

**EFFECTS ON HUNGER
AND FULLNESS LEVELS
AND VISUAL
PERCEPTIONS BY
VARYING PORTION SIZES
BY 10%**
An intervention study

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Abstract

Objective

Eating big portions of high energy dense foods is one of the behaviours associated with overweight and obesity. Thus, interventions aiming at reducing the portion sizes of this type of foods might be an important contributor to decreasing obesity and overweight rates. This study examined whether decreasing the portion size of a brownie by 10% affected the hunger/fullness levels of the participants compared to eating the entire portion, and whether participants observed visual differences between two portion sizes (100% size and 90% size) of 7 different high energy dense foods.

Research Methods and Procedures

The first experiment was done in the canteen area of the Danish Cancer Society on two different days, where the size of a brownie varied from a standard portion (80g) to a 10% smaller portion (72g). Adults (n=27) aging between 24 - 55 y.o. randomly divided into tables A and B were asked about their hunger/fullness levels (using a SLIM scale) before, right after and 20 minutes after consuming the brownie. In the first day table A ate the standard brownie (100%) and table B ate the 10% smaller brownie (90%), and on the second day the portions were switched between the tables in order to compare their hunger/fullness levels of each day.

The second experiment was done at the same organization, where two portions of varying sizes (100% and 90% portion sizes) of different high energy dense foods were presented to participants (n=24) who had to answer a short questionnaire regarding whether they could observe any differences between them.

Results

The first experiment showed that the participants did not experience any significant difference in hunger/fullness levels between the 80g brownie and the 72g brownie right after consumption. However, the participants did experience a significant difference between the 80g brownie and the 72g brownie 20 minutes after consumption, with the majority of the participants (19 out of 26) indicating that they were feeling more full from the 72g brownie.

The second experiment showed that out of the different 7 pairs of high energy dense foods tested, the majority of participants could not detect there was a size difference in 5 of the tested pairs of foods.

Discussion

From the two experiments it can be concluded that a decrease in portion size of approximately 10% do not affect the hunger/fullness levels and is not visually detectable. These results support interventions aiming at sustainably decreasing portion sizes of high energy dense foods in order to benefit public health.

1. Introduction

Overweight and obesity are a rising challenge globally. In 2016 more than 1.9 billion adults (18+) were overweight, and out of these more than 650 million were obese. In the same year more than 340 million children and adolescents between 5 and 19 years old and 41 million children under the age of 5 were overweight and obese (WHO, 2018). These numbers are projected to increase further the next couple of years (Obesity Update 2017, p. 6).

The challenge with overweight and obesity are prevalent in Denmark as well. In 2017, 51% of the adult population in Denmark were either overweight or obese, and out of these 16,8% were classified as obese (Danskernes Sundhed – Den Nationale Sundhedsprofil 2017, p. 95 + 97).

Obesity has been linked to many NCDs, one of them is cancer, which imposes a global threat to health. Currently, there are at least 13 different types of cancers linked to overweight (American Institute for Cancer Research, 2018), and it can also lead to cancer treatment failures (Vucenik and Stains, 2012), meaning that interventions to prevent and treat greater body fatness should have substantial benefits for public health.

Obesity and overweight are caused by an imbalance between calories consumed and calories expended (WHO, 2018). In the past decades portion sizes of high energy dense foods have increased. This is problematic in relation to overweight and obesity, since studies are showing that the energy intake of people are increasing when larger portions are offered (Steenhuis & Poelman et al. 2017, p. 11), and additionally a considerably more sedentary lifestyle are likely to lead to overweight and obesity (WHO, 2018). It is clear that portion sizes are having a substantial influence on the consumption patterns of people and thereby also an influence on the development of overweight and obesity.

Many studies acknowledge the relationship between big portion sizes and excess energy intake (Freedman and Brochado, 2012; Diliberti et al., 2012; Rolls et al., 2002; Livingstone and Pourshahidi, 2014). Another study provides evidence on how exposure to big portion sizes of a meal alters the perception of what a normal size portion actually is (Robinson et al., 2016). Furthermore, a review of portion size related articles concluded that interventions aiming at sustainably decreasing exposures to larger-sized food portions could successfully achieve a reduction in calorie consumption (Hollands et al., 2015), and therefore contribute to decreasing overweight and obesity rates.

The study "*Portion size of food affects energy intake in normal-weight and overweight men and women*" demonstrated the effect of portion size on energy intake during a single meal. The results showed that the energy intake at lunch was significantly influenced by portion size, and when the participants were offered the largest portion they consumed 30% more in energy than when they were offered the smallest portion (Rolls et al. 2002).

Similar results were found in the study "*Increased Portion Size Leads to Increased Energy Intake in a Restaurant Meal*", where the objective was to examine whether increasing the portion size of an entrée affected energy intake at a restaurant meal. Again the results demonstrated that when the participants were purchasing the larger portion their energy intake increased by 43% for the entrée and 25% for the entire meal compared to the participants purchasing the standard portion (Diliberti et al. 2012).

Another important point when it comes to the issue of increased rates of overweight and obesity is how portion sizes are perceived by people. The amount of food presented may indirectly suggest that it is appropriate to consume entirely independent of its actual size. This might influence how much people are expected to consume and how much they actually consume. This is what a study applying self-refilling soup bowls showed. Even though participants eating from these bowls consumed 73% more soup than the ones eating from normal bowls, they did not believe they had consumed more nor felt more satiated than those who ate from normal bowls (Wansink, Painter and North, 2012).

This shows another important aspect to address, which is whether people are experiencing any differences in the feelings of fullness and hunger when being exposed to the varying portion sizes. Studies are indicating that participants are not experiencing any significant differences in fullness and hunger when being exposed to varying portion sizes (Rolls et al. 2004) (Rolls et al. 2006). However, as mentioned in the review "*Portion Size: Latest Developments and Interventions*" there are still missing more evidence on which strategies, regarding targeting portion size, would be most effective to apply in creating successful interventions (Steenhuis & Poelman et al., 2017).

Our research will contribute to the lacking evidence and knowledge by adding support to interventions aiming at sustainably decrease portion sizes of high energy dense foods. We will perform a consumption experiment and a visual experiment, both with the aim of demonstrating whether people are capable of telling both visual and hunger/fullness differences between two portions with a 10% variance in size. This will be used to feed into the project "Smaller Portions" ("Mindre Portioner") which is a part of the campaign "Keep a stable weight within the normal range" ("Bevar normalvægten") that is being performed by the Physical Activity and Diet-group at the Danish Cancer Society.

In the consumption experiment we will investigate whether there are significant differences in the participants' levels of hunger/fullness when eating slightly different portion sizes (100% sized and 90% sized) of a brownie.

Based on the indications from the previously mentioned literature we hypothesize that the different portion sizes will not lead to a significant difference in hunger/fullness levels of the participants.

In the visual experiment, we will investigate whether participants can notice size differences when looking at pairs of different high energy dense foods varying 10% in size between its pairs.

Based on the indications from the previously mentioned literature we hypothesize that the participants will not be capable of observing a 10% size difference between the pairs of high energy dense foods.

2. Research Methods and Procedures

2.1 Study Design

2.1.1 The consumption experiment

The consumption experiment was a crossover study where the participants (n=27) acted as their own control, receiving both the intervention and control at different points in the study. In the first experiment on two days over two weeks, participants were asked to eat a brownie and answer a questionnaire (Appendix A and B). The participants were randomly divided into two groups: table A and table B. On the first day table A ate the 80g brownie (100% portion) and table B ate the 72g brownie (90% portion), and on the second day the two portions were switched between the groups. On both days they had to answer a questionnaire revolving their personal behaviour and habits and indicate their hunger/fullness levels by marking a Satiety Labeled Intensity Magnitude (SLIM) scale before, right after and 20 minutes after eating the brownie.

2.1.2 The visual experiment

In the visual experiment participants (n=24) were individually asked to answer a short online questionnaire (SurveyXact) regarding if they could observe any visual differences between the high energy dense foods of 100% and 90% portion sizes presented to them.

The participants were presented with 7 pairs of food items, and then asked to mention all the differences they could visualize between each pair of food (including control pairs). Afterwards they were specifically asked about whether they could observe any size differences between the food pairs (including control pairs) (Appendix D).

2.2 Subjects

The subjects for both of the experiments were employees working at the Danish Cancer Society that met the inclusion criteria, which were: participants should be working in Kræftens Bekæmpelse; should have lunch at around 12 pm in the canteen in the days of the experiment; should be able to participate in the 2 days of the experiment; should not be gluten- or lactose intolerants; should not be vegan; should not be pregnant or lactating; not starting a new diet or make other drastic changes in their diet in the experiment-period; not making any drastic changes in exercise-habits in the experiment-period.

2.2.1 The consumption experiment

For the consumption experiment, subjects were recruited both through recruitment posters spread around the organization and on its intranet, and through recruitment days around the organization where employees were offered a small piece of brownie and invited to participate. Overall it gathered 44 participants that were randomly divided into 2 groups

(tables) of 22 participants each. However, in both study days there were some dropouts or lost to follow-ups, leaving the study with a total of 27 participants that met the inclusion criteria. Table A was left with 10 participants and table B with 17. The characteristics investigated are presented in table 1. Table A and Table B differ in sex, weight, age and sleep quality days 1 and 2.

Table 1: Participant characteristics¹

	Table A	Table B
Sex		
Male	6 (60%)	5 (29.4%)
Female	4 (40%)	12 (70.6%)
Estimated body weight		
Underweight or Normal weight	8 (80%)	11 (64.7%)
Overweight	1 (10%)	6 (35.3%)
Average Age (years)	34.7	40.7
Education level		
Bachelor's degree	2 (20%)	3 (17.65%)
Master's degree	2 (20%)	4 (23.53%)
PhD	6 (60%)	8 (47.06%)
Other	-	1 (5.88%)
Currently undertaking education	-	1 (PhD) (5.88%)
Physical Activity (PA)²		
Average Minutes of Moderate PA (per week)	241.5	252.94
Average Minutes of Vigorous PA (per week)	109.5	105.6
Sleep Quality 1st day³		
Very Satisfied	2 (20%)	-
Fairly Satisfied	5 (50%)	7 (41.18%)
Slightly Satisfied	-	2 (11.76%)
Neither unsatisfied nor satisfied	-	2 (11.76%)
Slightly Unsatisfied	3 (30%)	3 (17.65%)
Fairly Unsatisfied	-	3 (17.65%)
Very Unsatisfied	-	-
Sleep Quality 2nd day³		
Very Satisfied	2 (20%)	-
Fairly Satisfied	1 (10%)	5 (29.4%)

Slightly Satisfied	1 (10%)	1 (5.9%)
Neither unsatisfied nor satisfied	3 (30%)	2 (11.8%)
Slightly Unsatisfied	1 (10%)	5 (29.4%)
Fairly Unsatisfied	1 (10%)	4 (23.5%)
Very Unsatisfied	1 (10%)	-
Stress Circumstances 1st day⁴		
Not at all	1 (10%)	2 (11.8%)
Barely	6 (60%)	9 (52.9%)
Once in a while	2 (20%)	4 (23.5%)
Often	1 (10%)	2 (11.8%)
Very often	-	-
Stress Circumstances 2nd day⁴		
Not at all	1 (10%)	2 (11.8%)
Barely	6 (60%)	10 (58.8%)
Once in a while	1 (10%)	3 (17.6%)
Often	2 (20%)	2 (11.8%)
Very often	-	-
Under medication that might affect appetite		
No	9 (90%)	15 (88.2%)
Yes	1 (10%)	-
Don't know	-	2 (11.8%)
Average Lunch Time		
Day 1	11:54	11:39
Day 2	11:53	11:45

¹Numbers do not always add up to total sample size because of missing data on the questionnaires.

²PA is measured by asking the participants how many hours and minutes per week they perform moderate or vigorous intensity physical activity on average (see appendix A questions 15 and 16)

³Sleep Quality is measured on a seven-point likert-type scale with the end-points being 'Very Satisfied' and 'Very Unsatisfied', where participants are asked to mark how satisfied they were with their sleep quality the past week (See appendix A question 17 and appendix B question 9)

⁴Stress Circumstances is measured on a five-point likert-scale with the end-points being 'Not at all' and 'Very Often', where participants are asked to mark how often they felt nervous or stressed in the past week (see appendix A question 18 and appendix B question 10)

- No answer / 0%.

2.2.2 The visual experiment

For the visual experiment subjects were recruited in a convenient way, that is, the ones that wanted and had time to answer the questionnaire, at the time they were asked, could participate. The only exclusion criteria was that people who participated in the consumption experiment could not participate in the visual experiment. In total we recruited 24

participants, 17 females (71%) and 7 males (29%) and an age range varying from 24 to 69 years old.

2.3 Food

2.3.1 The consumption experiment

The food item used for the consumption experiment was a brownie varying in size; the 80g (100%) sized portion which represented the full portion size and the 72g (90%) sized portion being 10% smaller than the full portion size.

2.3.2 The visual experiment

For the visual experiment 7 types of food items were used, which were displayed for the participants on a table trolley while they had to answer the survey. The 7 types of food items were: brownies, donuts, pizza slices, sausages, ham, whole grain buns and croissants.

Each food item was displayed on two plates with two portions of the item per plate. In that way one of the plates was a control plate with two full sized portions (2 x 100%), being the control pairs, while the other plate was the test plate containing one full sized portion and an approximately 10% smaller portion (1 x 100% and 1 x 90%), being the test pairs. This arrangement is illustrated in figure 1 and figure 2.

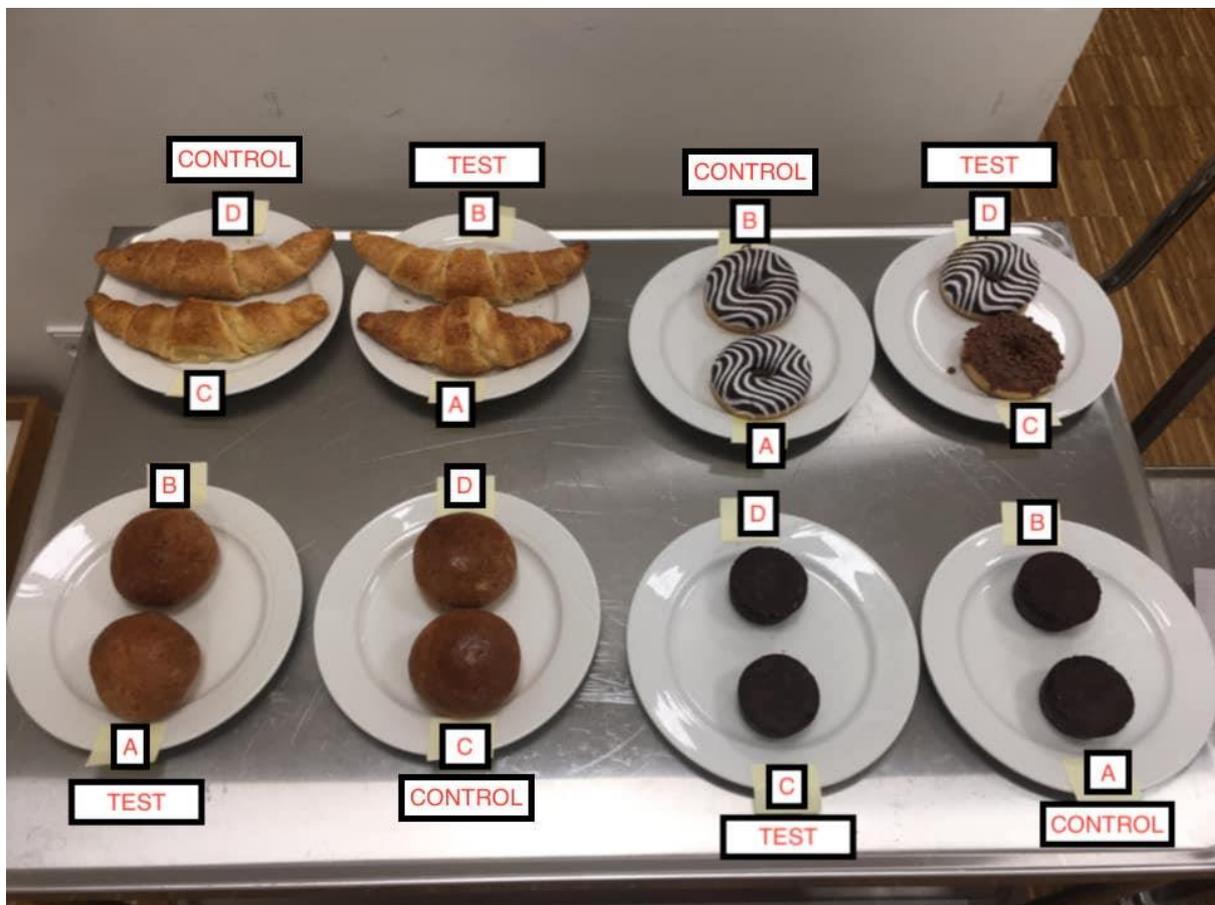


Figure 1: Arrangement of 4 of the 7 types of food items used for the visual experiment

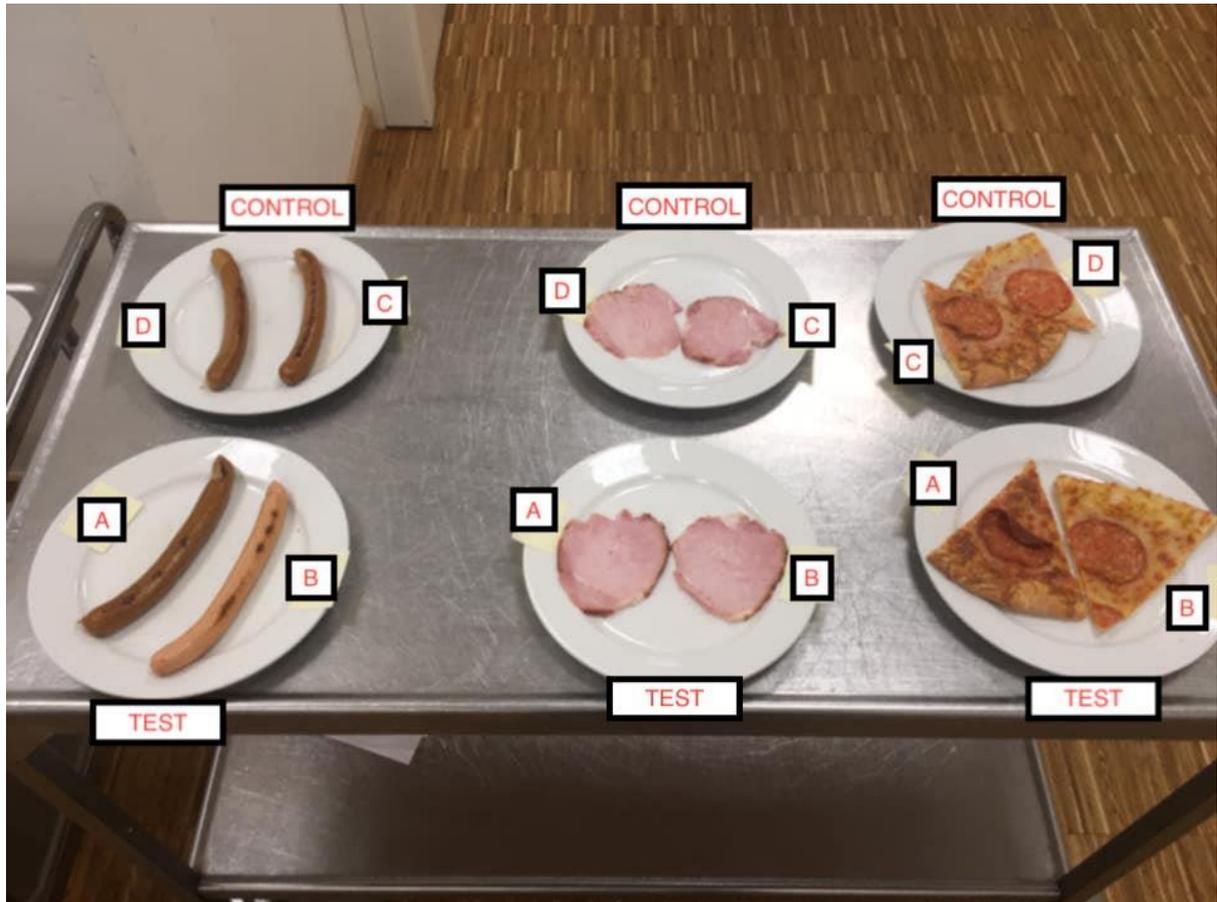


Figure 2: Arrangement of 3 of the 7 types of food items used for the visual experiment

Each portion was given a letter to allow the participants to answer questions referring to the portions. Table 2 provides an overview of the food items, their function (test/control), assigned letter and their weights. Some of the foods did not have the desired weights, because they either ended up losing water during the baking process or were purchased already premade. Therefore, the experiment was done with food items having approximately the desired weights.

Table 2: Overview of used food items, their function, assigned letter and weights

Food item	Function (test/control)	Assigned letter	Weight (g)
Brownie	Control	A	69
		B	69
	Test	C	63
		D	70

Donut	Control	A	74
		B	73
	Test	C	69
		D	77
Pizza	Test	A	49
		B	57
	Control	C	57
		D	58
Sausage	Test	A	60
		B	56
	Control	C	58
		D	60
Ham	Test	A	34
		B	31
	Control	C	34
		D	34
Whole grain bun	Test	A	98
		B	106
	Control	C	107
		D	107
		A	75

Croissant	Test	B	87
	Control	C	83
		D	86

2.4 SLIM scale

For the consumption experiment a SLIM scale (Cardello et al., 2005) was used to investigate the hunger/fullness levels of the participants before, right after and 20 minutes after consumption. The SLIM scale used is a 10 centimeter long horizontal, bi-directional, visual analogue scale with 11 verbal labels placed along the scale (figure 3) which is described in the article “*Development and testing of a labeled magnitude scale of perceived satiety*” together with the explanation behind the location of each verbal label on the scale (Cardello et al., 2005).

In the questionnaire for both days the participants were provided with three SLIM scales. One for the participants to fill in right before the consumption of the brownie, one for them to fill in right after consumption and one for them to fill in 20 minutes after consumption. For each of the SLIM scales participants were asked to mark their feelings of hunger or fullness by placing a vertical dash on the scale.

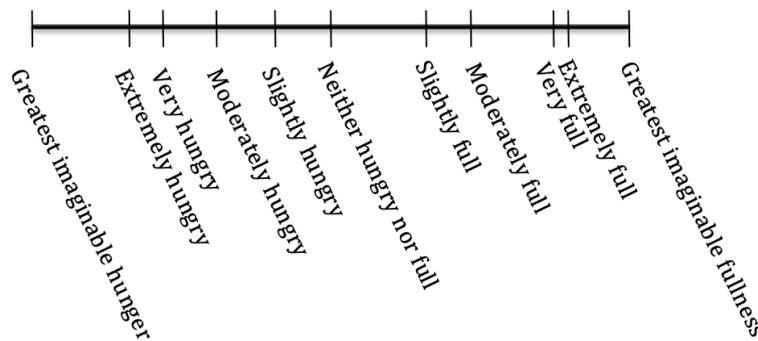


Figure 3: The SLIM (Satiety Labeled Intensity Magnitude) scale.

This made it possible to measure (in millimeters) the range between the hunger/fullness levels for each participant before consumption, compared to the hunger/fullness level right after consumption, as well as the range between the hunger/fullness level before consumption compared to the hunger/fullness level 20 minutes after consumption. Therefore, these ranges indicate the differences in hunger/fullness levels of each participant before and after consumption.

The following dataset was then developed: the difference in hunger/fullness levels before and right after consumption for the 80g brownie (80B&A); the difference in hunger/fullness levels before and right after consumption for the 72g brownie (72B&A); the difference in hunger/fullness levels before and 20 minutes after consumption for the 80g brownie

(80B&A20); and the difference in hunger/fullness levels before and 20 minutes after consumption for the 72g brownie (72B&A20). This dataset was used in the statistical analysis.

2.5 Statistical analysis

For analysing the data for the consumption experiment it was firstly investigated whether the four datasets 80B&A, 72B&A, 80B&A20 and 72B&A20 were normally distributed. To investigate this a Shapiro-Wilk test was performed. The results showed that the datasets 80B&A and 72B&A were not normally distributed, and the datasets 80B&A20 and 72B&A20 were normally distributed. Therefore, a Wilcoxon Signed-Rank test had to be performed for the datasets 80B&A and 72B&A, and a student's t-test for the datasets 80B&A20 and 72B&A20 to test for significant differences between the datasets.

The variables sleep quality and stress levels were also analysed through Wilcoxon Signed-Rank test (due to the data from the single subgroups not being normally distributed) to determine whether they might have influenced potential variances of the hunger/fullness levels between the two portion sizes.

3. Results

3.1 The consumption experiment

3.1.1 SLIM scale datasets

The Wilcoxon Signed-Rank test showed no significant differences in the levels of hunger and fullness of the participants right after consumption of the 80g brownie and 72g brownie.

The student's t-test showed a significant difference in the levels of hunger and fullness of the participants 20 minutes after consumption of the 80g brownie and 72g brownie.

It was then investigated whether the participants were feeling more full from the 80g brownie or the 72g brownie 20 minutes after consumption. The results showed that the majority of the participants (19 out of 26 of the participants) were experiencing a greater increase in the levels of fullness 20 minutes after consuming the 72g brownie, meaning that the 72g brownie was leading to a greater increase in the levels of fullness 20 minutes after consumption than the 80g brownie.

3.1.2 Effect of stress-levels and sleep-quality

The results from the data of the stress-levels of the participants between the two days showed that there was no significant difference in the stress-levels of the participants between the two days.

The results from the data of the sleep quality of the participants between the two days showed that there was no significant difference in the sleep quality of the participants between the two days.

3.2 The visual experiment

In 5 out of the 7 pairs of test foods the majority of the participants could not detect any size differences, and the majority of the participants (%) answered that there was no size differences for the following test pairs: donuts (71%), pizza slices (96%), sausages (83%), whole grain buns (50%) and ham (96%).

However, the majority of the participants (54%) were capable of detecting a size difference between the brownies of 63g and 70g, where they correctly answered that the 70g brownie was the bigger one. They also detected a size difference between the croissants of 75g and 87g, however the majority of the participants (71%) wrongly guessed that the 75g croissant was the bigger one.

4. Discussion

The results of the consumption experiment showed that there was not a significant difference in the levels of hunger and fullness right after consuming the two different sized brownies. However, there was a significant difference in the levels of hunger and fullness 20 minutes after consuming the two different sized brownies, where the participants felt more satiated with the 72g brownie than with the 80g brownie.

It would be expected that if the participants were experiencing any differences, then they would have experienced a greater increase in the levels of fullness after consuming the 80g portion.

One possible explanation for the participants feeling more satiated with the 72g brownie than with the 80g brownie 20 minutes after consumption could be that the participants filled in the last scale at a wrong time. This is because the participants were allowed both to fill in the last measurement in the area the experiment took place and back at their own offices, as the experiment was conducted during work hours at their workplace. Since the majority of the participants answered the last measurement in their offices, they could have filled the last scale at the wrong time, that is, not after the 20 minutes.

Additionally, they could also have misunderstood the way they were supposed to use the scale, meaning that they did not know how to classify their feelings of hunger/fullness, leading to wrong measurements of the scale.

The results of the visual experiment support the hypothesis that the participants will not be capable of observing a 10% size difference between the pairs of high energy dense foods.

What was interesting to note was that regarding the test pairs of croissants, the majority of the participants were answering that they thought that the small croissant (75g) was bigger than the big croissant (87g). This might be because participants might have gotten biased by the shape of the croissant since the bigger croissant (87g) was longer but less wide than the smaller one, which was wider.

This is an important aspect to take into consideration when wanting to downsize products, since a factor such as shape can affect the visual size perception of a portion. This is also supported by other studies showing that visual cues of foods, such as the size of package and the shape of the food, influence the choice of consumers when it comes to estimating the quantity of it and the amount they are gonna eat (Madzharov and Block, 2010). Additionally, certain types of package shapes are perceived to be bigger in volume than others with identical volumes, and people are more likely to choose food items by the shape

of the package than by its actual volume. For example, people buy more elongated versions of the same food product even though the volume is the same as the previous version (Raghubir and Krishna, 1999).

Another potential bias to acknowledge for the visual experiment is that the participants might have been led to look for specific size differences which they otherwise would not have noticed, as in the last part of the survey they were specifically asked to look for any size differences.

This may also be supported by the fact that in the first part of the questionnaire, where the participants were asked to look for any differences between the test food pairs, a big part of the differences the participants detected were not related to size (Appendix C).

5. Conclusion

5.1 The consumption experiment

The results of the consumption experiment showed that the 10 % size difference between the 72g brownie and 80g brownie did not lead to any significant differences in levels of hunger and fullness of the participants right after consumption.

However, this 10 % size difference did lead to a significant difference in levels of hunger and fullness of the participants 20 minutes after consumption, with the participants feeling more satiated with the 72g brownie than the 80g brownie.

Based on these results, it is clear that further research is needed in order to draw precise conclusions on whether a 10 % size difference is affecting the levels of hunger and fullness of people, and it may also be relevant to pay special attention to measurement methods and ensuring that future involved participants knows how to classify feelings of hunger and fullness to avoid potential wrong measurements.

5.2 The visual experiment

The results of the visual experiment showed that the majority of the participants could not detect any size differences in 5 out of the 7 pairs of test foods, only correctly detected a size difference in 1 test pair of food, and in 1 test pair wrongly guessed that the smaller portion was the biggest.

So, it can be concluded that a 10% size difference between most tested high energy dense foods are not noticeable by the majority of participants (Appendix C).

These results are indicating that the reduction of only 10% in size of high energy dense foods may be an efficient tool in decreasing energy intakes. However, based on the limited number of intervention studies targeting the reduction of portion sizes, it should be further investigated by scientific researches. Additionally, those interventions should be tested in real-life settings where valid measurements should be developed in order to increase the validity and reliability of these strategies.

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7. Appendices

Appendix A: The consumption experiment - questionnaire day 1

Questionnaire

We will kindly ask you to follow the steps in this questionnaire since it will guide you through the experiment. However, if you have any questions you can raise your hand and one of us will come and help you.

You can either choose to fill in the full questionnaire in the canteen, or you can choose to fill in part 1 of it in the canteen and the part 2 and 3 at your office.

If you choose to fill in the full questionnaire in the canteen:

- You just have to fill in the whole questionnaire here and when finished hand it in to Georgia and Emilie together with the signed consent form.

If you choose to fill in some of the questionnaire in the canteen and the rest at your office:

- First you have to fill in part 1 of the questionnaire (which includes eating the brownie) in the canteen, and then after doing that you can go back to your office and fill in part 2 and 3. However, this requires that you remember to measure the time when finished eating the brownie since you have to fill in part 3 of the questionnaire 20 min. after finish eating the brownie.

The information you will provide in this questionnaire will be kept confidential and will be completely anonymised before analysis as well as presentation of the results.

PART 1:

1. Name (in capital letters):

2. Write your assigned table letter for this experiment (tick a box):

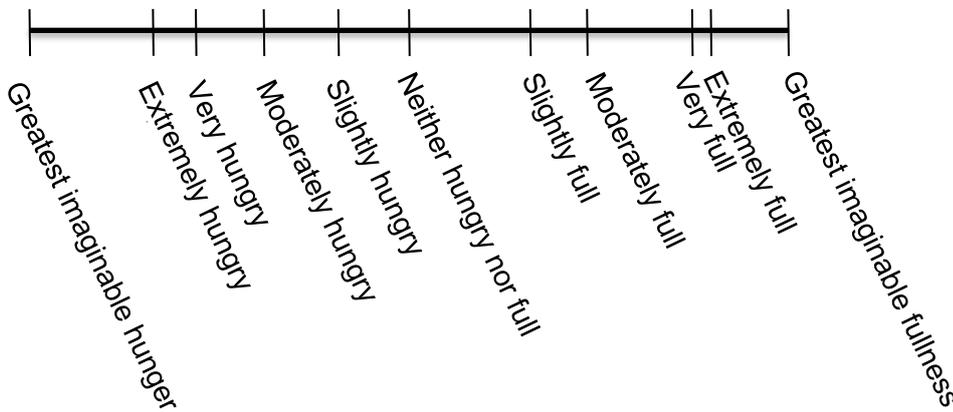
- A
- B

3. Around what time did you start eating lunch today?:

4. Did you have any snacks between lunch and now? If yes, around what time and what did you eat?:

5. Write down the current time (hour:minutes):

6. Please mark your feelings of hunger or fullness by placing a vertical dash (|) on the scale below:

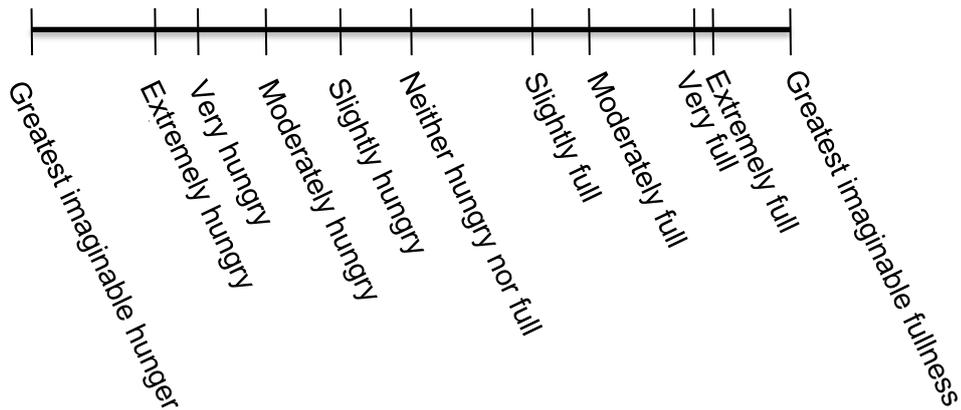


You can now eat the brownie.

When you finish eating the brownie, please measure the time for 20 minutes. Meanwhile, you should continue answering question 7, 8 and part 2 of the questionnaire. When the 20 minutes have passed, you should answer part 3.

7. Write down the current time (hour:minutes):

8. Please mark your feelings of hunger or fullness by placing a vertical dash (|) on the scale below:



If you want to fill out the rest of the questionnaire at your office, you are now welcome to go back and do so. Just remember to answer part 3 20 minutes after eating the brownie.

PART 2:

9. Age:

10. Sex (circle your answer):

- Female
- Male
- I don't want to specify

11. Educational level (tick a box):

- Currently undertaking education. Specify the educational level: _____
- Basic education
- Upper secondary education
- Bachelor's degree
- Master's degree
- PhD
- Other. Specify which: _____
- I don't want to specify

12. Department you work in at Kræftens Bekæmpelse:

13. Weight (in kg) (optional):

14. Height (in meters):

15. How many hours and minutes per week do you perform moderate intensity physical activity (that increases breathing, sweating, and heartbeat but permits one to carry on a conversation) on average?:

16. How many hours and minutes per week do you perform vigorous intensity physical activity (that significantly increases breathing, sweating, and heart rate, which makes it difficult to carry on a conversation) on average?:

17. How satisfied were you with the quality of your sleep the past week? (tick a box):

- Very unsatisfied
- Fairly unsatisfied
- Slightly unsatisfied
- Neither unsatisfied nor satisfied
- Slightly satisfied
- Fairly satisfied
- Very satisfied

18. How often have you felt nervous or stressed in the past week? (tick a box):

- Not at all
- Barely
- Once in a while
- Often
- Very often

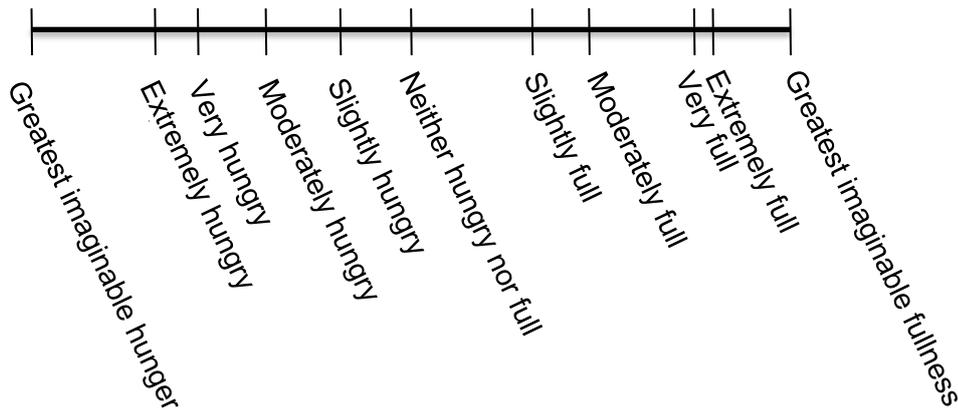
19. Are you currently taking any medication that is known to affect appetite? (tick a box):

- Yes
- No
- I don't know

PART 3 (FILL OUT 20 MINUTES AFTER EATING THE BROWNIE):

20. Write down the current time (hour:minutes):

21. Please mark your feelings of hunger or fullness by placing a vertical dash (|) on the scale below:



Appendix B: The consumption experiment - questionnaire day 2

Questionnaire

The steps in this questionnaire will guide you through the experiment. However, if you have any questions you can raise your hand and we will come and help you.

You can either choose to fill in the full questionnaire in the canteen, or you can choose to fill in part 1 in the canteen and part 2 and 3 at your office.

If you choose to fill in the full questionnaire in the canteen:

- You just have to fill in the whole questionnaire here and when finished hand it in to Georgia and Emilie.

If you choose to fill in part 1 in the canteen and the rest at your office:

- First, you have to fill in part 1 of the questionnaire (which includes eating the brownie) in the canteen, and then after doing that you can go back to your office and fill in part 2 and 3. However, this requires that you remember to measure the time when finished eating the brownie since you have to fill in part 3 of the questionnaire 20 min. after finish eating the brownie.

The information you will provide in this questionnaire will be kept confidential and will be completely anonymised before analysis as well as in the presentation of the results.

PART 1:

1. Name (in capital letters): _____

2. Write your assigned table letter for this experiment (tick a box):

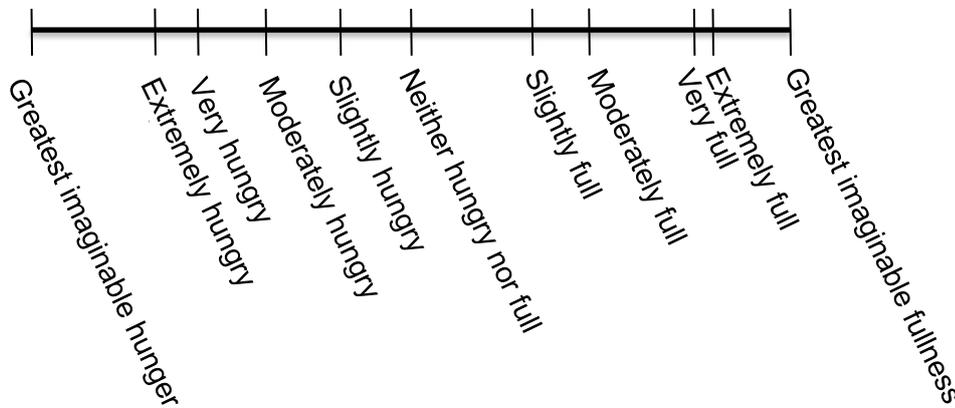
- A
- B

3. Around what time did you start eating lunch today?: _____

4. Did you have any snacks between lunch and now? If yes, around what time and what did you eat?:

5. Write down the current time (hour:minutes): _____

6. Please mark your feelings of hunger or fullness by placing a vertical dash (|) on the scale below:

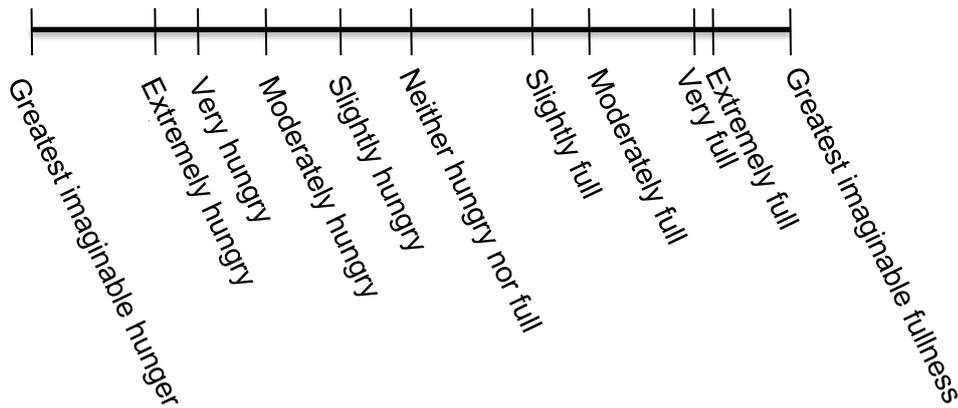


You can now eat the brownie.

When you finish eating the brownie, please measure the time for 20 minutes. Meanwhile, you should continue answering question 7, 8 and part 2 of the questionnaire. When the 20 minutes have passed, you should answer part 3.

7. Write down the current time (hour:minutes): _____

8. Please mark your feelings of hunger or fullness by placing a vertical dash (|) on the scale below:



If you want to fill in the rest of the questionnaire at your office, you are now welcome to go back and do so. Just remember to answer part 3 20 minutes after eating the brownie.

PART 2:

9. How satisfied were you with the quality of your sleep the past week? (tick a box):

- Very unsatisfied
- Fairly unsatisfied
- Slightly unsatisfied
- Neither unsatisfied nor satisfied
- Slightly satisfied
- Fairly satisfied
- Very satisfied

10. How often have you felt nervous or stressed in the past week? (tick a box):

- Not at all
- Barely
- Once in a while
- Often
- Very often

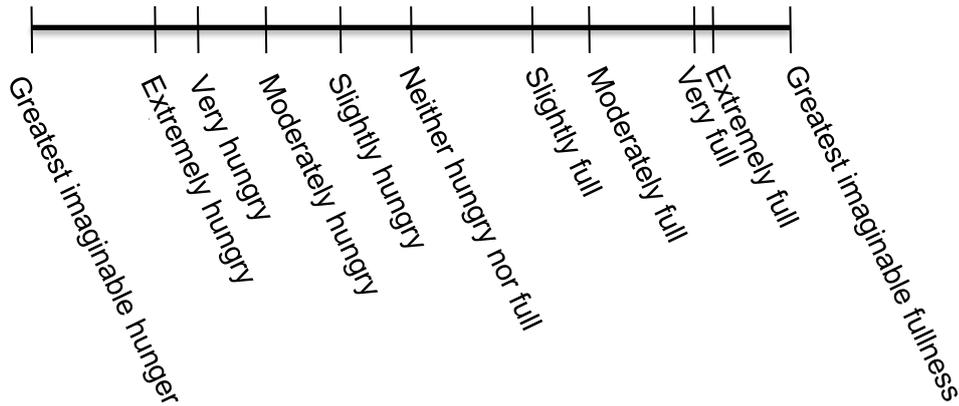
11. Are you currently taking any medication that is known to affect appetite? (tick a box):

- Yes
- No
- I don't know

PART 3 (FILL OUT 20 MINUTES AFTER EATING THE BROWNIE):

12. Write down the current time (hour:minutes): _____

13. Please mark your feelings of hunger or fullness by placing a vertical dash (|) on the scale below:



- If you have finished the questionnaire in the canteen please hand it in to us.
- If you have finished the questionnaire at your office please hand it in in the reception before you leave Kræftens Bekæmpelse today.

Appendix C: Analysis Visual Experiment

Brownies

→ Brownie A and B: A 69g B 69g => CONTROL

→ Brownie C and D: C 63g D 70g => ~ 10% difference

Responses:

A and B:

<u>1st part</u> 83% no differences 17% differences → noted differences: color, shape, B bigger (1x), and surface differs.	<u>2nd part</u> 92% no difference 4% B bigger 4% A bigger
---	--

C and D:

<u>1st part</u> 58% no differences 42% differences → noted differences: size differences (8x), shape, one has less frosting.	<u>2nd part</u> 54% D bigger 42% no difference 4% C bigger
--	---

Croissants

→ Croissant A and B: A 75g B87g => ~10% difference

→ Croissant C and D: C 83g D86g => CONTROL

Responses:

A and B:

<u>1st part</u>	<u>2nd part</u>
100% differences → noted differences: Size (6x), Shape (18x), Baking differences (1x), Color (2x), A is bigger (2x), B is bigger (1x), A is more inviting (2x).	71% A bigger 13% B bigger 17% no difference

C and D:

<u>1st part</u>	<u>2nd part</u>
63% no differences 38% differences → noted differences: Shape (5x), Size (1x), Texture (1x), Color (2x), D is bigger (1x).	71% no difference 25% D bigger 4% C bigger

Donuts

→ Donuts A and B: A 74g B 73g => CONTROL

→ Donuts C and D: C 69g D77g => ~10% difference

Responses:

A and B:

<u>1st part</u>	<u>2nd part</u>
88% no differences 12% differences → noted differences: Shape (1x), Style (1x), A is bigger (1x).	92% no difference 4% A bigger 4% B bigger

C and D:

<u>1st part</u>	<u>2nd part</u>
100% difference → noted differences: Frosting (24x), C heavier (1x), C smaller (1x).	71% no difference 21% D bigger 8% C bigger

Pizza

→ Pizza A and B: A 49g B 57g => ~10% difference

→ Pizza C and D: C 57g D 58g => CONTROL

Responses:

A and B:

<p><u>1st part</u> 17% no difference 83% difference → noted differences: A is more baked (13x), Folded salami (3x), Color (5x), A is older (1x).</p>	<p><u>2nd part</u> 96% no difference 4% B bigger</p>
--	--

C and D:

<p><u>1st part</u> 12% no difference 88% difference → noted differences: C bigger (5x), Size (3x), Baking (9x), More cheese on D (1x), Different salami (1x), C is older (1x).</p>	<p><u>2nd part</u> 92% C bigger 4% D bigger 4% no difference</p>
--	--

Sausage

→ Sausage A and B: A 60g B 56g => ~10%

→ Sausage C and D: C 58g D 60g => CONTROL

Responses:

A and B:

<p><u>1st part</u> 100% differences → noted differences: Color (21x), Grill pattern (2x), Different meat (3x), Baking (2x), A is more inviting (1x).</p>	<p><u>2nd part</u> 83% no difference 13% A bigger 4% B bigger</p>
--	---

C and D:

<p><u>1st part</u> 75% no differences 25% differences → noted differences: C is shorter (1x), Baking (3x), Size (1x), Toast marks (1x).</p>	<p><u>2nd part</u> 50% no difference 46% D bigger 4% C bigger</p>
---	---

Whole Grain Buns

→ Whole Grain Bun A and B: A 98g B 106g => ~10% difference

→ Whole Grain Bun C and D: C 107g D 107g => CONTROL

Responses:

A and B

<p><u>1st part</u></p>	<p><u>2nd part</u></p>
------------------------	------------------------

<p>54% no differences 46% differences → noted differences: A is smaller (4x), Color (3x), Shape (5x).</p>	<p>50% no difference 42% B bigger 8% A bigger</p>
---	---

C and D:

<p><u>1st part</u> 71% no differences 29% differences → noted differences: Color (2x), Shape (2x), Baking (1x), D bigger (2x), C bigger (1x).</p>	<p><u>2nd part</u> 63% no differences 29% D bigger 8% C bigger</p>
---	--

Ham

→ Ham A and B: A 34g B31g => ~10% difference

→ Ham C and D: C 34g D34g => CONTROL

Responses:

A and B:

<p><u>1st part</u> 67% no differences 33% differences → noted differences: Fat (4x), Cut (2x), Color (1x), A has more cartilage (1x).</p>	<p><u>2nd part</u> 96% no difference 4% A is bigger</p>
---	---

C and D:

<p><u>1st part</u> 29% no differences 71% differences → noted differences: Cut (8x), Thickness (2x), Shape (2x), Fat (4x), The slices comes from different animals (1x), One has a hole (1x), C is smaller (3x), D is neater (1x).</p>	<p><u>2nd part</u> 21% no difference 71% D is bigger 8% C is bigger</p>
--	---

Appendix D: Survey Visual Experiment

1. Sex:

- Female
- Male
- I do not want to specify

2. Age: _____

Part 1:

Brownies

1. Do you observe any differences between A and B?

- No
- Yes

1.1 (if yes) Which difference(s) do you observe?

2. Do you observe any differences between C and D?

- No
- Yes

2.1 (if yes) Which difference(s) do you observe?

Croissants

1. Do you observe any differences between A and B?

- No
- Yes

1.1 (if yes) Which difference(s) do you observe?

2. Do you observe any differences between C and D?

- No
- Yes

2.1 (if yes) Which difference(s) do you observe?

Donuts

1. Do you observe any differences between A and B?

- No
- Yes

1.1 (if yes) Which difference(s) do you observe?

2. Do you observe any differences between C and D?

- No
- Yes

2.1 (if yes) Which difference(s) do you observe?

Pizza

1. Do you observe any differences between A and B?

- No
- Yes

1.1 (if yes) Which difference(s) do you observe?

2. Do you observe any differences between C and D?

- No
- Yes

2.1 (if yes) Which difference(s) do you observe?

Sausage

1. Do you observe any differences between A and B?

- No
- Yes

1.1 (if yes) Which difference(s) do you observe?

2. Do you observe any differences between C and D?

- No
- Yes

2.1 (if yes) Which difference(s) do you observe?

Whole Grain Bun

1. Do you observe any differences between A and B?

- No
- Yes

1.1 (if yes) Which difference(s) do you observe?

2. Do you observe any differences between C and D?

- No
- Yes

2.1 (if yes) Which difference(s) do you observe?

Ham

1. Do you observe any differences between A and B?

- No
- Yes

1.1 (if yes) Which difference(s) do you observe?

2. Do you observe any differences between C and D?

- No
- Yes

2.1 (if yes) Which difference(s) do you observe?

Part 2:**Brownies**

1. Do you observe any differences in size between A and B?

- (a) A is bigger than B
- (b) B is bigger than A
- (c) No, there is no difference.

2. Do you observe any differences in size between C and D?

- (a) C is bigger than D
- (b) D is bigger than C
- (c) No, there is no difference.

Croissants

1. Do you observe any differences in size between A and B?

- (a) A is bigger than B
- (b) B is bigger than A
- (c) No, there is no difference.

2. Do you observe any differences in size between C and D?

- (a) C is bigger than D
- (b) D is bigger than C
- (c) No, there is no difference.

Donuts

1. Do you observe any differences in size between A and B?

- (a) A is bigger than B
- (b) B is bigger than A

(c) No, there is no difference.

2. Do you observe any differences in size between C and D?

(a) C is bigger than D

(b) D is bigger than C

(c) No, there is no difference.

Pizza

1. Do you observe any differences in size between A and B?

(a) A is bigger than B

(b) B is bigger than A

(c) No, there is no difference.

2. Do you observe any differences in size between C and D?

(a) C is bigger than D

(b) D is bigger than C

(c) No, there is no difference.

Sausage

1. Do you observe any differences in size between A and B?

(a) A is bigger than B

(b) B is bigger than A

(c) No, there is no difference.

2. Do you observe any differences in size between C and D?

(a) C is bigger than D

(b) D is bigger than C

(c) No, there is no difference.

Whole Grain bun

1. Do you observe any differences in size between A and B?

(a) A is bigger than B

(b) B is bigger than A

(c) No, there is no difference.

2. Do you observe any differences in size between C and D?

(a) C is bigger than D

(b) D is bigger than C

(c) No, there is no difference.

Ham

1. Do you observe any differences in size between A and B?

(a) A is bigger than B

(b) B is bigger than A

(c) No, there is no difference.

2. Do you observe any differences in size between C and D?

(a) C is bigger than D

(b) D is bigger than C

(c) No, there is no difference.