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The influence of anchor points on calorie estimations

MSc Thesis: MCB 80433

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For quality of life

MSc thesis	**|**	**The influence of anchor points on calorie estimations**
Chair group	**|**	Marketing and consumer behaviour
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Date	**|**	December 2013

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Summary

A lot of effort is done to give consumers credible nutrition information on food products. Nutrition information like a GDA (Guideline daily amount) label or DV's (daily values) provides nutrition information to consumers, in such a way that they can adjust their calorie intake during the day. However, it is questionable in which way this information is used by consumers and how effective it is in decreasing calorie intake. In addition, the change of numerous different factors in the environment goes simultaneous with the increase of overweight and obese people. People have a poor knowledge of the caloric content of a meal. However, the ability to estimate calories in a correct way is important to reduce food intake. We assumed that product decisions are often made on vague internal knowledge and external cues, because it takes a lot of effort to exam every food product on their nutrition value.

People are strongly affected by external cues/signals in their environment and this influences their decision process. This process is called anchoring. Anchoring is a process that influences decisions and it refers to: *"a common human tendency to evaluate information differently depending on the presence of absence of a numerical 'anchor' or reference point" (Paek, Yoon et al. 2011),* or *"Anchoring effects will be explained as cases in which a stimulus or a message that is clearly designated as irrelevant and uninformative nevertheless increases the normality of a possible outcome" (Kahneman 1992).* So when putting a product with a (different) anchor influenced the way a consumer perceives a product. However, less is known about how calorie estimations and perceived healthfulness are influenced by anchor points. Therefore the following research question is established for this study: *"What is the influence of anchor points on consumers' ability to estimate the correct amount of calories in a meal?"*

We conducted a between subjects design with five conditions and one control condition. The five conditions are distinguished in three categories: 1) Numeric: GDA; 2) Product: Healthy (salad) or unhealthy (dessert) component; 3) Person: person with overweight or person with a normal weight. In all conditions, a hamburger was shown in combination with one of the five anchors. The depicted hamburger contained 856 calories. We assumed that the conditions with a dessert or a woman with overweight combined with a hamburger, would lead to higher respondents' calorie estimations. The conditions with the GDA, salad or a woman with a normal weight combined with a hamburger would lead to lower calorie estimations. We conducted an online Qualtrics survey under the Dutch population. 540 respondents participated in our experiment, on average there were 90 respondents per condition.

The overall estimation over all the conditions was 626 calories, this is an underestimation of 27%. Respondents in the control condition estimated 608 calories. In the GDA (712.6 calories), dessert (627 calories), the woman with a normal weight (609.7 calories) and the woman with overweight condition (621.1 calories) people estimated the amount of calories higher than in the control condition. In the salad condition people estimated the amount of calories lower (570.07 calories). However, only the GDA condition showed a significant ($F(1,165)= 4.01$, $p= .047$) effect. These calorie estimations were substantially higher and therefore more realistic than without GDA information. A logical line of thinking is that consumers estimated that this meal contains a big part of their recommended daily amount and perhaps that is why this estimation is bigger, because this anchor is really used.

Based on the results of this study it is showed that displaying GDA is useful because GDA labelling causes for more realistic calorie estimations. If they want that people are going use caloric estimations to decrease eating, it is useful to give them education about calories and GDA.

Acknowledgement

This report is the result of eight months of hard work on my Master thesis: 'The influence of anchor points on calorie estimations'. I would like to thank my super visor Dr. ir. Ellen van Kleef for her feedback, supervision and mental support. Her enthusiasm always encouraged me to work on my thesis and made me enjoy doing this. I would also like to thank my second reader Prof.dr.ir. Hans van Trijp. His knowledge about my subject really contributed to the quality of my report, his critical view on my thesis was very valuable for me.

Next to this, I would like to thank Frederique Papavoine for her cooking, photography and Photoshop skills. She has proven a great service to me by helping me with conducting the stimulus material.

Last but not least I would like to thank all the 500+ respondents for filling out my survey.

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1. Introduction

1.1 Problem selection and background

In the last thirty years the number of people in the Netherlands with overweight and obesity increased with fifty percent. This growth does not only occur under adults but also under youngsters, nevertheless this growth is the highest under adults (POLS 2011). Fifty percent of the men above forty have overweight. In total four out of ten people is overweight or obese (CBS 2012). Overweight and obesity is not only a problem that exist in the Netherlands, it is a phenomenon that is global (WHO 2012). To help consumers to make better and healthier choices, food and beverage products are provided with nutrition labels. In North and South America, Asia, Oceania and Europe almost all the countries are obligated to provide nutrition labels on some or all pre-packaged food products. Those labels are present in different varieties and with different information, such as the place of the information; front-of-pack (FOP) and back-of-pack (BOP), number of nutrients labelled, references values and guidance for consumers. There is a growing attention for the provision of nutrition information on the FOP (EUFIC 2012).

Since 2008 it is mandatory in New York City that food service establishments give calorie information for food products. This applies to standardized portions and content menu items and is part of a food service establishment that has at least fifteen locations that have a common ownership or are individual franchised and operate under the same name. This information supply is only mandatory for products that are longer on the menu than 30 days. The reason for this new regulation is that people who live in New York consume at least 33% of their calories outdoors and there is a lack of calorie information in food service establishments (NewYorkCityGovernment). The goal of this regulation is to give consumers calorie information when they are outside their home, this can help people to make more informed choices (NewYorkCityGovernment , GovernmentPrintingOffice 2011). The U.S. Food and Drug Administration (FDA) also proposed regulations to make calorie information on menu boards mandatory on a more national level.

There is a general good understanding under consumers what a calorie is. In different quantitative and qualitative studies, calories and fat are spontaneously mentioned first by consumers when it comes to nutrition information (Grunert and Wills 2007). A lot of effort is done to give consumers credible nutrition information on food products. However, it is questionable in which way this information is used by consumers and how effective it is in decreasing calorie intake. Nutrition information like a GDA (Guideline daily amount) label or DV's (daily values) provides consumers with nutrition information in such a way that consumers can adjust their calorie intake during the day. This gives consumers the possibility to make their own dietary trade-offs (FDA 2004, Voedingscentrum 2011). However, although people sometimes say they use calorie information, consumers found it (too) difficult to use nutrition labels in a correct way (van Herpen and Trijp 2011). Among US consumers there is a lack of knowledge on how much calories people should consume. Research showed that 30% of the respondents were able to correctly estimate the daily requirements regarding calories for average people with a normal body weight. However, 50% of the respondents underestimated the calorie requirements (Elbel 2011).

The researchers Wansink and Chandon (2006) stated that the ability to estimate calories in a correct way is important to reduce food intake. We assume that product decisions are often made on vague internal knowledge and external cues, because it takes a lot of effort to exam every food product on

their nutrition value. In addition, the change of numerous different factors in the environment goes simultaneous with the increase of overweighed and obese people. There are several factors in the environment, like taste, cheap costs and portion size, which stimulate overconsumption of energy. Besides this, other factors like watching television and reduced physical labour, causes that energy expenditure decreases. People agree that the environment stimulates the obesity epidemic, but the relative contributions of the different factors that contribute to this problem are not clear (Hill, Wyatt et al. 2003). An example that contributes to the idea of Wansink and Chandon is that restaurants (Subway) with a healthy image causes that people underestimate the calorie content of a meal and that they order higher calorie dense side dishes (Chandon and Wansink 2007).

The example mentioned above shows that people are strongly affected by external cues/signals in their environment and this influences their decision process. This process is called anchoring (Chapman and Johnson 2002). However, less is known about how calorie estimations and perceived healthfulness are influenced by anchor points. Anchoring is a process that influence decisions (Chapman and Johnson 1999). It refers to: *"a common human tendency to evaluate information differently depending on the presence of absence of a numerical "anchor" or reference point" (Paek, Yoon et al. 2011),* or *"Anchoring effects will be explained as cases in which a stimulus or a message that is clearly designated as irrelevant and uninformative nevertheless increases the normality of a possible outcome" (Kahneman 1992).* So putting a product with a (different) anchor, influenced the way a consumer perceives a product. For example, when providing information for a sandwich with a within-category-anchor (only 10 grams of fat compared to the 30 grams of other sandwich brands) consumers perceive the sandwich with such an anchor as healthier than without an anchor (Paek, Yoon et al. 2011). The anchoring effect influence a person when one is uncertain about making a numeric judgment (Chernev 2011) and even though anchors are random they can have the same influence as an informative anchor (Furnham and Boo 2011). External cues have often a negative effect on the ability to estimate calories. By investigating how several anchor points influence one product, a better understanding can be gathered on how calorie estimations are influenced by signals in the environment. When is known how anchor points manipulate these estimations it can be used to stimulate healthier choices. We incline that the effects of anchor points are often undermined.

In this research there will be several anchors points set next to that a meal that meets the guidelines for a standard meal. The anchor points that will be invested are divided into three categories. We expect that within the different categories comparable processes will take place: A numeric anchor which involves the reference effect, product anchors which involve assimilation and contract effects and a person anchor which includes priming and identification.

This research will focus on the effects of various anchors on the estimated amount of calories in meals. Therefore, the research question of this research is: *"What is the influence of anchor points on consumers' ability to estimate the correct amount of calories in a meal?"*

Method

To find an answer to the research question an experiment will be conducted. The research will have a between subjects design done under the Dutch population and the respondents are asked to fill out an online questionnaire.

2. Theoretical framework

This chapter will first explain the anchoring process which is a form of biasing in judgement and decision making. It will explain how people are getting influenced by irrelevant reference points. After this we will deliberate consumers' knowledge on calorie knowledge and calorie estimation skills. This section discussed 'calorie estimation: a model of anchoring and adjustment'. This model gives insides in the different anchors and which processes that calorie estimation can influence. At last the hypotheses will be discussed and which underlying processes are expected.

2.1 Anchoring and adjustment

Anchoring is a form of biasing in judgement and decisions making. It is using a given value to estimate an unknown quantity. When you have to estimate a quantity for something you really do not know, you stay close to so called anchor points. Those anchoring effects occur in everyday life. For example, you have to consider how much you want to pay for a house, this guess will be influenced by the asking price (Northcraft and Neale 1987). Those given values or quantities that are considered as a possible solution for your problem are causing the anchoring effect (Kahneman 2011). Anchor points are clearly irrelevant and uninformative information, but it has an influence on the possible outcome (Kahneman 1992).

Anchoring can occur due to priming and due to insufficient adjustment. System 1 and system 2 are involved in this process. This is a dual process model that states that there is a slow, rule based information-processing mode based on high-effort systematic reasoning, and a fast, associative information-processing mode based on low-effort heuristics (Chaiken and Trope 1999). System 1, system 2 is a relatively new dual. Whereby system 1 operates fast and automatically and system 2 operates slow and controlled. The decisions made with system 1 are made with no information and with peripheral cues. Decisions made with system 2 are made after you looked for information (Kahneman 2011). System 2 is influenced by the anchoring effect. This system retrieved information from the memory, but functions in the automatic system 1. An example of priming is that your system 1 beliefs for a moment that the given quantity is true. Because the quick working system 1 want to make a construct whereby the given anchor is true. Insufficient adjustment is when you get a number and you stay close to that number, which is a result of a failing system 2 (Kahneman 2011).

There is a difference between self-generated anchors and anchors given by the experimenter. Anchoring is strongly dependent on who has set the anchor, self-generated or set by experimenter. When the anchor is self-generated people will adjust their estimated value. Self-generated anchors are numbers that has to be, according to you, related to your estimation/ answer. For example, 'What is the freezing point of vodka?' Your self-generated anchor is 'it has to be below minus degrees' causes that you come from your anchor (zero degrees) to an adjusted value ('I think vodka freezes at minus 30 degrees'). People know that their anchor is not correct and therefor they will adjust it (Epley and Gilovich 2001). When an anchor is set by an experimenter people keep in mind that the given anchor might be true (Epley and Gilovich 2001). At the moment that one has to estimate a number, they will fall back on the biased given value. Some argue that adjustment not occurs, but are more a result of that one wants to stay close to the given hypotheses (Chapman and Johnson 2002). When extern anchors are provided they argued that a mechanism of selective accessibility is activated. However, people rely more often on a self-generated anchors (Epley and Gilovich 2001).

2.2 Calorie knowledge and calorie estimation skills

2.2.1 Knowledge recommended calories

Far not all people know how much calories they should be consuming each day. Research showed that 67% of the participants know how much calories they should be consuming every day (between 1500 and 2500 calories per day). This study was done under community and college students, and showed that female college students are significantly more accurate in estimating their caloric daily needs (Krukowski, Harvey-Berino et al. 2006). Although, looking at a more diverse sample, 30% estimated correctly the recommended calories per day for an average person with a normal body weight. Still 50% underestimated their caloric requirements (Elbel 2011). One study compared consumers' caloric daily need with their estimated caloric needs. And it showed that consumers regardless of their BMI underestimated their caloric requirements. With caloric requirements is meant, the amount of calories that is needed to maintain their current weight (Headrick, Rowe et al.).

2.2.2 Calorie estimation skills

A study under 687 American respondents showed that when they had to answer the question 'How many calories are in this bottle of Coke?' it strongly dependent on how the calorie information was provided, if the respondents were able to give the right amount of calories. When they saw calorie information per container (whole bottle) on FOP or on BOP the participants were correct most of the time when they had to give the calorie amount per bottle, 84,7% and 99,4% of the time. Nevertheless, when the calorie information per serving was given the participants found it more difficult to give the right calorie information than for a whole bottle. When only FOP information was given per serving size, only 6,5% of the respondent could give a correct caloric amount for the whole bottle. When BOP nutrition information per serving size was given, only 16,4% of the respondents could give the correct caloric information for the whole bottle (Vanderlee, Goodman et al. 2012). However, in this study the given caloric content was more or less present on the bottle.

2.2.3 Categorizing foods' healthfulness

People are tended to categorize food in healthy or unhealthy. They think that if a product is harmful in large amounts, it is also harmful in small amount. This is called 'dose insensitivity'. Participants were asked to estimate which product had the most calories, a large amount of a product with less calories or a small amount of a product that had more calories. Products in a small amount such as chocolate, ice cream and animal fat were seen by almost half of the respondents, higher in calories compared to bread, cottage cheese and olive oil. This showed that consumer's belief that latter products have lower caloric impact, whatever the dose is (Rozin, Ashmore et al. 1996). People who are participating in a dieting program have difficulties in estimating the amount of calories in healthy and unhealthy food. They underestimated the amount of calories in healthy food with 16% and overestimated the amount of calories in unhealthy food with 17%. This shows that consumers determine food in simple heuristics as 'good' (healthy, weight loss) or 'bad' (unhealthy, weight gain). The adult, mostly middle aged participants showed that snacks with an unhealthy image, but lower calories were thought to cause more weight gain than snacks that are lower in calories but have a healthier image. For example, consumers think that a Snicker (47 kcal) lead to more weight gain then cottage cheese (1% fat), 3 carrots and 3 pears (569 kcal). So, there can be said that consumer judge food names generally to be good or bad, this can promote overeating. Consumers think that certain types of food promote slenderness, vigour and will extent life and were you can eat a lot of. While other types of food causes obesity and diseases and are better to avoid (Oakes 2005).

2.3 Calorie estimation: a model of anchoring and adjustment

The essence of this model of anchoring and adjustment is how different types of anchors influence the final judgement of calorie estimation. These anchors are distinguished into three main categories; numeric, product and person. We assume, based on prior research that the different anchors in a category will lead to similar kind of processing regarding adjustment. This section will first introduce anchoring based on the findings of Kahneman. Secondly, it will give insight in the three main categories and their underlining processes and how this (probable) will influence caloric estimation. Thirdly, the different moderators will be discussed that presumably will have an influence on how the different processes will manifest themselves. Finally, the anchoring index will be discussed. This index is the percentage one is influence by the anchor.

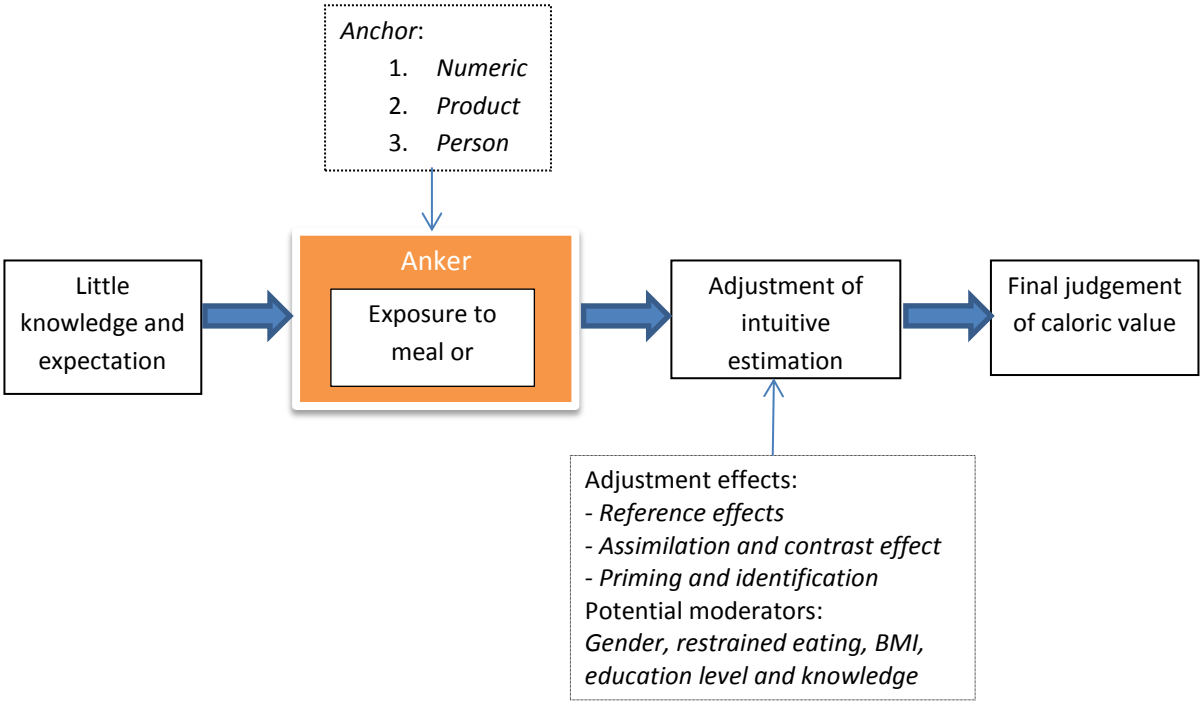

Figure 1 A model of anchoring and adjustment

2.3.1 Anchoring processes and the influence on caloric estimations

In general people are influenced by the value of an anchor and will assimilate their estimation toward that reference (Furnham and Boo 2011). People see a given anchor often as very useful, but this leads to insufficient adjustment, this causes that their final estimation is biased by the given anchor (Tversky and Kahneman 1974, Epley and Gilovich 2006).

Group 1: Numeric anchor

Using an anchor point leads to insufficient adjustment. When people have to estimate a quantity they do not know, but can only be guessed, they will use a given value as a starting point and move away from that anchor until an acceptable value is reached. This called the anchoring-and-adjustment heuristic. However, this adjustment often goes wrong due to the fact that people stay close to this given value, also called the anchor point (Tversky and Kahneman).

The estimated amount of calories will be an adjustment of the calories provided. Along with the tendency to overestimate calories of a meal that is seen as unhealthy leads therefore to the following hypothesis:

H1: Compared to estimating a dish without being providing of daily calorie needs, estimating a dish while being provided with daily calorie needs will lead to lower calorie estimations.

To clarify this hypothesis the following example is given: Without an anchor people will estimate, let's say that mac and cheese contains 800 calories, because they see this as quite unhealthy and will overestimate the calories content, and with this anchor it will be 600 calories because they will adjust their value from the 2000. Therefor this anchor will cause that people see this plate lower in calories.

Group 2: Product as an anchor

You would expect that when one has to estimate the calorie content of a meal with different components (e.g. salad+ vegetables+ meat), one would estimate the calories of the different parts of that meal and then add them up together. This is not the case, because products that serve different goals tend to bias this estimations and leads to underestimation. When you are on a diet, you will be more likely to choose a hamburger with a side salad because you believe that this is healthier. You think it will help you to reach your goal and it will contain fewer calories than a hamburger alone. Putting this in a more general content, when one has to estimate the amount of calories in a product, a healthy and indulgence item in a meal will have perceived fewer calories than only the indulgence item (Chernev and Gal 2010).

Besides this, people have a tendency to categorize food into good for one's health and bad for one's health, dichotomization of food. 48% of the Americans agreed with the statement: "Although there are some exceptions, most foods are either good or bad for health". Although salt is a necessary component in one's diet, participants from the research mentioned above, think that a diet without any salt is healthier than a diet with only traces of it. People think categorical because it makes life easier, food can be simple divided in good/safe and not good/unsafe (Rozin, Ashmore et al. 1996, Chandon 2012). People do not always categorize food in good or bad, but they also make health inferences. Various cues and processes causes consumers to make inferences that go beyond the information given (Kardes, Posavac et al. 2004). Therefore, there will also be measured if the respondents are thinking dichotomous. The expectation is that the higher the degree of thinking dichotomous the more the side dish influences the calorie estimation.

As mentioned above, consumers often distinguish products as vices or virtues. A vice is a food product that gives gratification/ fulfilment and short term pleasure. Also called indulgence food and are chocolate, chips etc. A virtue is based on long term (e.g. losing weight) and does not give immediately fulfilment (e.g. fruit). Products with the claim light, fat free and organic are sometimes also seen as product that is a virtue (Wertenbroch 1998).

Combining a vice with a virtue will lead to that people will average their benefits. That is why they think a hamburger with a salad is healthier than a hamburger alone (Chernev and Gal 2010). This will lead to lower estimated calories, because when a meal looks healthy it would have fewer calories (Chandon and Wansink 2007). Research showed that when added a broccoli salad next to a hamburger the perceived amount of calories decreased compared to showing a hamburger alone.

When adding a chocolate cookie next to hamburger the amount of perceived calories increased. The averaging bias only occurs when there is a virtue and a vice and not when two vices are given. When a hamburger is presented next to a chocolate cookie the perceived calorie content of the total meal increased with 12,9% (Chernev and Gal 2010).

Due to the contrast effect that are caused by vices and virtues, people estimate a meal with a salad next to it lower in caloric content than when the hamburger is presented alone. Contrast effect means a judgment has a negative relation between the information and judgment (Chernev and Gal 2010). So, a virtue next to a vice, is a contrast, but adapted to stay in line with your good habits. Thus, the vice is evaluated as virtue, therefor one will evaluated an unhealthy product as having a lower calorie content when presented next to a health product (Bless and Schwarz 2010). Assimilation effect means that a judgment is positive related to the information and the given judgment. When a vice presented next to a vice as part of a product, for example a hamburger and fries on one plate, will result in a higher overall evaluation of the whole meal (Chernev and Gal 2010). This research asked participants to estimate the calorie content of the entire meal. Whether the assimilation or the contrast effect occurs depends on the information that was given (Bless and Schwarz 2010). We assume that due to contrast and assimilation the perceived calories content for the hamburger alone also increases/decreased when showed next to a vice/virtue product, but participants are asked to only estimate the calories of a single meal component. The hypotheses will therefore be:

H2a: Compared to estimating a dish without being provided with a virtue, estimating a dish presented with a virtue will lead to lower calorie estimations.

H2b: Compared to estimating a dish without being provided with a vice, estimating a dish presented with a vice will lead to higher calorie estimations.

Group 3: Person as an anchor

Images that are seen as similar to the self will be assimilated towards and images that are seen as dissimilar will be contrasted away from (McFerran, Dahl et al. 2010). We identify our self with people in our environment. For example, when you are in a restaurant and you are on a diet you identify on a greater degree with an obese waitress than when one is not on a diet. When a waitress is thin the opposite is true, non-dieters can identify more with a thin waitress (McFerran, Dahl et al. 2010). But also the mere presence of other people in your environment, so non-interactive social presence, has an influence (Argo, Dahl et al. 2005).

Peoples' behaviour is influenced by the posture of people that are around them. When one is on a diet people are tend to eat more when the waitress of a restaurant was heavy, non-dieters eat more when the waitress was thin. Dieters are also more persuaded by a waitress that was heavy than a thin waitress. This shows that behaviour can be shape due to stimuli from the environment. In which way one is primed is strongly depends on one's personal goals. When one is primed this means that an improvement or change has taken place in their identification of a stimulus as a result of prior encounter with the same or a related stimulus, this can be implicit or non-conscious process (Stevens, Wig et al. 2008). When you are primed to a negative stereotype you will adapt the same health goals commitment as your negative stereotype. (Campbell and Mohr 2011). When being primed with a negative stereotype, a person with overweight, this stereotype is activated this increases stereotype conducive behaviour, such as eating unhealthy (Campbell and Mohr 2011). If

you are on a diet you feel the constant urge to lose weight, and assimilate towards one who is heavy. So feeling a constant urge to lose weight one feels more the same with a person with overweight. This results in assimilation toward the behaviour of the person with overweight. Putting this further this leads to assimilated food choices. This means that when on a diet one will choose the food a heavy waitress recommended. Dieters will choose more often cookies that are recommended by a heavy person than a thin person. When carrots were recommended, the dieters selected more often cookies when the waitress was thin (vs. heavy) (McFerran, Dahl et al. 2010). An explanation that non-dieters display the opposite effects can be due to the fact that when served by an obese person, this increases the accessibility of the causal link between eating and becoming overweight. So when seeing a person with overweight and food the reminder of the direct connection between eating and becoming overweight is made by consumers (Campbell and Mohr 2011).

So the degree one assimilates or contrast away from is dependent on the degree of identification with the person one is primed to. When a person identifies him/herself strongly with a person there will be a higher degree of assimilation. The higher degree of identification the greater the influence of the anchor, however this is on a strong degree dependent on the moderator if one is a restrained eater or not (Campbell and Mohr 2011).
A person with overweight that is shown with food is assumed to have less self-control (Campbell and Mohr 2011). Therefor we assume that when one has to estimate the calorie content of a product which is primed with a person with overweight this will lead to a higher estimated calorie content. The hypothesis will therefore be:

H3a: Compared to estimating a dish without being provided with a person, estimating a dish being presented with a person with a normal weight will lead to the lower calorie estimations.

H3b: Compared to estimating a dish without being provided with a person, estimating a dish presented with a person with overweight will lead to higher calorie estimations.

In conclusion, the expectation is that the estimations will assimilated towards the anchor and therefor contrast away from the control group. See figure 2 on the next page for a schematic overview.

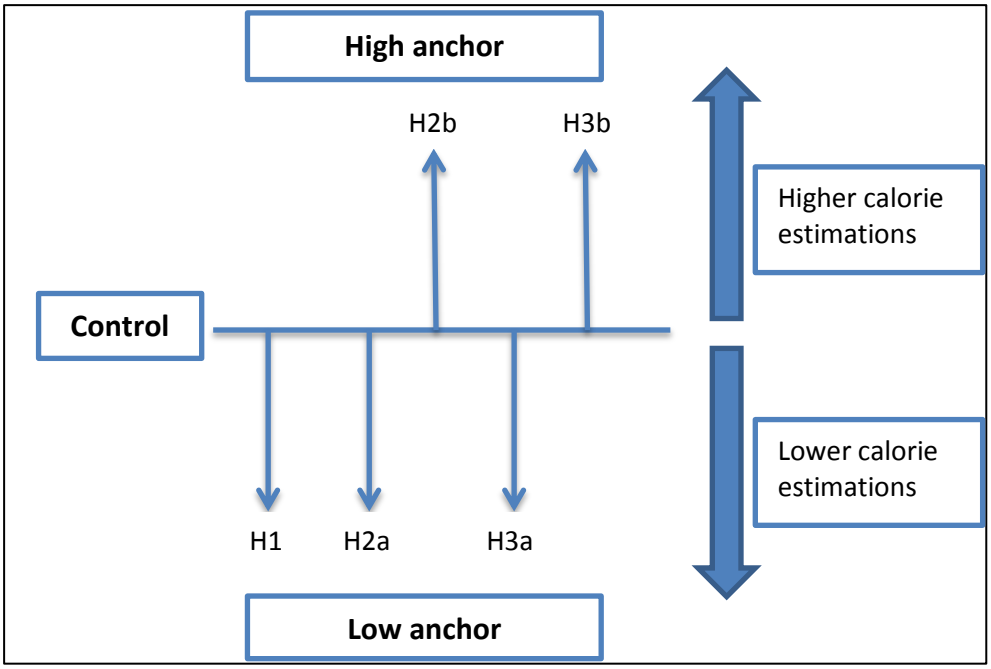

Figure 2 Schematic overview hypotheses

2.3.2 Anchoring Index

The anchoring index is the percentage one is influenced by the anchor that is set. When it is 100% people just adopt the anchor and when it is 0% when people were able to ignore the anchor completely. To clarify this, an example of Kahneman from his book 'Thinking, fast and slow' is given. This example is about a research where people had to estimate the height of a redwood (highest tree in the world). A high and low anchor was given. The high anchor was: 'Is the height of the tallest redwood more or less than 1.200 feet?' In the case of the low anchor they asked: 'Is the height of the tallest redwood more or less than 180 feet?' The second question asked was: 'What is your best guess about the height of the tallest redwood?' In the case of the high anchor they estimated 844 feet and in case of the low anchor they estimated 282 feet. The difference is 562 feet. The ratio of the two differences, 562/1200, is 55%. So the anchoring effect in this case is 55%. This percentage is not just a coincidence. More experiments show similar results. In the experiment where experts and not experts had to estimate the price of a house the only difference was that the experts did not admitted that they were influenced by the anchor, but the non-experts did, although both were influenced. The anchoring indexes were 41 and 48%. Even totally useless anchors can have an anchoring effect of 50%. A study done under judges in Germany showed that throwing a dice had an anchoring effect of 50% when they sentence a woman for shop lifting. A manipulated dice would give the number three of nine. First the judges were asked if they would give a higher of lower sentence than the number on the dice, and they were asked how many months of sentence they would give the woman. When they throw the number 3 they gave the woman 5 months sentence and when they throw they number 9 they gave the woman 8 months sentence (Englich, Mussweiler et al. 2006).

2.4 Potential moderators

In this part the different moderators that can have an influence on calorie estimation will be discussed. Namely, socio-demographic variables (education level, BMI and nutrition knowledge) and restrained eaters.

Education level

For an experiment, respondents had to do simple reading and calculations to derive to the correct amount of calories of a portion. When they were higher educated, they more often assessed the amount of calories correctly (Sinclair, Hammond et al. 2013). Divers studies also showed that higher education level is positively related to label use and also to accurate information location and retrieval from labels (Campos, Doxey et al. 2011) (Byrd-Bredbenner, Alfieri et al. 2000). Also literacy and numeracy are related to understanding food labels. A lower literacy and numeracy was significant related with poorer label comprehensive (Rothman, Housam et al. 2006). However one study showed no significant difference with education, in this study participants were ask to give the calorie content of a bottle of coke whereby the calories were given in different contexts, depending on the condition (Vanderlee, Goodman et al. 2012). However, these researches never let respondents actually estimate the calorie content of a meal whereby caloric information was totally excluded. We therefore assume that people with a higher educational background will be able to give more accurate calorie estimation.

BMI

There is no unambiguous explanation whether or not a higher BMI is related to poorer calorie estimation. A logical line of thinking would be that when one is overweight or obese this person is also less good in estimating the calories of a meal. However, here is no unambiguous evidence if this is really the case. It is not clear what the relation is between restraint eating and BMI and how this affect calorie estimation (Brogden and Almiron-Roig 2010). On one hand there is an association found that people who were participants in Body Weight Loss Programs had a greater inaccuracy in caloric estimation (Carels, Harper et al. 2006). On the other hand, there was no difference found in calories estimation accuracy between overweight and non-overweight participants (Carels, Konrad et al. 2007). A different study whereby participants had to read and/or estimate calories in different conditions there was also no significant difference when looking at BMI (Vanderlee, Goodman et al. 2012).

However, there can also be another explanation for this poor calorie estimation. People are better in estimating the calories of a small meal than of a large meal. Calorie underestimation is caused by the increase of meal size. People who have a higher BMI are tended to choose larger meals. That is why people that are overweight or obese underestimate the amount of calories in a meal. This means that poor calorie estimation is not bounded to BMI (Wansink and Chandon 2006, Chandon and Wansink 2007).

Nutritional knowledge

People that have more nutritional knowledge in general also maintain a healthier diet. This is not only the case among students but also among non-students. Having knowledge about dietary guidance causes that people have a healthier eating patron. Relating to students, when exposed with question about a specific food type, they are to put their knowledge into practice or at least make the healthiest choice (Kolodinsky, Harvey-Berino et al. 2007). People that are in the highest group op

nutritional knowledge are almost 25 times more likely to meet the recommended quantities for fruit, vegetables and fat than the people that are in the lowest groups (Wardle, Parmenter et al. 2000). Infer from this, we assume that people who have more nutritional knowledge are also better in estimating the right amount of calories.

Restrained eaters

It is likely that restrained eaters which choses a salad (1200kcal) will eat more at the moment when they receive accurate calorie information, than those who did not receive accurate calorie information (600kcal), because they wanted to maintain their goals. A salad with 1200kcal is perceived as high in calories, so when restrained eaters saw this, they felt less need to keep up with their restrained eating habits and consume more of the salad (Girz, Polivy et al. 2011). A research of Girz et al. under only women showed that restrained eaters ordered a salad when they thought the salad had fewer calories than the overall preferred pasta. Calorie information had no influence on people who were non-restrained eaters. Another study of Girz showed that unrestrained eaters ate less when calorie information is provided. When the two products (pasta and salad) had the same amount of calories the restrained eaters preferred the pasta, when they did not have any calorie information they preferred the salad (Girz, Polivy et al. 2011). Because restrained eaters are very involved with calories, we assume therefor that they are better in estimating a correct amount of calories of a meal. However they are strongly influenced by cues, such as packaging that is why we think that the various anchors will have a stronger effect on them. Also restrained eaters that are in the conditions of priming and identification will identify themselves to a stronger degree with the person with overweight than the thin person (McFerran, Dahl et al. 2010). People who are restrained eaters identify themselves more with people who are heavy than people who are non-restrained eaters. Restrained eaters will feel more influenced in the third category by the heavy person, and non-dieters will feel more persuaded by the person with a normal weight.

3. Pre-test

3.1 Pre-test

The aim of this pre-test was to identify a meal- and body type that was suitable as stimulus material in the main study. We wanted to find a meal what is commonly known in the Netherlands, but is also seen as unhealthy. Besides that, we wanted to investigate if the BMI standards of a woman are also seen by the population as very thin normal/average and obese. If the women indeed are seen as having the assumed thin, normal and fat body posture this will be used to shape (Photoshop) the different postures of a woman in the real experiment.

Participants

We recruited the respondents via social media. After two hours 35 persons filled out the survey and the survey was closed.

Measures

First, the respondents were asked for their gender and age. Then, we asked them to evaluate two meals on a 5 point Likert scale how healthy they found the shown meals. One meal was a hamburger (figure 3), with cheese and the other meal was macaroni with cheese and ham (figure 4). We asked the respondents; 'If I see this meal (show picture of meal), I find this meal:' Then they could answer this question by filling out one of the following options: 'I find this meal: (1) very unhealthy- (2) unhealthy- (3) neutral- (4) healthy- (5) very healthy'. See figure 7 and 8 for the hamburger and the pasta.

Figure 3 Hamburger used for the pre-test

Figure 4 Pasta used for the pre-test

We also asked them to evaluate the posture of four women on a 5 point Likert scale. The four women were classified into three groups based on their BMI knowing, very thin, normal/average and obese. One woman was supposed to be thin (BMI of 16.4), two were supposed to be normal/ average (BMI 23.9 and 25.2) and one was supposed to be obese (BMI 42) (figure 5, 6, 7 and 8 on the next page). We asked the participant; 'If I look at the posture of this person (show picture of woman), I find this person:' Then they could answer this question by filling out one of the following options: 'I find this posture: (1) very thin- (2) thin- (3) normal- (4) overweight- (5) very overweight'. The photos were obtained via the image hosting website Flickr, a dieting website and the website Posh 24. The BMI's were given on the websites and are probably self-conducted.

Figure 5 BMI 16.4

Figure 6 BMI 23.9

Figure 7 BMI 25.2

Figure 8 BMI 42

Procedure

The data was gathered by a Qualtrics questionnaire. All the questionnaires, with randomized questions were assigned to the respondents. So any bias due to the order of the questions will be filtered out as much as possible.

Analyse

We wanted to know the mean of the different questions to determine how the respondents saw the different meals and body postures. Using SPSS's frequencies we investigated these different means.

Results

Of the 35 respondents, 28 surveys were filled out completely, the other seven will be removed from the data base. The average age of the respondents was 29, and the major part female (64%).

The hamburger, with a mean of 1.57 (*SD*=0.5) was significantly seen as unhealthier than the pasta with a mean of 2.54 (*SD*=0.84).

Table 1 Results pre-test of the meals

	Hamburger	Pasta	P-value
Meal	1.57 (0.5)	2.54 (0.84)	0,001

Looking at the body postures, the woman with the BMI of 16.4 had a mean of 1.39 (*SD*= 0.57), the woman with the BMI of 23.9 had a mean of 2.71 (*SD*= 0.66), the woman with a BMI of 25.2 had a mean of 2.79 (*SD*= 0.57) and the woman with and BMI of 42 had a mean of 4.75 (*SD*= 0.44). These results were significant ($F(3, 108)=168.44$, $p<0.001$). This shows that the mean of the different postures is in line with the BMI's of the different women.

Table 2 Results pre-test of the BMI's

	BMI 16.4	BMI 23.9	BMI 25.2	BMI 42	F- value	P- value
Judgement posture	1.39 (0.57)	2.71 (0.66)	2.79 (0.57)	4.75 (0.44)	168.44	0,00

Putting this further, according to the Student-Newman-Keuls the four BMI's can be divided into three subsets, subset a, which contains of the person who is the thinnest with a BMI of 16.4, subset b,

where BMI 23.9 and 25.2 sharing a subscript and therefore do not differ significantly (P=0.01) and subset c, the person with the fattest with a BMI of 42. Between those three subsets there is a significant difference.

Table 3 Results Student-Newman-Keuls pre-test BMI's

Posture	N	Subset		
		1[a]	2[b]	3[c]
BMI 16.4	28	1,39		
BMI 23.9	28		2,71	
BMI 25.2	28		2,79	
BMI 42	28			4,75
Sig.		1,000	0,637	1,000

Discussion

The hamburger is seen as unhealthier than pasta, therefor the hamburger will be used in the main experiment. The different BMI's of the women were in line with the opinions of the respondents. The woman with a BMI that represents obesity was seen as very overweight by the respondents. This was also the case with the women with the low and average BMI's. Therefor the postures of these women will be used as an example in the main experiment to conduct (Photoshop) the different postures of a woman. However, there were some limitations. The presented pictures were taken from the internet, there is no guarantee that the reported BMI's were true. Besides this, the pose and the clothing of the women also have an influence on the perceived body postures.

4. Method survey

4.1 Research design

The aim of this study was to get a systematic overview in how anchor points influence caloric estimations. It was a between-subject design with five conditions and one control condition. The five conditions were distinguished in 3 categories, because similar processes were expected within the categories. This product was a hamburger with 856 calories. In Appendix A the whole questionnaire is shown.

Table 4 Anchoring conditions

Category anchor	Anchor	Extra
Control condition	**No anchor**	
Numeric anchor	**1.** Recommended **daily amount of calories**	Woman: 2000 kcal Man: 2500 kcal
Product anchor	**2a.** Meal component of something **healthy** **2b.** Meal component of something **unhealthy**	Healthy: salad Unhealthy: dessert
Person anchor	**3a. Person with a normal weight** behind the meal **3b. Person with overweight** behind the meal	A female will be used in these conditions. The person with a normal weight will be used as the baseline

4.2 Participants

The respondents of the questionnaire were recruited under the Dutch population. The survey was opened from Sunday evening until Wednesday afternoon the next week. It was sent to a mailing list with 760 email addresses. These addresses came from the WUR chair group, Marketing and Consumer Behaviour. The questionnaire was also spread via the social network of the research including, emailing and Facebook. The third way the respondents were recruited was to ask random people on the street for their email address and asked if we could send them an email once, with the link of the questionnaire. This happened for two days, one day in the city centre of Arnhem and one day in a shopping mall in Rotterdam. The aim was to get at least 40 respondents per conditions, so in total (6*40) 240 respondents.

4.3 Stimulus material

The stimulus material contained out of 5 different pictures, each pictures was linked to an anchor condition. The five pictures that were used are shown here below. The hamburger was self-made, so we could ensure that we knew the correct amount of calories. The hamburger was made out of a sandwich, which had 207 calories. The burger itself was made out of pork/beef meat, egg and breadcrumbs, which had 427 calories. The topping on the burger was made of cheddar cheese, bacon, fried onions, pickles, tomato, lettuce, ketchup and mayonnaise this contained 220 calories. So the total amount of calories of the hamburger was 856.

Photo one is a picture of the hamburger alone, see figure 9. Photo two and three were pictures of the hamburger with a salad or dessert next to it, see figure 10 and 11. The salad and the dessert standing next to the hamburger were also self-made. Photo four and five were stock photos of a

woman with a normal weight and a woman with overweight, see figure 12 and 13. The hamburger was photo shopped in front of the persons.

Figure 9 Hamburger

Figure 10 Hamburger with salad

Figure 11 Hamburger with dessert (ice cream with chocolate sauce)

Figure 12 Woman with a normal weight behind hamburger

Figure 13 Woman with overweight behind hamburger

4.4 Measures

The dependent variable in all the conditions is the estimated amount of calories. The independent variables are the different anchors provided. The anchoring index can give a percentage of how much the anchor causes to deviate from the control condition. Besides this, in anchor 2a and 2b the assimilation and contrast effect was measured. In anchor 3a and 3b the degree of priming and identification will be measured. First the measures of the different anchors and then the various moderators will be discussed here below.

To make sure that all respondents across the different conditions got a clear understanding of the ingredients of the hamburger, a short description of the ingredients of the hamburger was given. This information was provided above each photo. It read as follows 'A hamburger made out of beef and pork meat, on a white sandwich, with as an topping cheddar cheese, bacon, fried onions, pickles, mayonnaise and ketchup'.

4.4.1 Measures

Numeric anchor

The first anchor category was a numeric anchor and therefor there was only a numeric comparison. The anchoring index was used for this. When it was 100% people just adopt the anchor and when it was 0% people were able to ignore the anchor completely. You have to take the mean differences that are estimated of both conditions and take the difference between them. Then you divide the difference by the highest anchor and multiple these with 100. Depending on the hypothesis the anchor was high or low (Kahneman 2011).

Product as an anchor

In the second anchor category there was, besides the numeric comparison which was made on the basis of the anchoring index, measured in which degree the assumed vice and virtue are seen as vice and virtue. We asked all the respondents at the end of the questionnaire to evaluate the salad and dessert, these two questions were randomized. There was asked on a five point Likert scale: I found the side dish of this product very: '(1) very unhealthy- (2) unhealthy- (3) neutral- (4) healthy- (5) very healthy'.

Person as an anchor

In the third anchor category there was, besides the numeric comparison which was made on the basis of the anchoring index, measured in which degree the respondents identified themselves with the person on the picture. The respondents will be asked 'What is the first think that came to mind when you saw this person?' Besides this, to get an answer to the main question: 'I identify myself with this person on the picture'. Four questions were asked. These four questions are answered on a five point Likert scale: '(1) I strongly disagree – (5) I strongly agree':
'I compare myself with the posture of the woman on the picture'
'The woman on the picture eats too much'
'The choice of this woman is very unwise'
'The hamburger is fattening for this woman'

To check the stimulus material, the respondents were asked to fill out several questions to investigate how they saw the hamburger. They were asked eleven statements about the hamburger on a seven point Likert scale (1) totally disagree- (2) disagree- (3) slightly disagree- (4) neutral- (5) slightly agree (6) agree- (7) totally agree. The statements about the hamburger were: 'The hamburger on the photo…': is healthy, is fattening, gives energy, is crispy, is a treat, contributes weight gain, is filling, is tasty, is satisfying, looks delicious and is salty.

4.4.2 Moderators

Several moderators were expected to have an effect. Assumed effects were: Socio-demographic variables (Age, gender, education level, BMI) nutrition knowledge and restrained eaters. How they are measured will be discussed shortly. BMI, education level and age are control variables. Restrained eaters and gender were carried out as moderator because they were expected to have an influence on the degree of identification. Nutrition knowledge was also taken as a moderator because there was expected that a have a higher degree of nutrition knowledge would result in better calorie estimation.

Restrained eating

To measure the degree of restrained eating the "restraint scale of Dutch eating behaviour questionnaire" (Van Strien, Frijters et al. 1986) was used. This scale contains of 10 questions are answered on a five point scale from 1 (never) to 5 (very often). The lowest score was 10, the highest score one could get on the scale is 50. The cut-off point was the median. The mean of the restrained eater scale was 24.82 (*SD*=7.72). The median was 25.00, which was also the cut-off point.

The reliability analysis showed that the ten restrained eaters questions indeed measured the construct (Cronbach's α = 0.89). This showed that this scale is reliable to measure restrained eating.

BMI

The BMI was measured according to the following formula: BMI= kg/height in m2. The length and weight of the respondents will be self-reported. The BMI was categorized in to two different groups, not overweight (BMI <24.99) and overweight (BMI >25) (WHO 2006).

Education level

Educational level was distinguished into three categories: Low, middle and high. There was asked at the respondents: 'What is the highest educational level you are following/ followed?' and followed by seven options, this question was a multiple choice question, where it only was possible to choose one answer. The distinction low, middle, high will was not visible for the respondents. The following distinction is made:

Low:
- Basisonderwijs
- Lager beroepsonderwijs
- (Voorbereidend) middelbaar beroepsonderwijs (VMBO, MAVO, MULO)

Middle:
- Middelbaar beroepsonderwijs (MBO)
- Hoger voortgezet onderwijs (Havo, VWO)

Higher:
- Hoger beroepsonderwijs (HBO)
- Wetenschappelijk onderwijs

Nutritional knowledge

For measuring the nutritional knowledge the 'Nutrition knowledge (subjective)' was used, developed by Burton, Garretson, and Velliquette. We used two of the three subjective questions on a five point scale *(Bruner, Hensel et al. 2001).* Besides this the caloric knowledge was measured by an objective scale. This scale has been derived from the 'Consumer nutrition knowledge scale, (CoNKS)', developed by Dickson-Spillmann, Siegrist and Keller, but customized to the purpose of this research (Dickson-Spillmann, Siegrist et al. 2011). The cut-off point will be the median. The two groups will therefore be, low and high subjective knowledge. After recoding one question the reliability analysis showed that the three subjective knowledge questions indeed measured the construct (Cronbach's α = 0.75). This means that this scale is reliable to measure subjective knowledge. The mean of the subjective knowledge scale was 9.71 (*SD*=2.41). Subjective knowledge is split in to low and high knowledge with as cut-off point the median, which was in this case 10.

The mean of the objective knowledge scale was 13.77 (*SD*=1.17). Objective knowledge is split in to low and high knowledge with as cut-off point the median, which was in this case 14.

Background information

Gender and age were asked at the end of the questionnaire. The mean of age was 38.56 (*SD*= 17.91). Age is split in to low and high with as cut-off point the median, which was in this case 32.

4.5 Procedure

The respondents were assigned to one of the six conditions, this happened randomly by Qualtrics. Depending on which condition the respondents were in, they were exposed to one of the anchors or the control condition. In the case of the first anchor they first saw the anchor and then the hamburger. In the case of the anchors 2a, 2b, 3a and 3b the respondents saw the anchor and the hamburger combined. In the control condition the respondents only saw the hamburger. When the respondents were exposed to the hamburger, the question was asked 'How many calories you think this hamburger alone contains?'. After this the various moderators and background variables were measured. The respondents were recruited via social media, various mailing lists of the researcher herself and via printed versions of the questionnaire. The respondents filled out the survey on their own at their own occasion.

4.6 Data analysis

First we checked our dataset for irregular values and outliers. We also looked at normality of the data and we checked the manipulation. Furthermore, using analyses of variance (ANOVA's) we checked whether there were differences between conditions in gender, restrained eaters, BMI, education level, subjective and objective knowledge, and age and restrained scores. The primary ANOVA examined the effect of our manipulations on the estimated calories content of the hamburger. At last we examined the effect of the moderators.

5. Results

Outliers

The data was checked for irregular values and outliers. The outliers were deleted, in order to prevent that this would influence the data set. There were three respondents who only opened the questionnaire but never filled out anything. After deleting these outliers and irregular values, we gave all the surveys a respondent's number. Nine questionnaires from respondents who did not answer all the questions, (for example, a few people stopped already after they gave the calorie estimation) were deleted from the data. Next to this, calorie estimations that did not include a number (for example, 'a lot of calories') were also changed into a missing value. After this, a boxplot was conducted, to see the outliers. Two estimates were deleted, namely 250000 and 300000. At last, estimations with a value of three times the standard deviation plus the mean in their respective condition were deleted. Eight extra estimations were deleted from the data, leaving in total 510 estimations in the analysis and 540 respondents.

Table 5 Outliers per condition

Condition	Condition	Mean	SD	3x SD.	outliers (std. +mean)
0	**Control**	690.89	627.671	1883.013	2573.903
1	**GDA**	731.78	376.53	1129.59	1861.37
2	**Salad**	586.89	314.038	942.114	1529.004
3	**Dessert**	704.54	612.286	1836.858	2541.398
4	**Woman with a normal weight**	647.81	447.395	1342.185	1989.995
5	**Woman with overweight**	637.34	295.500	886.5	1523.84
	Total	667.27	462.225	1386.675	2053.945

Normality

Per condition, the data was checked for kurtosis and skewness. The Kolmogorov-Smirnov test (all at least below ($p < .01$) showed, just like the Shaprio-Wilk test ($p < .01$), a significant difference for all the conditions. Checking the standardized residuals in a scatterplot also showed some variation. Table 6 provides details about the means and median next to the skewness and kurtosis of the different conditions. Looking at the P-P plot, the data varied per condition. There are peaks around the fifties (e.g. 350, 650 and 850 kcal) and hundreds (e.g. 300, 600 and 800) regarding their estimations. This caused the kurtosis and skewness. Because the maximum value of the skewness is 1.73 and kurtosis is 5.05 and literature stated that thresholds are 2.0 for skewness and 7.0 for kurtosis (Curran, West et al. 1996), a parametric test was conducted.

Table 6 Kurtosis, skewness, mean and median of the conditions

Condition	Skewness	Kurtosis	Mean	Median
Control	1.732	5.054	608.83	550
GDA	0.951	1.026	712.57	650
Salad	1.079	1.539	570.07	500
Dessert	1.282	3.561	627	550
Woman with a normal weight	0.992	1.501	609.72	600
Woman with overweight	0.978	1.089	621.12	562.5

Manipulation check

An Univariate Analysis of Variance was performed in order to check the manipulations of the different conditions. It was checked if the hamburger was seen as unhealthy. With a mean of 1.66 (*SD*= 0.94) on a five point-Likert scale, this was indeed the case. There were no significant differences between the conditions ($F(5, 539) = 0.94$, $p=.46$).

Randomisation

The randomization check examines whether respondents are equally divided across conditions, with regard to particular characteristics. Any factors, which can influence the results, will become covariates in further analysis. Gender ($F(5, 524)=1.43$, $p=.21$), BMI ($F(5, 534)=0.41$, $p=.84$) and education level ($F(5, 534)=1.59$, $p=.16$) are equally divided over the different conditions. Age showed a marginal effect ($F(5, 534)=1.93$, $p=.08$). Therefore this will be a covariate.

Restrained eaters were also equally divided over the different conditions ($F(5, 534)=0.71$ $p=.62$). Subjective knowledge was not equally divided over the different conditions ($F(5, 534)=3.25$ $p<.001$). This significance is found in the conditions were the hamburger was showed next to the woman with a normal weight ($F(1, 175)= 6.08$, $p=.02$) and the woman with overweight ($F(1, 173)=10.148$, $p<.001$). For this reason, this will be a covariate during the analyses. Objective knowledge was not equally divided over the different conditions (F (5, 534)=2.462, $p=.03$). However, this will not become a covariate, because only one question was significant (F(F5, 534) =2.96, $p<.001$). In conclusion, age and objective knowledge will become covariates.

Results

The ANOVA showed that there is a significant effect between the conditions ($F(5, 502)=2.541$, $p=.03$), see figure 14. Without the covariates it would be: ($F(5, 504) = 2.23$, $p = .05$). There was not a significant effect found between the certainty of the estimations ($F(5, 532)= 0.58$, $p = .72$). This indicates that there was no difference between the different conditions of how certain people were about their estimation. Table 9 provides an overview of the results regarding calorie estimation, certainty and inference making.

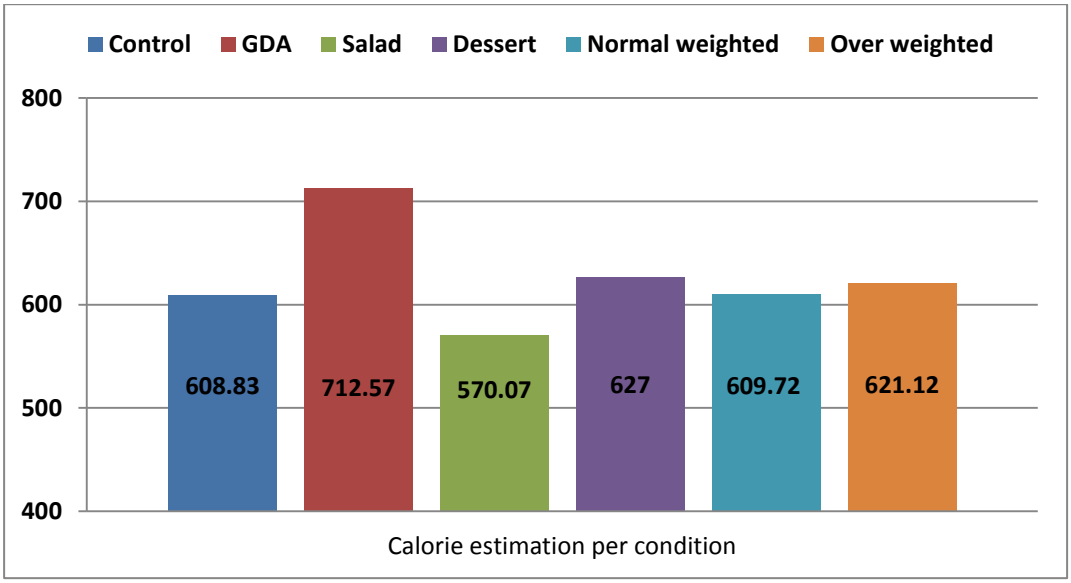

Figure 14 Graph with the calorie estimations per condition

Before discussing the hypotheses, noteworthy is the fact that all the calorie estimations are lower than the real amount of calories in the hamburger. It was expected that people would overestimate the calorie in the hamburger, because people tend to overestimate unhealthy products. The real amount of calories in the hamburger was 856. The mean value of the hamburger in all the conditions was underestimated, with a mean of 626.36 (*SD*=301.5). The percentage of underestimation compared to the real calories in the hamburger is displayed in table 8.

Table 7 Difference in percentage between real amount of calories and estimated amount.

Condition	Percentage underestimated
Control	28.88%
GDA	16.76 %
Salad	33.40 %
Dessert	26.75 %
Woman with a normal weight	28.77 %
Woman with overweight	27.44 %
Total	26.83 %

500 calories was the most frequently chosen caloric estimation with 66 times, followed by 600 and 800 calories, both 44 times estimated, then 400 with 39 times estimated. Noteworthy is that all the fifties (e.g. 350, 650 and 850 kcal) and hundreds (e.g. 300, 600 and 800) are chosen more often than other numbers. Ten people estimated the caloric content of the hamburger on 850 calories. The lowest estimation was 50 calories and the highest estimation was 2200.

5.1 Hypotheses testing

Table 9 shows the results of the calorie estimations and inference making.

Testing hypothesis 1

It was expected that providing the GDA with the hamburger would lead to more correct calorie estimations. Expecting that the calories of the hamburger would be overestimated, we assumed that providing the GDA would lead to lower, and therefore, more correct estimations, hypothesis 1 was:
H1: *Compared to estimating a dish without being providing of daily calorie needs, estimating a dish while being provided with daily calorie needs will lead to lower estimations.*

The results showed that there was a significant effect between the control condition and the GDA condition ($F(1, 165)=4.01$, $p=.047$). Although the result was significant, it was pointed the other way than expected, however it leads to a more correct estimation. The GDA provided in this condition resulted in higher estimations.

Testing hypothesis 2a

It was expected that combining a vice (hamburger) with a virtue (salad), would cause that the amount of calories would be perceived as lower. When a meal looks healthy it is assumed that it would have fewer calories. The hypothesis was as follows:

H2a: Compared to estimating a dish without being provided with a virtue, estimating a dish presented with a virtue will lead to lower calorie estimations.

However there was not a significant difference found between the control condition and the condition with the salad next to the hamburger ($F(1, 157)=0.88$, $p=.35$).

Testing hypothesis 2b

It was expected that a hamburger with a vice next to it, would lead to higher calorie estimations of the hamburger compared to the control condition. The hypothesis was as follows:

H2b: Compared to estimating a dish without being provided with a vice, estimating a dish presented with a vice will lead to higher calorie estimations.

However, there was no significant difference found between the control condition and the condition with a dessert next to the hamburger ($F(1, 158)=0.00$, $p=.97$).

Testing hypothesis 3a

We assumed that a person with a normal weight behind a hamburger would lead to lower calorie estimations. The hypothesis was as follows:

H3a: Compared to estimating a dish without being provided with a person, estimating a dish being presented with a person with a normal weight will lead to the lower calorie estimations.

However, there was no significant difference found between the condition with the woman with a normal weight and the control condition ($F(1, 161)=0.02$, $p=.89$).

Testing hypothesis 3b

It was expected that respondents who see a person with overweight would think that this person would have less self-control. Respondents would be primed with this person and would therefore lead to higher calorie estimation. The hypothesis was as follows:

H*3b: Compared to estimating a dish without being provided with a person, estimating a dish presented with a person with overweight will lead to higher calorie estimations.*

However, there was no significant difference found between the hamburger with person with overweight behind the hamburger and the control condition ($F(1, 161)=0.03$, $p=.88$).

5.2 Inference making questions

The inference making questions showed that there was no significant difference between the conditions and the degree of respondents who saw the hamburger as healthy, fattening, gives energy, crispy, a treat, contributing to weight gain, filling, tasty, satisfying, looks delicious and i salty (all p-values >.05). However, comparing the different conditions with the control conditions did gave some significant results. The condition with the salad next to the hamburger was significantly seen as crispier ($F(1, 170)=4.07$, $p=.05$) and looked more delicious ($F(1, 170)=5.52$, $p=.02$). With the dessert next to the hamburger it was significantly seen as more fattening ($F(1, 169)=5.29$, $p=.02$). A marginal effect was found on the statement 'the hamburger looks delicious' with a dessert next to the hamburger ($F(1, 196)=3.2$, $p= 0.08$) and the woman with a normal weight behind the hamburger ($F(1, 173)=3.79$, $p=0.05$), see table 9.

Table 8 Survey results caloric estimations and inference making (1= totally disagree—5= totally agree)

Condition Variables	Control (N= 84)	GDA (N=93)	Salad (N=90)	Dessert (N=89)	Woman with a normal weight (N=93)	Woman with overweight (N=91)	F- value*	P-value*
Caloric mean	608.8 (351.8)	712.57 (329.6)a	570.07 (274.7)	627 (308.8)	609.7 (268.0)	621.1 (256.4)	2.54	0.03
Certainty estimation	2.6 (1.0)	2.8 (0.9)	2.7 (0.9)	2.7 (0.9)	2.8 (0.8)	2.9 (0.9)	0.6	0.72
Inference making ***The hamburger on the photo…':***								
is healthy	1.7 (1.0)	1.7 (0.9)	1.7 (1.0)	1.6 (1.0)	1.8 (0.94)	1.5 (0.7)	0.71	0.61
is fattening	3.9 (1.2)	4.2 (0.2)	4.2 (1.1)	4.3 (1.0)a	4 (1.04)	4.0 (1.2)	1.42	0.22
gives energy	3.4 (1.9)	3.5 (1.3)	3.5 (1.2)	3.5 (1.1)	3.5 (1.3)	3.6 (1.3)	0.21	0.96
is crispy	2.6 (1.1)	2.6 (1.3)	3.0 (1.3)b	2.5 (1.3)	2.8 (1.5)	2.7 (1.2)	2.14	0.06
is a treat	3.4 (1.5)	3.6 (1.4)	3.7 (1.3)	3.5 (1.3)	3.5 (1.4)	3.4 (1.5)	0.50	0.78
Contributes to weight gain	4.3 (0.9)	4.4 (1.0)	4.4 (1.0)	4.5 (0.9)	4.2 (0.9)	4.2 (1.0)	1.24	0.29
is filling	3.6 (1.3)	3.5 (1.4)	3.8 (1.2)	3.6 (1.1)	3.7 (1.3)	3.7 (1.2)	0.59	0.71
is tasty	3.2 (1.4)	3.4 (1.3)	3.5 (1.3)	3.5 (1.3)	3.5 (1.3)	3.3 (1.4)	0.89	0.49
is satisfying	3.5 (1.2)	3.5 (1.3)	3.7 (1.1)	3.5 (1.2)	3.5 (1.2)	3.6 (1.2)	0.41	0.84
looks delicious	3.3 (1.3)	3.5 (1.2)	3.8 (1.2)a	3.6 (1.3)b	3.6 (1.3)b	3.3 (1.3)	2.23	0.05
is salty	4 (1.9)	4.1 (1.0)	4.1 (1.0)	4.2 (0.9)	4.1 (0.9)	4.2 (1.0)	0.41	0.84

*Tests are conducted with the covariates: subjective knowledge and age. a: Significant when P-value < 0.05; b: Significant when P-value < 0.1,
Note: The means of the 'certainty estimation' and 'inference making' are on a five point Likert scale.

5.3 Salad vs. dessert

We also checked whether the salad and dessert were seen differently in terms of health. The mean of the salad was 4.30 (*SD*=0.62) on a five point Likert-scale. This showed that there was no significant difference between the conditions how the respondents saw the salad ($F(5, 532)=1.39$, $p=.23$). The mean of the dessert was 1.86 (*SD*=0.62) on a five point Likert-scale. There was also not a significant difference between the conditions looking at the dessert ($F(5, 531)=0.44$, $p=.82$).

5.4 Identification

The question 'I compare myself with the posture of the woman on the picture' showed a significant difference between the woman with a normal weight and woman with overweight ($F(1, 180)=8.74$, $p<.001$). People compared themselves more to the woman with a normal weight than to the woman with overweight. The question 'The woman on the picture eats too much' showed a significant difference between the woman with a normal weight and the woman with overweight ($F(1, 180)=73.82$, $p<.001$).Whereby the respondents found that the woman with overweight ate more than the woman with a normal weight. The question 'The choice of this woman is very unwise' picture' showed a significant difference between the two conditions ($F(1, 180)=8.11$, $p<0.01$). This choice of the woman with overweight was found more unwise than the choice of the woman with a normal weight. The question 'The hamburger is fattening for this woman' picture' showed a significant difference between the two conditions ($F(1, 180)=6.7$, $p<0.01$). Respondents perceived the hamburger for the woman with overweight as more fattening than for the woman with a normal weight. See table 10 and figure 15 for an overview.

Table 9 Identification questions normal vs. overweight woman

Condition Questions	Woman with a normal weight	Woman with overweight	F-value*	P-value*
'I compare myself with the posture of the woman on the picture'	2.43 (1.26)	1.92 (1.17)	8.74	0.00a
'The woman on the picture eats too much'	2.04 (1.09)	3.42 (1.17)	73.82	0.00a
'The choice of this woman is very unwise'	3.14 (1.19)	3.58 (1.16)	8.11	0.01a
'The hamburger is fattening for this woman'	3.29 (1.21)	3.73 (1.12)	6.7	0.01a

*Tests are conducted with the covariates: subjective knowledge and age. a: Significant when P-value < 0.05
Note: The means of the questions are on a five point Likert scale.

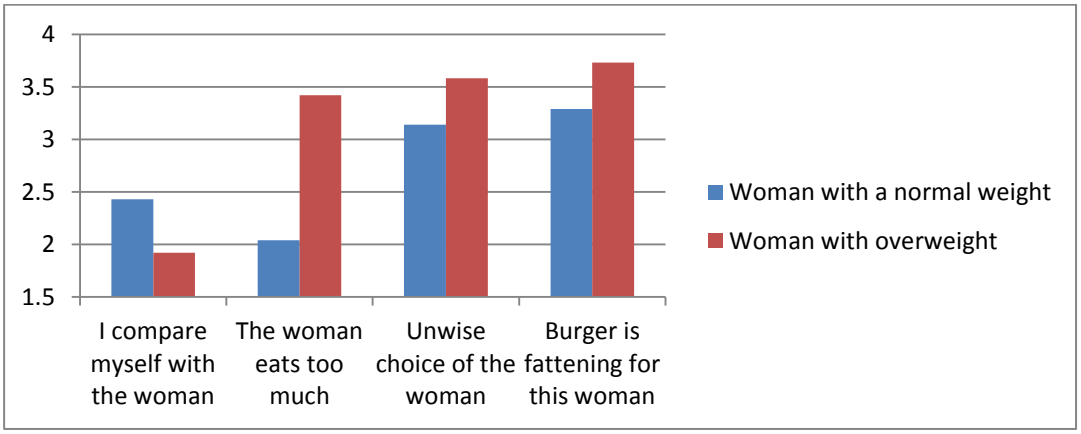

Figure 15 Difference between the woman with overweight and the woman with a normal weight.

Respondents being exposed to the hamburger including the woman with overweight, did not respond differently in terms of caloric estimation and inference questions compared to the control conditions (all *p-values* >0.05).

However, using the woman with a normal weight behind the hamburger as baseline showed a few significant differences, see table 11. A marginal effect is found for, that people find the hamburger unhealthier when the woman with overweight is sitting behind it than when a woman with normal weight is sitting behind the hamburger ($F(1, 180)=3.63$, $p=.06$). The hamburger was also perceived as less delicious when the woman with overweight was sitting behind the hamburger ($F(1, 180)=4.4$, $p=.04$).

Table 10 Survey results caloric estimations and inference making with a woman with a normal weight as baseline (1= totally disagree—5= totally agree)

Condition	Woman with a normal weight	Woman with overweight	F value*	P-value*
Variables				
Caloric mean	609.7 (268.0)	621.1 (256.4)	0.02	0.90
Certainty estimation	2.8 (0.8)	2.9 (0.9)	0.44	0.51
Inference making ***The hamburger on the photo…':***				
is healthy	1.8 (0.9)	1.5 (0.7)	3.63	0.06b
is fattening	4 (1.0)	4.0 (1.2)	0.04	0.84
gives energy	3.5 (1.3)	3.6 (1.3)	0.22	0.64
is crispy	2.8 (1.5)	2.7 (1.2)	0.88	0.35
is a treat	3.5 (1.4)	3.4 (1.5)	0.19	0.67
contributes to weight gain	4.2 (0.9)	4.2 (1.0)	0.15	0.70
is filling	3.7 (1.3)	3.7 (1.2)	0.01	0.93
is tasty	3.5 (1.3)	3.3 (1.4)	1.29	0.26
is satisfying	3.5 (1.2)	3.6 (1.2)	0.22	0.64
looks delicious	3.6 (1.3)	3.3 (1.3)	4.4	0.04a
is salty	4.1 (0.9)	4.2 (1.0)	0.12	0.73

*Tests are conducted with the covariates: subjective knowledge and age
a: Significant when P-value < 0.05; b: Significant when P-value < 0.1
Note: The means of the 'certainty estimation' and 'inference making' are on a five point Likert scale.

5.5 Moderators

This paragraph gives the results of the different moderators. The dependent variable was the calorie estimation. De different moderators were gender, restrained eaters, BMI, education level, subjective and objective knowledge, and age. An Anova was conducted with the condition and the different moderator to check for any main and interaction effects. The covariates were 'age' and 'subjective knowledge'. Table 12 provides an overview of all the means per conditions and the *F*- and *p*-values.

Gender

The dependent variable was the calorie estimation. 'Conditions' and 'gender' were the independent factors. There was no significant main effect of gender ($F(1, 486)=0.61$, $p=.44$). There was also no interaction effect found between gender and the conditions ($F(5, 486)=1.28$, $p=.27$). This indicates that men do not estimate the caloric content of the hamburgers differently than women. Besides this, it also showed that a different gender does not respond differently to the various manipulations.

Restrained eaters

The dependent variable was the calorie estimation. 'Conditions' and 'restrained eaters' were the independent factors. There was no significant main effect of restrained eating ($F(1, 496)=0.03$, $p=.87$). There was also no interaction effect found between the restrained and non-restrained eaters per condition ($F(5, 496)=0.71$, $p=.62$). This means that restrained eaters do not estimate the caloric content of the hamburger differently than non-restrained eaters. Next to this, it also shows that restrained eaters did not respond differently to the various manipulations.

Noteworthy is the interaction effect of people who are not restrained eaters, they compared themselves to a lower degree with the woman with overweight than restrained eaters ($F(1, 178)=5.48$, $p=.02$), see figure 16.

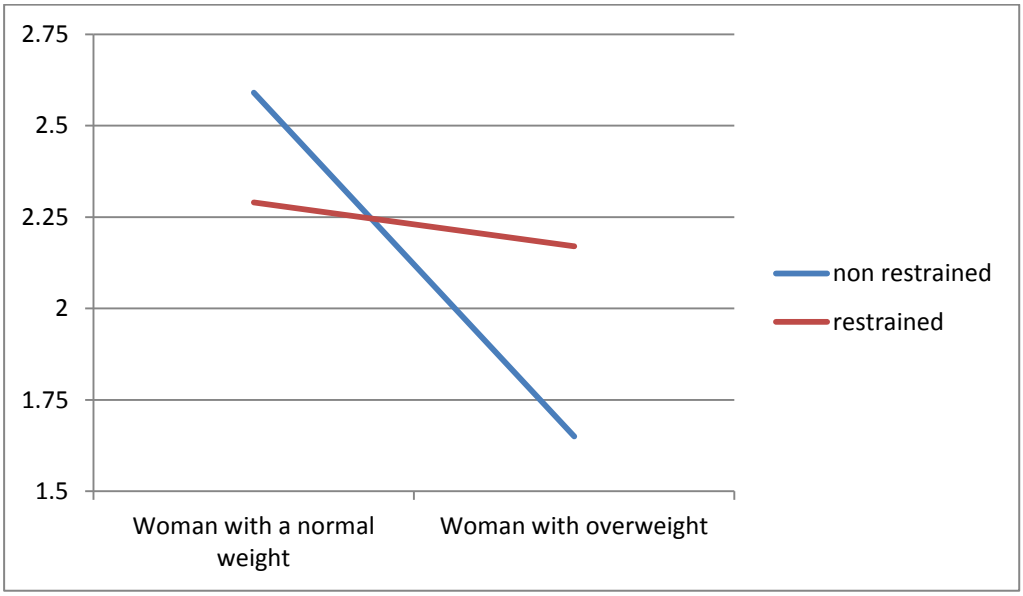

Figure 16 Interaction effect between (non)restrained eaters and normal vs. over weighted condition 'I compare myself with the posture of the woman on the picture'

BMI

The dependent variable was the calorie estimation. 'Conditions' and 'BMI were the independent factors. There was not a significant main effect of the respondents with overweight (F(1, 496)=1.29, p=.26). There was also no interaction effect found between overweight and non-overweight respondents per condition (F(5, 496)=0.93, p=.46). This indicates that being overweight does not make you estimate the caloric content of the burger differently than people who are not overweight. It also shows that people who are overweight do not responded differently to the various manipulations.

Education level

The dependent variable was the calorie estimation. 'Conditions' and 'education level' were the independent factors. Due to the small sample size of the people with a low education level (N=27), medium education level and low education level are merged to one, namely low education level. There was no significant main effect of high and low education level (F(1, 496)=0.09, p=.77). There was also not a significant interaction found between the low and high educated respondents per condition (F(5, 496)=0.11, p=.99). This indicates that people with a high education level do not estimate the caloric content of the hamburger differently than people with a low education level. Besides this, it also shows that people with a higher education level did not respondent differently to the various manipulations.

Subjective knowledge

The dependent variable was the calorie estimation. 'Conditions' and 'subjective knowledge' were the independent factors. In this case only 'age' was taken as a covariate. There was no significant main effect of subjective knowledge (F(1, 497)=0.19, p=.66).There was also no significant interaction effect found between subjective knowledge per condition (F(5, 497)=1.45, p=.21). This indicates that people with higher subjective knowledge do not estimate the caloric content of the hamburger differently than people with low subjective knowledge. It also shows that people with higher subjective knowledge did not respondents differently to the various manipulations.

Objective knowledge

The dependent variable was the calorie estimation. 'Conditions' and 'objective knowledge' were the independent factors. There was a marginal main effect found for objective knowledge (F(1, 496)=3.44, p=.06). However, there was not a significant interaction effect found between objective knowledge per condition (F(5, 496)=1.52, p=.18). It appeared that the respondents who scored higher on the objective knowledge test, estimated on average the caloric content of the burger as lower (M=604.1) than participants who scored lower on the same test (M=663.9).

Age

The dependent variable was the calorie estimation. 'Conditions' and 'age' were the independent factors. In this case only 'subjective knowledge' was taken as a covariate. There was not a significant main effect found for age (F(1, 497)=1.54, p=.22) There was no significant interaction effect found between age per condition (F(5,497)=0.84, p=.92). This indicates that older people do not estimate the caloric content of the hamburger differently than younger people. It also showed that older people did not respond differently to the various manipulations.

Table 11 Survey results of the calorie estimations, F- and P- values of the main effects of the moderators

Condition **Moderators**	Control (N= 84)	GDA (N=93)	Salad (N=90)	Dessert (N=89)	Woman with a normal weight (N=93)	Woman with overweight (N=91)	Overall	F-value*	P-value*
Gender								0.61	0.44
Male (N= 177)	641.5 (494.1)	777.7 (351.3)	517.9 (274.1)	612.5 (369.5)	612.0 (300.8)	714.3 (305.4)	642.5 (355.2)		
Female (N=323)	592.9 (277.0)	694.2 (371.9)	597.5 (274.1)	641.2 (268.3)	616.8 (248.5)	583.9 (226.2)	621.4 (271.3)		
Restrained eater ***(non-restrained: median <24.99; restrained: median >25)***								0.03	0.87
No (N=258)	594.9 (334.8)	765.7 (360.6)	556.5 (306.9)	634.7 (360.6)	634.3 (318.9)	601.5 (266.7)	636.3 (331.4)		
Yes (N=282)	623.2 (372.9)	659.5 (289.5)	580.3 (250.8)	620.7 (263.5)	588.3 (215.4)	637.3 (249.9)	617.7 (273.0)		
BMI ***(non-overweight <24.99); overweight >25)***								1.29	0.26
Non-overweight (N=345)	638.4 (361.5)	728.1 (339.7)	596.8 (276.0)	670.7 (324.7)	648.9 (277.1)	596.3 (252.3)	646.8 (306.6)		
Overweight (N=195)	565.0 (337.9)	684.9 (313.8)	519.3 (296.7)	564.6 (277.6)	537.7 (238.2)	679.7 (261.60)	590.2 (289.5)		
Education level ***(Low is 1,2,3,4 and 5; high: 6 and 7)***								0.09	0.77
Low (N=156)	576.4 (449.9)	683.3 (357.0)	545.4 (275.7)	608.8 (328.9)	612.0 (264.8)	628.3 (300.7)	611.0 (335.0)		
High (N=384)	625.4 (293.4)	727.5 (316.7)	579.9 (276.0)	634.2 (303.1)	608.5 (272.0)	619.6 (248.2)	632.8 (286.7)		
Subjective knowledge ***(Low <9.99; High >10)***								0.19	0.66
Low (N=244)	558.3 (399.8)	735.6 (376.2)	562.0 (307.5)	631.6 (379.8)	638.3 (317.7)	688.2 (264.1)	635.6 (350.6)		
High (N=296)	672.8 (272.2)	688.6 (274.8)	577.7 (242.7)	624.3 (260.8)	592.6 (234.8)	579.9 (245.0)	618.9 (255.4)		

Condition **Moderator**	Control (N= 84)	GDA (N=93)	Salad (N=90)	Dessert (N=89)	Woman with a normal weight (N=93)	Woman with overweight (N=91)	Overall	F-value*	p-value*
Objective knowledge ***(low <13.99; high>14)***								3.44	0.06b
Low (N=201)	613.3 (394.9)	817.8 (350.5)	647.4 (325.1)	651.7 (416.0)	625.9 (317.3)	589.8 (281.8)	663.9 (354.4)		
High (N=399)	604.9 (314.1)	638.5 (295.3)	512.1 (215.7)	617.3 (258.5)	602.2 (244.3)	636.8 (243.9)	604.1 (263.2)		
Age ***(younger <31.99 years; older> 32 years)***								1.54	0.22
Younger (N=265)	653.6 (380.6)	750.7 (362.8)	577.3 (276.3)	633.7 (316.1)	621.9 (234.8)	617.7 (277.4)	637.8 (303.0)		
Older (N=275)	560.4 (315.7)	689.1 (308.4)	531.3 (276.2)	617.9 (302.8)	599.6 (294.9)	625.7 (294.0)	614.7 (300.1)		

*Tests are conducted with the covariates: subjective knowledge and age (Except in the case of objective knowledge and age).
a: Significant when P-value < 0.05; b: Significant when P-value < 0.1

5.6 Self-given estimated GDA

We also asked the respondents how many calories they think they need per day. We first removed the outliers. The estimations of respondents 231 (estimation: 250000) and 540 (estimation: 1800000) were deleted after conducting an overall boxplot. After this we checked the estimations per condition and removed the outliers that were three times the standard deviation plus the mean, this causes that seven estimations were deleted from the data. In the beginning there were 499 estimations, after we removed all the outliers there were 490 estimations left.

Table 12 Outliers per condition

Condition	Condition	Mean	SD	3x SD.	outliers (std. +mean)
0	**Control**	2117.3	1150.8	3452.4	5569.6
1	**GDA**	2060	465.3	1395.8	3455.8
2	**Salad**	2183.7	1291.3	3874.0	6057.7
3	**Dessert**	2285.5	1052.4	3157.1	5442.6
4	**Woman with a normal weight**	1952.8	532.6	1597.9	3550.6
5	**Woman with overweight**	1943.1	553.7	1661.0	3604.1

*Tests are conducted with the covariates: subjective knowledge and age.
a: Significant when P-value < 0.05; b: Significant when P-value < 0.1

The respondents thought they needed on average 2140 (*SD*= 323.9) calories per day. Men though they needed 2362.2 (*SD*=1100.9) calories per day and women thought they needed on average 1932,7 (*SD*=728.9) calories per day. An ANOVA with 'daily caloric need estimations' as dependent variable and conditions as independent variable revealed a marginal significant main effect ($F(5, 582)=2.17$, $p=.06$). There was a main effect found for men and women ($F(1, 476)=59.76$, $p<.001$). Men estimated their GDA significantly higher than women.

Putting this further, according to the Student-Newman-Keuls, the 6 conditions can be divided into 2 subsets. Subset a, where the control condition and the conditions with the woman with overweight, the woman with a normal weight, the GDA and the salad are sharing a subscript and therefore do no differ significantly ($p=.59$). Subset b, where the GDA, salad and dessert condition are sharing a subscript do not differ significantly ($p=.15$). Between those subsets there is a significant difference ($F(5,484)=2.5$, $p=.03$), see table 14.

Table 13 Results Student-Newman-Keuls for GDA estimations per condition.

Condition	N	Subset for alpha: 0.05	
		1a	2b
Control	72	1927.71	
Woman with overweight	86	1943.08	
Woman with a normal weight	91	1952.75	
GDA	83	2025.30	2025.30
Salad	80	2054.75	2054.75
Dessert	78		2188.97
Sig.		0.590	0.146

6. Conclusion and discussion

There is a major increase in people with overweight and obesity in the Netherlands and worldwide. Anchor points have an effect on calorie estimation, however this is often undermined. By investigating how several anchor points influence a product, a better understanding can be gathered on how calorie estimations are influenced by signals in the environment. We conducted a survey where a hamburger was displayed with the GDA, a virtue (salad), a vice (dessert), a person with a normal weight or a person with overweight.

With this research we also wanted to decrease the contradictions in the literature and provide clarity regarding different moderators which could have an effect on caloric estimation.

The experiment

It is not easy for many customers to estimate the amount of calories of a product, this was shown by the high standard deviations around the mean estimated content. This big deviation also occurred in other studies where the researchers let people estimate the caloric content of a meal (Brindal, Wilson et al. 2011). It also showed that people had a poor knowledge of the caloric content of a meal.

In all the conditions the caloric content of the hamburger was underestimated compared to the real hamburger (856kcal). We assumed that the hamburger would be seen as unhealthy and therefore would be overestimated (Oakes 2005). A possible explanation for the calorie underestimation could be that the salad and tomatoes were visible on the hamburger which could lower the overall estimation of the hamburger (Chernev and Gal 2010). The calorie estimations ranged from 50 till 2200, people used fifties (e.g. 350, 650 and 850 kcal) and hundreds (e.g. 300, 600 and 800) as anchor points for their estimations. It is already an important conclusion that people are having difficulties with estimating the caloric content of a meal when they do not have a reference point.

Only a significant effect was found between the control condition and the GDA condition. Although respondents from the GDA condition made more realistic caloric estimations, this did not lead to higher certainty about their estimation. Noteworthy is that it let to better estimations, but it showed an opposite effect than expected. However, this numeric anchor (the GDA) showed that it caused better caloric estimations than without an anchor. Next to this, people had a middling good idea how much calories they need per day. Men as well as women underestimated a little the amount of calories they need in real life.

The calorie estimations were influenced by provided information about daily calorie needs (GDA). More specifically, calorie estimations were substantially higher and therefore more realistic than without GDA information. A logical line of thinking is that consumers estimated that this meal contains a big part of their recommended daily amount and perhaps that is why this estimation is higher, because this anchor is really used. An explanation could be that people used the 2000 and 2500 calories as an anchor point and moved away from this anchor to their own estimation. This could have caused that the estimation of the GDA condition was higher due to the fact that they stay more nearby the given anchor, because they really had no clue what the calorie content of the hamburger was.

Experimental studies showed that the understanding of different food labels is reasonable when shopping for food, however there is no real life evidence with nutrition labelling linked to changes in

body weight (genannt Bonsmann and Wills 2012). Wansink and Chandon stated that the ability to estimate calories in a correct way is important to reduce food intake (Wansink and Chandon 2006). Research shows that 27% of the consumers looked at nutrition labels. GDA was named as a main source of information. Notwithstanding this, consumers are able to interpret FOP nutrition information in a correct way at the moment they have enough cognitive means. (Grunert, Wills et al. 2010)

Calorie estimations were not influenced by the different anchors as a salad- and dessert condition. Chernev did a similar experiment (Chernev and Gal 2010). He let people estimate the amount of calories of a hamburger. In the first condition the hamburger was presented with a broccoli salad, in the second condition the hamburger was presented next to a chocolate cookie and in the control condition only the hamburger was presented. He found significant effects even with a smaller sample size, on average 62 people per condition. A possible explanation for these founded effects could be, that he showed the respondents first another hamburger and told them that this hamburger contained 500 calories, in order to prevent great deviation. This hamburger was used as reference point and causes that it would calibrate the estimations of the respondents. It indeed showed that the variance between his estimations per condition were much smaller than in this research. This could explain the difference in results between our and Chernevs study.

This research showed that the anchors of the woman with a normal weight and the woman with overweight did not have an effect on the calorie estimations. An explanation could be that the stimulus material was not strong enough, the respondents saw only a picture of the woman sitting behind the hamburger and it could be the case that the woman with overweight was not perceived by the respondents as obese. We found that people who are not restrained eaters identify themselves to a lower degree with the woman with overweight and people who are restrained eaters identify themselves more with the woman with overweight. This is in line with what we expected based on other research (McFerran, Dahl et al. 2010). The woman with overweight was indeed seen as having less self-control, she was seen as one that eats too much and that the hamburger was an unwise choice for the woman, also this result is in line with other research (Campbell and Mohr 2011). Using the woman with a normal weight as baseline next to the woman with overweight showed that there were some effects relating to the inference making. The hamburger was seen as unhealthier, less delicious and more fattening when the woman with overweight was sitting behind the hamburger than when the woman with a normal weight was sitting there. This means that people are influenced by the person behind the hamburger and assumes that the hamburger would cause more weight gain for the woman with overweight.

Moderators

People with overweight, restrained eaters, men versus women, subjective and objective knowledge, education level and age did appear that it had no effect on how the estimated calories and how the different conditions were seen.

We expected that a higher education level resulted in better caloric estimations skills. However, we did not find any effect for this expectation. It could be that we had a very low number of respondents that were low educated, therefore we had to combine the low and middle educated respondents. Further research with more low educated respondents would therefore be desirable.

Being overweight or not did not seem to have any effect on calorie estimations. This is in line with the existing literature (Carels, Konrad et al. 2007) (Vanderlee, Goodman et al. 2012). Wansink and Chandon found that poor calorie estimation was not bounded to the BMI of the respondents, but that poor calorie estimations is linked to meal size (Wansink and Chandon 2006) (Chandon and Wansink 2007).

We assumed that people with more nutritional knowledge would be better in caloric estimations. Because, based on existing literature, people with more knowledge would maintain a healthier diet (Kolodinsky, Harvey-Berino et al. 2007) (Wardle, Parmenter et al. 2000). There was a main effect found for people with more objective knowledge. People with more objective knowledge were poorer in estimating the caloric content. The underestimated caloric content is higher than of people with less objective knowledge. However, research in existing literature was not specifically focused on calorie estimations but more on label use. Therefor more research should be done about the relation between objective knowledge and calorie estimations.

Limitations

The sample is limited representative. This study was conducted under the Dutch people and it showed some weaknesses. Men and women were not equally represented, only 35 percent of the respondents were men. There were also too few lower educated people, compared to the actual population in the Netherlands.

Looking at the stimulus material, after all, the respondents were only given a picture of a hamburger and not the hamburger in real life. In some conditions there was a manipulation shown next to the hamburger. It is therefore questionable how the respondents saw the hamburger, especially relating to the size of the hamburger. The ratio between woman and hamburger could be seen out of proportion and it could manipulate how big the respondents saw the hamburger. The two women on the pictures were different, not only looking at body size. They were different in terms of appearance, relating to hair colour, the way they were sitting, how they looked in the camera and the clothes they wore.

At last, the survey was filled out online. It was not possible to check under which condition respondents filled out the survey. There is a chance that respondents, for example, were distracted.

Implications

Although people sometimes say they use and appreciate detailed (calorie) information, consumers found it difficult to use nutrition labels in a correct way and often do not pay attention to the labels. Besides this, if there are only nutrition labels on a product there is no significant difference in making healthy food choices compared with a control condition without labels. This is conflicting with what participants say, namely that nutrition labels are most likely and the best option to use when making healthy food choices (Drichoutis, Lazaridis et al. 2006, van Herpen and Trijp 2011). Overall, less is known about the effects of GDA labels in real life practices (Grunert and Wills 2007). However, based on the results of this study it showed that displaying GDA is useful. It showed that GDA labelling causes for more realistic calorie estimations. If they want people to start using caloric estimations to decrease eating, it is useful to give them education about calories and GDA. However, there is still a lot that has to be investigated relating to label use in real life practice and the effect on weight (loss).

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Appendix A. Questionnaire

Vragenlijst

Beste deelnemer,

Mijn naam is Janna de Geus en ik ben bezig met mijn afstudeeropdracht aan de Wageningen Universiteit. Fijn dat u mee wilt doen aan dit korte onderzoek over calorieën, het duurt maximaal 4 minuten. Ik wil u vragen om de vragenlijst alleen in te vullen. Er zijn geen goede of foute antwoorden, wilt u invullen wat als eerste bij u opkomt? Als deelnemer aan dit onderzoek blijft u geheel anoniem. Er zijn geen gevolgen verbonden aan het invullen van de vragenlijst. U kunt op ieder moment beslissen om te stoppen.

Wilt u kans maken op één van de drie bol.com tegoedbonnen van 10 euro? Dan kunt u aan het einde van de vragenlijst uw emailadres achterlaten. De winnaars zullen willekeurig worden gekozen.

Door op 'ja' te klikken geeft u aan dat u bovenstaande heeft gelezen en ermee instemt:

- Ja, ik doe mee aan dit onderzoek

Page break

(Control condition)

Bekijk rustig de volgende foto, een hamburger gemaakt met half om half gehakt op een wit bolletje, met als topping cheddarkaas, uitgebakken ontbijtspek, gebakken uitjes, augurk, tomaat, sla, ketchup en volvette mayonaise:

Hoeveel calorieën denkt u dat er in deze hamburger zitten?

Page break

Geef aan in hoeverre je het eens bent met de volgende beweringen.

De hamburger op de foto.....

	Volledig mee oneens	Mee oneens	Een beetje mee oneens	Neutraal	Een beetje mee eens	Mee eens	Volledig mee eens
is gezond	○	○	○	○	○	○	○
is dikmakend	○	○	○	○	○	○	○
geeft energie	○	○	○	○	○	○	○
is knapperig	○	○	○	○	○	○	○
is een verwennerij	○	○	○	○	○	○	○
draagt bij aan gewichtstoename	○	○	○	○	○	○	○
is volmakend	○	○	○	○	○	○	○
is erg lekker	○	○	○	○	○	○	○
is verzadigend	○	○	○	○	○	○	○
ziet er heerlijk uit	○	○	○	○	○	○	○
is zout	○	○	○	○	○	○	○

Page break

(Conditie 1)

Bekijk rustig de volgende foto, een hamburger gemaakt met half om half gehakt op een wit bolletje, met als topping cheddarkaas, uitgebakken ontbijtspek, gebakken uitjes, augurk, sla, tomaat, ketchup en volvette mayonaise:

De aanbevolen dagelijkse calorieën voor vrouwen is 2000 en voor mannen is 2500.

Hoeveel calorieën denkt u dat er in deze hamburger zitten?

Page break

Geef aan in hoeverre je het eens bent met de volgende beweringen.

De hamburger op de foto.....

	Volledig mee oneens	Mee oneens	Een beetje mee oneens	Neutraal	Een beetje mee eens	Mee eens	Volledig mee eens
is gezond	○	○	○	○	○	○	○
is dikmakend	○	○	○	○	○	○	○
geeft energie	○	○	○	○	○	○	○
is knapperig	○	○	○	○	○	○	○
is een verwennerij	○	○	○	○	○	○	○
draagt bij aan gewichtstoename	○	○	○	○	○	○	○
is volmakend	○	○	○	○	○	○	○
is erg lekker	○	○	○	○	○	○	○
is verzadigend	○	○	○	○	○	○	○
ziet er heerlijk uit	○	○	○	○	○	○	○
is zout	○	○	○	○	○	○	○

Page break

(Conditie 2a)

Bekijk rustig de volgende foto, een hamburger gemaakt met half om half gehakt op een wit bolletje, met als topping cheddarkaas, uitgebakken ontbijtspek, gebakken uitjes, augurk, tomaat, sla, ketchup en volvette mayonaise:

Hoeveel calorieën denkt u dat er in deze hamburger zitten?

Page break

Geef aan in hoeverre je het eens bent met de volgende beweringen.

De hamburger op de foto.....

	Volledig mee oneens	Mee oneens	Een beetje mee oneens	Neutraal	Een beetje mee eens	Mee eens	Volledig mee eens
is gezond	o	o	o	o	o	o	o
is dikmakend	o	o	o	o	o	o	o
geeft energie	o	o	o	o	o	o	o
is knapperig	o	o	o	o	o	o	o
is een verwennerij	o	o	o	o	o	o	o
draagt bij aan gewichtstoename	o	o	o	o	o	o	o
is volmakend	o	o	o	o	o	o	o
is erg lekker	o	o	o	o	o	o	o
is verzadigend	o	o	o	o	o	o	o
ziet er heerlijk uit	o	o	o	o	o	o	o
is zout	o	o	o	o	o	o	o

Page break

(Conditie 2b)

Bekijk rustig de volgende foto, een hamburger gemaakt met half om half gehakt op een wit bolletje, met als topping cheddarkaas, uitgebakken ontbijtspek, gebakken uitjes, augurk, tomaat, ketchup en volvette mayonaise:

Hoeveel calorieën denkt u dat er in deze hamburger zitten?

Page break

Geef aan in hoeverre je het eens bent met de volgende beweringen.

De hamburger op de foto.....

	Volledig mee oneens	Mee oneens	Een beetje mee oneens	Neutraal	Een beetje mee eens	Mee eens	Volledig mee eens
is gezond	○	○	○	○	○	○	○
is dikmakend	○	○	○	○	○	○	○
geeft energie	○	○	○	○	○	○	○
is knapperig	○	○	○	○	○	○	○
is een verwennerij	○	○	○	○	○	○	○
draagt bij aan gewichtstoename	○	○	○	○	○	○	○
is volmakend	○	○	○	○	○	○	○
is erg lekker	○	○	○	○	○	○	○
is verzadigend	○	○	○	○	○	○	○
ziet er heerlijk uit	○	○	○	○	○	○	○
is zout	○	○	○	○	○	○	○

Page break

(Conditie 3a)

Bekijk rustig de volgende foto, een hamburger gemaakt met half om half gehakt op een wit bolletje, met als topping cheddarkaas, uitgebakken ontbijtspek, gebakken uitjes, augurk, tomaat, ketchup en volvette mayonaise:

Hoeveel calorieën denkt u dat er in deze hamburger zitten?

Page break

Wat was het eerste waaraan u dacht toen u de persoon achter de hamburger zag?

Hieronder volgen 4 stellingen over de vrouw die u net achter de hamburger zag zitten.

	Volledig mee oneens	Een beetje mee oneens	Neutraal	Een beetje mee eens	Volledig mee eens
'Ik vergelijk mijzelf met het postuur van deze vrouw'	❍	❍	❍	❍	❍
' De vrouw op de foto eet veel	❍	❍	❍	❍	❍
'De keuze van de vrouw is zeer onverstandig'	❍	❍	❍	❍	❍

‘ Een hamburger is dikmakend voor deze vrouw’	❍	❍	❍	❍	❍

Page break

Geef aan in hoeverre je het eens bent met de volgende beweringen.

De hamburger op de foto.....

	Volledig mee oneens	Mee oneens	Een beetje mee oneens	Neutraal	Een beetje mee eens	Mee eens	Volledig mee eens
is gezond	○	○	○	○	○	○	○
is dikmakend	○	○	○	○	○	○	○
geeft energie	○	○	○	○	○	○	○
is knapperig	○	○	○	○	○	○	○
is een verwennerij	○	○	○	○	○	○	○
draagt bij aan gewichtstoename	○	○	○	○	○	○	○
is volmakend	○	○	○	○	○	○	○
is erg lekker	○	○	○	○	○	○	○
is verzadigend	○	○	○	○	○	○	○
ziet er heerlijk uit	○	○	○	○	○	○	○
is zout	○	○	○	○	○	○	○

Page break

(Conditie 3b)

Bekijk rustig de volgende foto, een hamburger gemaakt met half om half gehakt op een wit bolletje, met als topping cheddarkaas, uitgebakken ontbijtspek, gebakken uitjes, augurk, tomaat, ketchup en volvette mayonaise:

Hoeveel calorieën denkt u dat er in deze hamburger zitten?

Page break

Wat was het eerste waaraan u dacht toen u de persoon achter de hamburger zag?

Hieronder volgen 4 stellingen over de vrouw die u net achter de hamburger zag zitten.

	Volledig mee oneens	Een beetje mee oneens	Neutraal	Een beetje mee eens	Volledig mee eens
'Ik vergelijk mijzelf met het postuur van deze vrouw'	❍	❍	❍	❍	❍
' De vrouw op de foto eet veel	❍	❍	❍	❍	❍
'De keuze van de vrouw is zeer onverstandig'	❍	❍	❍	❍	❍
' Een hamburger is dikmakend voor deze vrouw'	❍	❍	❍	❍	❍

Page break

Geef aan in hoeverre je het eens bent met de volgende beweringen.

De hamburger op de foto.....

	Volledig mee oneens	Mee oneens	Een beetje mee oneens	Neutraal	Een beetje mee eens	Mee eens	Volledig mee eens
is gezond	○	○	○	○	○	○	○
is dikmakend	○	○	○	○	○	○	○
geeft energie	○	○	○	○	○	○	○
is knapperig	○	○	○	○	○	○	○
is een verwennerij	○	○	○	○	○	○	○
draagt bij aan gewichtstoename	○	○	○	○	○	○	○
is volmakend	○	○	○	○	○	○	○
is erg lekker	○	○	○	○	○	○	○
is verzadigend	○	○	○	○	○	○	○
ziet er heerlijk uit	○	○	○	○	○	○	○
is zout	○	○	○	○	○	○	○

Page break

(Achtergrond variabelen)

Hieronder volgen nog een aantal vragen over uw voedingskennis en een aantal algemene achtergrond vragen.

De volgende vragen gaan over voedingsgedrag. In hoeverre ben je het met de volgende stellingen eens?

	nooit	zelden	soms	vaak	heel vaak
Wanneer je iets zwaarder bent geworden, eet je dan minder dan gewoonlijk?	❍	❍	❍	❍	❍
Probeer je minder te eten tijdens maaltijden dan dat je eigenlijk zou willen?	❍	❍	❍	❍	❍
Hoe vaak weiger je eten of drinken omdat je bang bent dat je zwaarder wordt?	❍	❍	❍	❍	❍
Houd je exact bij wat je eet?	❍	❍	❍	❍	❍
Eet je opzettelijk producten waarvan je afvalt?	❍	❍	❍	❍	❍
Wanneer je teveel hebt gegeten, eet je dan de daarop volgende dagen minder?	❍	❍	❍	❍	❍
Eet je opzettelijk minder om te voorkomen dat je zwaarder wordt?	❍	❍	❍	❍	❍
Hoe vaak probeer je geen tussendoortjes te nemen omdat je op je gewicht let?	❍	❍	❍	❍	❍
Hoe vaak probeer je ’s avonds niet te eten omdat je op je gewicht let?	❍	❍	❍	❍	❍
Hou je rekening met je gewicht wanneer je eet?	❍	❍	❍	❍	❍

Page break

In het algemeen, hoeveel kennis heeft u op het gebied van voeding?

❍ Helemaal geen kennis ❍ Redelijk weinig kennis ❍ Gemiddeld ❍ Redelijk veel kennis ❍ Heel veel kennis

In hoeverre bent u het eens met de volgende stellingen?

	Volledig mee eens	Redelijk mee eens	Neutraal	Redelijk mee oneens	Volledig mee oneens
'Ik weet niet veel af van voedinswaarde'	❍	❍	❍	❍	❍
'In vergelijking met andere mensen weet ik vrij veel van voedingswaarde'	❍	❍	❍	❍	❍

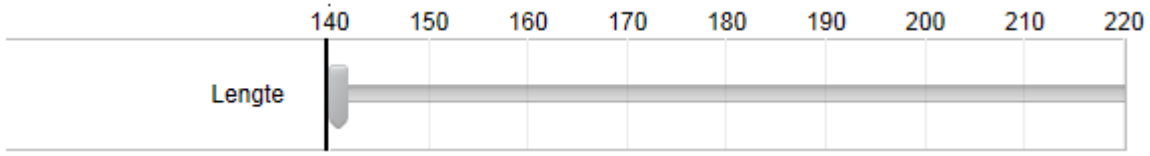
Page break

Hieronder volgens acht vragen over uw caloriekennis die u met waar of niet waar kunt beantwoorden

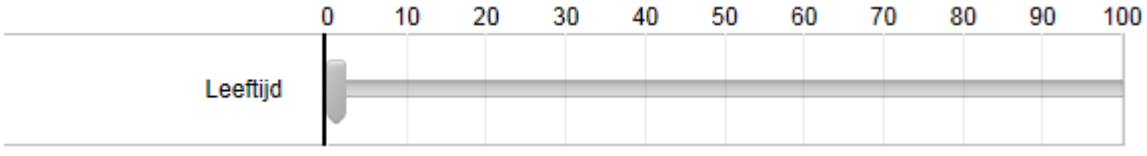
	Waar	Niet waar
Vet bevat minder calorieën dan dezelfde hoeveelheid vezels	❍	❍
Bacon bevat minder calorieën dan ham	❍	❍
Dezelfde hoeveelheid biefstuk en kipfilet bevatten dezelfde hoeveelheid calorieën	❍	❍
Dezelfde hoeveelheid suiker en vet bevatten dezelfde hoeveelheid calorieën	❍	❍
Een boterham met jonge 48+ kaas, bevat dezelfde hoeveelheid calorieën als een boterham met oude 48+ kaas	❍	❍
Magere melk bevat minder calorieën dan volvette melk	❍	❍
Bruine suiker bevat minder calorieën dan witte suiker	❍	❍
Een zak chips van 100 gram bevat de helft van de aanbevolen hoeveelheid calorieën voor een volwassen vrouw	❍	❍

Page break

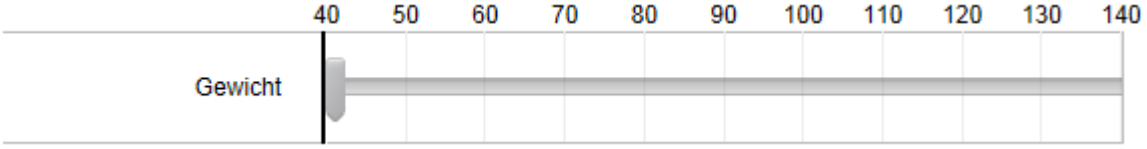
Wat is uw lengte in centimeters?



Wat is uw leeftijd in jaren?



Wat is uw gewicht in kilo's?



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Wat is uw hoogst voltooide opleiding? Of welke opleiding volgt u nu?

- Basisonderwijs
- Lager Beroepsonderwijs
- (Voorbereidend) Middebaar Beroepsonderwijs (VMBO, MAVO, MULO)
- Middelbaar Beroepsonderwijs (MBO)
- Hoger voortgezet onderwijs (HAVO, VWO)
- Hoger beroepsonderwijs (HBO)
- Wetenschappelijk onderwijs

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Hoe gezond beoordeelt u deze salade?

- Heel ongezond
- Ongezond
- Neutraal
- Gezond
- Heel gezond

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Hoe gezond beoordeelt u dit dessert?

- ❍ Heel ongezond
- ❍ Ongezond
- ❍ Neutraal
- ❍ Gezond
- ❍ Heel gezond

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Waar denkt u dat dit onderzoek over ging?

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Marktkunde en Consumentengedrag voeren verschillende keren per jaar worden korte onderzoekjes gehouden met vragen over consumentenproducten, consumenten-meningen, koopgedrag en dergelijke, achter de computer of op papier. Het onderzoek waaraan u zojuist hebt meegedaan valt hier onder. Aankondigingen voor deze onderzoeken worden per e-mail rondgestuurd (ongeveer 3 mails per periode). U kunt u ten allen tijde weer afmelden. Wilt u per e-mail op de hoogte worden gehouden of wilt u kans maken op een tegoedbon? Vul dan uw email adres in.

- ❑ Ja, ik wil op de hoogte worden gehouden van de onderzoeken, mijn emailadres is: _____
- ❑ Ja, ik wil kans maken op een tegoedbon, mijn emailadres is: _____
- ❑ Nee
- ❑ Ik word al op de hoogte gesteld van deze onderzoeken

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WAGENINGEN UR
For quality of life

Wij danken u voor de tijd die u aan deze enquête hebt besteed.
Uw reactie is opgeslagen.

0% 100%