, β_k is the importance of the k^{th} attribute in the utility, and $\boldsymbol{x_{ijk}}$ is consumer *i*'s perception of attribute *k* for alternative *j*.

The utility's deterministic component in our study is: [9]

$$V_{ij} = \beta_1 PS1 + \beta_2 PS1 + \beta_3 Health_{ij} + \beta_4 Taste_{ij} + \beta_5 \Pr ice_{ij} \quad (2)$$

where:

$Taste_{ij}$ is consumer *i*'s perception of the taste of alternative *j* (*j* = 1, 2, 3)

$Health_{ij}$ is consumer *i*'s perception of the healthfulness of alternative *j* (*j* = 1, 2, 3)

[9] We omitted calories from the choice model, as they are highly correlated to health.

$Price_{ij}$ is consumer *i*'s perception of the price of alternative *j* (*j* = 1, 2, 3)

PS1, PS2 are product-specific constants that capture the idiosyncratic effects of Alternatives 1 and 2 respectively[10]; and

β_k are parameters to be estimated (*k* = 1, 2, 3, 4, 5)

4. Results

We begin by rejecting the explanation that gender differences in food choices derive solely from cultural and social expectations, or signaling during mating; we continue with an analysis of gender-related perceptual differences; then we present the results of the choice model, followed by choices of the various products.

If the arguments that women and men are similar regarding their perceptions and desires, and the only differences therebetween derive from social and cultural expectations that are intensified during the mating game, then we can expect that gender will negatively affect the choice of the choice sifters (gender contestants). Table (2) presents the estimation of Equation (2) in the memory-based task (control) when gender affects product constants only[11].

Table 2 here.

The results presented in Table (2) suggest that gender does not affect significantly the product constant (the hamburger and chicken sandwiches relative to the salad) and therefore, the assumption that solely cultural, social, and mating considerations account for gender differences in food choices is not supported. Next we test for significant gender differences in the perceptions of the three food items.

[10] Only two product-specific constants are used instead of three, to avoid singularity.

[11] $V_{ij} = (\beta_1 + g_1) PS1 + (\beta_2 + g_2) PS1 + \beta_3 Health_{ij} + \beta_4 Taste_{ij} + \beta_5 Price_{ij}$;
g_1 and g_2 are gender constants of Products 1 and 2 respectively.

4.1 Perceptions and perceptual associations

First, we present differences in perceptions of calorie densities of the three products sorted by gender and manipulation. Consumers were asked to valuate the calorie densities of the hamburger, the chicken sandwich, and the salad on a Likert scale that ranged from extremely high to very low. As hypothesized earlier, differences in initial perceptions of the three products' calorie contents may affect perceptions of the products' other attributes. Calorie content and burn (workout) time may change perceptions of products' attributes both directly (correction effect) and indirectly, via priming on calories, which implies health and potential weight gain. The results of these estimations are presented in Table 3.

Table 3 here.

Calorie information did not change males' caloric valuations of the three products. Females updated (increasing) their calorie valuations of the chicken sandwich only. This result may indicate either that consumers are already informed regarding the calorie densities of these foods, or that their attention thereto and motivation to process such information are low. Motivation to process information is a necessary condition to utilizing nutrition information (Morman 1990). The ordinal ranking of the three products' caloric values has been maintained therefor. Post-exposure to calorie and burn information, both males and females increased their perceptions of the hamburger's calorie density; and females updated their valuation of the salad upwardly relative to that of the control condition.

There were no significant gender differences in calorie estimations in the control group. Presenting information on calorie densities increased females' perceptions of the hamburger's calorie density, while males' perceptions were not affected by this information. The changes in females' valuations created a significant

gender difference in the valuation of the hamburger's calorie density, and a marginally significant difference in valuing the chicken sandwich's caloric value. These results suggest that in the control group, gender differences in valuations of calories are not the reason for gender difference in choice processes or ultimate choices, if such exist. Calorie information, particularly calorie information combined with burn time, affects females more strongly, and thus we expect to observe greater changes in perceptions and greater effect on females' choice processes than on males'. Next we present an analysis of perception differences of the three products both within and between treatments.

4.2 Perceptions

We begin this analysis by comparing perceptions of the three products — hamburger, chicken sandwich, and salad — between males and females across the three experimental conditions. Table (4) presents these perceptions.

Table 4 here

Memory-based perceptions (control group) indicate that gender differences are apparent only in the perceptions of the chicken sandwich and the salad, which females perceive as tastier than do males. The perceptions of healthfulness or price of hamburger, chicken sandwich, and salad do not significantly differ between males and females.

Calorie information caused differences in perceptions of the hamburger's tastiness, while they eliminated perceptual differences regarding the chicken sandwich's tastiness. Regarding healthfulness of the three menu items with and without calorie information, men's and women's perceptions were similar. Presenting calorie information resulted in changes in perceptions of price, with females now perceiving the chicken sandwich and the salad to be more "costly" than did males. Finally,

calorie and burn information did not change gender perceptual differences relative to those of the control group. Overall, the results shown in Table 4 support our first hypothesis, i.e., that gender differences will be reflected in perceptual differences in the taste of food in general and vegetables (salads).

In Table 5 we present the perceptual differences of products by gender and experimental conditions (control and the two manipulations).

Table 5 here.

Females and males hold differing views of the three products. While the ordinal attribute rankings of the three alternatives are identical across products for both genders, the attributes' overall values differ greatly: Whereas males perceived both sandwiches as similar in tastiness and healthfulness, and as being similarly priced; females perceived the chicken to be tastier and healthier than the hamburger, yet more costly. While the salad was perceived by both males and females to be a less tasty option than either a hamburger or a chicken sandwich, these differences were larger for males (30% less) than for females (20%). Salad was perceived to be the healthiest choice regardless of gender.

Calorie information changes the three products' perceptual positioning, rendering the health attribute more distinctive. While the three products were perceptually differentiated on health, prior to their calorie information being presented, the two sandwiches did not significantly differ in their perceived healthfulness. Both sandwiches were perceived as contributing similarly to tastiness regardless of gender, as before. Salad remained differentiated in both dimensions: as inferior in taste and price, yet superior in healthfulness.

While females increased their perceptions of the chicken sandwich's caloric density, they also increased their perceptions of its healthfulness. This result may

imply that consumers now pay more attention to health that became more accessible. The chicken sandwich was perceived as having lower caloric value even after its valuation was adjusted; thus calorie information caused consumers of both genders to focus on calories and to invest more effort in the task of comparing products. Comparison of the two sandwiches sharpened perceptions of the chicken sandwich.

Calories combined with burn time information did not change the three products' perceptual positioning much, relative to the structure under calorie information only. The only change — caused by the additional perceived burn effort — is that males now perceived the chicken sandwich to be similar to the salad with respect to its healthfulness.

Calorie information affected perceptions of price, rendering the gender differences significant in this dimension. It also eliminated the gap in females' perceptions regarding tastiness between the hamburger and the chicken sandwich. The most prominent change was that for both genders, post-exposure to caloric values, healthfulness turned out to be the most distinctive attribute on which the three products were differentiated. Calories did not change the positioning of the salad as a differentiated product: it remained perceived as healthy, less tasty, and costly.

The negative perceptual relationships between calories and health are intuitively understandable. The shift in perceptions of price can be explained by consumers paying more attention to the posted menu price, which was higher for lower-calorie food items; yet the correction of taste in the negative direction, opposite to that of calories, implies that taste and perceived healthfulness are positively correlated while healthiness tastiness and calories are negatively correlated.

In the next section we present the perceptual correlations between products' attributed and the effect of calorie information on strength and directions of these correlations.

4.3 Perceptual relationships

Pre-calorie information (memory-based judgment), males' perceptions of price and health are positively correlated (0.579); calories and health perceptions are negatively correlated (-0.573); and these two relationships led to high correlation between calories and cost (-0.693). Females' perceptions resulted in correlation between healthfulness with tastiness (0.498), while males did not perceive a similar correlation. This result is consistent with that of Digby and Stewart (1996), and implies that females perceive healthier foods to be tasty as well.

Like males, females perceive health to be associated with higher price, with healthfulness and price positively correlated (0.286); yet the strength of this relationship is lower than that perceived by males: Unlike males, females perceive higher calorie density to be associated with lower tastiness of a product (-0.329); and similar to males, among females, the higher the caloric value, the lower the product's healthfulness (-0.593).

Provision of calorie information changes the perceptual correlations such that most become weaker. Post-calorie information, males perceptually associate calories with healthfulness and tastiness, while taste and price are negatively correlated (respectively). Females' perceptual association between health and taste declined to (0.147) post-calorie information, and the negative relationship between calories and health disappeared.

Information on calories and the efforts needed to burn them did not significantly affect perceptual differences; the strength of correlations lies between those of the control group and the calorie manipulation.

The inverse perceptual relationship between healthfulness, cost, and taste reflects many restaurants' and fast food chains' pricing policies, as they price their healthier and lighter selections higher than the less healthy and non-dietary dishes.

Hypothesis (3) suggests that females' willingness to trade taste and income for health and physical attraction is greater than that of males, who continue to base their food choices on taste, even post-information exposure. Our results as described above support this assertion.

Hypothesis (4) suggests that calorie information will affect health perceptions, rendering health salient in the choice process. Table (6) presents the empirical estimation of Equation (2) in the control and the two manipulation groups. These estimates enable us to verify whether or not there are gender-related differences in the choice processes between fast food products, and if so, to what extent information affects these choice processes.

Table 6 here.

Pre-calorie information, both males and female based their choices on the taste attribute only. This result supports H2 and is a repetition of Heiman and Lowengart (2010) in a different setting of products and research design. Calorie information did not affect the choice process of either gender: Information on calories and burn efforts resulted in changes in females' choice processes that now incorporated the health attribute in addition to the taste attribute. These results partially support H4.

The comparison between calorie and calorie-and-burn manipulations is intriguing. The difference between the two manipulations is the information on burn

time, which caused females to consider the tradeoff between health and taste, while males ignored this information. One explanation therefor is that burn efforts "increase the perceived cost of" a calorie by expressing those efforts in terms of workout time. The literature documents females being more intensively engaged in fitness as a means to weight control than are males (e.g., Frunham et al. 2002). Familiarity with workout efforts enables visualizing the "effort price" of burn time, thus possibly causing females to more readily incorporate calories (the health attribute) into their choice processes, while males' unfamiliarity therewith may cause them to discount burn efforts. In our sample, however, there are no significant differences between workout frequencies measured as (weekly) frequency of engaging in physical activities[12].

Another possible explanation for males' stable choice processes is that the caloric values of the meals in our study are not alarming, i.e., they do not pose health hazards. The calories added by eating an ordinary hamburger are reasonable for the mid-day meal of an average male (consuming 2,000-2,500 calories a day). A third explanation, which in our view is the more logical, is that males corrected their calorie valuation of one product and in one manipulation (out of six possible cases), while females corrected theirs for two products and in two manipulations. In the calorie-plus -burn time manipulation group, females corrected their previous valuations for two out of three products (2/3), which may explain why their choice processes changed.

The most significant result, at least in our view, is that differing manipulations affected males and females differently: Females' choice processes were affected by

[12]

	Male	Female	P-value
Look	2.90	3.71	0.000
Clothing	2.06	2.84	0.000
Exercising	2.51	2.40	0.504

calorie and burn time; while males' remained stable independent of differing types of information.

The literature suggests that females are more aware of and consider the tradeoff between health and taste and between calories, health, and taste; while males are more likely to ignore the consequences of their food choices. Our results suggest that females indeed are aware of calories and their undesirable contribution to weight gain.

Considering only the magnitude and the direction of changes in calories densities perceptions while ignoring that changes calorie content perceptions affects the perceptions of taste and health that affect the choice process may have led us to erroneous direction(s) of changes in final choices. Males did not change their calorie valuations post-information, and thus no change ought to have been observed. Females, on the other hand, adjusted their calorie valuations of the chicken sandwich without changing their valuations of the salad or the hamburger; thus we would expect that females would switch from chicken to either salad or hamburger. Table 7 presents the market shares and their corresponding changes in light of consumer exposure to calorie-plus-burn time information.

Table 7 here.

Calorie information (in both versions) hardly affected females' choices of hamburger, while males shifted their choices to the chicken sandwich and the salad. Females shifted from chicken sandwich to salad, and slightly increased their choice of hamburgers post-calorie information, while their choices post-calorie-and-burn information reversed, similar to the choices in the control. While the added information of burn time deflated females' perceptions of all three products' healthfulness, it increased perception of the chicken sandwich's tastiness, and

decreased perceptions of the salad's tastiness by largerer magnitude. The increased importance attributed to health did not compensate for the decline in the perceptions of tastiness, thereby causing the chicken sandwich to regain its market share.

5. Conclusions

Being white and male increases the odds of being overweight in comparison to white females (71.0% and 57.6% respectively), while the odds ratio is reversed in the African-American population (67.0% males and 79.6% females), and among Hispanic-American males and females, the difference is insignificant (*NHANES [2001-2004], NCHS. Health, United States, 2006 as cited by* the American Heart Association (AHA), 2008[13]). Males' BMIs are higher than those of females (Morse and Driskell 2009), resulting in higher risk of the formers' becoming chronically ill, including diabetes, as well as increased odds of suffering stroke and heart attack.

Public policy scholars and policy-makers are in disagreement regarding effective ways to fight the obesity epidemic. Some (Nestle and Jacobson 2000) argue that calorie labeling is an effective strategy. Others (Mensah et al. 2004) are skeptical about the effect of calorie information on eating behavior, arguing that individuals lack the willpower to change their eating habits, and therefore the only effective way to fight obesity is to regulate it.

In this study we tested the effect of calorie information on perceptions, choice processes, and market shares of the three leading fast-food a la carte items (as opposed to fixed meals). We found that females and males made fairly accurate valuations of the salad's nutritional value, while the chicken sandwich's caloric density was underestimated by females only. The surprising knowledge of the

[13] http://www.AmericanHeart.org/downloadable/heart/1197994908531FS16OVR08.pdf.

hamburger's caloric content may be attributable to media information that compares "bad" foods to healthier alternatives, giving readers a fairly accurate idea of the magnitudes (high / medium / low) of popular foods' calorie contents. When burn time information was added, the cost in time and effort was demonstrated in concrete terms, and consumers reacted by correcting their perceptions of calorie contents.

Updating perceptions of calorie contents and priming on calories and their effect on weight gain potential reduced perceptions of foods' healthfulness. This finding is consistent with Carels et al. (2007), who found that ratings of a food's perceived ''healthfulness'' and its ''capacity to affect weight'' were quite similar, indicating a strong correlation between calories, weight, and health. Since health and taste are positively correlated, the valuations of the three products change. In addition, females' choice processes changed in the calorie-and-burn time manipulation.

The corresponding changes in choices indicate that various information menus have dissimilar effects on changes in diet of males and females respectively: While females increased consumption of salad in the desired direction post-exposure to calorie information only, males responded affirmatively to calorie-and-burn information.

This result implies that information menus targeted by gender may be more effective in fighting obesity and adjusting the message as per individual differences in goals, orientation, and differences in choice processing. Likewise, tailoring the message that aims at changing unhealthy behaviors such as smoking (e.g., Rimer et al. 1994[14]) or drug abuse according to socio-demographic variables has been found to increase the message's efficiency.

[14] Smoking Cessation Guides were adapted to older smokers.

From a public policy point of view, our results indicate that the optimism of supporters of mandatory calorie posting is conditionally justified, since calorie information may affect choices if the right information menu is chosen. When the wrong information menu is selected, the effect of calorie posting may be the opposite of that desired, even when calories are not overestimated. For example, calorie information increased females' choices of hamburgers, and commensurately reduced their selections of the chicken sandwich.

From a marketing scholar's point of view, the study shows that while perceptions of food attributes vary by gender, the basic differences are observed only in the taste dimension. While this finding may provide support to the notion that there are inherent gender differences in taste, it can also be a result of the affect of sociopolitical variables on perceptions of taste. Information affects perceptions in a modest way for males, and more notably among females. This result supports previous literature that reports that women respond more favorably than do men to nutritional information. Furthermore, one type of informational menu (burn time) changed females' choice processes, again providing support to the notion that females are more responsive to information.

Future research will benefit from estimating the importance placed on physical appearance and calorie information's effect on this dimension.

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Table (1) - Research Hypotheses

H1	Gender differences will be reflected in perceptual differences in the taste of food in general and vegetables (salads) in particular.
H2	The choice of fast food without additional information will be based on taste only. We do not expect to see gender differences in the choice process.
H3a	The likelihood that males will perceive calories as a positive trait of a product is stronger than that of females doing so.
H3b	Males will not perceive a negative relationship between calorie content and physical attractiveness or health, while females are expected to perceive a negative relationship between physical attractiveness, health, and calorie content.
H4	Calorie information will affect perceptions such that the health attribute will be salient for women in the food choice process, while males' choice processes will remain unaffected.

Table 2: Memory-based choice (control): Gender affects choice through constants

	Control
Variable	**Coefficient**
Tastiness	1.103*
Healthfulness	0.017
Price	0.044
PS1	-0.008
PS2	-0.475
PS1*Gender	-0.310
PS2*Gender	0.158
Log likelihood	-128.9288
R-square	0.310

* - significant at the 0.05 level

Table 3: Calorie overestimation (underestimation), gender comparison across products, and manipulations

	Male				Female			
	Control	**Calories**	**Exercise**	**P-value**	**Control**	**Calories**	**Exercise**	**P-value**
Hamburger	6.19[b]	6.12[b]	7.53[a]	0.004	6.62[b]	7.31[b]	8.25[a]	0.001
Chicken sandwich	4.73	4.94	4.87	0.873	4.30[b]	5.58[a]	6.35[a]	0.001
Salad	2.94	3.26	2.78	0.328	3.16	3.32	3.31	0.818

Table 4: Perceptual differences by gender across products and between treatments

	Hamburger			Chicken			Salad		
	Male	**Female**	**P-value**	**Male**	**Female**	**P-value**	**Male**	**Female**	**P-value**
	Control								
Taste	9.67	9.36	0.319	9.04	9.70	0.046	6.25	8.75	0.000
Health	8.71	8.06	0.135	9.04	8.98	0.8590	9.98	9.86	0.659
Price	6.65	6.48	0.7300	7.56	8.16	0.1090	9.71	9.48	0.424
	Calories								
Taste	9.62	8.94	0.033	8.90	8.94	0.906	6.17	8.12	0.000
Health	7.54	7.60	0.871	8.69	8.70	0.979	9.64	9.70	0.775
Price	5.74	5.23	0.116	6.73	7.33	0.026	8.22	8.86	0.031
	Burn								
Taste	8.77	8.96	0.604	7.80	9.05	0.001	5.87	7.32	0.001
Health	7.00	7.26	0.538	8.43	8.15	0.396	9.22	9.21	0.977
Price	5.88	5.24	0.089	6.97	6.63	0.166	8.67	8.61	0.839

Table 5: Perceptual differences between products regarding taste, healthfulness, and price: Comparing within and between treatments

	Attribute	Hamburger	Chicken	Salad	Sig. level
	Males				
Control	**Taste**	9.67[a]	9.04[a]	6.25[b]	*0.001*
	Health	8.71[b]	9.04[b]	9.98[a]	*0.001*
	Price	6.65[b]	7.56[b]	9.71[a]	*0.001*
	Females				
	Taste	9.36[ab]	9.70[a]	8.75[b]	*0.001*
	Health	8.06[c]	8.98[b]	9.86[a]	*0.001*
	Price	6.48[c]	8.16[b]	9.48[a]	*0.001*
	Males				
Calories	**Taste**	9.25[a]	8.92[a]	7.23[b]	0.001
	Health	7.57[c]	8.70[b]	9.67[a]	0.001
	Price	5.46[c]	7.06[b]	8.57[a]	0.001
	Females				
	Taste	9.62[a]	8.90[a]	6.17[b]	0.001
	Health	7.54[c]	8.69[b]	9.64[a]	0.001
	Price	5.74[c]	6.73[b]	8.22[a]	0.001
	Male				
Burn	**Taste**	8.77[a]	7.80[a]	5.87[b]	0.001
	Health	7.00[b]	8.43[a]	9.22[a]	0.001
	Price	5.88[c]	6.97[b]	8.67[a]	0.001
	Female				
	Taste	8.96[a]	9.05[a]	7.32[b]	0.001
	Health	7.26[c]	8.15[b]	9.21[a]	0.001
	Price	5.24[c]	6.63[b]	8.61[a]	0.001

Key: a, b, c = The perceptions of this product attribute differ significantly (at 0.05 level) from those of the other product attribute in a pair-comparison test.

ab = The perceptions of this product's attributes do not differ significantly (at 0.05 level) from those of either product attribute *a* or *b*.

Table 6: Choice processes as a function of calorie information by gender

	Control		Calories		Calories & Exercise	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
Variable:	**Coefficient**	**Coefficient**	**Coefficient**	**Coefficient**	**Coefficient**	**Coefficient**
Taste	0.933*	1.079*	1.128*	0.855*	0.535*	0.533*
Health	-0.021	0.026	0.256	-0.098	0.044	0.322*
Price	-0.118	0.156	0.04	0.050	0.129	0.09
PS1	-0.599	-0.157	-0.651	-1.22	-0.114	-0.33
PS1	-0.495	0.216	-0.939	-0.695	-0.508	-0.11
Log likelihood	-52.733	-134.031	-85.69	-102.171	-65.917	-120.85
R-square	0.301	0.316	0.446	0.339	0.264	0.215
N	48	122	78	93	60	110

* - significant at the 0.05 level

Table 7: Market shares with and without calorie-and-burn information

	Hamburger	**Chicken sandwich**	**Salad**
	Control		
Male	68.4%	30.0%	1.6%
Female	26.7%	41.5%	31.8%
	Calories		
Male	46.8%	42.1%	11.1%
Female	28.6%	35.0%	36.4%
	Exercise		
Male	45.4%	39.7%	15.0%
Female	26.6%	41.7%	31.7%

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9.02 Yacov Tsur and Amos Zemel - Endangered aquifers: Groundwater management under threats of catastrophic events.

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2.03 Yair Mundlak - Economic growth: Lessons from two centuries of American Agriculture.

3.03 Yoav Kislev - Sub-Optimal Allocation of Fresh Water. (Hebrew).

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5.03 Catherine Benjamin and Ayal Kimhi - Farm Work, Off-Farm Work, and Hired Farm Labor: Estimating a Discrete-Choice Model of French Farm Couples' Labor Decisions.

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12.03 Yoav Kislev and Evgeniya Vaksin - Statistical Atlas of Agriculture in Israel - 2003-Update (Hebrew).

1.04 Sanjaya DeSilva, Robert E. Evenson, Ayal Kimhi - Labor Supervision and Transaction Costs: Evidence from Bicol Rice Farms.

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