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The impact of packaging attributes on portion decisions: Consumer values are important

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Abstract

Research shows that features of food packaging can help to promote healthy food choices. Laboratory-based studies demonstrate that smart design of packaging facilitates portion control. However, the extent to which consumers notice packaging features for portion control is not known. Therefore, this study investigated how individuals interact with food packaging, how they utilise the on-pack serving-size guidelines and how they make portion decisions. To do this, 25 adult participants were recruited to participate in an online semi-structured interview. Data were analysed using thematic analysis until saturation was achieved. Participants reported that they rarely attend to on-pack serving recommendations and indicated some resistance to them. Some structural features (small/single serving, pre-portioned and resealable packaging) were identified as facilitators of portion control. In contrast, the healthiness evaluation of the product from packaging cues was described as a permissive cue to eat more of the product. Participants in this study value their autonomy and control, preferring convenient behavioural choices over recommended portion servings. They also reported future concerns about the effects of their diet on health, but that current context (hunger, convenience) sometimes presented a barrier to healthy eating. Packaging does more than protect its contents, packaging can affect eating decisions to support portion control, and for some, offers permission to overconsume. This study identified ways that participants use packaging to make portion decisions, revealing the role of habits, current context and future health considerations. The interviews revealed the importance of consumer values on food choice in general and portion control in particular. In conclusion, smart food packaging design could use these findings to nudge healthy portion decisions by incorporating consumer values and by recognising consumer needs for habitual, current and future concerns.

KEYWORDS
consumer values, food intake, packaging design, portion control, portion size

INTRODUCTION

Food intake is driven by need (biology) and by food contextual cues (environment), with the current obesogenic environment promoting excess energy intake and poor dietary decisions (Lake et al., 2022; Townshend & Lake, 2017). Over the last 30 years, the portion sizes of some high energy density (HED), highly palatable foods have increased (Carruba et al., 2023; Steenhuis & Poelman, 2017). Systematic studies of portion size manipulations show that large portion sizes of these foods promote increased intake (Crino et al., 2015; Rolls et al., 2004), known as the portion size effect (PSE) (Hetherington et al., 2018).

Despite increases in intake when presented with large portions, individuals typically do not report increased levels of fullness, suggesting that hunger and satiety signals are disregarded or overridden under the PSE (Ello-Martin et al., 2005). Many restaurants, fast-food chains and food companies provide portions of food that are much larger than is necessary to satisfy hunger or to meet recommended serving sizes (Ledikwe et al., 2005; Murphy et al., 2020; Robinson et al., 2018). This can make it difficult to gauge what an appropriate portion size looks like and can lead to overeating. As Robinson and Kersbergen (2018) found, the default size of food products provided to consumers in a laboratory setting affected their perception of what a normal-sized serving is expected to be. To be specific, serving consumers with a smaller portion of quiche at a lunchtime meal resulted in participants believing a "normal"-sized portion was smaller and resulted in them choosing to eat less.

At the population level, portion control is needed to promote healthy and sustainable eating habits, reduce the risk of chronic disease and have positive impacts on the environment and the economy (Springmann et al., 2018). For example, smaller portions of highly palatable HED foods may help with weight management, and smaller portion sizes for foods may lead to less waste. Reducing landfill from food waste helps the environment, and encouraging populations to achieve a healthy weight improves the economy through lower healthcare costs and improved productivity (Oster et al., 1999). As an adjunct to weight management, Rolls (2014) reviewed experimental and trial evidence on the role of portion control, for example, using portion control tools and providing pre-packaged foods during weight loss trials. Overall, this review reported some success in promoting weight loss especially with pre-packaged items (Rock et al., 2016). While many individuals report having difficulty implementing portion control by themselves (Seagle et al., 2009), pre-packaging shifts this responsibility away from the consumer. Clearly, there is a need to promote portion control given the ubiquity of large portion sizes of HED, palatable foods in our environment (Hetherington & Blundell-Birtill, 2018), both from the consumer perspective and from the food industry perspective.

Pressure is exerted on food companies to respond to portion control strategies from at least two angles; there is demand from consumers who want to eat a more healthy and sustainable diet (Riis, 2014) while, at the same time, the World Health Organization recommends food policy to promote and protect health (World Health Organization, 2002). In response, at least 85 countries have implemented some type of sugar-sweetened beverage tax. When smaller portion sizes are offered in response to consumer health concerns and government-based tax on foods/drinks such as the UK Soft Drinks Industry Levy (SDIL), consumers increased purchases of smaller-sized carbonated soft drinks (<300 mL) and decreased purchases of the largest-sized drinks (≥2000 mL) (Jensen et al., 2021). While this has worked well for beverages, it has not been seen for confectionery. Therefore, despite an increase in the availability of small-size confectionery products (<50 g), sales of small package sizes declined in some countries (Australia and Canada) whereas sales of larger package sizes (>100 g) remained the same in the United States, Canada and the United Kingdom (Jensen et al., 2021).

Food packaging serves as the interface between the consumer and the product, with several functional and informational purposes, such as preserving food quality, protecting food from contamination and providing important details about the product (ingredients, nutritional content). Our previous research has revealed a potential role for packaging in promoting portion control (Chu et al., 2021; Tang et al., 2020, 2022). For example, indicating the recommended serving size for a given food product can help consumers make informed decisions about how much to eat. This information can be presented in a variety of ways, including visual cues (e.g., weight/amount description or portion size graphics) (Aerts & Smits, 2019) and structural cues (e.g., small/single serving packaging or partitioned packaging or resealable packaging) (Aerts & Smits, 2017; Raynor et al., 2009). Overall, packaging has been identified as a possible tool for promoting portion control and reminding consumers to select and consume appropriate portion sizes of foods high in energy density and high in fat, salt and sugar (HFSS) (Chu et al., 2021).

However, portion control strategies must align with consumer values. Consumers are aware that their food choices influence individual health (Vermeer et al., 2010) and environmental impact (Onwezen & Dagevos, 2023). Indeed, the meta-review by Onwezen and Dagevos (2023) highlighted environmental redesign, including changes to recipes and portion size defaults, as promising drivers for the protein transition (reducing and replacing meat intake). Consumer values are crucial in guiding food choice in step with broader health and sustainability goals (Boer et al., 2007; Luomala et al., 2004). Food choice decisions are determined by complex factors ranging from immediate biological need and pleasure to longer term health goals and from longstanding cultural traditions to modern convenience (Rappoport et al., 1992). In studies of how consumers prioritise values, Maehle et al. (2015) demonstrated that decisions are made in the face of often competing values. For example, some foods are consumed for pleasure and others for nutritional value. Some consumers place greater value on health than taste, and others value the environmental impact of the foods selected more than their price, for example. Maehle et al. (2015) demonstrated the "trade-off" consumers make between

different values when making food choice decisions, but it is not clear how consumer values influence portion choice decisions.

Many countries have established portion guidelines or recommendations to help consumers navigate the complex food environment (Cámara et al., 2021; Herforth et al., 2019). The pack serving-size recommendation is a statement on food packaging that suggests the appropriate amount of a product that should be consumed in a single serving. Current portion recommendations on food packaging in the United Kingdom are provided by several formats on nutritional labels which include energy content and nutrient content per 100 g—called the nutrition declaration (Gibson-Moore & Spiro, 2021). Few studies have examined the direct impact of serving size guidance on consumer behaviours and in those that have, there are equivocal results (see- Bucher et al. 2018). In this review, three studies found lower consumption of candies, pizza and cereal (granola) for the conditions with smaller serving size labels. In contrast, one study reported smaller consumption when using larger serving size labels on M&M's and another study showed there is no effect on cereal. Van der Horst et al. (2019) reviewed consumers' interpretation of serving size information finding that some studies showed a good understanding of serving size information and smaller labelled serving sizes resulted in smaller self-selected portion sizes, while others reported that consumers may misinterpret the meaning of the serving size. The participants of one of the reviewed studies by Zhang et al. (2016) expressed some distrust about the serving size information, for example, some considered it to be a random number or believed that manufacturers used it to mislead consumers. The impact of serving size guidance on consumer choice and attitudes merits further investigation to ensure that future guidance from packaging resonates with consumers by being more understandable, usable and acceptable.

In laboratory settings, food packaging can influence portion choice and the amount consumed. However, it is still not clear, in real-world contexts, the extent to which consumers are aware of packaging features that facilitate portion control and whether packaging influences eating behaviours. Therefore, we investigated features of packaging that might facilitate portion control as part of a larger study, in which we used participant-driven photo-elicitation (PDPE) (Chu et al., 2022). We reported that packaging contributes to trust building, stimulating appetite and self-identity from foods already purchased. Applying these packaging features to foods which are low in energy density and nutritious could increase their attractiveness and encourage intake (Chu et al., 2022). Structural reminders and health prompts were noted as useful to encourage portion size awareness. Following on from the PDPE, the second part of the study was designed to investigate how individuals interact with food packaging generally, and more specifically how they utilise the on-pack serving size guidelines and how they make portion decisions.

METHOD

Participants

Recruitment for the main study was achieved via social networks, word of mouth and the University Participant Pool. Recruitment was challenging since data were collected in 2021 as pandemic-related restrictions were being lifted and students were gradually returning to campus, necessitating a reliance on snowball sampling and informal social networks for recruitment.

Participants were informed that the focus of the research was on food/drink packaging. They had to be aged over 18 years and gave informed consent after reading the information sheet with details of secure data storage, anonymisation of data and the right to withdraw. Following previous photo-elicitation studies, the aim was to achieve a sample size of at least 30 adults (Green et al., 2021). In total, 32 participants agreed to participate, but seven participants withdrew from the study: some mentioned the effects of the pandemic and others gave no reason (this was an option on the consent form).

Procedures

The present study formed the second part of a photo-elicitation study (Chu et al., 2022). The protocol was approved by the School of Design Ethics Committee (LTDESN-139). Detailed demographic information of each participant was obtained via a short questionnaire asking about gender, age, weight, height and dieting status. All participants uploaded relevant food/drink packaging photographs (representing meals, snacks and drinks). Once the photographs had been uploaded, a semi-structured interview was scheduled online. The first author offered participants the opportunity to be interviewed in English ($n = 12$) or their native tongue (Chinese) ($n = 13$). An average interview lasted about 40 minutes, and each one was audio recorded with the participants' permission. Participants were instructed to complete three tasks during the interview. The first task was to further explain the photographs, the findings of which have been presented previously (Chu et al., 2022). The second task requested participants to choose up to five options from the provided packaging-related factors (there were 21 food packaging-related options, see OSF https://osf.io/hczp9/ for details) that they considered relevant to their portion decisions and to provide the corresponding justifications. The last task investigated how individuals engage with food

packaging, how they utilise the serving-size recommendations on the packaging, and how they make portion decisions (see OSF for question details). As shown in Figure 1, this study reported the findings from the last two tasks of the interview.

Data analysis

Exploratory analysis was used to interpret the interview data from consumers, given that questions were asked using a semi-structured format. Each participant was assigned an ID (gender-number-diet status), for example, F_01_D means a female participant number 1 who is on a diet. The audio recordings were transcribed from audio to text. For those who chose to be interviewed in their native language (Chinese) the recordings were translated into English from the Chinese audio recordings by the first author who is a native Chinese speaker. Then, a qualitative, thematic analysis (Clarke et al., 2015) was conducted. The data were iteratively coded and analysed using MIRO boards to map out connections between quotations. The first author started with familiarisation of the data via transcription, then by reading the interview responses word by word. Then, data codes were applied, and some codes were categorised into themes or aggregated into crosscutting themes. The codes and themes were reviewed and any common or contradictory issues across interviews were then identified and discussed by all the authors. Any consensus or dissent on identified themes across interviews and any implications for portion control within packaging design were interpreted in detail by all authors. Finally, after discussion, any significant themes and sub-themes were considered and presented in the subsequent results.

RESULTS

The final sample comprised 17 females and 8 males, aged from 20 to 32 years. Most (23/25) were full-time university students with a bachelor's degree or higher. Most were in the healthy weight range (16/25, 64%), seven had overweight (28%) and two were in the underweight range (8%). Of those who completed the question about dieting status, most were not on a diet to lose weight (60%) and most had English as an additional language (Table 1).

TABLE 1 Descriptive characteristics of the participants with number (percentage) and mean ± SD for age and body mass index (BMI).

Participant characteristics ($n = 25$)	
Age, years (mean ± SD) (range)	25 ± 3 (20–32)
BMI, kg/m^2 (mean ± SD) (range)	23 ± 3 (18–29)
Not dieting	15 (60)
Currently on a diet	10 (40)
Native English speaker[a]	9 (36)

[a]Most participants spoke Chinese as their first language which is the first language of the first author.

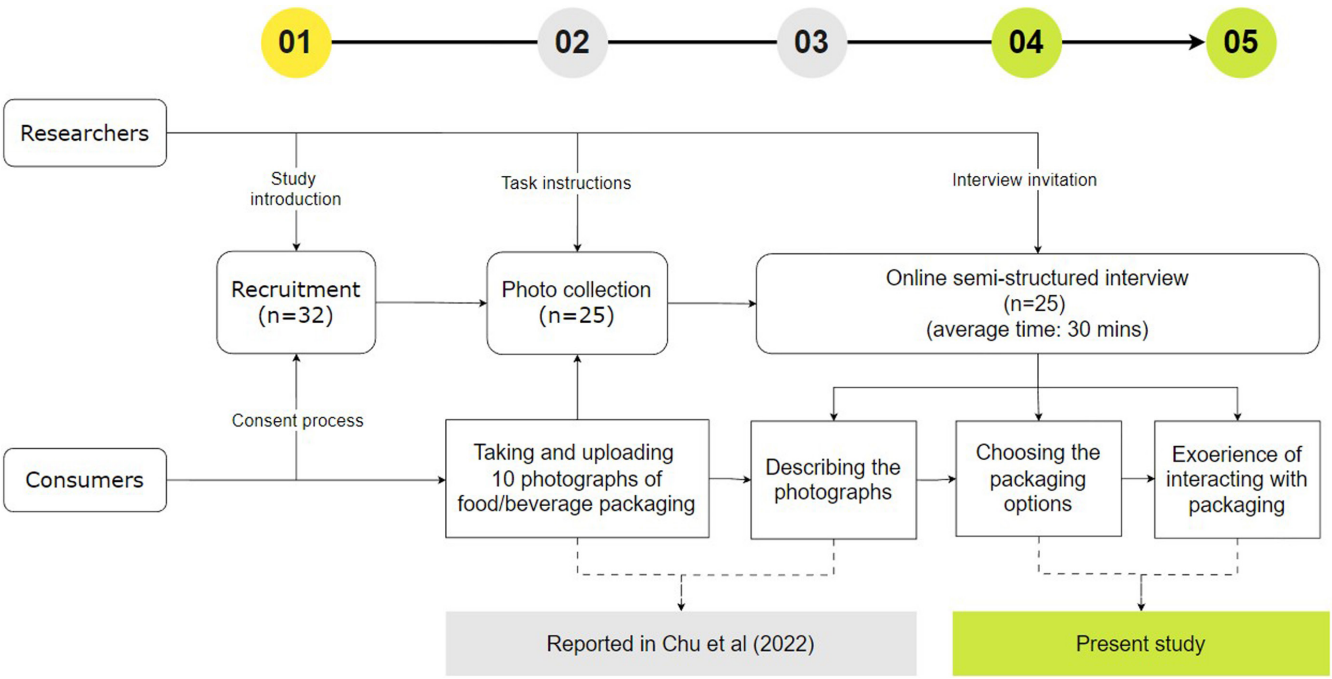

FIGURE 1 The timeline for the procedure of the main study (previously reported) and the current study.

Participants typically equated packaging size and on-pack weight quantity, which was believed to be the most influential factor for food intake. The larger the size of the packaging, the more food may be consumed. The energy content and its placement on a pack (e.g., on the front, on the back, in the middle or the corner) also had a significant role in customers' intended consumption. Some participants would consume smaller or fewer portions when they noticed that the product was high in energy content. Two other physical characteristics of the packaging, portioning and resealability, were seen as conditional factors on the portion decision; participants liked to follow the pre-division of the packaging. In addition, participants tended to eat less and to make the product last longer when resealable packaging was available. Figure 2 shows the frequency of factors influencing portion decisions.

Several overarching themes were identified based on the participants' responses, outlined in Figure 3. Some participants reported that they ignored on-pack information including, for example, the serving-size recommendations, expressing that they did not care about the portion recommendation. Others looked at portion/serving size as this was used as a portion reference for times when they were on a diet. Of interest, was the expressed attitude of "resistance" to written, on-pack recommendations for the amount to eat as a serving from the pack.

Some packaging attributes (packaging size; partitioning; resealability) were found acceptable and useful for portion control. Participants' portion decisions often relied on the situational context of these packaging attributes. The healthiness perception of a product could remind the participants to pay attention to intake; however, some health-related on-pack cues were misleading in their assessment of the healthiness of the food, many of which were seen as permissive cues for overeating. The main themes are summarised and discussed below.

Deliberate resistance to the serving-size recommendation

Participants were keen to inform the interviewer that they did not check the serving recommendations on food packaging. Of note, participants indicated some

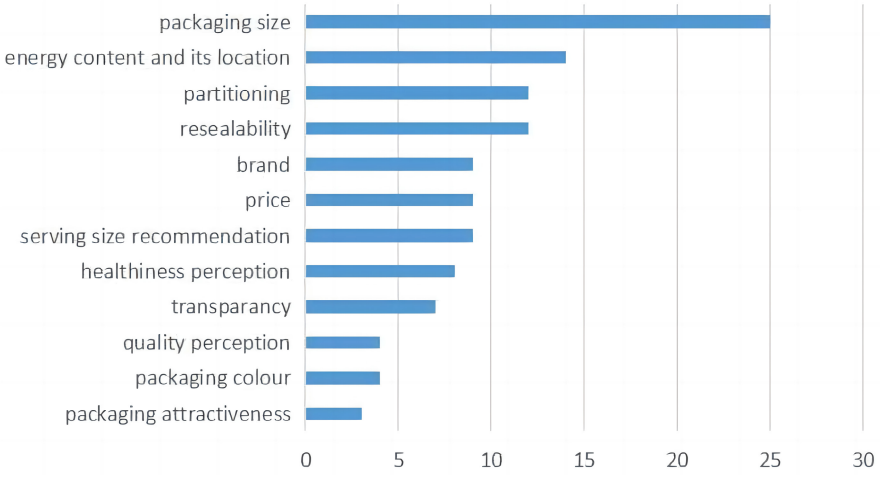

FIGURE 2 The most frequent factors affecting portion decisions (each of 25 participants choosing up to 5 options from 21 packaging-related features).

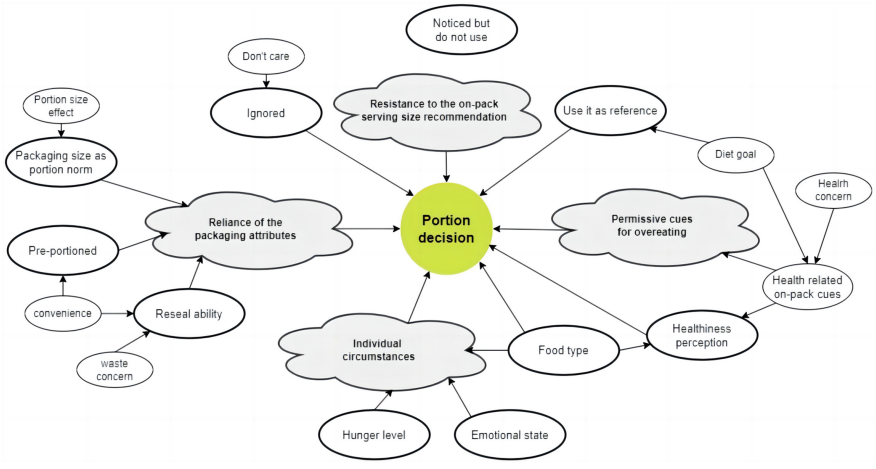

FIGURE 3 Portion decision-related themes generated from the interview qualitative data, including the four main themes (presented in cloud shapes) and the initial sub-themes (presented in oval shapes) and outside of the main diagram the sub-theme of packaging attributes which were noticed but not used.

resistance to the serving-size recommendations. By way of explanation, participants suggested that it is their right to consume any portion they want to. They preferred not to be restricted and they thought it was a waste of time for them to check the portion instruction. Instead, they reported that they knew what was right for them and wanted to manage their own portion without serving size guidance. This was especially evident for beverages where participants did not pay attention to any portion limitations.

> I don't like to follow any rules, any serving recommendations. So, I do not really check
> (F_13_ND)

> I don't like to check. And I don't like to be restricted. I think I can control by myself.
> (F_08_ ND)

> The point is, I bought it, I can eat/drink any portion I want.
> (M_03_D)

> Probably not. The main reason is I think it is rare to see such information on the food I usually buy. And I don't like to find it either. I do notice that most of the drinks would tell you how many servings it contained, but, still, I won't follow it because I only drink it with meal, I won't drink too much
> (M_18_ND)

Reliance on packaging attributes

Portion size was influenced by package design/configuration. Consumers were aware of how much a large package promoted overeating, in their experience, compared to single-serve bags. One package was seen as a portion norm, consumers reported eating all that was offered in a single package, even when that package was normally intended to contain more than one serving. Similarly, consumers noticed when packaging was small or given as an obvious single serving pack, that this helped to limit their intake. Indeed, in some cases, the participant chose a smaller size package when multiple sizes were available, despite the higher per unit price for the smaller compared to the larger (sharing or family size) package. Typically, packaging with partitioned or resealable features encouraged the selection of smaller portions, especially for snacks and drinks. According to some consumers, these features provided convenience, as these structural features were interpreted as supporting the intention to limit intake.

> When the packaging size is small, I will eat less, when it is large, I may eat all as well, which means I will eat more.
> (F_10_ND)

> I usually choose the small one. I am trying to eat less junk food and avoiding food waste. I will still accept it if the smaller one is more expensive, I mean it is less value for money comparing with the bigger pack.
> (F_06_ND)

> It makes you feel like it is not a one setting kind of thing. You feel like it is not supposed to be eaten at one time.
> (F_20_D)

> I usually plan the amount I think I should consume and then during eating if you feel like full or something, then I stop eating. For snacks or drinks, it depends, if they have been already portioned out, I will just eat the portion. If they are not, I will probably eat until I don't want to eat any more.
> (M_17_ND)

> I can reseal it, Oh, you don't need to eat it all once I open it, like it just makes everything easier.
> (F_13_ND)

Permissive eating cues

Participants reported their tendency to consume smaller or fewer servings when a product was identified as “high calorie” or energy dense, due to health concerns. At the same time, the perception of the product as healthy was interpreted as a permissive signal to eat a lot. For those on a diet, more attention was paid to the healthiness claims of the food or drinks, compared to those not dieting. The sense from participants was that if a product was perceived as healthy, then it could be eaten without “guilt” (see below). The participants generally considered products described as “low-calorie”, baked not fried and foods with other health claims as an encouragement to consume and a prompt to eat more.

> If it is like unhealthy food and the portion size is made very obvious, then I will pay attention to it.
> (F_24_ND)

> I probably eat more when I think the food is healthy.
> (F_22_ND)

> If I know something is low calorie, I will happily eat more of it. Like if it is a big bag of popcorn, you won't feel that guilt. If it is a whole cheesecake, you may feel guilt more.
> (F_20_D)

> If it looks healthy, it is fine to eat more.
> (F_13_ND)

> I think I would eat more if I see the food as healthy.
> (F_19_ND)

> I tend to eat more if I think it is a kind of healthy food. If I know it will lead to gain weight, I won't eat too much.
> (M_18_ND)

> When I notice the food is low in calories, I will be happy to eat more. Similar effect if it is organic or non-fried food. When there are some expressions on the packaging that reflect the safety and health of food, I will eat more.
> (M_07_ND)

Individual feelings and circumstances

Participants described some circumstances which determine their choice and willingness to control portion sizes, for example hunger level, emotional state and social needs. To be specific, some participants relied on hunger feelings to decide when and how much to eat, especially for meals. At other times, participants just wanted to eat something for comfort, the portion was not of concern in this situation. In some circumstances, for example at social events or family gatherings, participants did not think about food portion size since their goal was to enjoy the food, the circumstances and the social experience not to restrict which foods to eat or to limit how much is eaten.

> I do try to only eat when I am hungry. So, I usually decide how much to consume based on how hungry I am feeling and how much physical activity I did during a day.
> (M_16_ND)

> For meals, it truly depends on the degree of hunger. For a beverage, it depends on the capacity of my cup, I just drink a cup of cola. For Doritos, I will eat them all after opening the packaging. For cakes, I just eat whatever I can and then put the rest into the fridge.
> (F_02_ND)

> For snacks, chocolate, I think they are for emotional eating, you will eat it when you feel depressed. In the evening, I just want to eat some snack. I am not hungry, I just want to eat something. At that time, I don't read the serving portion because sometimes I eat too much, two or three person's portion.
> (F_11_D)

> If I am in a social situation and I am enjoying myself, I just wouldn't think of that. If I have a goal or something, I would like to know my portion size more than anything. Especially when it is lockdown, I won't look at that, when it is lockdown, I won't look at that, I just eat everything.
> (F_20_D)

DISCUSSION

Overall, the results reflected how participants interact with packaging to make portion decisions. Participants did not habitually pay attention to the on-pack serving recommendations, nor did they typically follow these. Interestingly, participants mentioned deliberate resistance to on-pack serving-size recommendations, since they trusted their own judgement about what was right for them. Participants showed some reliance on the packaging when making portion decisions. For example, two aspects of the portion size effect were noted, one was that smaller portion sizes, pre-portioned packs and resealable packaging were effective ways to help portion control. The second aspect was that large packages presented, at times, a cue to eat more. The perception of a product as healthy also appeared to act as a cue to eat more of that food. In addition, immediate circumstances (e.g., individual hunger level; emotional state; food type) directly influenced portion decisions.

One way to understand these findings is to view portion decisions within a timeframe. To be specific, some past habits, current contexts (both individual and packaging-related) and consumers' future concerns collectively contribute to explaining consumers' portion decisions. Packaging attributes (e.g., pack size, partitioning) influence habitual portion control. Furthermore, certain packaging attributes, such as health-related claims and re-sealability, may encourage consumers to make informed decisions about portion size, supporting future health concerns (e.g. nutritional content, potential benefits or overall health impact of the product). This information empowers individuals to make informed decisions. In addition, the feature of reseal-ability in packaging is a practical attribute that extends beyond the immediate consumption of a product. The convenience of re-sealable packaging allows users to

preserve the freshness of the product, promoting mindful consumption and reducing potential food waste.

To further understand why the packaging attributes mentioned above have an impact on participants' portion decisions, the reasons behind them were analysed in the context of relevant research from consumers' perspectives. An attempt is made to summarise the values of consumers when making portion decisions.

Loss of autonomy and control

Results from the current study revealed that participants tended to disregard serving size advice on packaging and some disclosed that they deliberately resisted on-pack guidance. This finding supports a previous review (Faulkner et al., 2012) reporting that consumers were often unwilling to act on serving guidance despite recognising that guidance would be helpful (Vermeer et al., 2010), but not always considered relevant to themselves (Anderson et al., 2008). Awareness of serving size guidance does not necessarily translate to changes in eating behaviour, the knowledge–behaviour gap is well known (Juvan & Dolnicar, 2014; Scholes-Balog et al., 2012) and it would be useful to understand what is needed to both make the guidance more salient and applicable to food intake.

The ineffectiveness of the on-pack serving recommendation has been demonstrated in several studies (Johnson et al., 2009; Rippin et al., 2019). Guideline Daily Amounts (GDA) labelling of the EU showed no effect on the portion choice of soft drinks in a field experiment (cinema) conducted by Vermeer et al. (2011). As (Noar et al., 2016) revealed, no matter how the text is changed on the packaging, the impact on the customer is minimal, and pictorial warnings were more effective than text-only warnings for 12 of 17 effectiveness outcomes. Taken together, this evidence suggests that serving size information may not serve the function of guiding intake in the way it was designed to do (Ueland et al., 2009).

At a population level, intake of high energy dense foods which are also high in fat, sugar/salt exceeds recommended amounts. For example, Rippin et al. (2019) compared and calculated the difference between consumed portion size and on-pack serving size based on a survey of 2377 adults. The results demonstrated that the consumed portion sizes of UK energy dense foods were significantly higher than on-pack serving-size recommendations. It is assumed that the serving-size recommendations on packaging will guide consumers to understand and then act on this understanding to determine intake and make informed dietary decisions (Kliemann et al., 2018). However, this assumption is not supported by consumer research. Given the theme of deliberate resistance, a future step would be to work with consumers to determine how best to articulate guidance to translate into behaviour change.

Resistance to guidance may incorporate the consumer's need for autonomy and control, as well as trust in themselves to know what they need in terms of amount/portion size. While recommended serving sizes are offered as a guide, participants have interpreted this as a means of restricting food choice and intake by an external force rather than their own internal cues. This can lead to feelings of frustration, rebellion, and resistance. According to Self-Determination Theory (SDT) (Ryan & Deci, 2017), people are active agents in their behavioural decisions including eating behaviours, rather than simply being passive recipients of external influence. Therefore, one interpretation of the current findings is that individuals with a strong desire for control over their food choices may be more likely to resist dietary guidance and recommendations.

Perceived control and convenience

Some default structural packaging settings were reported to be useful methods for portion control compared to the on-pack serving-size recommendation, including small-sized packaging, partitioned packaging, and re-sealable packaging. For example, consumers respond to pack size by eating more when more is offered (Rolls et al., 2004), but if pictorial serving sizes are shown on the package, this reduces expected intake from large packs (but not small pack sizes) (Versluis et al., 2015). Small pre-portioned packs and pictorial representations of appropriate serving sizes might help to promote portion control and could help establish a healthy portion norm over time (Robinson & Kersbergen, 2018).

Partitioning, size and resealability features are consistent with findings from previous studies on downsizing measured food intake (De Bondt et al., 2017; Raynor et al., 2009). Consumers tend to follow the default environmental settings—namely pre-selected options or default choices that are presented to them (Jachimowicz et al., 2019) in eating-related contexts. Johnson and Goldstein (2003) also stated that people are more likely to accept default options. Based on the response of the participants, another reason these packaging features are more accepted is that they give people the impression that there are more portion choices to choose from. For example, consumers can choose to eat one sub-pack or two packs or more, which gives them a greater sense of control. As revealed by Veitch and Gifford (1996), people in the choice and preference-given conditions had more perceived control than those under no-choice and no preference-given conditions, meaning that more choice increases the perception of control and thus, has a positive effect on acceptance. A study with children (Warren et al., 2008) showed that the older consumers are, the greater store they place on control

over their eating decision-making. Thus, a more flexible approach to offer multiple size packs but within recommended ranges may promote better portion control than family size and single serve sizes.

Convenience was also revealed as important given that structural features such as partitioning, size and resealability reduce effort or concerns about freshness and food waste. This supports previous studies which have shown that behaviours can be influenced positively by making small, subtle changes to the environment (Hanks et al., 2012; Thaler & Sunstein, 2008) making behavioural change more convenient. This is consistent with the idea of "nudging", which functions by appealing to people's cognitive biases, gently steering decisions toward the option which appears to be the 'default' (Hansen & Jespersen, 2013). The review by Cadario and Chandon (2020) also revealed that "convenience enhancements" are an effective nudge for healthy eating. The packaging size presents a portion norm (Robinson et al., 2019) and this is an obvious, convenient and easy means to determine how much to consume.

Healthiness perception and "paradoxical" overeating

Most people make choices that lead to better future outcomes (Loewenstein, 1996). As consumers become more health conscious, food packaging and labelling will become increasingly important to consumers to reassure them of the health value of eating certain products. The results of the present study support this idea indicating that health claims and descriptions of food such as "low-calorie" are noticed and used in food choice decisions.

On one hand, when a product is seen as "unhealthy," some consumers who care about their health tend to consume less of it, especially for those on a diet. A product perceived as "unhealthy" does not align with the health goals of the consumers, thus, they apply a self-monitoring process, intentionally eating less. This is consistent with an earlier study which demonstrated that health claims can help consumers from France, Japan and the United States make better-informed food choices (Sanchez & Casilli, 2008). This is due to the reported correlation between perceived unhealthiness and guilt, specifically, perceived unhealthiness increased predicted guilt about eating too much (Faulkner et al., 2014; Hur & Jang, 2015).

On the other hand, when a food is perceived as healthy there is a sense in which consumers construe this as "permission" to eat more than the recommended serving size. "Guiltless" eating was a theme identified from a series of ten focus groups conducted on the Island of Ireland by Spence et al. (2013) where participants discussed the barriers to portion control. It revealed that, once food was deemed 'healthy', portion control for that food was seen as unnecessary. This illustrates the potential for foods framed as "healthy" to be eaten without guilt ("guiltless eating") and is an illustration of the so-called "Snackwell effect" (Walsh, 2014) in which marketing of foods which were "low-fat" or "low-calorie" paradoxically increased unit intake, thereby reducing any benefit of the reduction in fat, sugar and energy.

The framing of foods/beverages as healthy may produce a "health halo effect" namely inflating the benefits of certain foods as more healthy than other products. For example, some on-pack labels (e.g., organic, high protein) may exaggerate a product's health value (Schuldt, 2011), which may guide choice based on perceived rather than actual benefit. Once established, health halo effects may be difficult to shift. For example, in a study investigating front-of-pack labelling for protein bars, investigators compared health perceptions of a "Zing" bar with no traffic light (control) against two products with traffic light warnings for sugar content called "Zing Protein Bar" or "Zing Bar" and a nutrient content claim "good source of protein". Having protein mentioned in the title increased perceived healthfulness and the traffic light warning was noticed but did not ameliorate the perceived healthfulness of the bar (Fernan et al., 2018). Interpreting nutrition content or health claims as permission to eat more could result in eating too much, although this may depend on the health consciousness of the consumer. For example, Her and Seo (2017) showed that ordering a dessert in a meal scenario depended on both the health consciousness of the participant and the health framing of the main meal. Highly health-conscious consumers in this US research were less affected by a main meal framed as healthy (health halo), and scored willingness to order dessert as low, whereas less health-conscious consumers were more likely to order dessert after the "healthy" main meal than the unhealthy main meal. This suggests that framing meals as "healthy" may unwittingly induce less healthy subsequent eating as reported for the Snackwell effect.

Participants' descriptions of the influential packaging attributes, coupled with their daily interaction with the packaging, revealed consumer values on their portion decisions (see the summary of Figure 4). Furthermore, building on the findings, some implications have been put forth for stakeholders, including the food industry and policymakers. For example, the recommendations below are intended for food companies to enhance packaging, alongside considerations for potential policy options:

1. Tailor packaging design to align with existing eating habits of consumers such as portion norms. Then leverage food packaging as a tool to nudge new expected portion norms. This might involve

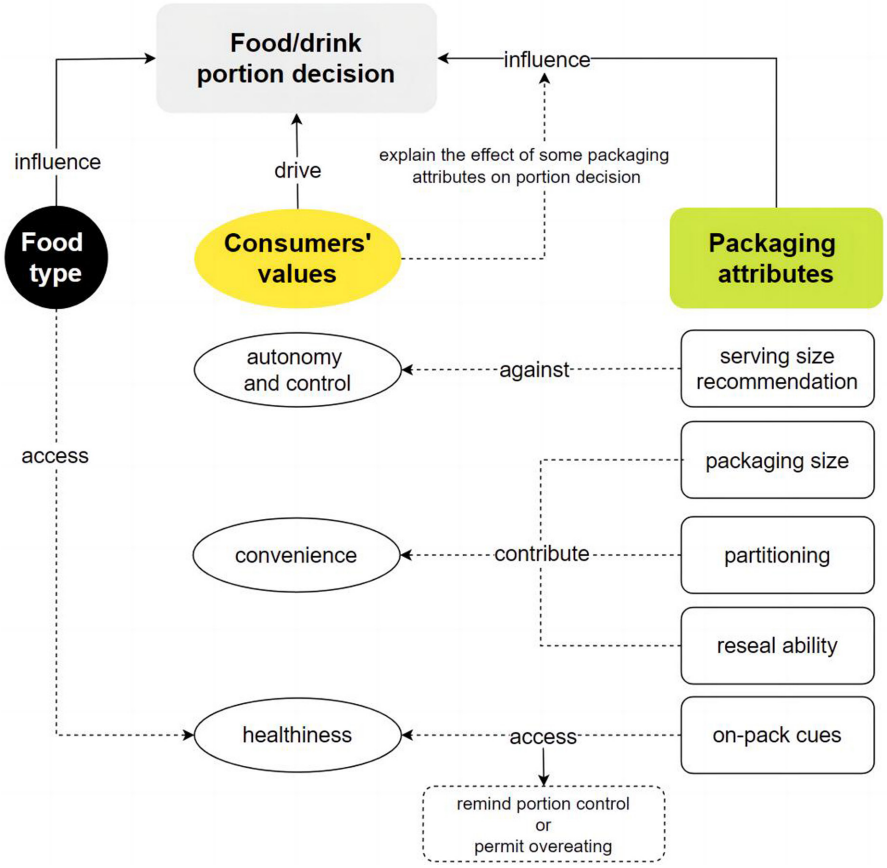

FIGURE 4 Diagram to summarise the overarching influences of food type, consumer values and packaging attributes on food/drink portion decisions. Food type and packaging attributes are conceptualised as external influences with direct effects on food/drink portion decisions, whereas consumer values are considered as internal drivers on food/drink portion decision, which mediate the influence of packaging attributes on portion decisions. Dotted lines represent an influence to some extent as reported by our participants.

using pictorial representations or simple images that consumers are familiar with rather than weight (g). Consumers appear to understand graphics more easily than the weight of a portion.

2. Utilise current contexts including packaging attributes and individual needs to guide consumers' immediate portion response. This may involve offering pre-portioned options to suit the value of convenience, catering to different eating scenarios.
3. Employ health claims that resonate with consumer interests, avoiding misinformation conveyed by packaging. For instance, emphasise not only positive indicators like "low fat", but also potential risks, such as highlighting "high sugar", if applicable.
4. Consider consumers' values when designing packaging interventions. This enhances acceptance and implementation of the packaging-related portion interventions, recognising that consumers prioritise these values in their food choices.

STRENGTHS AND LIMITATIONS

To our knowledge, this is the first study that has explicitly linked packaging attributes and their impact on portion decisions to consumers' values, including autonomy and control, convenience and healthiness. These values provide the food packaging designer with key points to consider when trying to nudge consumers to make healthier portion choices. Apart from the novelty of the study, another strength was to gather a rich, in-depth dataset to explore interactions with packaging. This method offers greater insights than using questionnaires only.

Several limitations must be acknowledged—first of all the interviews were preceded by a photo-elicitation task during which many packaging photographs were discussed, thus, participants' thoughts and answers may have been linked to specific food and beverage packaging. In the future, studies could be separated by a "washout" period to mitigate this potential association. The packaging-related attributes checklist was used before the open-ended questions in the interview which helped people pay more attention to the packaging's influence on their portion decisions. However, this may have constrained participants' responses to those presented packaging attributes. Finally, the participants were drawn from a convenience sample of mainly students who were highly educated, relatively affluent and young. Therefore, this limits the generalisability of the findings to other populations. However, some of our findings correspond to observations from earlier studies in other countries and with a wider range of consumers.

CONCLUSION

Consumer values influenced how participants interacted with packaging to make portion size decisions. Participants reported that current on-pack serving-size recommendations were resisted, possibly conflicting with their value of autonomy and control. In contrast, some packaging attributes such as size, partitioning and resealability contributed to ease of use, preventing waste which aligns with the value of convenience. On-pack cues helped participants with the assessment of the product's healthiness which may promote portion control for those who are health conscious. Paradoxically, some consumers appear to use health labels as a permissive cue for overeating.

Some packaging design insights were proposed which could be used to guide the promotion of portion control. Insights for future packaging design could be framed within a timeline (building on previous purchase habits to form a new habit, for example portion norms; making use of current portion decision-related contexts to guide portions; presenting appropriate health-related claims). The other important principle is taking consumers' values (autonomy and control; convenience; healthiness) into consideration, aligning values to portion decisions. More design opportunities could be further explored from these insights by packaging designers and food companies to better achieve nudges to portion control.

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CONFLICT OF INTEREST STATEMENT

There are no conflicts of interest to declare.

DATA AVAILABILITY STATEMENT

All data is available from the Open Science Framework (OSF) here - https://osf.io/hczp9/.

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