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Designers' Needs in Leveraging the Evolving Role of Packaging for Promoting Healthy Eating

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Abstract: Promoting healthy eating improves both planetary and human health, aligning with sustainable development goals. Eating healthy, locally sourced foods that are rich in nutrients and low in energy density produces benefits for public health in the long term and enhances resource sustainability. Despite the importance of increasing intake of fresh fruits and vegetables, consumers still frequently choose pre-packaged foods, making packaging design crucial in influencing food choice and intake as well as promoting healthy diets. Designers of food packaging are in a crucial position to contribute to health and well-being by influencing consumer knowledge, attitudes and behaviours towards healthy eating. However, designers may yet be unaware of their potential to influence and the challenges they may face in this domain. This study investigates designers' perspectives, understandings, needs and challenges regarding packaging design for promoting healthy eating. A total of 20 designers (n = 10 professionals, 10 students) from various design backgrounds participated in this study, engaging in a packaging design task (centred on either reducing intake of high-energy density foods or increasing intake of fruits and vegetables), followed by one-to-one interviews. A thematic analysis of the interviews revealed that the designers primarily focused on enhancing the healthiness of food items through packaging design but often overlooked the potential to regulate consumer intake of energy-dense foods. In addition, the designers expressed concerns regarding consumer preferences and market acceptance for such designs. They faced significant challenges in accessing relevant resources and emphasised the need for health-related information, data on packaging impacts and consumer preferences, practical design examples and theoretical support. These findings highlight the demand for additional support to enable designers to develop tailored packaging designs, contributing to a supportive environment for promoting healthy eating.

Keywords: packaging design; healthy eating; designer needs; packaging role; public health

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1. Introduction

Healthy eating significantly contributes to overall health promotion and the reduction in obesity and prevalent chronic diseases [1]. More sustainable foods will also reduce carbon footprints and environmental impacts [2]. There is a recognised necessity for comprehensive efforts to promote sustainable, healthy eating habits [3]. A consensus is developing in psychology that the consumption of healthy foods can enhance well-being as well as physical health [4]. Maintaining a balanced diet that is rich in fruits, vegetables and essential nutrients is associated with better brain health throughout an individual's lifespan, impacting cognitive function and overall mental well-being [5,6]. Research also indicates the broad-reaching impact of promoting healthy eating across diverse population groups [7]. Despite these initiatives, individuals often struggle to adhere to dietary recommendations, resulting in increased energy intake through the consumption of excessive quantities of high-energy-density (HED) foods [8]. Promoting healthy eating through effective packaging design not only supports human health but also

contributes to environmental sustainability [9] by reducing food waste and encouraging the consumption of locally sourced, nutrient-rich foods.

1.1. Barriers to Healthy Eating

The implementation of healthy eating practices is complex and often hindered by various barriers [10]. The interplay of human, social–cultural and socio-economic status, along with environmental factors, appears to be of importance for achieving healthy eating [11]. Cultural influences and personal preferences significantly shape dietary habits, posing obstacles to the adoption of healthier eating patterns [12]. Socio-economic status, including factors such as education level and income, can impact dietary habits, as individuals' knowledge and concerns about the affordability of healthy food influence their food and nutrient intakes [13]. Moreover, environmental factors, such as food advertising and the availability of less healthy foods, further compound the challenge of making nutritious choices [14]. The current environment poses challenges to fostering sustainable and healthy eating habits among the population [15]. The abundance of choices in the current market can lead to decision fatigue and cognitive overload for consumers, hindering their ability to make healthy and informed food choices [16]. These barriers and ongoing challenges in maintaining a healthy diet [17] suggest the need for action aimed at fostering a supportive environment for healthy eating.

1.2. Food Market and Packaging Design

The food market and packaging design are crucial environmental factors that significantly influence consumer choices and, consequently, impact healthy eating behaviours [18,19]. While the primary function of food packaging is to protect the product and facilitate sales [20], it also serves as a powerful marketing tool, helping to differentiate products from competitors and creating positive associations in the consumer's mind [21]. Food packaging's ability to engage with consumers in a consistent way is a further feature that highlights the potential for packaging as a communication tool [22] within the food market, reaching consumers at the point of purchase and consumption [23]. Various design elements, such as shape, colour and materials, convey information about sustainability, brand identity, product contents, nutritional value and health claims.

However, packaging design contributes to the consumption of less nutritious foods, particularly processed and high-energy-dense products [24]. For example, persuasive techniques, such as vibrant colours and enticing imagery, are often used on HED food to promote consumption [25]. Moreover, packaging size and portioning can influence consumption patterns, potentially leading to overconsumption of unhealthy foods [26,27]. Furthermore, nutrition labels such as NutriScore [28] provide simple, colour-coded, evidence-based nutrition information on the front of the pack but may not be noticed by consumers. Buzgeia et al. [29] revealed that while most participants were aware of the necessity of nutritional labels on pre-packaged foods, many had a low level of awareness regarding the information provided on these labels. Similarly, serving size recommendations may be ignored, unnoticed or disregarded by consumers [30]. Consumers remain unaware of marketing strategies that include the "health halo" effect caused by packaging design [26,31]. For example, a product labelled 'low-fat' might lead consumers to perceive it as healthy overall, despite it being high in sugar. Even when they are aware of the persuasive intention behind them, they may not realise that their consumption decisions are being influenced [32]. In addition, some companies overstate the environmental benefits of their products, so-called "greenwashing", where some promotional claims (e.g., "natural" or "organic") are presented to encourage purchase intention, which may not align with actual environmental practices [33,34]. Greenwashing may occur when companies adopt corporate social responsibility practices prematurely for reputational reasons without fully integrating them into their operations [35]. Therefore, understanding the evolving role of packaging design in shaping consumer perceptions and behaviours is essential for promoting healthier dietary choices within the complex landscape of the food market.

1.3. New Roles of Packaging and Designers

As the impacts of food packaging features on consumer intake become clear [26], there is a growing demand for innovative approaches to assist consumers in making healthier food choices and effectively managing portion sizes [30,36]. Designers have the potential to play a crucial role in promoting a healthy lifestyle [37], and this has been demonstrated across several examples [38,39].

Designers are not just responsible for effectively communicating business values to consumers through visually appealing packaging but also for fostering a supportive environment for consumers to adopt healthy eating habits. Tang et al.'s study [40] has revealed opportunities for food companies to achieve profitable "win–win" outcomes by aiding consumers in making healthier food choices through packaging design. By embracing these new responsibilities, designers need to consider how to positively influence consumer dietary patterns and contribute to the creation of a healthier food environment. The role of a designer extends beyond mere aesthetics; they have the power to shape consumer choices, behaviours and habits and to advance health.

Existing research has extensively explored the relationship between packaging features and consumer food-related decisions [30] and behaviour [26,41,42]. However, the perspective of designers—who play a crucial role in creating these packaging features—remains underrepresented. Understanding designers' views is essential for developing packaging that effectively promotes healthy eating. Therefore, this study aims to explore the understandings, needs and challenges of designers regarding food packaging design for promoting healthy eating (see Figure 1 for a summary of the research model for this study). Specifically, we address the following research questions:

- How do designers perceive the role of food packaging design in promoting healthy eating?
- What challenges do designers face in accessing and utilising relevant information?
- What types of support do designers need to create health-promoting packaging designs?

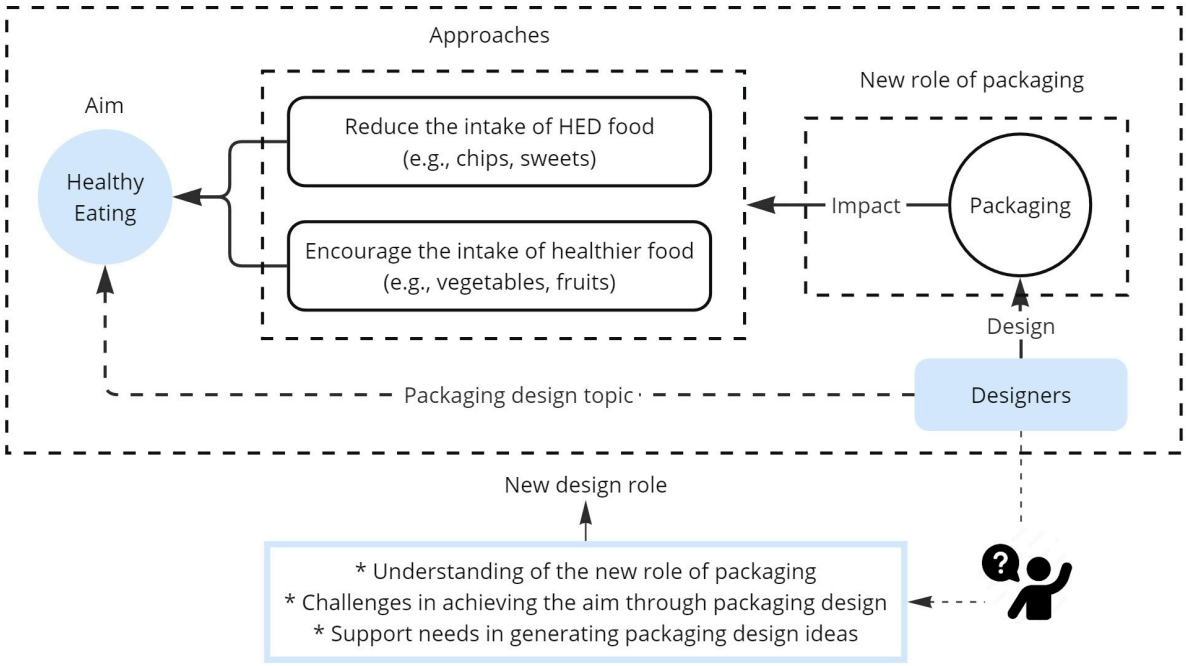

Figure 1. Introduction to the research model and the objectives of this study.

2. Methods

2.1. Research Framework

The main purpose of this research was to identify the key issues of this specialised field of design and to explore the essential needs for completing a packaging design task. This research took a qualitative exploratory approach [43], since it is well-suited for exploring

new areas and ideal for uncovering insights [44,45], allowing for flexible data collection from designers based on their experiences. Semi-structured interviews were chosen as the main data collection method [46]. A design brief was provided to designers participating in our study, encouraging deep thought about this specific packaging design topic [47]. Then, a series of semi-structured, in-depth interviews were conducted with the designers to address the main research question concerning their understanding of the design topic and their needs in the design practice.

2.2. Participants

The research conducted in this study received ethical approval from the School of Design, University of Leeds, UK (LTDESN-139).

The recruitment process involved reaching out to professional designers through online platforms, personal contacts and professional resources. Each professional designer was individually contacted and provided with information about the packaging design study. Similarly, student designers were university students enrolled in design programmes or engaged in design research. All participating designers were fully informed about this study's purpose and procedures, and they consented to take part in this study by signing a consent form. This ensured that all participants were formally recruited into this study in accordance with ethical guidelines.

A total of 20 designers were recruited for this study, consisting of 10 professional designers and 10 student designers. The professional designers represented various design disciplines, including industrial design, product design and graphic design (see Table 1 for a detailed profile). This diversity in experience could bring fresh perspectives and creative solutions to design challenges [48]. Their design experience ranged from two to seven years. The student designers were university students pursuing advanced degrees in design, including Ph.D. and postgraduate master's degrees. They were actively engaged in design research and academic studies in design-related fields.

Table 1. Participant profiles.

Professional Designers' Profiles			
No.	**Design Area**	**Years of Expertise**	**Occupation**
PD1	Customised furniture design	5	Product designer
PD2	Packaging design, illustration, logo design, UI	3	Designer
PD3	Packaging, Web, UI, VI (illustration, logo)	3	Designer
PD4	Interior and exterior design of automobiles	2	Car-styling designer
PD5	Industrial design, 3D rendering, graphic design	7	Product designer
PD6	Visual Design	2	Visual designer
PD7	Typography design	2	Graphic designer
PD8	Product design	5	Visual designer
PD9	Graphic design	2	Illustrator
PD10	Interactive design	4	Designer
Student designers' profiles			
No.	**Design area**	**Level of study**	
SD1	Product design	PhD programme in design	
SD2	Graphic design, visual design	Postgraduate programme in design	
SD3	Brand design, graphic design	Postgraduate programme in design	
SD4	Visual Design	Postgraduate programme in design	
SD5	Graphic design	Postgraduate programme in design	
SD6	Graphic design	Postgraduate programme in design	
SD7	Packaging design, visual design, logo design	Postgraduate programme in design	
SD8	Visual Design	Postgraduate programme in design	
SD9	Product design, graphic design	Postgraduate programme in design	
SD10	Graphic design	Postgraduate programme in design	

Note: Most of the designers have limited experience in packaging design.

2.3. Data Collection and Analysis

All participants were informed that this study focused on packaging design exploration and were given detailed information about the tasks involved. A design brief was created to briefly describe the significance of promoting healthy eating and reveal the impact of food packaging as an environmental factor on consumer eating behaviour. The design topic of using packaging design to guide people towards healthier eating behaviours was then proposed. After introducing the design brief (to design packaging that will promote healthy eating in adults, either by reducing HED food intake or encouraging the consumption of healthy food), the recruited designers were given a week to familiarise themselves with the topic, search for relevant resources and develop design ideas. Semi-structured interviews were then conducted individually with each designer participant. These interviews combined a set of core questions with flexible follow-up points as necessary to explore the designers' understanding regarding the potential impact of packaging design on healthy eating promotion. Additionally, the interviews aimed to elucidate the designers' specific requirements for design aids to support their work in this domain. All participants completed the whole study, averaging 40 min in duration. Figure 2 illustrates the detailed procedure of this study.

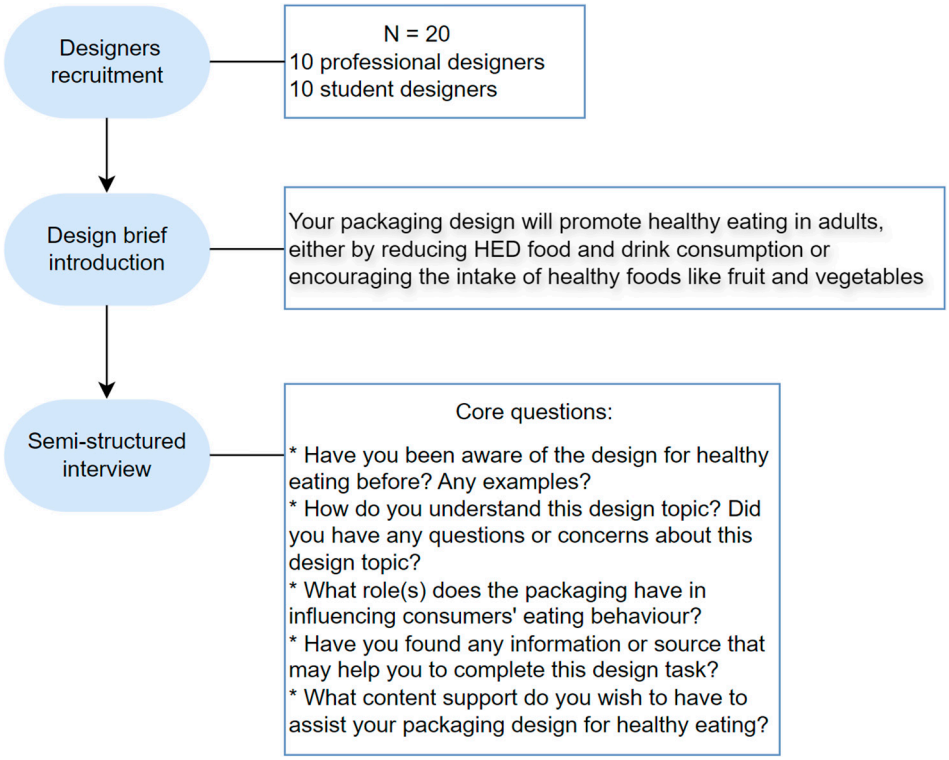

Figure 2. The timeline and procedure for the present study.

Each recorded interview was transcribed into text. All data obtained from the designers were anonymised as promised and assigned numerical IDs to maintain confidentiality. The thematic analysis process followed rigorous steps grounded in qualitative research methodology. Initially, raw data were coded by first author. This process involved multiple readings of the transcripts to gain an overall sense of the data, as recommended by Sandelowski [49]. Information was then extracted, and key topics within the data were identified. During this phase, open coding was applied, assigning codes to meaningful segments of text without preconceived categories. Following the initial coding, discussions were held among the research team to perform axial coding, linking related codes to form categories and subcategories. This collaborative approach ensured that the identified findings and corresponding quotations were thoroughly reviewed and agreed upon by all researchers. The iterative process of discussion and refinement ensured the reliability and validity of the

identified themes. The thematic analysis was informed by established qualitative analysis techniques [49]. This method emphasises a structured yet flexible approach to analysing qualitative data, allowing for a comprehensive understanding of the participants' perspectives. Selective coding identified core themes, focusing on understanding the designers' comprehension of this packaging design topic and identifying their needs for completing the packaging design task towards healthy eating.

3. Results

The thematic analysis of the data revealed two primary clusters: the designers' comprehension of the design topic and the articulated needs for design aids to facilitate their efforts in this area. These clusters, along with corresponding themes and sub-themes, are presented in Figure 3 and discussed in the subsequent discussion, enriched by participant quotations to provide contextual depth.

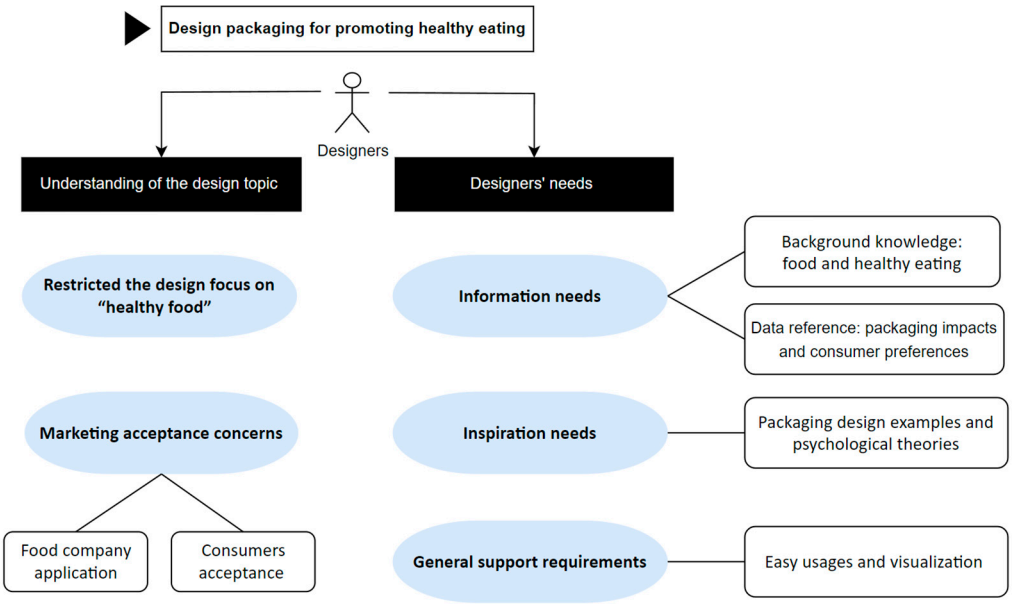

Figure 3. Main themes summarised from the designers' responses.

3.1. Understanding Packaging Design for Healthy Eating

3.1.1. Limited Awareness of Healthy Eating Promotion through Packaging Design

The thematic analysis revealed a prevailing lack of overall understanding among the participants regarding the potential of packaging design to promote healthy eating. Despite some designers acknowledging previous engagements with health-oriented designs, there was a notable disconnection between packaging design and dietary health.

> "I have had a short internship experience in packaging design and basic knowledge of packaging design, but I have not been exposed to the field of healthy eating." (ST-15-THW)

> "I haven't paid attention to the healthy food packaging design." (ST-17-YBP)

While some innovative designs of food containers and material innovation were considered beneficial for consumer health, the focus remained primarily on packaging for "healthy" foods such as "light food" and organic vegetables. Their initial design concepts also prioritised utilising the packaging to attract consumers and communicate eating benefits, with the aim of motivating individuals to go for healthier food options.

> "Yes, I have looked at some food carriers based on material innovations, such as Tupperware's plastic bowls and the containers of LOCK&LOCK brand." (PD-06-LJX)

> "I have done some design for health food packaging, like the packaging of the organic oats and organic fruit." (PD-03-TBB)

> "Yes, I have paid attention, but not much. I know there are some vegan restaurants opened in my home area, I've seen the decoration of the store and door logos and so on. Or some designs of boxes and takeaway bags for light food, like salads. Mainly see related the packaging for agricultural products." (PD-10-WX)

3.1.2. Conflict between Health Eating and Business Agenda

The results showed that many designers expressed apprehensions regarding the acceptance and implementation of packaging designs aimed at promoting healthy eating by food companies. They highlighted concerns regarding the potential negative impact of such designs on product sales and profitability. The primary focus of designers was on aligning packaging designs with the marketing objectives of food companies, which prioritise the attractiveness of the design and sales promotion. Thus, many designers expressed concerns that designs aimed at reducing the consumption of HED foods and drinks may not align with the profitability goals of food companies. The professional designers showed heightened concerns about the potential influence on the marketing performance of the products and the attitude of the food companies. They emphasised the necessity of striking a delicate balance between promoting health and satisfying commercial interests. This sentiment underscores the complexity of the relationship between packaging design, consumer health and business objectives by highlighting the potential conflict between the business and health agendas. There is, therefore, a need for thoughtful navigation of these considerations in the design process.

> "One of the main purposes of the design is trying to reduce the intake of HED food or beverage, while the packaging needs to attract consumers to buy more. Thus, the packaging under this topic may not be accepted by the food company. The design idea won't be selected and implemented." (PD-11-XLL)

> "The first thought of mine is to change the colour of the crisps to suppress the appetite, but I passed on this idea, because I am concerned it may go against the willingness of the food seller. There's a conflict. So, the design should provide a little bit restriction, but consumers should still love to buy it. The balance needs to be found here" (PD-09-RXY)

3.1.3. Concerns about Consumer Acceptance

Moreover, many designers expressed concerns about consumer acceptance and preferences regarding packaging designs intended to promote healthy eating. As participants pointed out, it is important to make the food packaging attractive and appealing to consumers while simultaneously encouraging healthier food choices. Many student designers showed a keen interest in gaining feedback from consumers. However, designers faced challenges in finding a balance between design intentions and consumer preferences. They recognised the need to address consumer preferences and ensure that packaging designs effectively resonate with their tastes and expectations while promoting healthy eating habits.

> "Has it ever been the case that if the design intends to reduce people's high calorie intake, will it be too much negative impact on the sale of the product itself?" (SD-05-XL)

> "Concerned that the design will not appeal to consumers" (ST-20-YWX)

3.2. Challenges in Designing Packaging to Promote Healthy Eating

The designers relied heavily on online resources for gathering information pertinent to their design tasks. However, they encountered numerous challenges in this process (see Figure 4 for details). To be specific, the designers felt it was time-consuming to search for trustworthy materials and struggled to identify useful content amidst the abundance of information available. Furthermore, they expressed frustration with the low quality, inconsistency and poor summarisation of the materials they accessed.

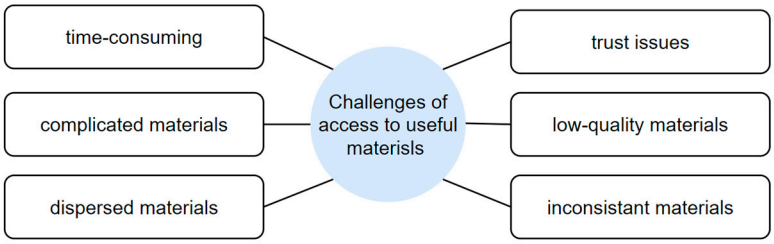

Figure 4. Challenges faced by designers in accessing healthy eating-promotion packaging design.

> "I search online, but hardly find any data I trust. Some fitness apps provide related information, but consistency among different apps is lacking." (PD-07-LXY)
>
> "High quality information resources are not very easy to find, especially websites" (PD-03-TBB)
>
> "It's a bit difficult for me to gather these sources, I need to find what I think is useful in a pile of complicated content, which is a time-consuming task for me. Some content is difficult for me to determine its usefulness by myself." (ST-12-DWH)

Based on the responses of these designer participants, two main categories of designers' needs for effective packaging design for promoting healthy eating were identified: information needs and inspiration needs.

3.2.1. Information Needs

Background Knowledge: Food and Healthy Eating

The designers expressed a clear demand for comprehensive information related to food and healthy eating to inform their packaging designs. Specifically, the designers sought clarity on various aspects related to food selection, specific nutritional information and general healthy diet knowledge.

- Target food selection: The designers sought guidance on identifying suitable target foods for their packaging designs. They expressed uncertainty about whether to focus on HED or nutrient-dense (ND) foods. For instance:

  "There is some question as to exactly which high calorie food to apply the design to" (PD-06-LJX)

  "Clear food target; The recommended daily portion intake of a person. This is important for me to decide the details of the design" (PD-09-RXY)

- Specific food product information: The designers emphasised the importance of accessing detailed nutritional information for the selected food products. This includes information about product nutrition, ingredients, specific benefits and potential risks. For example:

  "What is healthy food? The recommended daily intake of different nutrition." (PD-11-XLL)

- General healthy diet knowledge: The designers highlighted the need for an in-depth understanding of general healthy diet principles. This knowledge would help inform their design decisions effectively. For instance:

  "To get relevant healthy diet recommendations for daily intake. The recommended energy intake per day, daily protein or sugar intake for an adult are the key factors for the design of packaging details" (ST-16-YWZ)

Need for Solid Data and Insights into Packaging Impacts and Consumer Behaviours

The designers emphasised the significance of accessing solid data and insights into packaging impacts and consumer preferences. They expressed a desire for concrete infor-

mation that would enable them to understand how different packaging attributes influence consumer behaviour and food intake. They highlighted the lack of specific data on the effects of packaging on consumer behaviours, which poses a challenge to supporting purposeful and informed packaging design efforts.

> "It would certainly be helpful to have solid data and conclusions. It is like applying medicine according to indications." (PD-10-WX)

> "I know that packaging features could influence the intake but can't say more specific. I think it is very useful to access to that information. Especially the field experimental data, make design more reasonable." (PD-11-XLL)

> "I need data on target audience preferences and behaviours for healthy food packaging." (ST-14-SNS)

> "How different packaging elements affect people's mind and behaviour. Some survey data about the insights of the consumers on this food." (PD-09-RXY)

3.2.2. Inspiration Needs: Packaging Design Examples and Psychological Theories

In addition to the basic design background information, the designers expressed a clear desire for inspiration materials to enhance their packaging ideation process. Specifically, they emphasised the importance of accessing packaging design examples and understanding the psychological theories behind consumer behaviour. Many designers noted the scarcity of relevant packaging design examples in the current market or online sources, including both successful and poor examples. This limitation impeded their ability to learn from others' design ideas so that their design efficiency could be improved. For instance:

> "Tried to find some related design examples. But limited findings. It will take a long time to search everywhere online. Not convenient. I need to get some inspirations from other design area." (PD-09-RXY)

Moreover, the designers recognised the value of studying successful packaging cases to identify common characteristics and draw inspiration for their own designs. This sentiment underscored the importance of learning from industry best practices and leveraging successful design strategies to inform their own work.

> "Some popular design examples will be useful. Some bad examples are also useful to see, so that it can be avoided in my design." (PD-09-RXY)

> "Equally positioned packaging success cases, study the characteristics and identify commonalities" (PD-03-TBB)

Additionally, the designers expressed a keen interest in acquiring knowledge of colour theories and psychological theories to better understand consumer behaviour and apply this knowledge to their packaging designs. This reflected their recognition of the psychological factors influencing consumer perceptions and purchasing decisions, highlighting the need for a deeper understanding of these principles.

> "I wish to get more colour theories and psychological theories." (ST-17-YBP)

3.2.3. General Support Requirements

When asked about their preferences for design aids, the designers articulated two main components of their support needs: usability and information presentation. In terms of usability, the designers emphasised the importance of simplicity, convenience and free access to design aids. They valued tools that were easy to use and readily accessible, enabling them to efficiently gather information and support their design tasks. For example, the participants highlighted the need for tools that allow users to search and browse for information freely, emphasising the importance of user-friendly interfaces.

> "Convenient and easy to use." (PD-02-TBA)

> "Easy to use and could reach a wider audience." (PD-03-TBB)

"Allows users to search and browse for information freely." (PD-06-LJX)

Furthermore, the designers expressed a preference for concise and visually appealing information presentation. They emphasised the importance of visualising words or data through graphics and images, as well as the need for clear and concise communication of design concepts. The participants stressed the importance of tools that facilitate easy information retrieval and promote visualisation, allowing them to quickly find the information they need and effectively communicate their design ideas.

"Visualising the words or data; more pics." (PD-07-LXY)

"Inspire designers in a clear and concise way. Tell designers what you want to communicate in one sentence. This tool should let designers to easily find the information they need. Graphics-based, with a focus on visualization. Too many words will not have a good impact. If charts and data presentation are necessary, it is best to keep it simple and visualized" (PD-11-XLL)

Overall, the designers' inspiration needs revolved around accessing relevant design examples and understanding psychological theories, while their general support requirements focused on usability and information presentation. Addressing these needs is essential for providing designers with the necessary resources and tools to create effective packaging designs for promoting healthy eating.

4. Discussion

4.1. Building Understanding of the New Role of Packaging

The role of food packaging design has evolved significantly, expanding beyond its traditional function to encompass a multifaceted approach to promoting healthy eating. Contemporary perspectives emphasise packaging as a vehicle for communication, conveying brand identity and product information and influencing consumer behaviours [50,51]. Furthermore, designers are increasingly integrating sustainable principles into their packaging designs to address environmental concerns and contribute to sustainable product-package design [52], aligning with the industry's increasing emphasis on sustainable practices [53]. As research continues to explore the impact of food packaging on consumer eating behaviours [54,55], it becomes imperative for designers to understand the evolving needs of the public health-oriented packaging design market. Excessive intake of HED foods is not only harmful to humans' well-being [56], but also contributes to food waste to some extent [57]. Therefore, the promotion of healthy eating not only promotes the sustainability of human health but also the sustainability of food resources.

However, this study indicated a notable gap in understanding among designers regarding the promotion of healthy eating through packaging design, revealing that this remains a nascent area for designers. Currently, designers appear to focus primarily on sustainably promoting healthier food options, which means they prioritise encouraging healthy food intake [58], neglecting the opportunities to apply design principles to decrease the intake of HED foods. For instance, previous studies have demonstrated the potential of food packaging design to influence portion control, with strategies such as smaller sizes [59], partitioning of packaging [60] and resealable packaging [61] leading to decreased consumption. Furthermore, visual presentation cues, such as pictorial serving size recommendations [62,63] and pack image size [64], have been shown to affect the consumption of HED foods. These findings indicate the untapped potential for health-oriented food packaging design and highlight the need for designers to consider a broader range of strategies to support healthy eating behaviours.

In addition to the lack of understanding of the role of food packaging in portion control, the designers' concerns about marketing may have hindered their exploration of portion control strategies for HED foods. Professional designers, in particular, express apprehension about the potential impact on sales and profitability, viewing packaging as a primary marketing tool [65]. This reluctance among designers to explore portion control strategies in food packaging design stems from their perception that such approaches may

compromise the attractiveness of the package, potentially leading to negative feedback from consumers and impacting purchasing behaviour. This concern highlights the importance of incorporating consumer preference data into the design process. However, recent research, such as that conducted by Tang et al. [40], has demonstrated that it is indeed possible to strike a balance between attractiveness and the integration of portion control features, but it has also indicated a willingness to pay more for a product packaged in this manner compared to regular brand products. Similarly, Chu et al. [30] discovered that consumers favour packaging designs that facilitate portion control. For example, single-serving packs are perceived as a convenient and practical solution. Thus, it is essential to help designers build a deeper understanding of the role of packaging in promoting portion control. By gaining comprehensive insights into consumer preferences and behaviours related to portion control, designers can harness the potential of food packaging to positively influence consumer behaviour and encourage healthier eating habits through a daily, sustainable interaction with consumers. Therefore, providing designers with comprehensive insights into consumer preferences and behaviours related to portion control can empower them to develop innovative packaging solutions that maximise the impact of food packaging on promoting healthy eating.

4.2. Challenges of Gathering Useful Materials for Design Idea Generation

In the dynamic landscape of food packaging design, designers face the challenge of navigating interdisciplinary complexities. Restrepo and Christiaans [66] emphasise the importance of designers possessing specific experience in tackling design problems effectively. However, many designers express familiarity with traditional food packaging design but find themselves on unfamiliar terrain when it comes to designing for healthy eating. This unfamiliarity highlights the necessity of addressing designers' knowledge gaps to ensure they are equipped to navigate new design areas [67].

Designers highlight the multifaceted nature of the challenges in accessing reliable information across diverse domains when dealing with new design areas. They emphasise the time-consuming nature of gathering extensive information and the complexity of the terminology, compounded by the inconsistency of the available data. This reveals the urgent need for comprehensive, consistent and trustworthy information to support designers in their endeavours for a specific design [68] towards packaging design for healthy eating.

Designers underline the significance of comprehensive background information, including specific food categories, nutrition information and insights into healthy eating. Song et al. [69] also underscored the importance of supporting information in guiding specific design tasks. In addition, designers emphasise the need for data on how packaging impacts consumers eating behaviours. Such insights are crucial for informing design decisions and understanding consumer preferences. Incorporating such information into the design process is essential for providing designers with valuable insights and empirical characteristics to interpret their design task effectively [70] and the creation of impactful design ideas.

Many designers lament the scarcity of available design examples, highlighting the need for more diverse sources of inspiration. Sarkar and Chakrabarti [71] noted that external stimulus can lead to increased creativity during the idea generation phase of design. However, Viswanathan et al. [72] argued that the manner in which external examples are presented to designers can influence creativity and fixation. Therefore, while providing design examples is essential, efforts must be made to avoid fixation and encourage exploration and creativity.

Designers express a need for psychological theories to support their ideation processes. Such theories can guide learning and problem solving, providing valuable insights into consumer motivation and behaviours [73,74]. Understanding the underlying causes and mechanisms of design challenges is crucial for developing effective solutions in interdisciplinary project development contexts [75].

4.3. Support Requirements for Designers

Designers prioritise tools and resources that are designer-friendly, emphasising ease of use, simplicity and visual engagement. Visual materials play a crucial role in facilitating creativity and ideation among designers. Rose et al. [76] highlighted the importance of visual elements in enhancing accessibility and comprehension. Visual engagement allows designers to incorporate visual details into their ideas [77]. Moreover, Casakin [78] discussed the common use of visual analogies and displays in design problem solving, which aids in the search for creative design solutions. Incorporating meaningful visual cues and imagery datasets can provide valuable insights and inspiration for designers' work [79].

Addressing the challenges and needs of designers throughout the design process is essential for leveraging the potential of food packaging to encourage healthier eating behaviours. By providing comprehensive insights, data and examples, designers can develop innovative packaging solutions that maximise the impact of food packaging on public health.

4.4. Strengths and Limitations

The consideration of food packaging design from a new perspective presents a significant strength of this study. By introducing the new role of food packaging to designers, this study sheds light on the potential for packaging to play a pivotal role in promoting healthy eating. Furthermore, it highlights the importance of designers assuming greater responsibility in shaping the food packaging landscape, thereby potentially influencing consumers' dietary choices positively and sustainably. By gaining insights from both professional designers and student designers, this study achieves a deeper understanding of the challenges and needs faced by designers in this evolving field. By capturing diverse perspectives, our study provides a comprehensive view of the complexities inherent in food packaging design and the associated implications for healthy eating promotion.

However, it is important to acknowledge a limitation within this study's methodology: the recruitment of designers from different areas with varying levels of expertise, particularly the absence of direct involvement from designers working in food companies. To address this limitation, future research could benefit from the inclusion of a more targeted and specialised pool of participants. By engaging directly with designers immersed in food packaging design within relevant industries, researchers can obtain insights that are more directly relevant to the challenges specific to this domain. This targeted approach will enhance the validity and practical relevance of the study findings, thereby facilitating more informed decision-making and innovation within the field of food packaging design.

5. Conclusions

Food packaging plays a significant role in shaping consumers' perceptions and behaviours, making it a key environmental factor with significant implications for public health and sustainability. Studies have consistently shown that food packaging has a direct influence on consumer perceptions and eating behaviours. Designers, therefore, have a substantial role in leveraging their expertise in packaging design to create supportive environments that encourage healthier dietary choices and contribute to reducing food waste, creating a synergistic win–win scenario for both public health and environmental sustainability. The findings highlight the pressing need for additional design assistance tailored to the unique demands of food packaging design aimed at promoting healthy eating.

Moving forward, several avenues for future research and action emerge. Firstly, efforts should be directed towards guiding designers to fully understand the power and influence that their packaging designs can exert on promoting healthy eating behaviours. Given that both student and professional designers may be relatively new to the field, comprehensive educational initiatives are warranted to enhance their awareness and understanding. Secondly, there is a need to translate the identified needs of designers into appropriate support tools and resources that facilitate the effective use of food packaging to promote

healthy eating. By addressing these needs, designers can maximise the impact of their packaging designs on fostering healthier dietary choices among consumers. In addition, promoting healthy eating through food packaging requires a multifaceted approach. This includes researchers conducting further research to deepen their theoretical understanding of the impact of food packaging on consumer behaviour. This also requires designers to tap into their creativity on how to achieve sustainable positive guidance on consumer perception and eating behaviour through packaging design and thus promote the establishment of healthy eating habits. Furthermore, the observed conflict may be widely viewed as corporate social responsibility, holding a food company responsible for the product's environmental impact and the impact of the role of packaging. Thus, fostering a sense of responsibility [80] and the direction of the goal among food companies and policymakers is essential, alongside garnering governmental, policy-level support or initiatives [81] aimed at promoting healthy eating through packaging design towards a more supportive and sustainable food environment.

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