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Analyzing the Influence of Nutrition Labels on People's Portion Sizing of Ultra-Processed Foods

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ABSTRACT: This research assesses the impact per-serving and per-container nutrition labels have on people's portion sizing of ultra-processed foods (UPFs). People's portion size of foods is directly related to how much food they will consume. High consumption of UPFs is highly prevalent in the US and has been shown to lead to obesity and numerous chronic diseases. Previous studies have examined how nutrition labels influence food choices from a health perspective. Studies have also looked at portion sizing based on demographics. Combining portion sizing with the influence of food nutrition labels is yet to be studied. This paper uses a mixed-method approach: an in-person experiment and several questionnaires to gather data related to the research objective. This study concluded that people exposed to a per-serving label are likely to increase their portion size from before and after exposure to the label, and people exposed to a per-container label are likely to decrease their portion size. The conclusion that different nutrition labels of UPFs influence portion sizing can be used to strive for implications in food labeling standards to limit the overconsumption of UPFs.

KEYWORDS: Biomedical and Health Sciences, Nutrition Labels, Portion Sizing, Ultra-Processed Foods.

Introduction

Ultra-processed foods (UPFs) are not critical to survival, and their combination of fat and carbohydrates cannot be found in other natural foods. However, UPFs are usually significantly tastier and more addictive than other foods. Many of these foods are manufactured industrially and may be marketed as ready-to-eat/heat.[1] The rates at which people in the US are consuming UPFs are alarming because they can be linked to obesity and heart disease. Obesity in the United States is now a pandemic, and with obesity comes a higher risk of many other diseases, such as diabetes and various forms of cancer.[2] Misleading nutrition labels or not knowing how to read nutrition labels can greatly contribute to the overconsumption of UPFs. Some people may even choose not to look at nutrition labels due to time, lack of interest, confusing terminology, and difficulty finding nutrition information.[3]

Along with this idea, many people, subconsciously or sometimes consciously, correlate portion size with serving size; however, these are not synonyms. Portion size is the actual amount of food a person portions out to consume in one sitting, whereas a serving size is the recommended amount of a particular food to consume in one sitting.[4] Essentially, a serving size is the recommended portion size. An example of a portion size may be the size of the food dish you receive at a restaurant. A misconception is that these food dishes are equivalent to a serving size, which is usually not the case and can lead to overconsumption. Researchers Roberto & Khandpur found that differing serving sizes can skew people's perceptions of the health factor of food because a simple glance at the nutrition label may trick them into thinking a food with a smaller serving size (smaller amounts per serving) is healthier than a similar food that has a larger serving size.[4]

Literature Review

Ultra-Processed Food Consumption Trends:

As stated previously, in recent years, portion sizes of ultra-processed foods (UPFs) have been increasing rapidly. Portion sizing skews peoples' views on UPFs, altering their consumption patterns. In a study by the American Journal of Clinical Nutrition, over 40,000 adults took part from 2001-2018: participants were asked to report the foods they had eaten in the past 24 hours, and the researcher categorized the foods they ate by the level of processing. It was concluded that "ultra-processed food consumption grew from 53.5 percent of calories at the beginning of the period studied (2001-2002) to 57 percent at the end (2017-2018)."[1]

Many people realize that consuming excessive amounts of UPFs is not a healthy lifestyle and can be detrimental to their health, but they continue to do so anyway. An explanation is that people value the taste of the foods they consume over health factors. As a result, UPFs are typically what they gravitate towards to satisfy their taste buds. Most people will only let their health goals affect their food choices if the food also lives up to their taste goals.[5] The influence UPFs have on people is very real, causing key aspects of a person's health to be severely at risk with high consumption; therefore, reducing overconsumption is essential to improve public health.[6]

To reduce overconsumption, consumption patterns need to be understood. A study was done in 2012 on US college students' consumption of potato chips; the participants ate from a tube of potato chips while watching a movie. This study used salient cues, placing a red chip among the other regular potato chips at different times, including after every 7, 14, and none. It was concluded that "people ate the least number of potato chips from a can when a red chip appeared every 7 chips".[7] The red chip served as a reminder of how much people were

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consuming, so the chip appearing more frequently (every 7 chips) forced people to be more conscious of their consumption. When people are more conscious of how much they are consuming, they tend to consume less, which this study on chip consumption proved.

Portion Size and Serving Size:

The rate at which people in the US consume UPFs has accelerated in recent years. A possible explanation for overconsumption is the portion size effect (PSE). The PSE is the concept that when larger portions are offered, people consume more than when smaller portions are offered.[8] In fact, larger package sizes in recent years have contributed to a 30-45% increase in the intake of many snack-related foods.[9] This correlates with the concept presented in the previous study about red chips; people consume less when they are more conscious. Larger portions lend themselves to overeating because people do not realize how much they consume. They are presented with more food, causing them to overestimate the serving size of that food and mindlessly eat, even if they are complete. Another example of the PSE that Hetherington & Blundell-Birtill mentioned is the concept of "cleaning the plate" in children. Although a child may not be hungry anymore, they may continue to eat until they finish all the food on their plate due to parental influence. This trend may even continue into adulthood and cause excessive overeating. Children are also conditioned to expect larger portion sizes because they are so prevalent in today's society.[8]

In a study done on forty-seven children, ages 4-7, in a controlled school environment, researchers manipulated on-pack portion sizes (making one portion size larger and keeping one regular). They gave the children two snacks (red grapes and chocolate-covered nuts) and analyzed how much the children ate. This study concluded that the children tended to eat more when the on-pack labels suggested a larger portion of the grapes. However, portion size manipulation did not affect the consumption of chocolate nut snacks.[9] They inferred that a cause of this was that the children ate until they were not hungry anymore, and with the grapes, that may have taken longer.

As researcher, Harrison mentioned earlier, UPFs are full of many artificial additives, making them very addicting; therefore, hunger may not disappear in many cases, making portion size manipulation a fundamental problem of overconsumption.[1] The effect of PSE on people of all ages when consuming UPFs is not clear-cut based on previous studies; therefore, more research needs to be done to address the issue.

UPFs are typically presented in large portions, contributing further to the major problem of overconsumption in the United States.

When studying portion sizes, personal vs. social norms are important. A personal norm is what portion size people perceive as normal for themselves to consume, and a social norm is what people think is considered a normal portion size for other people to consume. A study done in 2015 by HB Lewis and his team of researchers on sixty healthy men and women assessed the differences in personal and social norms regarding portion sizes. In this study, the participants were shown 12 foods with 17 pictures of different portions. They were asked to choose which portion they would typically consume (personal norm) and which portion they believed others would consume (social norm). After this experiment, it was concluded that men had much larger personal norms than women and much smaller social norms. For women, there was not a large gap between the two.[10] As a result of this study, it is concluded that demographics play a role in portion sizing. This opens the possibility that other demographics, such as physical activity level and age, may also affect portion sizing.

Varying Nutrition and Food Labels:

Rewiring the brains of all people in the US to gravitate towards different food choices or completely stop consuming UPFs is not a feasible solution to limit overconsumption. Instead, it is important to look more in-depth at how these foods are presented to and portrayed by the public. When looking at peoples' food choices, nutrition labeling plays a key role in decision-making.

A study by Hieke & Newman was done on university students, who measured the healthiness of their food choices on a point scale. Healthier food choices resulted in higher point earnings. The students were separated into four groups, and all groups were exposed to different forms of nutrition labels (no label, GDA 100g/ml, GDA portion, nutrition table) on their food choice options. GDA stands for "guideline daily amounts." The participants were not asked to consider healthiness when making food choices and were asked to select foods from seven different categories. The healthier food choices within the categories were assigned more points than the less healthy foods. This research concluded that people in the group with the GDA portion label earned fewer points than those with the GDA 100g/ml label. People who gained the most points were offered the nutrition table label, followed by the GDA 100g/ml label, then the GDA portion label, and finally, no-label (only ingredient list).[11] Since nutrition labels do skew the perception of foods' healthiness, there is a possibility that their portion size is influenced by nutrition labels as well. People made the healthiest food choices when they had an entire nutrition table of information and the least healthy choices when they only had an ingredient list. This shows that leaving out key information on nutrition labels can cause people to misperceive the foods they choose or consume.

Adding to the concept of misperception, in a 2004 study, 90 health center patients were asked to look at serving size on nutrition labels, and 86% of participants misread the label and incorrectly equated serving size calories to calories of the entire package.[12] This is a common problem contributing to excessive overconsumption of UPFs. Not knowing how to read or understand a label can cause people to stop looking at nutrition labels.

Summary:

While there have been studies looking at personal portion sizes and nutrition labels, there is a gap in the research because no studies have directly tested both of these variables in conjunction with each other. As mentioned, personal norms have

been assessed by having participants view different images. However, when adding nutrition labels into the mix, how does viewing different nutrition labels affect porting sizing? This is a question that this research paper aims to answer. The portion size effect has proved that people eat more when presented with a large portion. This research will examine whether there is a similar concept regarding nutrition labels. It will study if participants portion out larger portions when presented with a "per-container" nutrition label instead of a "per-serving" label. The previously mentioned study by Geier *et al.*, which assessed the impact of red chips on consumption, shows that when people are more conscious of their eating, they consume less.[7] The information from the results of this study, in conjunction with the idea mentioned earlier that many people inaccurately equate serving size information to per-container information, has led to the need for research assessing portion sizing regarding "per-serving" and "per-container" nutrition labels. This examines if one label causes people to be more conscious of what they are eating or if people misinterpret certain information, leading to them altering their portion sizes as a response. It aims to answer the research question: How are ultra-processed food portion sizes affected after people are exposed to food nutrition labels that mention "per-serving" information compared to labels that mention "per-container" information?

Methods

Study Design:

This study will use the experimental design method to study how "per-serving" and "per-container" nutrition labels impact peoples' portion sizing of ultra-processed foods. All factors besides the nutrition label presented (the factor being tested) will be controlled in this experiment. Participants will be asked the same questions, the same protocol will be followed, and the increase or decrease in portion sizing after viewing nutrition labels will be measured the same way. Participants were acquired by sending a staff-wide email to a suburban high school, an email/message sent to students via a club advisor, and flyers distributed around the school. These emails and flyers included the link and a QR code to the pre-experimental questionnaire, a brief synopsis about what participants must do, and contact information. Participants were randomly separated into two groups (control and experimental) based on the order in which they responded to the pre-experimental questionnaire. The control group was exposed to the "per-serving" nutrition label because that is the standard label on all food products. The experimental group was exposed to the "per-container" label because not all food products contain a "per-container" label. The survey method was also used to get further information from participants after the experimental rounds to help further interpret people's views on nutrition labels and their importance. Therefore, this study can be categorized as a mixed-method design.

This study includes all age groups because no significant reason shows a need to look at a particular age group over another. The first part of this study was having participants fill out a pre-experimental questionnaire, asking them to consent to participate and for their age, gender, and physical activity level. This information was asked to group data later when analyzing results. The results from Lewis's study on portion sizing show that demographics do have the potential to play a role in portion sizing. Therefore, demographics were assessed in this study. After filling out this questionnaire, participants completed an in-person portion where they were asked a series of experimental questions and then completed a post-experimental questionnaire. This study assesses if people will have larger personal portion sizes after exposure to specific nutrition labels.

This study used a Mini Chips Ahoy Go-Pack as the ultra-processed food being portioned out by participants. This food was chosen because it contains a few servings, so "per-container" information (Figure 1) varies from the "per-serving" information (Figure 2). However, it is still a small enough container to be consumed in one sitting. This most accurately simulates real-world consumption and examines different perceptions of ultra-processed food.

Figure 1: Per-Container Information for Mini Chips Ahoy Go-Pack Cookies. The amounts on this label are higher than the amounts per serving, which will test if viewing per-container information correlates with higher or lower consumption levels.

Figure 2: Per-Serving Information for Mini Chips Ahoy Go-Pack Cookies. This label shows the basic per-serving information found on every Mini Chips Ahoy Go-Pack Cookies container without manipulating the label. Because of its normalities, it is used in this study as a control label.

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The post-experimental questionnaire asked participants how nutrition labels influenced their portioning and if they usually look at labels. This questionnaire was included to group qualitative data from the experiment with qualitative data from the questionnaire to explain further peoples' portion sizing and the influence of nutrition labeling. Once all three parts of the research are concluded, a chi-squared test will be conducted comparing portion sizing (increase, decrease, no change) and group (per-serving and container) to find any correlations and statistically significant data. Data with a p-value of <0.05 means the research is statistically significant. Chi-squared tests will also compare age, physical activity level, and gender within each group to portion sizing.

After this method process was finalized, it was proposed to an Institutional Review Board (IRB) panel at the high school where it would be conducted and approved to be performed on all human participants, including minors.

Experiment Procedures:

During the in-person experimental rounds, participants were asked to "pour out how many cookies they would consume as a snack." At this time, participants from both groups (control + experimental) were not exposed to any nutrition information, as the original label on the cookie container was purposely covered up. After this, both groups were provided with their coordinating nutritional information (control: per-serving, experimental: per-container) and asked, "If you would like to alter your portion, you can do so now." This aimed to determine if one label influenced people to consume larger portions compared to the other. The study mentioned earlier by Aerts & Smits showed that portion size manipulation caused children to consume more grapes due to the PSE but not chocolate nuts.[9] The experiment in this study will be very similar in concept but instead will use varying nutrition labels, not portion size manipulation. The results from the mentioned study have led to the hypothesis for this research being that people in the per-container group will have a larger decrease in portion size from before they are presented with the label to after they are presented with the per-container label, compared to people in the per-serving group. This is hypothesized because, in the Aerts & Smits experiment, the larger portion of chocolate nuts (UPF) did not cause high consumption of the nuts compared to the regular portion.[9] Therefore, when comparing nutrition labels to portion sizes, the per-container label may have the same effect as a larger portion, which this research aims to test. Additionally, the per-container label features larger numbers when looking at calories, fat, and sugar, which could cause people to become more conscious of what they are consuming. This is a similar concept to the research done by Geier *et al.* in the study with red chip salient cues, confirming that when people are more conscious of their consumption, they tend to consume less.[7] If people in this study are more conscious of the nutrition information, they might portion less, decreasing their portion sizes due to exposure to the per-container label.

Delimitations:

In this experiment, the nutrition labels for the control and experimental groups contained information regarding the number of servings in the container and the number of cookies per serving. However, the actual nutritional information (calories, fat, sugar, sodium, etc.) was specific to the label that corresponded with the particular group. This is intentional because this is how nutrition information is presented on products in real life at stores. Even if a product gives per-container information, it must also provide how many servings there are. Presenting the nutrition information in this way during the experiment allows for the most accurate responses from participants that would simulate behavior under circumstances that were not controlled (ex., eating a meal at home). Participants in this experiment were not explicitly asked to consider the nutrition information or factor it into their portioning of the cookies. This was implemented to simulate what participants would do daily if they were not being accessed. This will give the most accurate results regarding how nutrition labeling affects portion sizing and consumption.

Result and Discussion

On average, participants in the per-serving label group added 1.3 cookies from before exposure to the label to after exposure to the nutrition label. However, on average, participants in the per-container label group took away 1.2 cookies between exposure to any label and after exposure to the nutrition label. These results were considered statistically significant (p=0.032).

Figure 3 shows the difference in cookie portioning in each participant before and after being given the label corresponding with their group. A negative value shows a decrease in cookie portioning, a value of zero shows no change in cookie portioning, and a positive value shows an increase in cookie portioning.

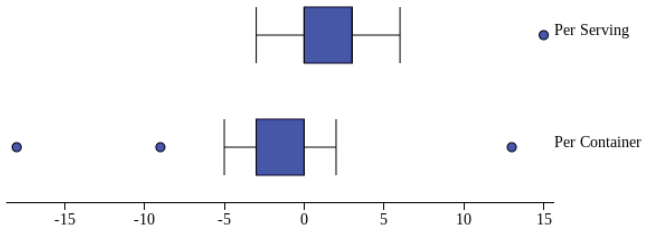

Figure 3: The difference in participants' portion sizing of cookies from before and after being given corresponding nutrition labels. Figure 3 shows that participants in the per-serving label group added 1.3 cookies on average, and participants in the per-container label group took away 1.2 cookies on average.

After the experiment, 40.9% of participants within the per-serving group said they preferred to have the per-container information on the nutrition label they were exposed to in conjunction with the per-serving information. 59.1% of participants said they would not have preferred to have the per-container nutritional information.

Within the per-container group, 64% of the participants said they preferred to have the per-serving information of the nutrition label they were exposed to in conjunction with the per-container information. 36% of the participants said they

would not have preferred the per-serving nutritional information.

In the per-serving group, 81.8% of adults (18+) showed "no change" as opposed to an increase or decrease in their portioning before and after viewing the nutrition label. No significant correlation between age and portion size was found in the pre-serving group for adolescents. These results were considered statistically significant (p=0.026).

Figure 4 shows the percentages of participants in the per-serving group who decreased, did not change, and increased their portion sizes from before and after exposure to the nutrition label, broken down by age (adolescents and adults).

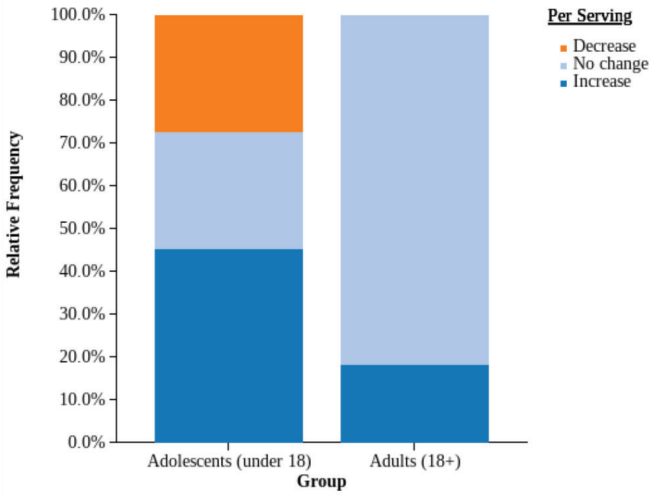

Figure 4: Portion sizing with the Influence of Age in the Per-Serving Group. The cumulative frequency graph, Figure 4, shows that about 46% of adolescents increased their portions, about 27% showed no change in their portions, and 27% decreased their portions. About 18% of adults increased their portions, 82% showed no change in their portions, and 0% increased their portions.

In the per-container group, age was not a significant factor in decreasing, not changing, or increasing participants' portion sizes before and after exposure to the nutrition label (Figure 5).

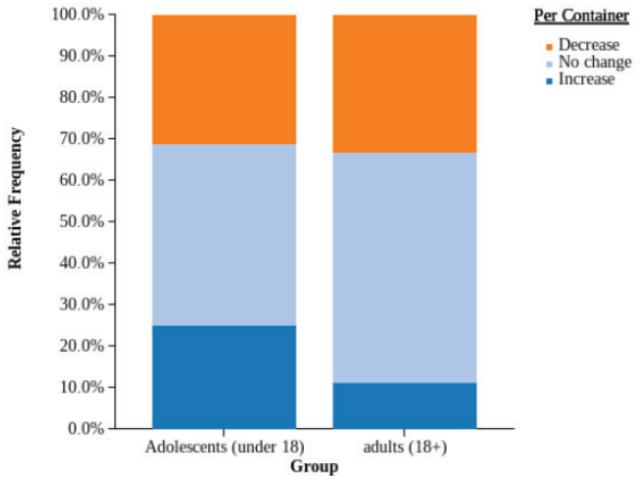

Figure 5: Portion Sizing with the Influence of Age in the Per-Container Group. The cumulative frequency graph, Figure 5, shows that about 25% of adolescents increased their portions, about 45% showed no change in their portions, and 30% decreased their portions. About 10% of adults increased their portions, 58% showed no change in their portions, and 32% increased their portions.

In both the per-serving and per-container groups, gender was not statistically significant in altering or keeping portion sizes before and after exposure to either label. However, in the per-container group, gender was slightly more relevant in participants decreasing the portion of cookies before and after being exposed to the per-container nutrition label, as 46.6% of females decreased their portion size and only 18.2% of males decreased their portion size (Figure 6 & 7).

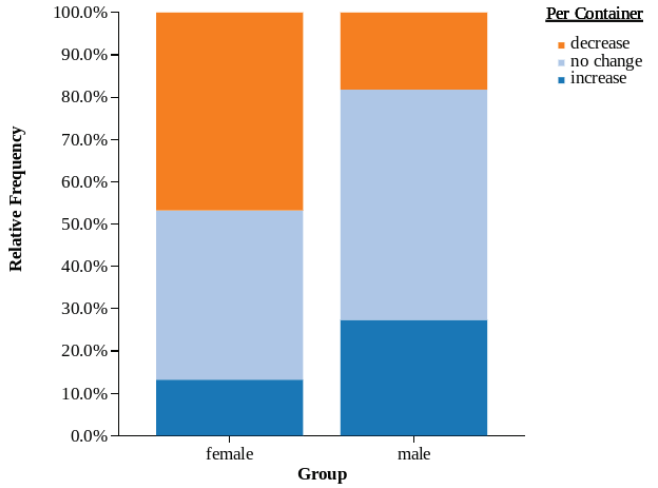

Figure 6: Portion Sizing with the Influence of Gender in the Per-Container Group. The cumulative frequency graph, Figure 6, shows that about 14% of females increased their portions, 39% showed no change in their portions, and 47% decreased their portions. About 28% of males increased their portions, 53% showed no change in their portions, and 19% decreased their portions.

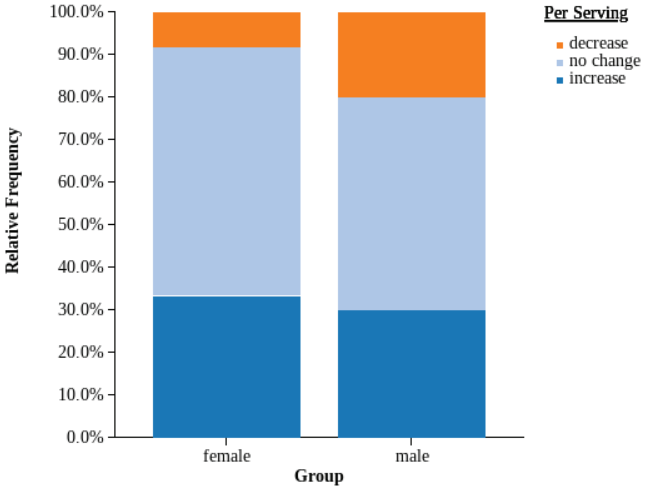

Figure 7: Portion Sizing with the Influence of Gender in the Per-Serving Group. The cumulative frequency graph, Figure 7, shows that about 34% of females increased their portions, 57% showed no change in their portions, and 9% decreased their portions. About 30% of males increased their portions, 50% showed no change in their portions, and 20% decreased their portions.

Review of Data:

This research proved that exposure to two different nutrition labels affected participants' portion sizes for the sample set of participants. As hypothesized, participants in the per-container group tended to decrease their portion sizes after exposure to the per-container nutrition label. The participants in the per-container group who said that "being exposed to the per-container information impacted their por-

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tion size" suggested various reasons. Some reasons participants stated were as follows: being exposed to the per-container information made them feel like they were overeating from the container, the calories were so high that they would refrain from eating any cookies at all, seeing the whole container information might make them portion less, and that they had no idea what a serving would be causing them to think more about what they portioned out. From the participants' answers, it can be concluded that exposure to the per-container label made participants more conscious of what they were eating. This concept relates to the study mentioned above in the literature review by Geier *et al*. about red chips within a container, which makes people more conscious of what they are eating and causes them to consume less.[7] This can be translated to nutrition labeling, with the per-container label acting like the red chips in the experiment. The per-container label caused the participants in this study to portion less (a 1.2 cookie decrease on average), partly because it made them more conscious of their consumption.

People in the per-container group also stated that it was difficult to accurately tell how many calories a serving would be by only looking at the per-container label. This finding is similar to the research done by Pelletier *et al*., which was mentioned earlier.[12] The researchers in this study found that most people found it extremely difficult to accurately interpret package-size calories to serving-size calories. This concept was also shown through the research at hand.

Participants in the per-serving group tended to increase their portion sizes (by 1.3 cookies on average) after exposure to the per-serving label in the experiment. When people view per-serving nutrition information, from a glance, the numbers regarding calories, sugar, fat content, etc., are smaller compared to per-container information. When people see that, they may consume a larger portion because it does not look too unhealthy from a health perspective. This is a common misconception that causes overconsumption: some people noted that the per-serving label made them think the cookies had fewer calories than they had. Another possible explanation for participants increasing their portion size after viewing the per-serving information is that the cookie container they were presented with contained 3.5 servings, and according to the portion size effect (PSE), people consume more when presented with a larger portion size. The cookie container contained multiple servings, making it a decently large portion, and this could have caused people to portion out more cookies. Some people who originally portioned out fewer cookies than the serving size also noted that adding more cookies after viewing the label was justified and that viewing the label caused them to add more cookies even if they would not necessarily have done it otherwise.

When looking at preferences for nutrition labels, less than half (40.9%) of the participants who were only exposed to the per-serving label noted that they would have liked to have been exposed to the per-container information as well. However, a much larger percentage of participants in the per-container group (64%) noted that they would have liked to have been exposed to the per-serving information. As a whole, most participants would have preferred the per-serving label over the per-container label.

Adults were significantly more likely to not change their portion size after viewing the per-serving nutrition label in the per-serving group than adolescents. A possible explanation for this is that adolescents are more cautious about what they eat and adhere their portion sizes to the serving size, or simply that the adults in this experiment were not as prone to follow serving sizes strictly. In the per-container group, there was lots of variation among adolescents and adults, and if they decreased, increased, or did not change their portion after viewing the nutrition label. This data showed no correlation between age and portion sizing when exposed to a per-container label.

In this study, gender was not a statistically significant factor affecting participants' portion sizing in the per-serving or per-container group. Still, it was slightly more relevant in the per-container group, showing that females were more likely to decrease their portion size after exposure to the per-container label than males. These results correlate with the study done by Lewis *et al*., as mentioned previously, which found that men have much larger personal norms regarding portion size compared to women.[10] If men consume larger portions on average, they may be less likely to decrease their portions even after viewing the per-container nutrition information. Females have smaller personal norms regarding portion size, so the idea that they would be likely to decrease their portion size after viewing per-container nutrition information (that suggests much larger quantities compared to per-serving information) is related.

This experiment took physical activity levels into account. Still, it did not significantly affect participants' portion sizing in either of the two groups, and no correlation between portion sizes and activity level was found in either group.

Limitations:

This study has four main limitations: sample size, controlling variables, hunger levels, and generational device usage. The sample size in this study was relatively small, being 47 participants. When that number was split between the two groups (per-serving container) and then split more among different categories, including age, physical activity level, and gender, the number of participants within each sub-group was minimal, so it was hard to directly confirm with certainty significant demographic factors that influenced portion sizing. This study could only be conducted within one high school, as it involved an in-person round of experiments: access to other schools in person was restricted. Controlling outside variables also needs to be accounted for in this study. People's previous relationships with food cannot be controlled within this study. Although there is a disclaimer in the consent form before participants complete this experiment, mentioning briefly what the experiment entails and who should not participate (to confirm that the research is ethical), it is not certain that previous eating habits of participants, eating disorders, or any childhood dietary upbringings do not impact the results of this study. Additionally, people were able to participate in this experiment at various times of day, so the time of day people participated in the experiment could have potentially affected

their hunger levels, which may have influenced their portion sizing of the cookies in the experiment. This study also has a generational limitation because younger generations are online on devices more often, so they are more likely to look up and be exposed to nutritional information. This exposure could make them likely to look at nutrition labels in person as well, which could have affected their actions in this experiment.

Conclusion

The main finding that this research proved is that the nutrition label people are exposed to statistically significantly influences the portion sizes of ultra-processed snack foods they consume. Age was a statistically significant factor within the per-serving group, as adults in this group were much more likely to keep their portion sizes of cookies the same, regardless of being exposed to a nutrition label, compared to adolescents. Gender was relevant within the per-container group only but was not statistically significant in either group.

Implications:

The results of this study can potentially be applied to combat overconsumption of UPFs. Labeling all UPFs with the per-container and the per-serving information, not just labeling select products, may be useful in this case. In this study, participants who were only exposed to the per-serving information increased their portions on average after exposure to the nutrition label, and participants who were only exposed to the per-container information decreased their portions on average. This suggests that when people are exposed to both labels on food products they purchase and consume, they may more accurately interpret the nutrition information and better understand regular portion size, preventing overconsumption. Being exposed to both forms of information may potentially stop limiting people's consumption, as well as stop enabling overconsumption.

Future Research:

This study demonstrated that age was not a statistically significant factor affecting portion size. Still, the per-container group was slightly more significant than the per-serving group. Future research looking into age and how it correlates with portion sizing based on viewing different nutrition labels is needed to determine how to best label UPFs to limit overconsumption and promote public health. Future research with a larger sample size in each group must also determine whether participants' physical activity level correlates with portion sizing. More research could also be conducted with a third group instead of only the two in this study, where the third group is exposed to the combined per-serving and per-container labels, not only a single one. This research could determine if a combined nutrition label is more beneficial in participants' interpretations of nutrition information and if participants prefer this label.

This study could also be replicated using unprocessed food instead of ultra-processed food to determine if the same patterns and responses to labeling occur. This would help determine if the results from this study are unique to UPFs.

To apply the results from this study to the public in the U.S., future research needs to be conducted with a very large sample size with participants from numerous locations and backgrounds. If the results from this study could be applied to everybody in the U.S., implications in general food labeling standards and regulations would be much more likely to occur.

This research presented nutrition information in a numerical way (amount of calories, amount of fat, amount of sugar, etc.), but another potential way to present this information is using a visual cue such as a shape depicting the serving size of a food. Another study on how a visual presentation of nutritional information affects people's portion sizing could be compared to the results of this study to help determine the best way to present nutrition information with the goal of limiting overconsumption.

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