



# Knowledge, Messaging, and Selection of Whole-Grain Foods: Consumer and Food Industry Perspectives

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## ABSTRACT

**Objective:** To explore whole-grain food definitions in labeling and relevance to consumers and the food industry.

**Design:** Semistructured focus groups and interviews.

**Setting:** Online.

**Participants:** Consumers (n = 43) aged  $\geq 18$  years currently purchasing/consuming grain foods. Food industry participants (n = 17) currently/recently employed within grain food companies.

**Phenomenon of Interest:** Impact of using whole-grain food definitions in labeling.

**Analysis:** Inductive thematic analysis.

**Results:** Six major themes included: consumer knowledge and understanding of whole-grain foods; factors affecting consumer grain food choices; consumer skepticism of labeling; consumer preferences toward whole-grain labeling; acceptability and feasibility of whole-grain food definitions in the food industry; and food innovation/reformulation. For the food industry, definitions impact feasibility, food innovation, and reformulation. Skepticism affected consumer knowledge and understanding, impacting grain food choice and their preference regarding whole-grain labeling. Consumers preferred whole grain in the name of a food and placing the percent of whole grain on the front-of-pack.

**Conclusions and Implications:** Our findings suggest that definitions and regulations, consumer education, and strategies addressing factors influencing consumer choice are needed to improve population whole-grain intakes. Future research may consider formal regulation and implementation of standardized whole-grain food definitions in labeling and explore the subsequent impact on consumer choice and whole-grain intake.

**Key Words:** whole grain, labeling, definitions, health promotion, qualitative (*J Nutr Educ Behav.* 2022;54:1086–1098.)

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## INTRODUCTION

Consumption of whole-grain foods contributes to a reduced risk of chronic disease and associated mortality.<sup>1,2</sup> Consequently, whole-grain consumption is encouraged in many regions of the world on the basis of dietary guidelines.<sup>3</sup> However, despite numerous health benefits and recommendations, whole-grain intake remains low globally.<sup>4</sup> A

recent study showed global whole-grain intakes were well below optimal levels, and a diet low in whole grains was the leading dietary risk factor for cardiovascular disease mortality and disability-adjusted life years.<sup>5</sup>

To improve population-wide whole-grain intake, various strategies, including whole-grain content labeling of foods, have been implemented across the globe to better

promote whole grains and their consumption. For example, in the US, the Whole Grains Council introduced the Whole Grain Stamp to help consumers identify products made with whole grains.<sup>6</sup> In Australia, the Grains and Legumes Nutrition Council has a nonbinding Code of Practice for Whole Grain Ingredient Content Claims, which provides guidance on minimum levels of whole grain to carry a content claim.<sup>7</sup> However, regulations around whole-grain content labeling and whole-grain foods are not enforced. For example, Food Standards Australia New Zealand governs aspects in relation to food composition and food labeling under the Food Standards Code and defines the term whole grain but not whole-grain food.<sup>8</sup> The Food Standards Code also regulates nutrient content claims, but whole grain is not included as it

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is not considered a nutrient.<sup>9</sup> When properties of foods are not covered under the standards (eg, whole grain), food manufacturers can state the food does or does not contain the property and/or specify the number of properties in the food with no limitations.<sup>10</sup> This is problematic, leading to inconsistent and misleading whole-grain messaging to consumers, and subsequently may hinder improvements in population whole-grain intake. Multifaceted strategies across multiple stakeholders, including clear, reliable labeling regulations, are needed to improve population whole-grain intakes successfully.<sup>6,11</sup>

There has been a lack of guidance for regulations on labeling because of the use of various whole-grain food definitions globally. This variation creates uncertainty in the food industry around product development and labeling and leads to consumer confusion from inconsistent and misleading product labeling that may further contribute to low whole-grain intakes.<sup>12</sup> To address this issue, the Healthgrain Forum and, more recently, the Whole Grain Initiative (WGI) have proposed recommendations for a unified and global whole-grain food definition.<sup>12,13</sup> The WGI proposal suggests that a whole-grain food shall contain at least 50% ingredients as whole grain based on dry weight, and foods containing a minimum of 25% ingredients as whole grain based on dry weight may make a front-of-pack claim on the presence of whole grain but cannot be designated whole grain in the product name. It is hoped that the adoption and application of consistent whole-grain food definitions in the food industry and public health settings will establish clear guidelines across the food industry for formulation and labeling of products, assist consumers in identifying and making higher and healthier whole-grain food choices, and ensure consistent messaging and promotion of whole grains.<sup>13</sup>

To explore the impact of these definitions, this study considered how whole-grain food definitions might resonate with consumers, their use in the food industry, and the relevance they hold in both settings to improve

population whole-grain intake. To achieve this, we conducted semi-structured focus groups with Australian consumers and interviews with food industry personnel. We explored knowledge around whole grains and definitions of foods, with a particular focus on labeling.

## METHODS

This study consisted of 2 components: an Australian consumer and an international food industry perspective.

### Participants and Recruitment

Convenience sampling methods were used to recruit consumer participants by distributing advertisement flyers in several community locations, including a university campus, surrounding supermarkets, community notice boards and libraries, and social media. Inclusion criteria required that participants were aged  $\geq 18$  years and purchase and consume grain food products. We excluded individuals who had previously undergone formal nutrition and/or dietetics education. Following initial recruitment, a purposive maximum variation sampling method<sup>14</sup> was used to capture demographics underrepresented in the initial recruitment phase, particularly those relating to age and gender. This type of recruitment consisted of previously listed advertisements and word of mouth particularly targeted toward men and older individuals who were underrepresented in initial recruitment. Recruitment of consumer participants continued until data saturation occurred, whereby no new themes emerged during data analysis.

Purposive sampling techniques were used to recruit food industry personnel, including dietitians, nutritionists, food scientists, research and development personnel, marketing personnel, and regulatory personnel, all aged  $> 18$  years, to obtain a broad range of perspectives. Participants were currently or recently employed in the food industry within Australian or international companies involved in the processing, manufacturing, and marketing of

grain-based products. Participants engaged as individuals with expertise in the field rather than company representatives. Participants were recruited through direct email to relevant individuals known to the researchers and, after that, via snowballing.<sup>15</sup> Recruitment continued until data saturation occurred, whereby no new themes emerged during data analysis.

Ethics approval was granted by the University of Wollongong Ethics Committee (approval no. 2021/004) following an executive committee review for low/negligible risk studies. All participants provided written informed consent.

### Data Collection

Consumer perspectives were obtained through semistructured focus groups consisting of 3–5 participants between April and June 2021. All groups were conducted by the lead researcher or a secondary researcher and took 45–60 minutes to complete. When possible, a secondary researcher acted as an additional facilitator to the focus groups. Focus group questions were open-ended and divided into 4 main topic areas: (1) exploration of consumer grain food choices and whole-grain consumption, (2) consumer identification of whole-grain foods, (3) consumer perceptions on current front-of-pack labeling, and (4) consumer opinions on hypothetical front-of-pack labeling using varied whole-grain prompts (Supplementary Table 1).

For topic 3, participants were provided the front-of-pack labeling for 3 bread products and 5 ready-to-eat cereal products separately. All products contained whole grain and were sold on Australian supermarket shelves at the time of the study (Table 1). Products within each food category differed in their whole-grain content, and the types of labeling varied greatly, for example, the inclusion of nutrient profiling systems (Health Star Rating [HSR]),<sup>16</sup> various nutrient content claims, and claims related to specific health conditions such as low glycemic index. Based on packaging, participants were asked to identify and provide a reason as to

**Table 1.** Overview of Commercial Bread and Cereal Products Displayed to Australian Consumer Participants in Focus Groups (n = 43)

Products	Whole-Grain Content (%)	Health Star Rating Displayed <sup>a</sup> (Yes/No)	Description of Whole-Grain Specific Labeling	Description of Other Labeling
Bread				
Bread A	17	Yes	—	—
Bread B	60	Yes	—	—
Bread C	15	Yes	Whole grain in the name	Low glycemic index
Ready-to-eat cereal				
Cereal A	64	Yes	—	—
Cereal B	25	Yes	—	Gluten-free; prebiotic fiber; low FODMAP
Cereal C	53	Yes	Nutrients from whole grains are linked to health benefits	Other nutrient content claim
Cereal D	46	No	Mention of whole grain as an ingredient	Other nutrient content claim; no artificial colors or preservatives
Cereal E	73	Yes	Whole-grain content claim; mention of whole grain as an ingredient	—

FODMAP indicates fermentable oligosaccharides, disaccharides, monosaccharides, and polyols.

<sup>a</sup>Health Star Rating is a front-of-pack labeling system based on nutrient profiling in Australia.

which product they perceived as the healthiest and which product they believed contained the highest and lowest quantities of whole grain for each food category.

In topic 4, participants were given 5 hypothetical front-of-pack labels for a whole-grain product created by the researchers, consistent with the WGI recommendations for whole-grain food. All hypothetical labels (Supplementary Figure) shared generic features, including the brand name, esthetic design, and generic labeling. Nuances were present in the name of the food, for example, whole grain cereal vs cereal, and in the presence and wording of whole-grain content claims. All hypothetical labels represented a product with whole grain at 55% while comparing content claim options (ie, “contains whole grain” claim, a whole-grain percentage content claim, high in whole grain claim, and whole-grain content per serving claim). Based on the hypothetical labels shown, participants were asked to identify and provide a reason as to which label most resonated in relation to understanding whole-grain content and which label was most likely to

convey a meaningful description of the content and quantity of whole grain.

Food industry perspectives were obtained through semistructured interviews conducted 1-on-1 (or 1 instance of 2 participants) between March and April 2021. Interviews were 30–45 minutes each, conducted by the lead researcher or secondary researcher. Interview questions were open-ended and structured to gain insight into (1) current awareness and understanding of whole-grain food definitions and regulation, (2) hypothetical adoption of whole-grain food definitions in the food industry setting, and (3) the impact on consumers (Supplementary Table 2). An excerpt of the WGI’s Global Whole Grain Food Definition document detailing the definition of whole-grain food and requirements for designating the presence of ‘whole grain’ front-of-pack was used to guide questions on definitions (Supplementary Table 3). Probing questions and prompts were also used.

General demographic information was collected via a questionnaire before consumer focus groups (age,

gender, educational attainment, employment status, and residential area) and food industry interviews (gender, educational attainment, current employment role, and employment history in the food industry). Data related to gender was obtained through a choice response (man, woman, prefer not to say, or other) to describe the sample.

All focus groups and interviews were conducted online and audio recorded via the video conferencing platform Zoom (version 5.7.7, Zoom Video Communications Inc.) and transcribed electronically through the Otter.ai transcription program (Otter.ai Inc, 2021), with further review manually to ensure verbatim transcription. As deemed by the researchers, any identifiable information about the participant or food industry personnel was removed from the transcripts.

### Data Analysis

Data for both components were analyzed using inductive thematic analysis, following the 6-phase analysis guide outlined by Braun and Clarke (2006).<sup>17</sup> All researchers were

**Table 2.** Demographic Characteristics of Australian Consumer Participants (n = 43)

Characteristics	n (%)
Age, y	
18–25	23 (53.5)
26–35	2 (4.7)
36–45	2 (4.7)
46–55	10 (23.3)
56–65	4 (9.3)
≥ 65	2 (4.7)
Gender <sup>a</sup>	
Men	15 (34.9)
Women	27 (62.8)
Other	1 (2.3)
Highest level of education	
Partially completed high school	4 (9.3)
Completed high school/y 12	6 (14.0)
Certificate or diploma	7 (16.3)
Bachelor's degree	19 (44.2)
Master's degree	2 (4.7)
PhD/doctoral degree	4 (9.3)
Prefer not to say	1 (2.3)
Employment status	
Employed, working full time	25 (58.1)
Employed, working part time	4 (9.3)
Employed, casual	4 (9.3)
Not employed	3 (7.0)
Student	3 (7.0)
Retired	4 (9.3)
Geographical area	
Major urban (population ≥ 100,000)	36 (83.7)
Other urban (population 1,000–99,999)	7 (16.3)
Rural (population < 1,000)	0 (0.0)

<sup>a</sup>Gender was obtained through a choice response of man, woman, prefer not to say, or other to the question, What is your gender?

accredited practicing dietitians, with 2 researchers experienced in qualitative research and 1 a novice. First, researchers were familiarized independently with the data through reading and re-reading the transcripts. Initial codes based on all transcripts for focus groups and interviews were generated by the primary researcher using a systematic method and stored within the qualitative data analyses software NVivo (version 12, QSR International Pty Ltd, Melbourne, Victoria, Australia, 2018). Codes were then collated into broader potential themes. Generation and analyses of codes and potential themes were completed in duplicate independently by a second researcher, with the final development of themes and the relationships between themes determined by all

authors through discussion. Quotes reflective of themes were extracted by the primary researcher and included as examples following approval from all researchers. All quotes were deidentified and labeled according to focus group number, participant gender and number (eg, FG1W1), participant completion of interviews, and current employment role (eg, Industry 1 Food Scientist).

## RESULTS

A total of 43 consumers participated across 10 focus groups, whereas 17 food industry personnel participated across 16 interviews. Full demographic data for consumers and food industry personnel are presented in [Tables 2 and 3](#).

Six major themes were generated, and interrelation between themes was noted ([Figure 1](#)). The major themes identified included (1) consumer knowledge and understanding of whole-grain foods, (2) factors affecting consumer grain food choice, (3) consumer skepticism of grain food labeling, (4) consumer preferences toward whole-grain food labeling, (5) acceptability and feasibility of whole-grain food definitions in the food industry, and (6) innovation and food reformulation. Consumer skepticism fed into the key theme of consumer knowledge and understanding, which impacted factors affecting consumer grain food choices. Food industry personnel also highlighted this skepticism as highly relevant to whole-grain foods. When consumers were asked to choose preferred labeling in relation to the whole-grain content of foods (based on concepts from the WGI definition), they expressed relatively clear preferences, which were also informed by themes of understanding and, in particular, skepticism. Finally, it was highlighted that the definitions of whole-grain food in the food industry impact feasibility, food innovation, and reformulation; therefore, they affect consumer choice.

### Theme 1: Consumer Knowledge and Understanding of Whole-Grain Foods

It was evident among consumers that there was a lack of understanding around whole-grain foods, specifically confusion and uncertainty around what defines whole-grain food and how to identify such foods. Consumers defined whole-grain food as unprocessed, raw, or in its most natural state but could not provide further detail. There was evident confusion about the difference between whole grain and wholemeal, particularly in relation to bread, with some participants indicating that wholemeal did not contain as much grain as whole grain (although in Australia, wholemeal bread is considered whole grain). This limited understanding contributed to consumer skepticism and affected consumer views and opinions on whole-grain labeling

**Table 3.** Demographic Characteristics of Food Industry Participants (n = 17)

Characteristics	n (%)
Gender <sup>a</sup>	
Men	4 (23.5)
Women	13 (76.5)
Country	
Australia	12 (70.6)
US	3 (17.6)
France	1 (5.9)
Canada	1 (5.9)
Highest level of qualification	
Bachelor's degree	5 (29.4)
Master's degree	6 (35.3)
PhD/doctoral degree	6 (35.3)
Current position/role	
Dietitian/nutritionist	4 (23.5)
Food scientist	2 (11.8)
Regulatory personnel	3 (17.6)
Marketing personnel	2 (11.8)
Research and development personnel	1 (5.9)
Combined role	5 (29.4)
Length working in current role, y	
2–5	6 (35.3)
5–10	5 (29.4)
10–15	4 (23.5)
15–20	1 (5.9)
>20	1 (5.9)
Length working in the food industry, y	
2–5	1 (5.9)
5–10	5 (29.4)
10–15	2 (11.8)
15–20	7 (41.2)
> 20	2 (11.8)

<sup>a</sup>Gender was obtained through a choice response of man, woman, prefer not to say, or other to the question, What is your gender?

preference. Food industry participants were aware that there is predominantly a lack of consumer knowledge around whole-grain foods.

*I'm not really 100% sure of what whole grains are, I suppose just unprocessed grain. (FG10W1)*

*It says whole meal and I don't know if that's the same thing as whole grain. I don't know. (FG6W1)*

*I think they're really confused. First of all, they don't know what grains are counted as whole grains, and secondly, they have no idea how much they're meant to have. (Industry 11 Dietitian/Nutritionist)*

When consumers were asked how they identify whole-grain foods at the supermarket, the most common responses involved looking at the visual of the product, specifically looking for the grains or looking at the labeling of the product for the words whole grain. However, there was prominent uncertainty around whole-grain labeling on foods, with some participants unable to recall seeing any specific whole-grain labeling on food packaging.

*I'm literally looking to see the grains through the little plastic windows of the food. (FG1M1)*

*I look at the pictures on the label. Or if I'm in a particular aisle of a grocery store, I'll also make an assumption, based on that aisle,*

*that it's got whole grain foods in it. (FG10M2)*

*I'd be relying on the labeling on the food. (FG6M3)*

A few consumers noted that they had seen some form of whole-grain labeling, particularly on specific types of foods, but only some could describe or provide detail. Common types of whole-grain labeling identified were content claims or a symbol, but these images were not as well recognized as other types of labeling, such as those related to sugar, fat, or salt. Although some participants could not identify any specific whole-grain labeling on products, they did note that the packaging on whole-grain foods was often depicted as natural images.

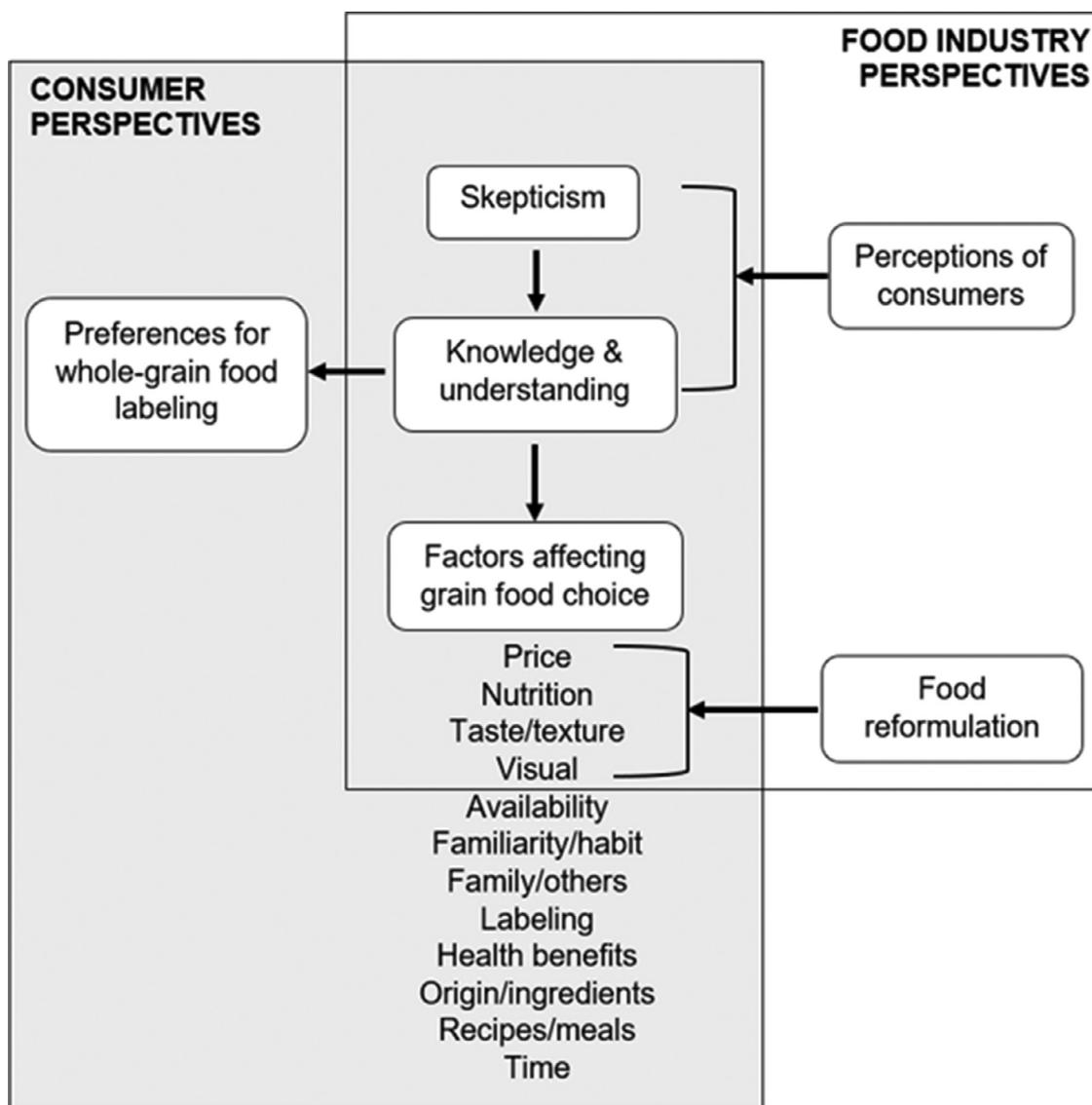
*Generally, they'll have on the packet made with whole grains, or whole grain, high in whole grain content, or something like that on the box. (FG7M2)*

*I can picture sugar contents and low sugar, low fat, you know, but no, I can't say I can see anything for the advertising whole grains on packaging. (FG5W1)*

## Theme 2: Factors Affecting Consumer Grain Food Choice

Participants consumed various grain foods depending on product type, ranging from white to wholemeal to whole grain to gluten-free. Across focus groups, it was clear that many factors influence consumer grain food choices. The confusion and lack of understanding held by consumers, specifically around whole-grain foods and labeling, led to a focus on some of these factors to guide choices. Some factors were relevant to grain foods, some specific to whole-grain foods, and others relevant to both (Table 4).

Consumers recognized that the availability of products influences choice as options might be limited in places such as rural communities or smaller food outlets. However, when choices were abundant, participants would choose products or brands they were familiar with, with many purchasing the same products out of



**Figure 1.** Relationship of themes arising from Australian consumer (n = 43) and food industry perspectives (n = 17) around whole-grain food definitions, labeling, and grain food choice.

habit. In addition, consumer choices were heavily influenced by the preferences and purchasing behaviors of those around them, namely family members.

Participants tended to choose products on the basis of the known level of health benefits. For example, consumers stated that they generally chose wholemeal or multigrain over white bread, identifying that these were better for health, although not understanding why. Consumers were also strongly guided by known metrics of food quality, such as the HSR, which they found an easy tool for product comparison. The overall

labeling, wording, and specific claims on the pack further influenced consumer choice, selecting products that look healthy or have claims around low glycemic index, high fiber, or low sugar. Participants were more likely to look for more deleterious ingredients and nutrients, especially sodium, sugar, and fat. Positive components considered were fiber, low glycemic index, and prebiotics, but rarely whole grain. Some participants preferred food products with minimal ingredients and were more likely to choose products made or grown in Australia, with some looking for a specific symbol to identify this. As

described in theme 1, it was apparent that participants used visual cues (what the product looked like) to make choices around products with higher whole grain.

When choosing grain foods in general, consumers reported that they would often consider the price of products and choose the cheaper product available. Many participants had a perception that eating healthfully, including consumption of whole-grain products, is expensive. Some participants would also choose product types and varieties on the basis of the dish or a specific recipe being followed. Taste and texture are

other factors that participants considered in making grain food choices. For some, this promoted choices toward whole-grain foods, whereas it deterred others. Finally, and most predominantly in relation to brown rice, participants would make their choice on the basis of the amount of time it takes to cook a product, hence choosing white rice.

### Theme 3: Consumer Skepticism of Grain Food Labeling

Skepticism was a prominent aspect affecting consumer understanding and, consequently, consumer grain choices. In consumer focus groups, there was skepticism of grain food labeling, specifically around whole-grain content claims, various symbols, including the HSR, and the marketing of products as healthy. This skepticism was evident following prompts with genuine products to consumer participants. In addition, some consumer participants were skeptical of the number of claims being used on the pack, but conversely, others were skeptical when minimal information was provided. Food industry participants believed many consumers were skeptical about claims used on front-of-pack labeling.

*I'm not always convinced by the labels... I don't know how much whole grain a product has to have, to get a label to say that it's made with whole grains. Does it mean it can only be 5%? 3%? I don't know. (FG1W3)*

*Not only does it say 4.5 stars, but I'm not being duped by that. Because I feel like this is like a scam. (FG4W3)*

*I feel like because [Cereal A] has like no information on the front, it's almost misleading to the point where it actually is the worst in my mind. But you know, I guess more information on the front the better. (FG6M2)*

*[Consumers] don't believe a lot of things, they probably don't believe the product name, and they probably don't believe the claim on pack. So they're very skeptical about things. (Industry 8 Regulatory Personnel)*

### Theme 4: Consumer Preferences Toward Whole-Grain Food Labeling

As described, consumers were confused and uncertain about current practices around whole-grain labeling, and this was influenced by their current understanding. When consumers were provided with various hypothetical labels related to whole-grain, they expressed a strong preference toward the use of whole grain within the name of the food (whole-grain cereal; hypothetical A) as opposed to a separate whole-grain content claim (contains whole grain; hypothetical B) not in the name of the product. Consumers liked the more prominent reference to whole grain and considered it more trusted and believable, whereas substantial skepticism toward the contains whole grain content claim emerged. In contrast, food industry participants generally did not consider consumers would be able to notice the nuances in front-of-pack labeling.

*The [whole-grain cereal] is probably more likely to be true than the one that put it as a little sidebar. (FG10M3)*

*You've advertised what it is front and center, you don't have to look too hard to know what the product is made of. (FG3W1)*

*It almost seems like they sprinkled in some whole grain just so they could put the bubble there you know. Like they're getting away on a technicality [re hypothetical B]. (FG7W1)*

*I don't think that [consumers] would decipher the nuances between saying a whole-grain cracker versus this contains a serving of whole grains. I think they see the word whole grains and think they are one in the same. (Industry 13 Combined Role)*

When provided with different labels describing whole-grain content, consumers stated that a simple statement on the percentage of whole grain in the product was preferred (hypothetical C). This statement was considered clear, and participants could easily understand the

meaning, whereas claims advertising a quantity of whole grain per serve were poorly understood (hypothetical E). Eleven participants preferred a broader type of claim, indicating a product is high in whole grain (hypothetical D), contrasting the majority of participants that were skeptical toward this content claim method.

*At least I know what 55% is. And I know whenever I took a spoonful of that I'd be getting more than 50%, half of it as whole grain. (FG10M2)*

*I don't really have any idea of what, like, what is 16 grams of whole grain per serve mean? (FG1W2)*

*High in whole grain because it's simple. When they start going into numbers, it gets a little bit more tricky. (FG2W1)*

*High, I mean, how much is high? They're not telling us. (FG4W2)*

### Theme 5: Acceptability and Feasibility of Whole-Grain Food Definitions in the Food Industry

Across food industry participants, there was general acceptability of whole-grain food definitions, specifically the WGI definition. Most food industry participants believed that the current percentages used in the WGI definition of 25% and 50% were clear, appropriate, and made sense to encourage greater whole-grain intake. However, a small number of participants questioned the minimum 25% for particular food categories, and a similarly small number believed the 50% should be even higher to meet consumer expectations.

*I think the 50% is [appropriate]. Obviously, we want to be driving innovation and change. (Industry 7 Combined Role)*

*Fifty percent is great, but if it's at 40% does that mean it's not great? (Industry 8 Regulatory Personnel)*

*Whether 50% is appropriate or whether 90% is appropriate, I don't know. I would have thought that the consumer, you know,*

*would be expecting that if it says whole-grain food, that it contains a lot more than 50%. (Industry 14 Combined Role)*

It was agreed by most food industry participants that the use of the WGI definition could decrease misleading information for both food industry personnel and consumers. Adopting this definition could provide guidance to food industry personnel and create a level playing field, whereas for consumers, it could provide guidance and clarity leading to increased consumer confidence.

*It standardizes across the industry, which levels the playing field, makes it fair for the consumer, they know what they're getting. And at the end of the day, removes ambiguity for everyone. (Industry 8 Regulatory Personnel)*

Food industry participants believed the application of whole-grain food definitions was generally feasible; however, it would be dependent on food categories, such that it may be more feasible for specific foods. Participants noted that the overall acceptability of foods to consumers was important and that manufacturing, development, cost, and reformulation needed to be considered, potentially hindering feasibility.

*I think it's going to be feasible for certain products. . . with oats, you know, I feel like all of them are going to be able to adhere to this no problem, the problem is going to be when it comes to like snack bars. (Industry 1 Food Scientist)*

*If we want people to eat more whole grains, we obviously need the product to taste good. If the minimum level of whole grain that's needed in order to communicate the products contain whole grains is too high, or what impacts the overall acceptability of a product, and that might have implications. (Industry 13 Combined Role)*

*How feasible it is from a manufacturing, development, cost perspective would be the challenge. (Industry 5 Research and Development Personnel)*

## Theme 6: Innovation and Food Reformulation

Food industry participants believed that adopting whole-grain food definitions might also impact reformulation. This may be positive or negative, providing an incentive to increase the whole-grain content in foods to reach requirements and make a claim or decrease the whole-grain content in foods when it is not possible to reach requirements for certain food types. That is, there would be no point adding any whole grain if a claim could not be made. However, all food industry participants recognized that there are multiple factors that drive or need consideration for the reformulation of foods, namely consumer demand and cost. The cost of the raw ingredients for food may increase because of increased whole-grain demand. Manufacturers may be tempted to reduce whole-grain food content or pass this cost on to consumers. In contrast, consumer demand often drives efforts for reformulation and may influence the whole-grain content or whole-grain labeling on the pack.

*[Food companies] might be inclined to sort of maybe boost, make sure that the whole grain content meets the 50%, but indeed the other way, maybe if it was originally sort of 55%, they might wind it back to 50% just to save a portion of a cent. (Industry 14 Combined Role)*

*We always have to think about the cost of goods, right, and what I would hate to see is that the number of whole-grain products on the shelf actually goes down because it becomes too costly. . . but you don't want it to be that they become too expensive for people to buy and eat. (Industry 17 Dietitian/Nutritionist)*

*If we can't claim it, so if the marketers can't talk about it, and it's an expensive ingredient, they're going to swap it, they're going to change it. (Industry 8 Regulatory Personnel)*

Other factors that need consideration for reformulation include the

potential health impact, the ability to market whole grain and healthiness, the impact on shelf life, and the acceptability of the product primarily related to taste, texture, and overall palatability as well as the visual aspects of the food.

## DISCUSSION

Both consumers and food industry personnel identified problems with the current labeling of whole-grain foods and highlighted the need for clear, consistent labeling. It was evident that limited consumer understanding and confusion relating to whole-grain foods contributed to consumer skepticism of labeling, in which they would depend on factors such as familiarity or seek signposts for healthier choices. This lack of understanding and skepticism also influenced the preferences consumers held for whole-grain labeling.

Similar to the current study, previous research highlights consumer confusion and a limited understanding of identifying whole-grain foods. Wilde et al<sup>18</sup> identified that consumers had difficulty identifying the healthiness and whole-grain content in grain products during a discrete choice experiment displaying hypothetical products with and without a whole-grain label and a comprehension assessment. Consumers were more likely to choose the product displaying a whole-grain label despite containing a lower whole-grain content and having other nutritional disadvantages. This indicates that consumers are often misled by front-of-pack labeling and supports the need for further consumer education and regulation around whole-grain labeling. Other studies found that consumers perceived products with whole-grain labeling (as a content claim or a symbol) as healthier than those without,<sup>19–21</sup> but this may not necessarily translate to increased purchasing behavior because of cultural differences, and perceptions may be influenced by product type.<sup>19</sup> Specifically with respect to whole grains, studies have also indicated that consumers could not recognize or were unaware of what a whole-grain food was and subsequently did not know how to

**Table 4.** Factors Affecting Australian Consumer Choices Around Grain Foods and/or Whole-grain Foods (n = 43)

Factor	Example	Relevant to All Grain Food Choices	Relevant to Whole-Grain Food Choices
Individual			
Familiarity and habit	"I've stuck to the same things with rice and cereals and bread probably for over 10 years" (FG10M1) "You tend to follow just what you were brought up on. For many years, I would only eat white rice, because that's all I knew as a child" (FG5W1)	✓	✓
Health benefits	"I generally just understand that wholemeal is more healthy than a refined product" (FG1M1) "I may tend to go for things because I've heard in advertising that it's better for me, but I don't really know why" (FG6W1)	✓	✓
Taste/texture	"I don't like whole grain because I don't like bread with things in it. I don't like the texture of having little grains in it, just makes me uncomfortable. And wholemeal bread, I'll eat it, but I just don't particularly like the flavor" (FG4W3) "I'm so used to eating whole-grain bread now, I wouldn't go back to eating just white bread, purely for taste" (FG6M4)	✓	
Time	"I sometimes don't opt for the brown rice because I can't be bothered waiting how long brown rice takes to cook" (FG6M3)	✓	
Visual cues	"[Bread A] and [bread C], they look like they have more grains and seeds and things through them. So therefore my perception is that they're a bit healthier" (FG4W4) "I wouldn't really look at a label. I just kind of try to look at the product inside, just kind of decide based on that" (FG5M1) "I would still say I'm probably swung, not by the written labels, but by the pictures of things" (FG7M2)		✓
Other individuals (including family)	"If you've got a family, you're having to cater for the majority, and they always seem to want white as well" (FG7W3) "I might lean towards [cereal A], just because my parents eat that. And hopefully I can trust that they've made good choices about their health" (FG3W2)	✓	✓
Recipes/meal	"We obviously eat whatever goes with the meal at the time" (FG9W2) "It's usually because I'm shopping to a recipe I want to make. . . I have a specific thing that will ask for brown rice" (FG10O1)	✓	
Community			
Availability of products	"When you're traveling the smaller towns and communities, it's availability as well, they don't have all the 1000 options that you have at a [major supermarket], you got a loaf of white and a loaf of brown if you're lucky" (FG2M1) "There's a local bakery where I used to live and they were usually out of wholemeal multigrain, they wouldn't really stock it" (FG7W1)	✓	

(continued)

**Table 4.** (Continued)

Factor	Example	Relevant to All Grain Food Choices	Relevant to Whole-Grain Food Choices
Environmental (food industry) Labeling	<p>"I am influenced by the packaging, as well. Like, what kind of looks right and healthy. And if it's got that messaging, I'll probably tend to go for it" (FG10M2)</p> <p>"You are very influenced by the packaging as well. So they all have like low GI or high fiber, all the different things" (FG4W4)</p> <p>"Just because they've made no claims at all, I just feel like if you had any whole grain in there you'd want to make that known" (FG7W1)</p>	✓	✓
Health Star Rating	<p>"I'll maybe use that little five star rating thingy that's down in the corner, as an easy way to choose one product over another" (FG4W1)</p> <p>"I like to think that the higher the health star, I'm thinking the more whole grains because it's better for you" (FG5W3)</p>	✓	✓
Price	<p>"Often I'll pick the dollar spaghetti over the \$4 whole-meal pasta or something" (FG2W1)</p> <p>"Sometimes, you know, healthier foods are more expensive" (FG3W1)</p>	✓	
Nutrients and ingredients	<p>"When I look at a label, I probably am looking at the fat content and the types of fats. I'm looking at the sugar content. . . whether or not it's got a high glycemic index or low glycemic index" (FG1W3)</p> <p>"I try and buy products that have less ingredients" (FG1W1)</p> <p>"It has lower sugar, that's something I would look for. . . normally I would look at the back to get the full nutritional breakdown" (FG3W2)</p>	✓	✓
Origin of products and ingredients	<p>"I like buying Australian products. I know it's better for me" (FG4W2)</p> <p>"I would look for the little Australia logo and the Australian made products" (FG4W3)</p>	✓	

identify whole-grain foods, particularly those described as wholemeal.<sup>22</sup>–<sup>24</sup> This lack of identification is a barrier to whole-grain consumption,<sup>25</sup> although including specific information and labeling on whole-grain content may assist consumers in reaching recommended intake levels.<sup>24</sup> Content and health-related claims used on product labeling appear to have a substantial effect on the dietary choices of consumers.<sup>26</sup>

Without clear regulation and labeling, and adequate consumer education, the benefits of front-of-pack labeling to improve whole-grain intake may be lost.<sup>23,25</sup> Although it is clear consumers gravitate toward

products with whole-grain labeling, our study highlighted the preferences consumers had toward whole-grain labeling types in which they liked whole grain in the name of the food, which could occur with the WGI definition (if the food is above 50% whole grain), and they preferred a percentage of whole grain, rather than grams or use of descriptive words (eg, high in whole grain).

It is also important to consider that consumers are often skeptical of labeling schemes, including the health and nutrient content claims used on products, which ultimately affect consumer choice at the point of sale.<sup>27,28</sup> Similarly, previous

research suggests that consumers are skeptical of front-of-pack labeling on the basis of the perceived credibility of the entity believed to endorse the claim or labeling scheme.<sup>29</sup> Some consumers were more skeptical if they thought the labeling was developed by the food manufacturer as they believed it was used to push particular products rather than provide useful information to assist consumer choice. For example, Pelly et al<sup>30</sup> indicated that consumers were skeptical of the Australian HSR labeling scheme and food industry because of a lack of transparency on how ratings were calculated and a concern that food companies could

alter the nutritional composition of foods to increase perceived healthiness of a product for marketing purposes.

The absence of a standardized whole-grain food definition remains a challenge for both consumers and the food industry and may limit the impact of public health messages.<sup>31</sup> Implementation of consistency across the food industry could provide consumers with clearer information and guidance around whole-grain food choices.<sup>12,32</sup> Previous research has identified that multifaceted whole-grain promotion strategies are needed to increase the number of whole-grain products available and assist consumers in identifying foods higher in whole-grain.<sup>6</sup> The Danish Whole Grain Partnership has shown huge success in increasing mean whole-grain intakes of Danish adults from 33 g/d in 2000–2004 to 69 g/d in 2015–2019 through consumer education and awareness, increased availability and accessibility of whole-grain foods, and clear whole-grain labeling.<sup>33,34</sup>

It was clear from both consumers and food industry personnel that many factors are relevant and affect the choices consumers make regarding whole grains, and these must be considered within whole-grain promotion strategies. Consumers depend on these factors to make decisions because of the uncertainty and confusion experienced around whole-grain foods and the labeling used on these products. The influence of other factors and the difficulty in substantially increasing population whole-grain intake may be explained by the Socioecological Model consisting of various systems and levels that interact between the individual, the community, and the environment.<sup>35</sup> As suggested within other studies,<sup>36,37</sup> influences were at the intrapersonal (eg, familiarity and habit of the individual), interpersonal (eg, influence from other individuals), community (eg, availability of products), and food industry level (eg, product labeling).

Research suggests that consumers are confused about the health benefits and identification of whole-grain foods, which can lead to avoiding certain foods.<sup>31,38</sup> Meanwhile, food availability and affordability, price,

and sensory properties, including taste and texture, were identified as major influences and potential barriers to grain food choice.<sup>22,25,31,38</sup>

Established dietary habits, other family members, and convenience have further influenced this choice.<sup>25,39</sup> Despite these barriers, our research, and recent work exploring perceptions of whole grain and food choice with Australian consumers<sup>38</sup> indicated a gradual shift toward greater whole-grain intake, with consumers preferring whole over refined grain bread, therefore deviating from previous research.<sup>31</sup> This is likely because of a change in consumer demand and increased consumer knowledge through education campaigns; however, as indicated in the current study, many factors continue to pose barriers to consumption.

Interestingly, some factors affecting consumer choice were recognized by food industry personnel in relation to the potential impacts of whole-grain food definitions on food reformulation. In particular, reformulation impacts the pricing of products and product acceptability, including taste, texture, and the visual aspects of the food. The cost associated with whole-grain reformulation, including the price of ingredients, manufacturing, and labeling change, has been identified as a factor negatively impacting both consumers and the food industry and consequently may hinder improvements in whole-grain intake.<sup>40</sup> Although whole grains are typically more expensive than refined grains, the relative cost of whole grains has reduced over time.<sup>41</sup> Food industry personnel recognized that standardized whole-grain food definitions might be beneficial in the development and reformulation of foods, but there were concerns with the viability of high whole-grain proportions in certain foods. Some research has identified high levels of consumer acceptance for foods reformulated with high whole-grain amounts,<sup>42,43</sup> whereas another study indicates reduced acceptability for various sensory properties.<sup>44</sup>

Limitations exist within the current study, predominately related to the recruitment of participants.

Consumer participants were mostly young adults and well-educated individuals, likely resulting from recruitment locations such as universities and social media platforms. A purposive maximum variation sampling method was implemented following initial recruitment to ensure a range of demographics was represented. Despite this, recruitment of older adults was difficult, potentially because of a lack of technological knowledge and hesitation around the privacy of technology as focus groups were held online. It is possible that consumer participants had a greater interest in health than the typical Australian consumer, and responses may not be representative. Social desirability bias may have also been present within focus groups and skewed consumer responses. The recruitment of food industry participants was based on researcher contacts initially, although snowballing assisted in diversifying participants. Although varied opinions were obtained from food industry participants, some individuals may not have been involved in the decision-making process for food labeling, and responses may not have captured the entirety of whole-grain food definition impacts. Furthermore, slight deviations in conducting focus groups (having 1 or 2 moderators) and interviews (involving 2 participants in 1 interview) may have altered responses. Finally, participants were not involved in validating focus groups or interview transcripts to remove identifiable information; however, researchers applied their professional discretion.

## IMPLICATIONS FOR RESEARCH AND PRACTICE

Using standardized whole-grain food definitions in the food industry could reduce misleading information and provide clearer guidance and labeling for consumers. Consumer skepticism could remain despite formal regulation of whole-grain labeling, thereby warranting further monitoring of consumer perceptions and choices. More broadly, a global whole-grain labeling scheme based on standardized whole-grain food definitions could be

beneficial to ensure consistency in messaging across countries; however, adoption into existing schemes may be difficult and require long and complex processes. Future research may consider formal regulation and implementation of standardized whole-grain food definitions in labeling and explore the consequent impact on consumer choice and whole-grain intake.

## SUPPLEMENTARY DATA

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.jneb.2022.08.006>.

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