# Caloric estimation of healthy and unhealthy foods in normal-weight, overweight and obese participants

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Conflict of interest:

The author(s) declare that there is no conflict of interest regarding the publication of this paper.

**Abstract**

Individuals make dietary choices each time they consume food or drink, and assign labels to each item, such as un/healthy, high/low in calories, high/low in nutrients. These labels are thought to be snap judgments based on prior, and often limited nutritional knowledge. The aim of this study was to examine the perception of the caloric content of 'healthy' and 'unhealthy' foods. Participants (N=141) rated 53 food images on perceived healthiness/un-healthiness alongside the caloric content. Participants were subdivided into three groups: BMI (normal-weight, overweight, obese). Findings suggest that weight status impacts on participant's caloric estimation of foods perceived as healthy, but only marginally for unhealthy foods. However, not all foods were consistently labeled as healthy or unhealthy, on these occasions weight salience appears not to have influenced estimations of caloric content. Foods that confound the dichotomous labeling of healthy or unhealthy appear to gain a 'branding' that confers either greater or fewer calories than they actually contain, on these occasions weight salience does not appear to influence the labeling; implications are discussed.

**Keywords**: Food; Obesity; Calories estimation; Food Perception; Food Labels

## Introduction

Information concerning food and drink confronts consumers on a daily basis (Carels, Harper, & Konrad, 2006). The information can come in the form of TV food commercials, government campaigns, and nutrition labels found on most packaged foods; the information concerning health and nutrition can be confusing and are often contradictory which inevitably leads to misperceptions about food (Carels et al., 2006; CDC, 2014; Kapil & Bhadoria, 2014; Kitahara et al., 2014; Volkow, Wang, Tomasi, & Baler, 2013; WHO, 2014).

Research on the evaluation and perceptions of food indicates that the general public is inclined to use dichotomous categorizations when labeling food, along the lines of good/bad, or healthy/unhealthy (Carels, Konrad, & Harper, 2007; Rozin, Ashmore, & Markwith, 1996). These categorizations tend to be based on heuristic judgments that influence the perceptions of other aspects of the food, such as the nutritional or caloric content (Carels et al., 2007). It would appear that as a consequence of these dichotomous labels, food that is judged to be ‘bad’ can be seen to possess more calories than it actually does whereas, ‘good’ foods are deemed to have fewer calories, (Carels et al., 2007) but the evidence for this observation is surprisingly scant given the robustness of the beliefs held regarding calorific content.

When an individual is given the name of a food (i.e., 'carrot' or 'grape') a judgment is made along the lines of ‘good/healthy’, but when the nutritional content is the only information available, the same food can be judged to be ‘bad/unhealthy’ (Oakes & Slotterback, 2005). The propensity to label foods as 'healthy' or 'unhealthy' has a carry-over effect on the judgment of the perceived vitamin, mineral and protein content of foods based primarily on reputation rather than nutritional knowledge (Oakes & Slotterback, 2001). Apples, carrots, and grapes for example, are judged to be healthy, but also perceived to contain many more vitamins, minerals and protein than they actually possess (Oakes & Slotterback, 2005). This therefore suggests that once a food achieves a ‘healthy’ reputation it gains an influential ‘branding or bias’ that can alter the perception of its nutritional properties. The results of these dichotomous categorizations may therefore influence the intake of calories and essential nutrients which could contribute to nutritionally poor, calorically dense diets (Oakes & Slotterback, 2005), and may even contribute to excessive weight gain.

Adding an unhealthy element (e.g., chocolate) to a healthy food (e.g., raisins) removes or negates the perceived nutritional and vitamin properties of healthy food

(Oakes, 2004). Adding butter (labeled unhealthy) to steamed carrots (labeled healthy) makes the carrots appear less healthy to consumers, ‘because butter is fat and fat is bad’, which is seen to lower the nutritional and vitamin content of the carrots (Oakes, 2004).

The label of healthy/unhealthy also has a specific impact on the estimated caloric density of the food. Individuals tend to overestimate the calories of 'unhealthy' foods, but underestimate the amount of calories of 'healthy' foods. This degree of discrepancy is routinely evident in individuals with a high BMI (Carels et al., 2006).

It is of concern that a dichotomous rubric of ‘healthy’/’unhealthy’ in relation to food perception has entered the public consciousness. The evaluative judgment regarding food types and the use of ‘rule of thumb’ judgments may influence food perceptions. The ‘healthy’/’unhealthy’ dichotomy, though a potential source of perceptual, and ultimately, behavioral influence, represents currently a disconnection between established methods of appraising food components and their nutritional composition and contribution to health and disease. Assessing the perceptual influence of this persistent dichotomous categorization is therefore important to anchor food science estimations of the healthiness of food to the lived experience of individuals in an everyday context. Consumers are more likely to routinely use a ‘healthy’/’unhealthy’ food selection and appraisal strategy over a systemic and accurate evaluation of the food composition of every meal consumed (Carels et al., 2007).

The aim of the current investigation was to determine whether evaluations of the healthiness/unhealthiness status of foods influences caloric estimation accuracy. According to Carels et al. (2007) individuals evaluate foods for healthiness/ unhealthiness, and caloric content as a factor of their weight. They report that individuals with a high body mass index show a greater discrepancy in their caloric estimations. Carels et al. (2007) however, draw participants from a pool of individuals known to have biased perceptions of food. Many of their participants were active dieters, and it had been shown that at the point of purchase dieters are inclined to rate fat content as the most important factor in their judgment of the foods healthiness, whereas non-dieters are different and attribute freshness as the most important attribute (Oakes & Slotterback, 2002). Carels et al. (2007) also compared older obese dieters with younger non-obese dieters. While weight status and age difference of participants has been shown to influence the perception of foods, there is limited evidence for homogenous groups of non-dieters of a similar age. To our knowledge associations between weight status and the characteristic that determine food un/healthiness had not been examined within and across BMI categories.

It was hypothesized: Hypothesis 1: Relatively high body mass index individuals would demonstrate greater discrepancy in food calorific estimations as a function of food labeled as unhealthy/healthy compared to those with a relatively lower body mass index. Hypothesis 2: Food calorie estimation would be comparatively less influenced by body mass index when the healthiness status of the food was ambiguous compared to those foods more readily classified as 'healthy'/'unhealthy'.

Methods

*Participants*

141 individuals (See Table 1 for specific subgroups) volunteered for this study. The local research ethics approved this study. Participants received course credit for participating and were recruited via the university's research participation scheme. Participants Body Mass Index (BMI) was calculated from their weight and height (BMI = $kg/m^2$) measured by Seca 799 column scales, and Seca 274 stadiometer.

Table 1 Somatotype characteristics

| BMI Category | Mean Age (SD) | N = Male/Female | Mean BMI (SD) | BMI Range |
|---|---|---|---|---|
| Normal-weight | 20.70 (1.39) | 14/46 | 21.7 (1.74) | 18.51 - 24.75 |
| Overweight | 22.33 (7.01) | 21/24 | 27.1 (1.43) | 25.22 - 29.83 |
| Obese | 22.83 (6.38) | 18/18 | 34.6 (3.03) | 30.65 - 42.60 |

*Study Design*

The study comprised of a 3x2 between participants design: Participants were subdivided into three groups based on their BMI: normal-weight (18.5 - 24.9), overweight (25 - 29.9), obese (>30). Participants were asked to label each item as either healthy or unhealthy and estimated the caloric content of 53 food images. A list of foods can be found in Table 2; compiled by pilot sampling of 153 students, and 2 health professionals.

*Pilot Data*

The 153 psychology students and 2 health professionals were asked to individually compile a list of single item foods (excluding items like whole meals). All lists were compared and foods items most frequently reported were added to the final food list shown in Table 2. Foods reported less than 3 times and whole meals (e.g. McDonald's happy meal, or Subway Sandwiches) were excluded from the final list. The healthiness/unhealthiness of each item was not a predetermined factor and no assumptions were drawn at the design stage.

*Inclusion –exclusion criteria*

Participants needed to have either normal or corrected to normal visual acuity, with no color perception deficits, have English as their first language and be 18+ years of age, with a BMI greater than 18.5. Participants who reported to be actively dieting (consciously restricting their dietary input for the purpose of weight loss) were excluded from the study. Any participants not fulfilling all criteria were excluded from the study (N=12).

Table 2. Foods, weight and description

| Foods | Description | Foods | Description |
|---|---|---|---|
| Pasta Uncooked | 54 grams plain straight | Pasta Cooked | 145 grams plain straight |
| Mixed Nuts | 33 grams Salted | Peanut Butter | 34 grams |
| Peanut Crackers | 39 grams Cookies | Baked Beans | 212 grams |
| Yoghurt | 196 grams Greek Style | Pretzels | 50 grams Salted Twists |
| Grapes | 290 grams White | Bagel | 70 grams |
| Milk | 333 ml Full Fat | Candies | 40 grams Non Branded |
| Muffin | 72 grams Strawberry | Ketchup | 226 grams Non Branded |
| Butter | 28 grams Unsalted | Kiwi | 228 grams |
| Turkey Slices | 204 grams Cooked | Kit Kat | 1 bar |
| Bread Roll | 66 grams | M&M | Almond 1 bar |
| Splenda | 52 grams Powder | Melon | 553 grams |
| Chocolate Bar | 41 grams Mars Bar | Sausage | 102 grams Sweet Italian |
| Candies | 43 grams Non Branded | Candies | 36 grams M&Ms |
| Peppers | 740 grams (Large) | Apricots | 85 grams |
| Breakfast Cereal | 51 grams | French Fries | 73 grams Cooked |
| Boiled Eggs | 47 grams | French Bread | 75 grams |
| Fried Corn Chips | 37 grams Non Branded | Sweat Corn | 290 grams |
| Soda Drink | 496 ml Coke Cola | Chicken Sandwich | 72 grams Plain |
| Donut | 60 grams Plain | Cheese Puffs | 42 grams Potato Chips |
| Carrots | 580 grams uncooked | Canola oil | 24 grams |

| | | | |
|---|---|---|---|
| Cheese Burger | 78 grams McDonalds | Garden Peas | 357 grams |
| Broccoli | 590 grams | Spinach | 857 grams |
| Salmon | 134 grams Pink | Cod | 190 grams Atlantic |
| Cheese | 51 grams Cheddar | Bacon | 34 grams Cooked |
| Apple | 384 grams (whole) | Orange Juice | 442 ml No Pulp |
| Avocado | 125 grams | Onions | 475 grams White |
| Potato Chips | 35 grams Ruffles Original | | |

*Materials*

A professional photographer using a digital camera within a purpose-built photographic studio created the food images specifically for this study. Food items were measured and weighed in consultation with nutritionists and dieticians, to contain precisely 200Kcals. The stimuli consisted 53 color images of food items, (e.g., cheeseburger, French fries, bagel etc.) sweets foods (M&M's, soft drinks, strawberry muffin etc.) fruits and vegetables (kiwi fruit, apples, broccoli etc.). Images were presented in color on a 21.5-inch iMac computer; images on screen measured 160mm x 110mm. A caption-describing each item was displayed below the image (e.g.: Potato Chips, Broccoli, Cooked Pasta etc.). Images were presented in a different order for each participant.

*Procedure*

Based on previous research (Carels et al., 2006), the following procedures were implemented in the same order for every participant. Participants provided informed consent; BMI ($Kg/m^2$) was calculated from the participants' height and weight. Participants were seated in front a desktop computer at a distance of 50cm. Specific instructions were displayed on screen; participants were asked to estimate the caloric value (Kcals) and assign a label of either healthy or unhealthy to each food item, participants were informed speed was a factor and to respond as rapidly as possible. In general the experimental sessions lasted approximately 20 minutes.

*Data analysis*

Means and standard deviations were obtained for all study variables, and demographic data were tabulated (see Table 3). Differences in caloric intake by condition (healthy or unhealthy vs. BMI category) were examined by a multivariate analysis of variance

(MANOVA). Prior to the main analysis data were subjected to parametric assumptions analysis. Preliminary analysis included screening data for missing values, outliers, skewness, kurtosis, and equality of covariance matrices. There were no missing values, or outliers, and data met the assumption of skewness and kurtosis (all values <1.96).

## Results

### *Statistical analysis*

A series of Pearson correlations were performed between the two dependent variables (healthy vs. unhealthy caloric estimations) in order to test the MANOVA assumption that the dependent variables would be correlated with each other in a moderate range, (Meyers, Gamst, & Guarino, 2006) see Table 3.

Table 3

Pearson correlations, and means estimations for food images which contained 200Kcals and Standard Deviations associated with weight status.

| Weight Status | Correlations | Healthy Mean | Unhealthy Mean | Healthy SD | Unhealthy SD | N |
|---|---|---|---|---|---|---|
| Normal-weight | .730* | 134.66 | 241.98 | 76.28 | 141.39 | 60 |
| Overweight | .562* | 116.70 | 244.31 | 54.48 | 115.0 | 45 |
| Obese | .600* | 96.81 | 218.93 | 53.31 | 116.5 | 36 |
| Total | | 119.26 | 236.84 | 65.79 | 126.85 | 141 |

* Correlation for healthy vs. unhealthy caloric estimations is significant at the .001 level.

Box's M value of .143 was associated with the *p* value of .190, was interpreted as non-significant based on Huberty and Petoskey (2000) guidelines (i.e., $p < .005$). Therefore the covariance matrices between the groups were assumed to be equal for the purposes of the MANOVA.

A one-way multivariate analysis of variance was conducted to test the hypothesis that there would be one or more mean differences between BMI categories (normal-weight, overweight and obese) and estimates of caloric content for un/healthy foods. A statistically significant MANOVA effect was obtained, Pillai's Trace = .07 $F(4, 276) = 2.50$, $p = .043$. The multivariate effect size was estimated at .035 which implies that 3.5% of the variance in the canonically derive dependent variable was accounted for by BMI.

Prior to conducting a series of follow-up ANOVA's, the homogeneity of variance assumptions were tested, for both subscales. Levene's F test for the homogeneity of variance assumption was satisfied ($p > .05$). A small series of one-way ANOVA's for each dependent variable was conducted as a follow-up to the MANOVA which revealed a statistically significant main effect for Healthy Food $F(2, 138) = 3.93$, $p = .02$, $\eta^2 = .05$, but a non-significant effect for Unhealthy Food $F(2, 138) = .48$, $p = .61$. Finally, a series of post-hoc analyses (Fisher LSD) were performed to examine the individual mean difference comparisons across all three levels of BMI, and healthy food. The results reveal a statistically significant difference ($p = .006$, M = 17.95 - 37.84, SD = 13.53 - 12.71) for normal-weight and obese individuals when estimating the caloric content of Healthy Food, no other significant differences were found. Figures 1 and 2 illustrate the mean difference in caloric estimation for healthy and unhealthy foods. From these results it would appear that healthy foods are significantly more difficult to evaluate in terms of their caloric content particularly for obese participants whereas the estimates for unhealthy foods are much more stable across different BMI categories.



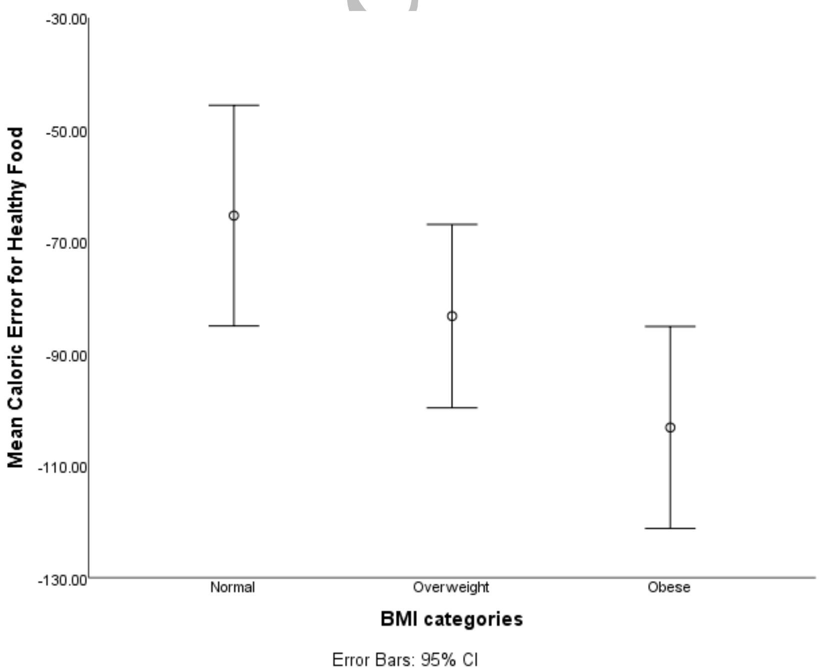


Figure 1: Mean caloric error for perceived Healthy food images set against BMI category. Post-hoc analyses (Fisher LSD) reveal just one significant difference $p = .006$ for Normal weight vs. Obese.

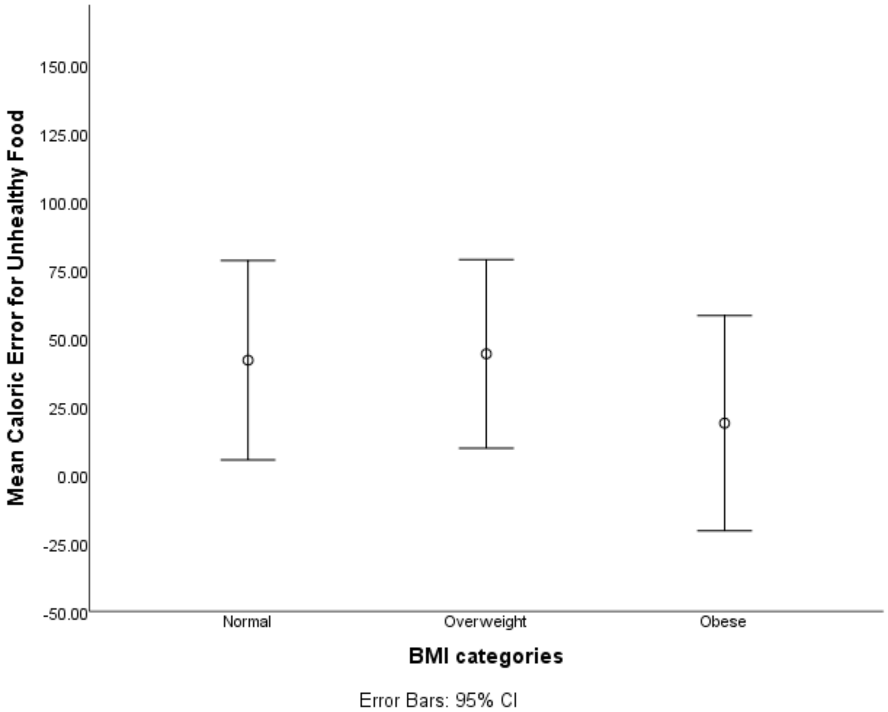


Figure 2: Mean caloric error for perceived Unhealthy food images set against BMI category. Post-hoc analyses (Fisher LSD) revealed no significant difference for BMI category.



*Healthiness vs. Unhealthiness*

In a second task participants were asked to decide whether each item represented unhealthy or healthy foods. For the vast majority of foods there was approximately 95% agreement, across all BMI categories. However, for a significant minority of foods, there was some disagreement on whether the image portrayed a healthy or unhealthy food, within and across BMI categories, illustrated in Table 4. These foods achieved both healthy and unhealthy labels and as such both healthy and unhealthy attributes. Data displayed in Table 5 indicate that calorie estimations were comparatively less influenced by body-mass index when the healthiness status of the food was ambiguous compared to those foods more readily classified as 'healthy' or 'unhealthy'. Data clearly show that when foods are perceived as healthy they are attributed with far fewer calories than when perceived as unhealthy, even within a given BMI category. For example, Salted Mixed Nuts were estimated to contain a group mean caloric content of 327.65Kcals when judged to be healthy but 448.06Kcals when judged to be unhealthy for those of normal weight. However, obese individuals estimated the same food to contain just 126.88Kcals when healthy and 414.30Kcals when thought to be unhealthy. This shows that regardless of weigh status the label placed on foods will have a significant influence on the perceived qualities of the food.

Table 4:

Un/healthy foods and percentage of dis/agreement on their perceived healthiness status

| Food | Normal-weight | | Overweight | | Obese | |
|---|---|---|---|---|---|---|
| | Healthy | Unhealthy | Healthy | Unhealthy | Healthy | Unhealthy |
| Salted Mixed Nuts | 46.6% | 53.3% | 42.2% | 57.8% | 44.4% | 55.6% |
| Whole Milk | 60.0% | 40.0% | 42.2% | 57.8% | 69.4% | 30.6% |
| Turkey Slices | 63.3% | 36.7% | 73.3% | 26.7% | 72.2% | 27.8% |
| Splenda | 38.3% | 61.7% | 55.6% | 44.4% | 58.3% | 41.7% |
| Peanut Butter | 30.0% | 70.0% | 22.2% | 77.8% | 16.7% | 83.3% |
| Baked Beans | 55.0% | 45.0% | 44.4% | 55.6% | 50.0% | 50.0% |
| Bagel | 21.7% | 78.3% | 33.3% | 67.7% | 30.6% | 69.4% |
| French Bread | 28.3% | 71.7% | 35.6% | 64.4% | 41.7% | 58.3% |
| Chicken Sandwich | 48.3% | 51.7% | 44.4% | 55.6% | 36.1% | 63.9% |
| Canola Oil | 41.7% | 56.7% | 46.7% | 51.1% | 19.4% | 80.6% |

Table 5: Foods images inconsistently perceived as either healthy or unhealthy. It should be noted that each image contains foods of 200Kcals

| Food | Weight Status | Mean Caloric Estimation | |
|---|---|---|---|
| | | Healthy | Unhealthy |
| Salted Mixed Nuts | Normal-weight | 327.65 | 448.06 |
| | Overweight | 116.32 | 434.42 |
| | Obese | 126.88 | 414.30 |
| Whole Milk | Normal-weight | 118.46 | 196.41 |
| | Overweight | 111.85 | 199.35 |
| | Obese | 111.88 | 174.00 |

| | | | |
|---|---|---|---|
| | Normal-weight | 124.87 | 308.04 |
| Turkey Slices | Overweight | 144.94 | 447.91 |
| | Obese | 300.69 | 387.00 |
| | Normal-weight | 36.61 | 169.71 |
| Splenda | Overweight | 41.08 | 130.68 |
| | Obese | 46.91 | 146.00 |
| | Normal-weight | 87.78 | 431.21 |
| Peanut Butter | Overweight | 98.50 | 432.85 |
| | Obese | 114.5 | 122.90 |
| | Normal-weight | 65.00 | 483.70 |
| Pork and Beans | Overweight | 171.00 | 465.76 |
| | Obese | 194.17 | 177.10 |
| | Normal-weight | 132.31 | 410.70 |
| Bagel | Overweight | 151.14 | 431.03 |
| | Obese | 122.64 | 177.88 |
| | Normal-weight | 226.37 | 338.77 |
| Chicken Sandwich | Overweight | 198.05 | 301.00 |
| | Obese | 192.39 | 486.39 |
| | Normal-weight | 65.32 | 439.41 |
| Canola Oil | Overweight | 74.86 | 438.69 |
| | Obese | 59.58 | 155.97 |

## Discussion

The principal aim of the present study was to investigate the effects of the perceived healthiness/unhealthiness of foods, and weight salience on the caloric estimation of 53 food images. We found that the healthiness/unhealthiness perception affected participants' caloric estimations, as did the weight salience categorizations, which both appear to influence the perceptions of various foods differently. Similar to previous research overweight participants tended to underestimate the caloric content of foods they perceived as healthy compared to normal-weight participants. Results suggest that there is a linear relationship between weight status and the underestimation of calories in foods perceived as healthy. This finding is consistent with Carels et al. (2006); Carels et al. (2007); Oakes and Slotterback (2005); Rozin et al. (1996) who found that participants were less accurate at estimating the amount of calories in foods perceived as healthy; they report that weight status impacted on the magnitude of the discrepancy. Obese individuals tended to underestimate healthy foods by the greatest amount when compared to the normal-weight and overweight individuals. However, normal-weight and overweight individuals maintained an inclination to underestimate the caloric content of healthy foods, although the size of the discrepancy was considerably smaller than for the obese, but still not entirely accurate. Provencher, Polivy, and Herman (2009) made the observation that when a food is perceived as 'healthy', individuals are inclined to consume it in greater quantities. It is therefore logical to conclude that individuals may attempt to consume a healthy diet, but because there appears to be an inclination to underestimate the caloric content of healthy foods by as much as 100 calories per-portion, this could lead to over indulgence, and perpetuation of weight maintenance or gain.

Similar to previous research (Carels et al., 2006; Carels et al., 2007; Oakes & Slotterback, 2005; Rozin et al., 1996) the present study also found that participants inaccurately estimated the caloric content of foods perceived as unhealthy. The present study however established that obese participants tended to be less accurate, than the normal-weight or overweight, when judging caloric content of perceived healthy foods. Carels et al. (2006) report that their participants tended to over estimate healthy food by as much as 16%; within the current study we found an average over estimation of 17%.

Data shown in Table 3 illustrate that the standard deviation for unhealthy foods is more than twice the magnitude than for healthy foods, across all three BMI categories. What is revealed by these data, and what is hidden to some extent by the mean data, is that the estimations for foods perceived to be unhealthy vary widely. On an individual level the estimates for unhealthy food can vary by as much as 652 Kcals. This finding indicates that regardless of the perception of the food, and regardless of weight status, that accurately estimating the caloric content of these foods is extremely difficult and may even amount to ill-informed guesses.

In the present study fifty-three images of foods were shown to participants, many of which were consistently perceived to be either healthy or unhealthy. In general, participants had little trouble using the healthy, unhealthy classification however, not all foods were consistently perceived as either un/healthy. A significant number of foods gained the perception of being concurrently healthy and unhealthy, as some individuals perceived these foods as healthy while others perceived the same foods as being unhealthy. Previous research (Carels et al., 2007) has shown that obese individuals tend to underestimate the calories in foods perceived to be healthy; the current research however has shown that this finding is not so straightforward, and that the health perception of a food can override weight salience, for particular foods.

What we found is that when foods were perceived as healthy they were estimated to contain considerably fewer than 200Kcals, whereas when perceived as unhealthy the same foods were estimated to contain many more than 200Kcals; this finding was consistent regardless of weight status. Translated this would mean that particular foods do not neatly fit the dichotomous labeling of healthy or unhealthy for all individuals, however, once labeled the foods assume a health bias or halo, therefore healthy foods equal fewer calories, unhealthy foods equal a greater number of calories. This finding is most likely to be a product of nutrition awareness, and knowledge, but this would need to be assessed in future studies.

This study has a small number of limitations that need to be addressed in future research endeavors. The homogenous nature of the sample (limited age range) limits the generalizability of the results. These individuals may have limited nutritional knowledge, and limited general knowledge concerning health benefits of certain foods. They also may have no general concerns about dietary composition that an older population may have. Young people are likely to view health in terms of body shape and appearance (Rozin & Fallon, 1988), however, there is an increasing trend of obesity among young adults (Ogden, Carroll, Kit, & Flegal, 2013) with over 30% of 20-39 years old who are obese in the USA. CDC (2014) state that obesity among young adults has increased from just 5% to 21% in the last 30 years, with an increased risk of cardiovascular disease, and other weight related illnesses. It would therefore be beneficial in future research, to increase the age demographic to include more mature adults to allow the findings to encompass a wider population.

The present study has several potential implications. Like the suggestion made by Carels et al. (2006) it would be important to inform participants (regardless of weight status) of the general tendency to underestimate the calories in healthy foods and overestimate calories in foods perceived as unhealthy. Nutrition awareness is in important component to formulating choices concerning the characteristics that contribute towards healthy diets. An important clinical implication concerns those individuals with existing pathology and psychopathology where food choices may impact significantly on clinical outcomes and overall well-being. Patients within the two main non-communicable disease groups (cardiovascular disease and diabetes mellitus) may benefit significantly from educational interventions focused on understanding the relationship between food groups and calorific value, interventions that takes into account the weight status-associated biases observed within the current study. Improving food selection strategies and decision-making in this group of patients while accommodating the weight status noted biases observed in the current investigation would likely be beneficial in the development of an effective and evidence-based intervention program.

## Conclusion

This study provides support for the contention that healthy foods are perceived to have fewer calories than they actually contain, and that unhealthy foods a greater number of calories. Findings suggest that weight status impacts participant's calorie estimation of healthy food; however, weight status does not significantly impact on the caloric estimation of unhealthy foods. Foods that confound the dichotomous labeling of healthy or unhealthy appear to gain a 'branding' that confers either fewer or greater calories than they actually have. On these occasions weight status does not appear to have influenced the labeling. Why there should be such a significant 'branding effect' is not immediately apparent, but is quite possibly a factor of nutritional awareness.

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