

Consumer Evidence Summary: ‘No Added Sugar’ Claims

Key Outcomes

- This rapid literature review considers evidence on consumer understanding and responses to ‘no added sugar’ claims on food products.
- Findings of the literature review suggest there is significant variation and uncertainty in consumer understanding of whether particular ingredients are ‘added sugars’ and whether they are prohibited on foods bearing a ‘no added sugar’ claim.
- The review also identified that ‘no added sugar’ claims may not be well understood by some consumers, with some perceiving the claim to mean food products had no sugar or reduced sugar.
- ‘No added sugar’ claims appear to modify consumer perceptions of the food products they are applied to in terms of healthfulness, naturalness and taste. The majority of studies looking at healthfulness perceptions indicate that ‘no added sugar’ claims increase how healthy consumers perceive food products to be.
- A New Zealand study further suggests that ‘no added sugar’ claims may mislead consumers about the overall healthiness of a product, particularly for certain ethnicities and those with lower incomes and education levels.
- ‘No added sugar’ claims were found to have an influence on purchasing decisions in studies relating to toddler and infant foods, fruit beverages and fruit juices. However, the relative importance of the claim compared to other claims or product attributes depended on the product and the other attributes tested.
- Overall, the ‘no added sugar’ claim appears to be sought out and utilised by 40-60% of consumers. However, the influence of ‘no added sugar’ claims may differ according to certain demographics.

Introduction

FSANZ Proposal P1062 is considering amending the Australia New Zealand Food Standards Code to define and clarify added sugars for the purposes of making voluntary nutrition content claims. To support the proposal, FSANZ undertook a rapid literature review of the evidence relating to consumer understanding and responses to 'no added sugar' claims.

The review builds on two literature reviews undertaken by FSANZ in 2017 and 2022 relating to sugar and added sugar. Drawing on this and new evidence, the current review seeks to answer three research questions:

1. How do consumers understand 'no added sugar' claims on food labels.
2. How do 'no added sugar' claims modify consumer understanding of foods.
3. How do 'no added sugar' claims influence purchasing decisions.

Methods

The review includes Australian, New Zealand and international research from January 2003 to July 2023. Both peer reviewed articles and grey literature, such as unpublished theses, are included. Literature was identified through:

- searching 19 online databases for peer reviewed or preprint studies
- hand searching via Google Scholar
- searching for relevant studies from previous FSANZ literature reviews on sugar (FSANZ 2017) and added sugar (FSANZ 2022), and
- information provided by stakeholders.

Due to the time available, reference lists and studies citing the identified research were not checked. As such, this rapid review is not considered to be systematic, and may not be a comprehensive overview of all evidence relating to consumer understanding and responses to 'no added sugar' claims.

The literature search, screening process and evidence synthesis was undertaken by three FSANZ social scientists and peer reviewed internally. Further detail on the review methods are outlined in Appendix 1.

FSANZ also undertook independent analysis on the raw data obtained from a survey run by the European Food Safety Authority (EFSA 2022). The methods used for this data analysis have been previously published in Appendix 2 of FSANZ's 2022 added sugar literature review (FSANZ 2022).

Findings

The review identified a total of 19 studies, including four from Australia, one from New Zealand, and one undertaken across both Australia and New Zealand. Seventeen studies were quantitative in nature, with only two mixed method and no qualitative studies identified. International evidence was included due to limited research from Australia and New Zealand. However, international findings may not be directly generalisable to the Australian and New Zealand context given different food regulatory systems, cultures and exposure to different messaging around sugar. Eight studies were also conducted in languages other than English. In addition to having limited generalisability to the Australian and New Zealand population, many studies identified in the review did not use nationally representative samples, and often had a very high proportion of female and/or highly educated participants. Not all of the 19 studies provided evidence towards every research question. Thus, in some

instances, conclusions are based on only one or two studies. For an overview of the studies that contributed to each research question, see Appendix 2.

Acknowledging these limitations, there are a number of conclusions that can be made. Key findings are summarised below, grouped by research question.

1 - How do consumers understand 'no added sugar' claims on food labels?

Research Question 1 sought to explore how consumers understand 'no added sugar' claims on food labels. Eleven studies contributed evidence towards this question, including one undertaken in Australia and New Zealand, two from Australia, one from New Zealand, two from Taiwan, two from the United Kingdom (UK), and one from Europe, Germany and Portugal respectively. Four of these international studies were undertaken in languages other than English. Many of these studies relied on convenience samples, which resulted in high proportions of highly educated and/or female participants. Thus, care should be taken when generalising the results from these studies the broader Australian and New Zealand populations.

1.1 Perception of ingredients allowed in products bearing 'no added sugar' claims

Seven studies investigated what ingredients consumers perceived to be 'added sugar', with two studies specifically asking participants about ingredients in relation to 'no added sugar' claims. Studies were undertaken in Australia (two), the UK (two), Europe (one), Germany (one) and Portugal (one). No research was found from New Zealand. Studies which quantitatively assessed whether consumers classified ingredients as added sugars are summarised in Table 1, with one additional study providing further quantitative evidence which could not be summarised in the table. The studies varied significantly in terms of question framing, which should be considered when interpreting results.

Table 1 - Perception of ingredients as 'added sugars'

Ingredient	% classifying as an added sugar*					
	Morley & Ilchenko 2022 Australia (n=2,254)	Nuss et al. 2020 Australia (n=2,062)	Ehrecke et al. (2022) Germany (n=469)	EFSA 2022 EU + Norway /Iceland (n=7,469)	Prada et al. 2020 Portugal (n=1,010)	Tierney et al. 2017 United Kingdom (n=445)
Honey	60.9%	70.2%	22.8%	71.5%	43%	7%
Maple syrup	-	-	-	-	49%	-
Golden syrup	75.9%	81.0%	-	-	-	-
Molasses	-	-	-	-	43%	18%
Malt syrup	-	-	-	-	48%	-
Rice syrup	48.5%	57.5%	-	-	-	-
Corn syrup	-	-	-	-	54%	42%
Agave syrup	-	-	-	-	45%	-
Agave nectar	-	-	-	-	-	10%

Glucose syrup	-	-	-	-	-	47%
Glucose-fructose syrup	-	-	60.8%	-	-	-
Isoglucose	-	-	-	-	-	23%
Glucose	-	-	-	-	24%	-
Fructose	65.5%	74.7%	30.9%	68.0%	24%	23%
Sucrose	67.8%	76.0%	-	-	-	36%
Household sugar	-	-	90.8%	-	-	-
Invert sugar	-	-	-	-	-	28%
Cane sugar	79.5%	88.2%	-	-	-	-
Coconut sugar	59.3%	68.3%	-	-	-	-
Maltose	44.0%	51.8%	-	-	28%	25%
Lactose	-	-	-	-	19%	-
Milk	9.4%	10.7%	-	-	-	-
Fruit juice	57.2%	65.1%	-	-	-	22%
Fruit juice concentrate	63.5%	71.7%	-	-	-	-
Fruit concentrate	-	-	-	-	55%	-
Fruit paste	42.1%	55.1%	-	-	-	-
Fruit puree	44.9%	55.0%	-	-	-	-
Dried fruit	36.5%	50.3%	-	-	-	-
Fruit powders	-	-	-	-	-	-
Date powder	-	-	9.4%	-	-	-
Apple sweetener	-	-	12.8%	-	-	-
Fresh fruit	29.4%	40.8%	-	-	-	-
Nuts	3.7%	2.8%	-	-	-	-
Oats	3.8%	4.5%	-	-	-	-
Stevia	-	-	81.4%	-	47%	-
Erythritol	-	-	75.9%	-	-	-
Xylitol	-	-	74.2%	-	39%	-
Maltitol	-	-	72.5%	-	-	-
Aspartame	-	-	-	-	47%	4%
Saccharin	-	-	-	-	43%	7%

* Question framing varied across studies, which influenced responses. See detailed explanation in text.

Ingredients and 'no added sugar' claims

Two international studies specifically considered how consumers viewed ingredients in relation to 'no added sugar' claims (Patterson et al. 2012; Ehrecke et al. 2022).

In a quantitative survey of a convenience sample of 367 adults from the UK, Patterson et al. (2012) asked participants which ingredients from a list¹ they would expect to see in the ingredient list of products with 'no added sugar' or 'reduced sugar' claims. Participants were primarily female (84%) and were the main household shopper. The study found that respondents were almost four times more likely to expect products with a 'reduced sugar' claim to contain sugars compared to products with a 'no added sugar' claim. Products with 'reduced sugar' claims were expected to contain marginally more sweeteners, saccharin, aspartame, xylitol, gum, stevia and fillers than products with a 'no added sugar' claim. Respondents were almost equally likely to expect fruit sugar or honey to be present in products with 'no added sugar' and 'reduced sugar' claims. However, participants were more than twice as likely to expect products with 'no added sugars' to contain none of the ingredients listed. As the study only reported relativities and not exact proportions it is challenging to draw conclusions from the results. However, they do suggest that consumers are less likely to think sugars are present in foods with 'no added sugar' claims, compared to foods with 'reduced sugar' claims.

A German survey with a convenience sample of 469 participants (72.7% female) asked respondents which ingredients were prohibited in products bearing a 'no added sugar' claim (Ehrecke et al. 2022). According to the study, allowed ingredients included maltitol, stevia, xylitol, and erythritol, while prohibited ingredients included apple sweetener, date powder, honey, fructose, glucose-fructose syrup and household sugar. However, inconsistencies in identifying which ingredients were prohibited throughout the article reduces confidence in the findings. As shown in Table 1, most participants (90.8%) correctly identified household sugar as a prohibited ingredient under the 'no added sugar' claim, while a majority (60.8%) correctly identified glucose-fructose syrup as a prohibited ingredient. However, beyond these, participants struggled to correctly indicate whether products carrying the 'no added sugar' label could contain other ingredients, with the proportion of participants answering correctly generally below 30%. Few people thought that apple sweetener (12.8%) and date powder (9.4%) were prohibited under the 'no added sugar' claim, while very high proportions (72.5% – 81.4%) thought that artificial sweeteners were prohibited. In contrast to the other study that considered artificial sweeteners (Tierney et al. 2017) the question framing in Ehrecke et al. (2022) did not provide an opportunity for consumers to classify products as artificial sweeteners. Thus, while the results do not provide insight into whether consumers perceive these products as sugars or sweeteners, it may suggest that some consumers expect artificial sweeteners to be prohibited when a 'no added sugar' claim is made.

Ingredients as 'added sugars'

A further five studies considered whether consumers believed ingredients were 'added sugar' (EFSA 2022; Morley & Ilchenko 2022; Nuss et al. 2020; Prada et al. 2020; Tierney et al. 2017), but did not directly consider whether these ingredients would be allowed in products where a 'no added sugar' claim was made.

Two surveys of Australian consumers undertaken in 2020 and 2022 asked participants which ingredients they identified as a sugar when added to a product. The first survey (Nuss et al. 2020) was completed by a non-representative sample of 2,062 adults aged between 18 and 65 years. The majority of the sample had at least some tertiary education (73.7%) and were the main grocery buyer (89.3%). The second survey was completed by a sample of 2,332 adults aged 16-65 years, that were nationally representative by gender, age and state and territory (Morley & Ilchenko 2022). When listed from most to least frequently categorised as a sugar, a similar order of ingredients was obtained across years, with cane sugar, golden

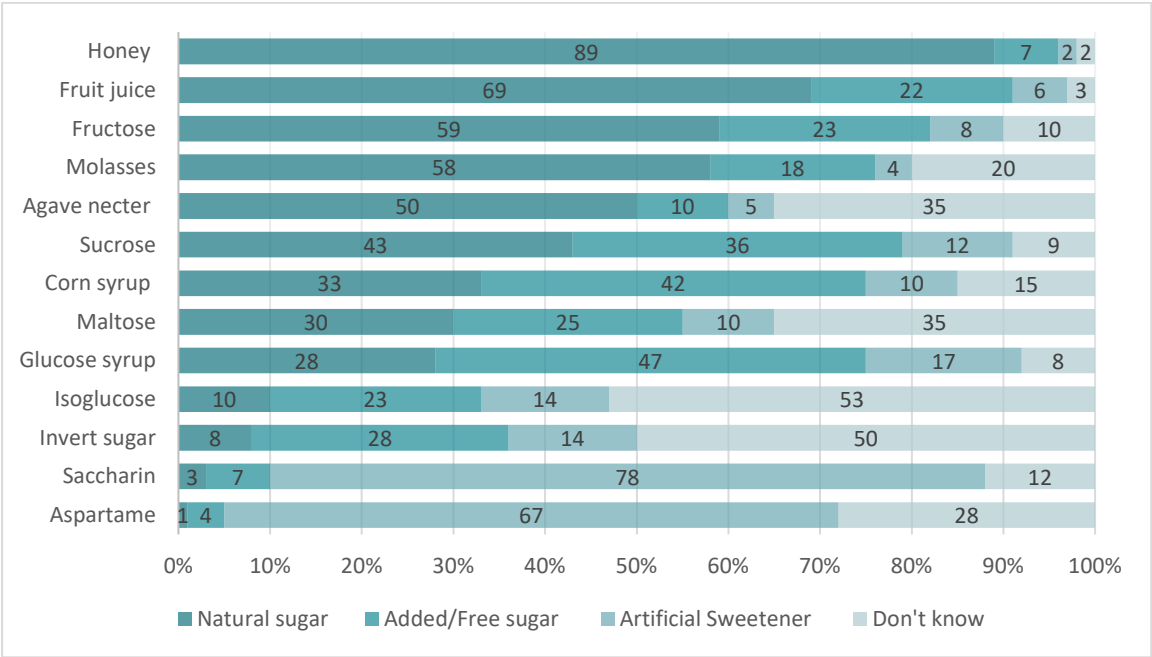
¹ Ingredients listed included: 'sweeteners', 'saccharin', 'aspartame', 'fruit sugar', 'honey', 'xylitol', 'sugar', 'gum', 'stevia', 'fillers', or 'none of these'.

syrup, and sucrose being the most likely to be identified as sugar, while nuts, oats and milk were infrequently perceived as a sugar. However, in 2022, fewer people categorised ingredients as sugars across the board, except for nuts. This difference may be due to the larger, more representative sample used in the 2022 survey. The greatest variation between the two surveys was seen in fruit products, including dried fruit, fresh fruit, fruit paste and fruit purees.

An online survey of 7,469 adults across the European Union, Norway and Iceland (EFSA 2022) presented respondents with a series of statements about whether honey and fructose should be considered added sugars. FSANZ’s analysis of the survey data found that the majority of participants agreed that fructose (68.0%) and honey (71.5%) ‘can be used as added sugar’.

In an online survey, a convenience sample of 445 adults from the UK (77% female) were asked how they would classify 13 commonly used ingredients if they were included in the ingredient list of a pre-packaged food (Tierney et al. 2017). Choice options included ‘natural sugar’, ‘added/free sugar’, ‘artificial sweetener’ or ‘don’t know’, with only one choice allowed per ingredient. ‘Added/free sugar’ was defined for participants as ‘sugars that are added to foods during manufacturing or cooking’. Other choices were not defined. Honey was most frequently categorised as a ‘natural sugar’ (89%), followed by fruit juice (69%) (see Figure 1). Fructose and molasses were also categorised as natural by over 50% of participants. Glucose syrup and corn syrup were most commonly categorised as ‘added/free sugars’. The study considered that the common ‘misclassification’ of ingredients such as honey and fruit juice as natural when they are actually added to a pre-packaged product may be due to the layman understanding of natural as being ‘associated with those sugars which are normal ingredients of non-processed foods’ (Tierney et al. 2014, p. 9). It may also suggest that consumers still perceive sugars from sources such as honey or fruit juice as being natural, even when they are added to another food. Being natural and added may not be mutually exclusive for consumers, and when forced to choose the most salient aspect, the fact that it is perceived as natural may be more important than the fact that it is added to another product.

Figure 1 - UK consumer classification of ingredients added to a pre-packaged food (n=445) (Tierney et al. 2017)



Note: Data estimated from Figure 2 in Tierney et al. (2017)

Building on the study by Tierney et al. (2017), an online survey of a convenience sample of 1,010 Portuguese adults (77% female) also investigated how participants classified common ingredients when they were included as an ingredient in another food (Prada et al. 2020). The survey was based on Tierney et al. (2017), but with some adjustments to investigate potential reasons why consumers may have classified ingredients in a particular way. Instead of being asked to classify ingredients as either natural sugar, added/free sugar or artificial sweetener, participants were asked to distinguish them by their composition, being either 'part of the composition of the product' (intrinsic), or 'added by the manufacturer' (added), and by their origin, being either 'natural' or 'artificial'. This aimed to reduce the potential association of something natural also being seen as intrinsic. Participants could also choose 'don't know'. Prada et al. (2020) used a different set of ingredients, which were presented in a randomised order rather than a fixed order. The fact that products were ingredients in another food was also emphasised in the instructions.

As all ingredients were added to another product (packet of cookies), classifications of ingredients as intrinsic rather than added were incorrect. Participant's overall accuracy when classifying as intrinsic or added was low and highly variable, with a mean of 42.8 out of 100 (95% CI 40.9 - 44.7) and a standard deviation of 30.6 (Prada et al. 2020). The ingredients most commonly misclassified as intrinsic were lactose (54% of sample), fructose (51%) and glucose (47%) (see Figure 2). Honey and sucrose were also misclassified as intrinsic by approximately one third of participants. In contrast, syrups including maple (9%), corn (8%), agave (8%) and malt (6%), and were infrequently misclassified as intrinsic, but had a very high proportion of people responding that they did not know (ranging from 46% for malt syrup, to 39% for corn syrup). In fact, a large proportion of participants were unable to classify ingredients as intrinsic or added across the board, with 'don't know' responses ranging from 56% for xylitol to 25% for fructose and honey.

Figure 2 - Portuguese consumer classification of ingredients added to a pre-packaged food – added or intrinsic (n=1,010) (Prada et al. 2020)

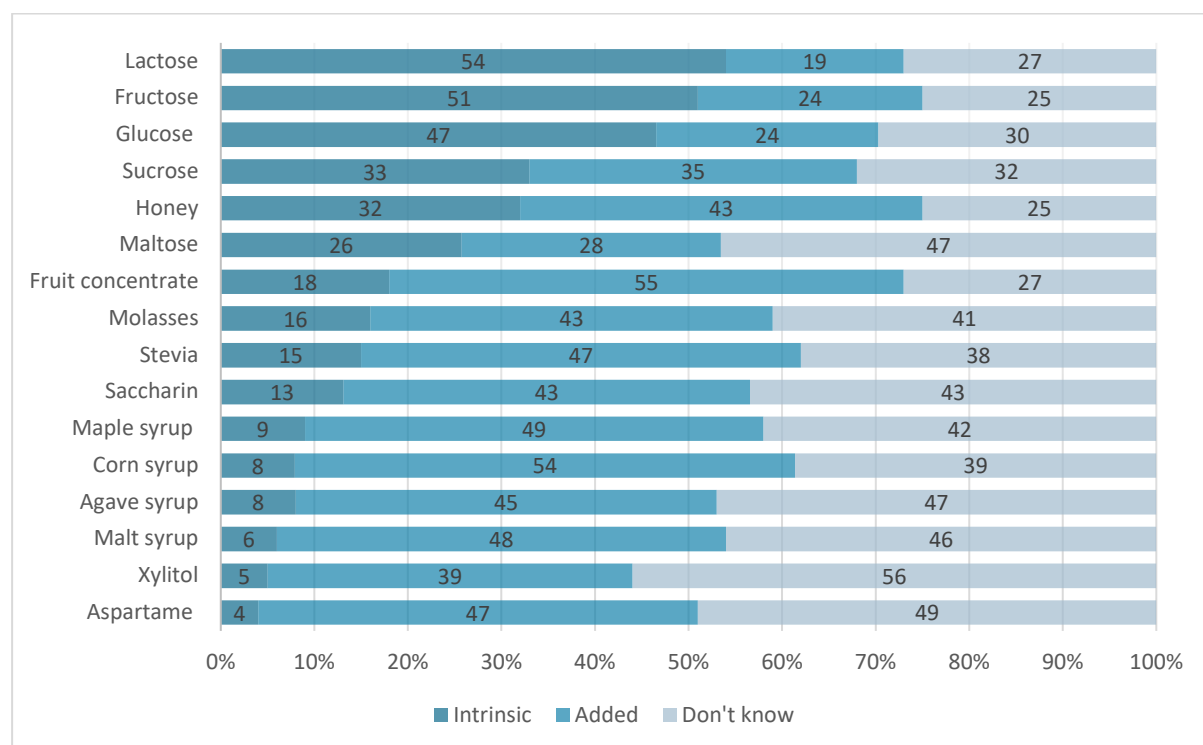
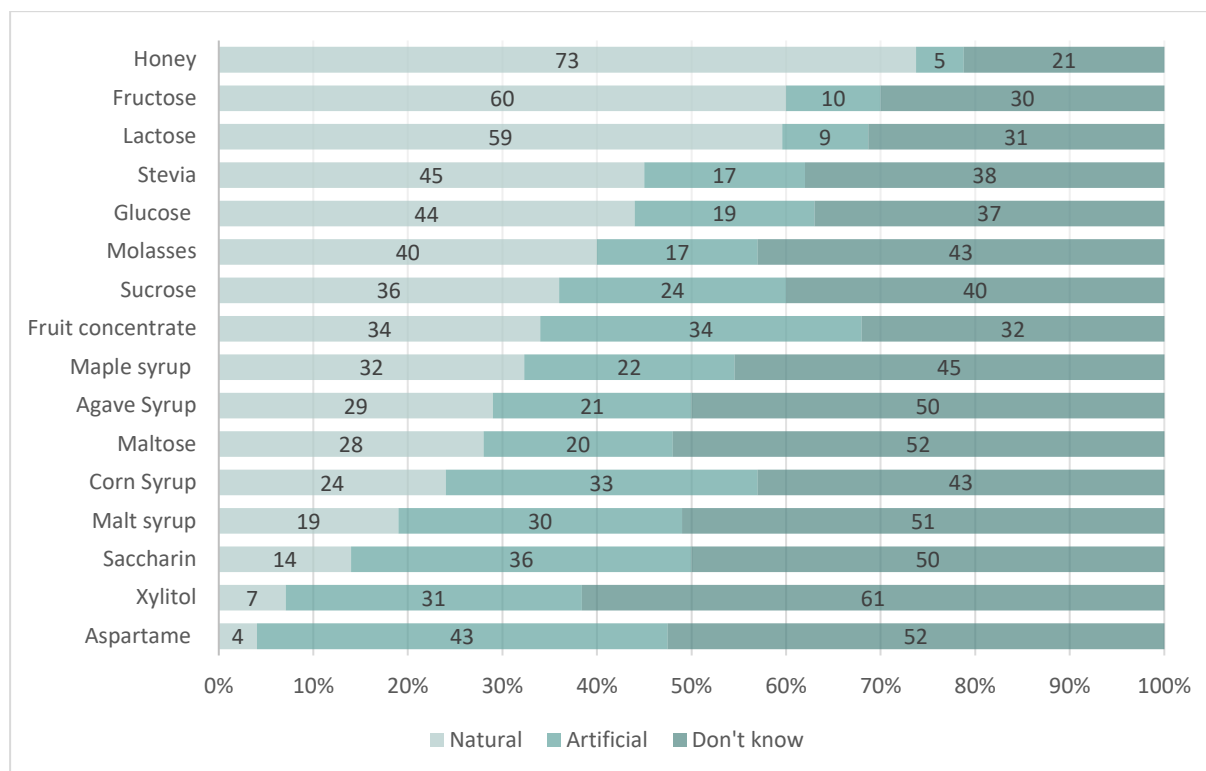


Figure 3 - Portuguese consumer classification of ingredients added to a pre-packaged food – natural or artificial (n=1,010) (Prada et al. 2020)



When asked to classify ingredients by origin (natural vs artificial) accuracy was even lower and remained variable, with a mean score of 36.9 out of 100 (95% CI 38.2 – 41.5) and a large standard deviation of 26.2 (see Figure 3). The range of participants reporting that they did not know also remained high when classifying as natural or artificial, ranging from 61% for xylitol to 21% for honey. Of the listed products, only saccharine and aspartame were considered artificial by the authors. Honey was most commonly classified as natural (73%), followed by fructose (60%) and lactose (59%). Only 32% of participants classified maple syrup as natural. Aspartame was most commonly classified as artificial (43%), followed by saccharin (36%), fruit concentrate (34%) and corn syrup (33%). The high proportion of participants classifying fruit concentrate and corn syrup as artificial suggests that the association between naturalness and fruit and vegetable products may not always be present. The uncertainty may also demonstrate that there are multiple possible interpretations of 'natural' and 'artificial'.

The results from these classification tasks (Tierney et al. 2017; Prada et al. 2020) suggest that if consumers perceive an ingredient as natural, they may also perceive it to be intrinsic or naturally occurring within a product. Items that were commonly thought to be natural such as lactose, fructose and glucose were also commonly mis-classified as intrinsic. However, for honey, which was most commonly perceived to be natural and had the lowest levels of uncertainty, 43% of participants understood that when added to another product, honey is an added sugar and not intrinsic. This may be due to consumers having greater familiarity with the ability to add honey to products, as they can easily do this in their own food preparation, relative to ingredients like lactose.

Summary 1.1

Taken together, the findings from section 1.1 suggest that there is significant variation and uncertainty in consumer understanding of whether particular ingredients are 'added sugars'

and whether they are prohibited on foods bearing a 'no added sugar' claim. Of the 40 ingredients tested across six studies, only six ingredients were considered to be 'added sugar' by more than two thirds of participants in at least two studies. This included honey, golden syrup, fructose, sucrose, cane sugar and fruit juice concentrate, noting honey and fructose were infrequently classified as added sugar in other studies. Similarly, only milk, nuts and oats were not considered to be added sugar by more than two thirds of participants in at least two studies. The greatest variability was seen in honey (range 7% - 71.5% classifying as 'added sugar'), fructose (23% - 74.7%) and sucrose (36% - 76%). Several studies also identified that some consumers perceive ingredients that are not currently prohibited in foods making 'no added sugar' claims, to be added sugar. For example, between 22% and 65% perceived fruit juice to be added sugar, while 42% - 55% perceived fruit paste, 45% - 55% perceived fruit puree, and 37% - 50% perceived dried fruit to be sugar when added to another food. However, responses indicating that consumers did not know were common in studies where this was provided as an option (Tierney et al. 2017; Prada et al. 2020).

Some of the variability seen in these results can be attributed to the different ways studies framed their questions. For example, in Tierney et al. (2017), consumers were asked to identify whether a sugar was 'natural', 'added/free', or an 'artificial sweetener'. This led to products perceived as 'natural', including honey and fructose, to be less frequently classified as 'added'. Similarly, a high proportion of consumers (72.5% - 81.4%) in one German study (Ehrecke et al. 2022) thought that artificial sweeteners were prohibited under the 'no added sugar' claim. However, the framing of this question did not provide an opportunity for participants to distinguish these products as artificial sweeteners. Where participants could distinguish between products being either added/free sugar or artificial sweeteners, much lower proportions (4% - 7%) considered these products to be added sugar (Tierney et al. 2017). Nonetheless, the results still indicate that a majority of German consumers may expect artificial sweeteners to be prohibited in products bearing 'no added sugar' claims.

1.2 Perception of 'no added sugar' as no sugar or reduced sugar

Seven studies investigated whether consumers perceived 'no added sugar' claims to mean that the food product contained no sugar or reduced sugar. The six studies that looked at this question using quantitative methods are summarised in Table 2, with one additional study providing qualitative evidence.

Table 2 - Perception of 'no added sugar' claims as meaning no sugar or reduced sugar

Study	Sample	Reference product	% of consumers who understood 'no added sugars' to mean the food product had...	
			No sugar	Reduced sugar
Chein et al. 2018	n = 940 Mothers of children 4m – 3y old Convenience	Infant cereals	40%	74%
Chen et al. 2020	n = 122 Mothers of children 1-6y old Convenience	Food in general	32.2% - 50.0%	70.0% – 90.6%
EFSA 2022	n = 7,469	Food in general	13.3%	-

EU + Norway and Iceland	51.3% female Nationally representative			
Ehrecke et al. 2022 Germany	n = 469 72.2% female Convenience	Food in general	4.3%	39.2%
FSANZ 2006 Australia and New Zealand	n = 1,007 50.0% female Small variations from nationally representative	Vegetable juice, yoghurt, fruit and nut bar, muesli, apple juice, canned peaches in fruit juice	17-29%	-
Gorton et al. 2010 New Zealand	N = 1,525 shoppers 71.5% female Convenience	Cereal	27%	-

Australian and New Zealand Evidence

Two studies from Australia and New Zealand suggest that while a majority of participants are aware that products with 'no added sugar' claims can contain sugar, a sizeable minority did not understand this distinction, with non-European ethnic groups more likely to be misled.

In an Australian (n = 506) and New Zealand (n = 501) online experiment (FSANZ 2006), participants were asked to assess the sugar level of six products (vegetable juice, yoghurt, fruit and nut bar, muesli, apple juice, and canned peaches in fruit juice) with 'no added sugar' claims, either with or without a 'contains natural sugar' disclaimer. Participants were shown the front label of each product and asked to assess the level of sugar (high, medium, low, or none) in the product. They could click to access the back label of the product, which displayed a Nutrition Information Panel and ingredient list. In the absence of the disclaimer ('contains natural sugar'), between 17% and 29% of respondents incorrectly believed the various food items with a 'no added sugar' claim did not contain any sugar. This was despite their ability to view total sugar information on the back of pack. If the disclaimer was present, participants were significantly less likely to report that the six products contained no sugar (range 8% - 14%, $p < 0.05$ for all products).

A New Zealand study (Gorton et al. 2010) sought to assess how consumers interpreted nutrition claims on food packaging. A total of 1,525 New Zealand shoppers from 25 Auckland supermarkets were presented with a mock cereal product with nutrition content claims on the package, one of which was 'no added sugar'. Of shoppers surveyed, 72% correctly identified that sugar may still be present in a product with a 'no added sugar' claim. However, 27% incorrectly believed that the claim meant the food could not contain any sugar. Certain ethnicities were less likely to understand the claim, with only 55% of those with Asian ethnic background, 60.3% Māori, and 65.1% Pacific answering correctly. These groups all differed significantly from those of New Zealand European origin, of whom 79.5% answered correctly. No significant differences were reported by income and education level. These results suggest that while most consumers understand that a product with 'no added sugar' may still contain sugar, a reasonable segment of the sample did not understand this, and this was more concentrated in those of non-European ethnicity.

International Evidence

Five international studies suggest there is greater variability in the proportion of consumers who believe products with 'no added sugar' claims cannot contain any sugar. Reflecting findings from Gorton et al. (2010) within New Zealand, studies of consumers in Asian countries (Taiwan) reported greater levels of this misunderstanding (Chein et al. 2018; Chen et al. 2020), relative to European studies (EFSA 2022; Ehrecke et al. 2022). This variability may reflect different attitudes towards or exposure to information about sugar in different countries. Four of the five studies were also conducted in languages other than English, with some differences in survey understanding possibly resulting from translation (Chein et al. 2018; Chen et al. 2020; EFSA 2020; Ehrecke et al. 2022). Caution is therefore warranted in generalising the findings to the Australian/New Zealand context.

Only one international study utilised a nationally representative sample (EFSA, 2022). In an online survey of 7,469 adults across European Union members states, Norway and Iceland, participants were asked to respond to a series of statements regarding sugars with either 'True', 'False', or 'Don't Know' (EFSA 2022). 69.8% of participants disagreed that "a product with no added sugars contains no sugar", with 16.9% unsure, and 13.3% agreeing, suggesting that the majority of consumers understand that sugar can still exist in products with a 'no added sugar' claim.

Three further international studies utilised convenience samples, which resulted in high proportions of highly educated female participants (Chein et al. 2018; Chen et al. 2020; Ehrecke et al. 2022). These studies may underestimate potential confusion, as highly educated females generally have higher levels of nutrition literacy (Bhawra et al. 2023).

A 2018 online survey of 940 mothers from Taiwan looked at the influence of 'no added sugar' claims on mothers' intention to purchase infant cereals (Chein et al. 2018). Of mothers surveyed, 60% answered false to the statement "packaging marked with 'no added sugar' signifies that the product is sugar free", indicating that 40% may be misinterpreting the claim. For the statement that "infant cereal with 'no added sugar' marked on the packaging has lower sugar content than other types", 74% of mothers agreed, with 16.7% neutral and 9.3% disagreeing.

A 2020 Taiwanese experiment investigated the impact of educational interventions on 122 mothers' understanding and use of nutrition labels to purchase low sugar foods (Chen et al. 2020). The first intervention included two 15 minute videos on sugar and health, and nutrition labelling (n = 90). The second intervention included the online training, plus a two – three hour in-person discussion (n = 32). A survey undertaken prior to the intervention asked participants to indicate whether they thought the statement "'no added sugar' signifies 'sugar free'" was true or false. Of those surveyed, 67.8% of the online only group and 50% of the in-person group correctly identified that the statement was false, indicating that between 32.2% and 50% may be misinterpreting the claim. In response to the statement "the sugar content of food with 'no added sugar' is lower than food without 'no added sugar'", 30% of the online only group and 9.4% of the in-person group correctly answered that the statement was false. This indicates that between 70% and 90.6% of consumers perceive foods with 'no added sugar' claims to be lower in sugar than those without the claim. Post intervention improvements were seen in both groups, with a 25% improvement in correctly interpreting the 'no added sugar' claim for the online group and a 50% improvement in the in-person group. This study may suggest that that mothers' incorrect perceptions could be modified using online videos and/or group discussions. However, a number of limitations reduce confidence in the findings. For example, the study had non-random allocation to the different intervention groups. While there were no significant differences between the groups on key demographics, more motivated participants may have opted to be involved in the in-person

group, which may partially explain the increased improvements seen for that cohort. There was also no control group, which limits the ability to understand whether the improvements were from the intervention itself, or just from awareness being raised through participation in the study.

A German experimental survey with a convenience sample of 469 participants investigated the impact of 'no added sugar' claims on the estimated sugar content of food products (Ehrecke et al. 2022). In the survey, participants were asked how much they agreed with a series of statements, on a six point scale ranging from 'totally agree' to 'do not agree at all'. Of all participants, 95.7% disagreed with the statement that "products with 'no added sugar' labels do not contain sugar", representing a correct understanding of the claim. The vast majority (70.8%) selected the strongest negative answer - 'do not agree at all' - indicating that most people were quite certain in their response. More participants were uncertain around whether "products with 'no added sugar' labels are lower in sugar", with 39.1% agreeing and only 9.2% responding that they 'do not agree at all'. These results contrast with other studies to suggest that very few consumers perceive that products with 'no added sugar' claims do not contain sugar, and that just over one-third believe the claim indicates reduced sugars.

In an experimental component of Ehrecke et al. (2022), participants were randomised to view the front-of-pack of products with either no claim, or a 'no added sugar' claim, and were asked to estimate how much sugar was in 100g of 11 different food products. Those who viewed the 'no added sugar' claim estimated sugar content to be significantly lower for chocolate ($p < 0.001$) and ketchup ($p < 0.05$), but not for the other products (frozen blackberries, dried dates, fruit yogurt, fruit muesli, oat milk, fruit gum, sweet corn, white chocolate granola bar and orange juice). However, effect sizes were small (chocolate Cohens $D = 0.38$; ketchup Cohens $D = 0.19$). These results suggest that the impact of 'no added sugar' claims may depend on product type. The experimental component of the study also utilised branded products available on the German market which contained other claims, such as '75% less sugar' or '98% fruit', as they appeared on current packaging. It therefore may provide a more realistic setting, where the 'no added sugar' claim is set against numerous other marketing features.

One UK study provided qualitative evidence. As part of a mixed methods study investigating sugar related claims, Patterson et al. (2012) conducted four focus groups, each with 9-10 female main household shoppers (total number of participants not provided). When presented with a 'no added sugar' claim, participants assumed that added sugars related to sucrose, rather than total sugar. All participants expected there to be some form of sugar in a product labelled 'no added sugar', and all expected artificial sweeteners to have been added. This suggests that consumers generally understood that 'no added sugar' claims do not necessarily mean the product is sugar free or free of artificial sweeteners.

Summary 1.2

Overall, six quantitative studies suggest that some consumers (4.3-50%) may not understand that 'no added sugar' claims do not necessarily mean the food has no sugar. However, the size of this cohort varied significantly, with one qualitative study also suggesting consumers were generally not misled by the claim. This variation may be due to country differences, such as exposure to information about sugar, or cultural differences in attitudes toward sugar. Four of the five international studies were also conducted in languages other than English, with some differences in survey understanding possibly resulting from translation. Several studies also used convenience samples, which had large proportions of highly educated female participants. This may lead to an underestimation of potential confusion, as this cohort typically has better nutrition literacy than other groups (Bhawra et al. 2023). Studies using larger, more representative samples (EFSA 2022; FSANZ 2006) suggest that

while most consumers understand that foods with 'no added sugar' claims may still contain sugar, a reasonable segment of the population (13.3% - 29%) may be misled. This was also reflected in New Zealand research, which showed that while 27% of study participants misunderstood the 'no added sugar' claim, those with non-European ethnicities were significantly more likely to think that products with the claim contained no sugar. In one Australian study, this misunderstanding occurred for between 17% and 29% of participants, despite them having the option to view total sugar information on the back of pack.

Three studies also highlighted that between 34.2% and 90.6% of consumers interpret a 'no added sugar' claim to mean that the product has reduced sugar, relative to a product without the claim. Again, the broad variation in these results may reflect country differences, with the belief much more common in Taiwan than in Germany. However, one German study (Ehrecke et al. 2022) demonstrated experimentally that 'no added sugar' claims did not significantly reduce consumers' estimations of sugar content, except to a small degree in ketchup and chocolate. This suggests that the impact of 'no added sugar' claims on sugar estimation may depend on product type. No identified Australian or New Zealand research investigated consumer perceptions of whether 'no added sugar' claims meant that products were generally lower in sugar.

2 - How do 'no added sugar' claims modify consumer understanding of foods?

Research Question 2 sought to understand whether 'no added sugar' claims change consumers' perceptions of the food products they are applied to. Ten studies contributed evidence towards this question, including two from Australia, one from New Zealand, two from the United States (US), two from Germany and one from Taiwan, Portugal and the UK respectively. Four studies were undertaken in languages other than English.

2.1 Impact of 'no added sugar' claims on healthfulness perceptions

Nine studies investigated the impact of 'no added sugar' claims on consumers' healthfulness perceptions. Studies were undertaken in Australia (two), New Zealand (one), the US (two), Germany (two), Portugal (one) and Taiwan (one). The studies used various types of quantitative research designs (cross-sectional surveys, conjoint designs, experimental designs). The majority of studies sampled participants that were highly educated, and mostly female. Only two studies used a sample that was representative of the general population of that country (Morley & Ilchenko 2022 in Australia; Jurkenbeck et al. 2022 in Germany).

Impacts on relative healthfulness perceptions

Four studies found that 'no added sugar' claims increased consumers' healthfulness perceptions of food products (Drewnowski et al. 2010; McCann et al. 2022; Morley & Ilchenko 2022; Sipple et al. 2022). However, it is unclear from these studies whether the claims produced a health halo effect per se (i.e. caused consumers to perceive foods as automatically healthy in a holistic sense because they had a 'no added sugar' claim).

Drewnowski et al. (2010) used a conjoint design to investigate the relative importance of different nutrient content claims (including 'no added sugar' claims) in determining perceived healthfulness of foods. In this study, 320 participants in the US (78% female) were asked to rate how healthy they would perceive a product to be if it contained the nutrient content claim, and translated this into a utility score for each statement's importance in determining healthfulness perceptions. Participants were not asked about specific types of products, but rather about products in general. Utility scores of 8 were considered important, while scores of less than -5 were considered unimportant. Overall, the study reported that claims relating

to sugar and added sugars had lower utility scores and contributed less to overall health perceptions than other claims (such as claims declaring presence of protein, fibre, calcium, and the absence of fat). The claim 'this product is free of added sugar' had a utility rating of 10, indicating importance in determining healthfulness perceptions. This suggests that, relative to other nutrients, sugar and added sugar related claims may not have as strong of an influence on healthfulness perceptions. However, their high utility score indicates they are still important. It is possible that health perceptions of sugar may have changed since this study was undertaken in 2010, given the increased research and media coverage of its impacts and the introduction of added sugar labelling in the US.

A more recent study also investigated the importance of 'no added sugar' claims in influencing health perceptions in the US (Sipple et al. 2022). This study also used a conjoint design, where 1,051 self-identified consumers of frozen desserts (78% female) were asked to rate the importance of various attributes in making these products 'better for you'. Consistent with Drewnowski et al. (2010), 'no added sugar' claims contributed to health perceptions of the desserts, but was relatively more influential, ranking second of the 30 attributes tested, behind 'is naturally sweetened'.

The remaining two of the four studies examined the effects of 'no added sugar' claims using Australian samples. In Morley and Ilchenko (2022), a survey was completed by a sample of 2,332 adults aged 16-65 years, that were nationally representative by gender, age and state and territory. Participants were asked how likely a 'no added sugar' claim would indicate to them that a particular food product is better for them. Response options included 'extremely likely', 'very likely', 'somewhat likely', and 'not at all likely'. Participants were not shown a particular type of food product when asked this question. Therefore responses reflect consumer perceptions of 'no added sugar' claims in general. More than half of participants (54.2%) indicated that they thought it was extremely or very likely that the claim would indicate to them that a food product is better for them.

In McCann et al. (2022), 207 Australian caregivers of toddlers (98% female) completed a discrete choice experiment. The experiment required participants to choose the 'most and least healthy' products between three alternatives. The products were highly processed toddler snacks, which displayed either a 'no added sugar, no added salt' claim or no claim. Participants were nearly 14 times more likely to perceive a product with the claim 'no added sugar, no added salt' as most healthy, compared to when this claim was absent. However, it is unclear whether this effect would change if only 'no added sugar' claims were examined. It is not possible to distinguish the effects of 'no added sugar' vs. 'no added salt' claims in this study.

Health halo effects

In contrast to the four studies described thus far, one New Zealand-based study examined not only whether 'no added sugar' claims caused changes in healthfulness perceptions of food products, but also whether the claims produced a health halo effect (i.e. indicated that the claim definitely made the product healthy in an absolute sense). Gorton et al. (2010) surveyed 1,525 New Zealand shoppers (72% female) from 25 Auckland supermarkets. Participants were presented with a mock cereal product with a 'no added sugar' claim, and were asked whether the claim means that the product is definitely a healthy food (response options: yes; no; unsure). Overall, 36% participants (CI: 33-39%) incorrectly believed that this claim meant that the food was definitely healthy. This percentage was even higher for Māori (61%), Asian (66%) and Pacific (53%) groups. Furthermore, low-income shoppers were significantly more likely to perceive the product as definitely healthy (30%) compared to high-income shoppers (12%). There was also a significant difference based on level of education (36% of tertiary-educated participants vs. 20% no secondary school qualification). It is important to note that this study is limited such that it is a cross-sectional survey, and

therefore it is not possible to draw definitive conclusions regarding cause and effect. Nevertheless, the findings suggest that 'no added sugar' claims may be particularly misleading for Māori, Asian, Pacific, low-income and lower educated groups, which may contribute to inequities.

Non-English speaking countries

The remaining four of the nine studies were similar to those already described above, except that the questionnaires and 'no added sugar' claims provided to participants were not in English. These studies sampled Chinese (Taiwan) - (Chein et al. 2018), Portuguese - (Prada et al. 2021) and German - (Ehrecke et al. 2022; Jurkenbeck et al. 2022) speaking participants. Caution is therefore warranted in generalising the findings to the Australian/New Zealand context.

Two of these studies (Chein et al. 2018; Prada et al. 2021) produced consistent findings with the studies described thus far, such that consumers' perceived products with 'no added sugar' claims as healthier. Chein et al (2018) investigated Taiwanese mothers' perceptions of 'no added sugar' claims on infant cereals. In this survey, 940 Chinese-speaking mothers were provided with the statement "Infant cereal with 'no added sugar' marked on the packaging is healthier than other types" (response options: agree; neutral; disagree). Most mothers (70.9%) agreed with the statement, whereas 20.2% were neutral and 8.9% disagreed.

Prada et al. (2021) used a within-subjects experimental design where 200 Portuguese participants (77% female) viewed four types of sugar claims (including 'no added sugar') on four different types of food products (breakfast-cereals, yoghurts, ice-cream and cookies). Participants were asked to evaluate each type of product/claim combination compared to their regular counterpart (i.e. when no claim is present), on a scale from 1 (less healthful) to 7 (more healthful). Participants generally viewed all food products with 'no added sugar' claims as more healthful than products without this claim (mean ratings ranged from 5.10 to 5.45 across the different types of food products).

In contrast, Jurkenbeck et al. (2022) found that 'no added sugar' claims had no significant effects on consumers' health perceptions of an oat drink. This study consisted of a between-subjects experimental design, where a representative sample of 1,103 German participants were randomly allocated to view with either a 'no added sugar' claim or no claim. Participants in both groups viewed the oat drink product as similarly healthy (group means were 3.84 and 3.89, where 1 = very healthy and 10 = very unhealthy; $p > 0.05$). The results of this study are inconsistent with the other studies that have been previously described. This inconsistency implies that 'no added sugar' claims may be less influential on products that are already perceived to be healthy. It is also possible that the different results may be explained by the different country that was sampled and/or a combination of the type of country and product examined.

Finally, the second German study conducted by Ehrecke et al. (2022) found that 'no added sugar' claims increased health perceptions of some food products, but not others. This somewhat supports previous speculation based on Jurkenbeck et al.'s (2022) findings that the effects of 'no added sugar' claims may depend on the type of product in question. However, this cannot be entirely explained by the theory that claims may be less influential on products that are already perceived to be healthy, as non-significant effects were also found for products that had low levels of perceived healthfulness overall. In this study, participants were randomly allocated to view either a 'no added sugar' claim or no claim on 11 different types of food products. Participants rated each type of product on perceived healthfulness (1 = very unhealthy; 2 = unhealthy; 3 = rather unhealthy; 4 = rather healthy; 5 = healthy 6 = very healthy). Participants who viewed the 'no added sugar' claim rated

chocolate (M = 2.17 vs. 1.85) and white-chocolate granola bars (M = 2.64 vs. 2.47) as significantly healthier, compared to those who viewed 'no added sugar' claims on these products. However, there were no significant differences for other products, irrespective of whether they were perceived as generally healthy (mean rating of at least four e.g. blackberries, sweet corn) or generally unhealthy (mean rating of 3 or less e.g. fruit gum, ketchup).

Summary 2.1

The majority of studies in section 2.1 indicate that 'no added sugar' claims increase consumers' perceived healthfulness of food products. One New Zealand-based study further examined whether 'no added sugar' claims mislead consumers about the overall healthiness of a product (i.e. indicated that the claim definitely made the product healthy in an absolute sense). This study found that 'no added sugar' claims are particularly misleading for those with Māori, Asian or Pacific ethnicities, as well as low-income and lower educated groups, which may contribute to inequities. Conversely, two German-based studies suggested that the 'no added sugar' claim had minimal impact on healthfulness perceptions, with one indicating that the influence may depend on the type of food product. However, caution is warranted when generalising international results to the Australian/New Zealand context, with the consistency across the two German studies relative to other countries indicating that country specific factors may be driving those findings. Findings that consumers' health perceptions of foods with 'no added sugar' claims are associated with particular demographics, further highlights the importance of considering the Australian/New Zealand context.

2.2 Impact of 'no added sugar' claims on naturalness perceptions

One study examined the impact of 'no added sugar' claims on how natural consumers' perceive food products to be. Chein et al (2018) investigated Taiwanese mothers' perceptions of 'no added sugar' claims on infant cereals. In this survey, 940 Chinese-speaking mothers were provided with the statement "infant cereal with 'no added sugar' marked on the packaging is more natural than other types" (response options: agree; neutral; disagree). Just over half of the mothers (54.3%) agreed with the statement, whereas 27.1% were neutral and 18.6% disagreed.

2.3 Impact of 'no added sugar' claims on perceived taste

The potential for 'no added sugar' labels to impact consumer expectations about the taste of food was addressed in one quantitative Portuguese study and in the qualitative component of a mixed methods study from the UK.

Qualitative evidence from the UK (Patterson et al. 2012) indicates that consumers may expect foods with 'no added sugar' claims to be less tasty and less satisfying. Findings from four focus groups of nine to 10 participants (all female) found that consumers perceived products labelled with 'no added sugar' to be less tasty and less filling than regular alternatives, but preferable to those with a 'reduced sugar' claim.

Prada et al. (2021) used a within-subjects experimental design where 200 Portuguese participants (80% female) viewed four types of sugar claims (including 'no added sugar') on four different types of food products (breakfast-cereals, yoghurts, ice-cream and cookies). Participants were asked to evaluate each type of product/claim combination compared to their regular counterpart (i.e. when no claim is present), on a scale from 1 (less tasty) to 7 (more tasty). Participants generally viewed all food products with 'no added sugar' claims as less tasty than products without this claim (mean ratings ranged from 3.50 to 3.62 across the different types of food products).

Summary 2.3

Findings from section 2.3 suggest that consumers may expect products with 'no added sugar' claims to be less tasty and less filling than their regular counterparts.

3 - How do 'no added sugar' claims influence food purchasing decisions?

Research Question 3 sought to better understand how 'no added sugar' claims influence food purchasing decisions. This is distinct from Research Question 2, as changes in perceptions about a product from 'no added sugar' claims may not necessarily translate into changes in purchase intent or behaviour. Six studies addressed this question. Two studies were from the US, and one each from Brazil, Australia, UK and Germany. Two studies were conducted in languages other than English. The influence of 'no added sugar' claims on food purchasing decisions may relate to consumer awareness and valuation of the claim, including its relative importance compared to other food product attributes. No identified studies tested purchasing behaviour in real world settings.

3.1 Awareness of 'no added sugar' claims

Two international studies looked at the extent to which consumers recalled seeing 'no added sugar' claims on food labels (Ehrecke et al. 2022; Patterson et al. 2012). These studies both utilised convenience samples, which resulted in high proportions of highly educated, female participants. Ehrecke et al. (2022) was also undertaken in the German language. Thus, care should be taken when generalising the results from these studies to the broader Australian and New Zealand populations.

Ehrecke et al.'s (2022) survey of 469 German consumers (72.2% female) asked participants about their shopping habits. Of participants, 81% agreed with the statement "I often see products that carry the label 'no added sugar'". However only 51.6% agreed "I often buy products that carry the label 'no added sugar'". This suggests that awareness of 'no added sugar' labels may not translate into purchasing decisions for a large segment of consumers.

A 2012 mixed methods study by Patterson et al. explored attention paid to claims on food labels, including their influence on purchasing decisions for self and others. In a quantitative component of the study, 367 survey respondents (84% female) were presented with a list of 14 claims² and asked which they had seen. 'No added sugar' was the most commonly seen claim (93.7%), followed by 'low fat' (92.6%) and 'no artificial colours or flavours' (91.6%).

Summary 3.1

The results from section 3.1 suggest that most consumers regularly see 'no added sugar' claims on food products, but only approximately half of consumers regularly purchase products with those claims.

² Other claims included: Low fat, no artificial colours, reduced fat, high in fibre, light, wholegrain, no artificial sweeteners, no preservatives, reduced sugars, low salt, lowers cholesterol, reduced calorie, low GI.

3.2 Importance of ‘no added sugar’ claims in purchasing decisions

Six studies investigated the importance of ‘no added sugar’ claims to food purchasing decisions. One study was undertaken in Australia, two in the US, and one in Europe, Brazil and the UK respectively. A different range of attributes were explored in each study (see Table 3). Four of the studies focused on a specific product (infant and toddler foods, fruit beverages, fruit juice, and ice-cream and frozen desserts), while two studies explored the relative importance of ‘no added sugar’ claims on food in general. Five studies identified the absolute importance of ‘no added sugar’ claims to purchasing decisions, while six identified the relative importance compared to other product attributes (see Table 3).

Table 3 - Top 10 rankings of product attributes contributing to food purchasing decisions

<i>Infant and Toddler Foods</i>	<i>Fruit Beverages*</i>	<i>Fruit Juice</i>	<i>Frozen Deserts</i>	<i>Food in General</i>	<i>Food in General</i>
Gascoyne et al. 2022 n = 638 Australia	Choi et al. 2022 n = 1,763 United States	Martins et al. 2020 n= 369 Brazil	Sipple et al. 2022 n = 578 United States	Patterson et al. 2012 n = 367 United Kingdom	EFSA 2022 n = 7,469 European Union, Norway and Iceland
1. Natural / natural ingredients	1. 100% juice	1. No added sugar	1. Price	1. Low fat	1. Low sugar
2. Statements that the food is made with real fruit and vegetables	2. Good source of vitamin C	2. No preservatives	2. All natural	2. No added sugars	2. No added sugar
3. Free from preservatives, colours, flavours, additives and/or thickeners	3. No added sugar/ less sugar	3. Cold pressed	3. Is naturally sweetened	3. Wholegrain	3. Sugar free
4. Statements that the food contains more than one serve of fruit and or vegetables	4. No diet sweeteners	4. Fresh juice	4. Short ingredient list	4. No artificial colours	
5. Indication that the product contains specific vitamins and minerals (such as iron, calcium, B vitamins)	5. Low price	5. Pressurised juice	5. Package size	5. Reduced fat	
6. No added sugar	6. All natural/ organic, no high fructose corn syrup/ no artificial		6. Made from dairy milk	6. No preservatives	

ingredients/ non-GMO			
7. Natural sweetness – that is, sweetened with fruit	7. My child asks for it	7. Has reduced sugar content	7. Low salt
8. Organic	8. Low in calories	8. Brand	8. No artificial sweeteners
	9. Comes in juice box or pouch	9. Has no added sugar	9. High in fibre
		10. Has reduced fat content	10. Light
		 Total 21 attributes	... Total 14 attributes

* Fruit beverages included 100 % juice, juice/water blends, fruit drinks and flavoured water.

Influence on food purchases for children and infants

Three of the studies considered food purchasing decisions made on behalf of children and infants (Gascoyne et al. 2022; Choi et al. 2022; Patterson et al. 2012). The influence of ‘no added sugar’ claims on purchases made for children may differ from other purchasing decisions, so these results may not be generalisable to purchases made for oneself or other adults. Two of these studies (Gascoyne et al. 2022; Choi et al. 2022) measured the influence of ‘no added sugar’ claims on purchasing decisions by directly asking consumers how important the claim was on a Likert scale. These results were then compared across product attributes to understand their relative influence. In contrast, Patterson et al. (2012) compared the proportions of participants who reported looking for different claims while shopping to determine their influence. Thus, the results from these studies reveal consumers’ perceived importance of ‘no added sugar’ claims, which may differ from actual importance in a real shopping scenario.

Gascoyne et al. 2022 surveyed Australian parents’ attitudes towards ready-made infant and toddler food product composition, labelling and promotional information. A total of 638 parents of children aged under five years (67.7% female) completed the survey, with the results weighted by age, gender, number of children, state/territory of residence, indigenous status and socio-economic area, to align with Australian census data. Parents were asked ‘how likely are the following claims on the packaging to make you choose to buy a particular ready-made baby or toddler food product?’ for eleven different claims. However results were only reported for eight claims (see Table 3). Response options included ‘extremely likely’, ‘very likely’, ‘somewhat likely’ and ‘not at all likely’. ‘No added sugar’ ranked sixth of the eight claims, with 88.5% of parents indicating that these claims were at least somewhat likely to make them choose to buy a ready-made baby or toddler food product. Of these, 31.9% chose ‘extremely likely’, 34.3% ‘very likely’, and 22.3% ‘somewhat likely’, suggesting that the claim is influential in purchasing decisions for baby and toddler foods for the majority of parents. The proportion of parents who reported being very or extremely likely to purchase baby and toddler foods because of a ‘no added sugar’ claim was significantly greater among parents who were partnered compared to sole parents (67.2% vs 61.4%; $p=0.048$) and

among those with a lower compared to higher education (76.3% vs 60.3%; $p=0.008$), where higher education was defined as undergraduate or above. The most influential claim tested was 'natural/natural ingredients' with 93.4% indicating that these claims were at least somewhat likely to make them choose to buy a ready-made baby or toddler food product. This was followed by 'made with real fruit or vegetables' (92.9% at least somewhat likely), 'free from preservatives, colours, flavours, additives or thickeners' (92.4%), 'contains more than one serve of fruit or vegetables' (90.8%), and 'contains specific vitamins or minerals (such as iron, calcium, B vitamins)' (89.5%). 'Natural sweetness – that is, sweetened with fruit' (86.3%) and 'organic' (84.7%) claims were slightly less influential than 'no added sugar'. Only the proportion who were at least somewhat likely to be influenced by these other claims was reported, so it is not possible to determine how many people were strongly influenced vs only minimally influenced.

A 2022 US survey of 1,763 caregivers explored the contributors to the frequency at which participants provided sweetened fruit-flavoured drinks (fruit drinks and flavoured waters) to their one to five year old children (Choi et al. 2022). Participants were asked to rate how important different product features were in their purchasing decisions for fruit beverages, including 100% juice, juice/water blends, fruit drinks and flavoured water (1 = not at all important to 7 = extremely important). Product features assessed included package claims ('No added sugar', 'Less sugar', '100 % juice', 'Good source of vitamin C', 'All natural', 'No diet sweeteners', 'Low in calories', 'Organic', 'No high fructose corn syrup (HFCS)', 'No artificial ingredients' and 'Non-GMO'), package type (whether the product comes in a juice box or pouch), the fact that their 'child asks for it' and 'low price'. Results for 'no added sugar' and 'less sugar' claims were combined in the reported results due to a high correlation. 'No added sugar' and 'less sugar' claims were seen as important to purchasing decisions ($M=5.1$, $SD\ 1.4$). This was the third highest attribute following '100% juice' ($M=5.4$, $SD\ 1.5$) and a 'good source of vitamin C'. ($M=5.2$, $SD\ 1.5$), and were of similar importance to 'no diet sweeteners' claims ($M=5.1$, $SD=1.9$) (see Table 3). 'No added sugar' and 'less sugar' claims also ranked above having a low price ($M=4.8$, $SD=1.7$). In contrast to Australian results from Gascoyne et al. (2022) where those with lower education were more influenced by 'no added sugar' claims, those with four or more years in college placed significantly more importance on 'no added' or 'less sugar' claims ($M=5.3$, $SD\ 1.3$), than those with two or less years college ($n=658$, $M=5.0$, $SD=1.4$) or high school education ($n=351$, $M=4.8$, $SD=1.5$) $p<0.05$. The study also found that caregivers who believed that 'no added sugar' or 'less sugar' were important product features served sweetened drinks (fruit drinks and flavoured waters) significantly less frequently (never vs low to high – $OR=0.88$, $p<0.05$; never and low vs moderate and high – $OR=0.80$, $p<0.05$; never to moderate vs high, $OR=0.88$, $p<0.05$). In contrast, looking at the nutrition facts panel was not associated with providing sweetened drinks to children. The relationship between perceiving 'no added' and 'less sugar' claims as important and serving of 100% juices and juice water blends was not reported.

A 2012 mixed methods study by Patterson et al. explored the influence of claims on purchasing decisions for self and others. In the quantitative component of the study, 367 respondents (84% female) were presented with a list of 14 claims and asked which they had actively looked for when shopping for themselves (see Table 3), and which they had actively looked for when shopping for a child or grandchild. 'No added sugar' was the second most common claim sought when shopping for oneself (52.0%), behind 'low fat' (52.9%). Similarly, 'no added sugar' (40.1%) was the second most commonly sought claim when shopping for a child or grandchild, behind 'no artificial colours' (43.6%). This contrasted with nutrients such as fat, which were much more salient when shopping for oneself.

Influence on food purchases in general

Three further studies considered purchasing decisions without a particular end consumer in mind (EFSA 2022; Martins et al. 2020; Sipple et al. 2022). Two of these studies (Martins et al. 2020; Sipple et al. 2022) utilised conjoint analysis to determine the importance of 'no added sugar' claims to purchasing decisions. This involves consumers indicating which product they would choose to purchase from a variety of options with varying product attributes. Consumers' choices were then used to determine the relative importance of the attributes. This method provides a more realistic scenario, where consumers are required to trade off against various product attributes, and thus provide an indication of revealed rather than stated preferences. In contrast, EFSA (2022) compared the proportion of participants reporting that they prioritised purchasing products with 'no added sugar' claims.

In addition to exploring the product attributes which influence healthfulness perceptions of 'better for you' frozen desserts (see section 2.1), Sipple et al. 2022 utilised conjoint analysis with the 578 people from their sample who had previously purchased 'better for you' frozen desserts to determine which product attributes drive purchasing decisions for these products. While 'no added sugar' was relatively influential in health perceptions (ranking second), it was less influential in driving purchasing decisions, ranking 9th out of 21 attributes (see Table 3). 'Price', 'all natural', and 'is naturally sweetened' were the most important purchase drivers for 'better for you' frozen desserts. It was not possible to determine whether 'no added sugar' claims were influential in an absolute sense from this study.

In a 2020 conjoint analysis with 369 Brazilian adults (75% female), Martins et al. 2020 explored the relative influence of four characteristics related to processing technology and formulation on consumers' purchase intentions for a mixed tropical juice. The variables included processing technology, added sugar, preservatives and cold pressing. The inclusion of information about no added sugar, no preservatives and cold pressing had a positive effect on consumers' choices. The 'no added sugar' claim had a significant coefficient of 2.041, indicating that participants were more likely to choose the product when the claim was present than when it was not present ($p < 0.001$). It also had the largest coefficient in the model, suggesting that this attribute had the highest relative importance (see Table 3). These results suggest that 'no added sugar' is important in driving purchases for fruit juices, and is relatively more important than other information about juice processing and formulation.

In an online survey of 7,469 adults across European Union members states, Norway and Iceland, participants were asked 'when you shop for products, do you prioritise buying products with the following claims, disregarding other factors?' for 'no added sugar', 'low sugar' and 'sugar free' (EFSA, 2022). Results suggested that 60% of respondents prioritised products with 'no added sugar' claims, compared to 66% for 'low sugar' and 54% for 'sugar free'. However, the study noted that these values varied substantially across the 29 countries surveyed (individual country data for 'no added sugar' not reported).

Summary 3.2

Studies exploring the influence of 'no added sugar' claims on purchasing decisions used a variety of methodologies, focus products and comparison product attributes, making direct comparison of the results challenging. Some studies also looked specifically at purchasing decisions for children, which may not be generalisable to purchasing decisions made for oneself or other adults.

'No added sugar' claims were perceived as important across the five studies that measured *absolute importance* to food purchasing decisions. This included purchases for infant and toddler foods, where the claim was at least somewhat likely to make 88% of consumers choose to buy a particular product (Gascoyne et al. 2022). Similarly for fruit beverages, participants on average rated 'no added sugar' or 'less sugar' claims as 5.1 out of 7, where 7 indicated being extremely important to purchasing decisions for their children (Choi et al. 2022). Choi et al. (2022) also identified that caregivers who believed that 'no added sugar' or 'less sugar' were important product features served sweetened fruit beverages (fruit drinks and flavoured water) significantly less frequently. Martins et al. 2020 also found that participants were more likely to choose to purchase a mixed tropical juice when a 'no added sugar' claim was present, compared to when it was not present. Patterson et al. (2012) identified that over 50% of consumers actively sought out the 'no added sugar' claim when shopping for themselves, while over 40% sought it out when shopping for a child or grandchild. Similarly, 60% of participants in a large European study reported prioritising purchasing products with 'no added sugar' claims (EFSA 2022).

Studies that looked at *relative importance* of 'no added sugar' compared to other claims or product attributes demonstrated variability in how highly 'no added sugar' ranked. This variability can be explained by the different product types considered and the variation in other product attributes tested. For infant and toddler foods, 'no added sugar' claims were less influential compared to claims such as 'natural/natural ingredients' and 'made with real fruit and vegetables', ranking sixth of eight claims. For fruit beverages 'no added sugar' or 'less sugar' claims were rated third of nine attributes, behind claims that were particularly relevant to fruit beverages, such as '100% juice' and 'a good source of vitamin C'. For fruit juice, 'no added sugar' was the most influential factor when compared with other information about juice processing or formulation. For 'better for you' frozen desserts, 'no added sugar' ranked 9th out of 21 product attributes, behind the price and claims such as 'all natural', and 'is naturally sweetened'. In one study that did not consider a specific food product, 'no added sugar' remained relatively influential (consistently ranked second of 14 attributes) irrespective of whether someone was shopping for themselves, or shopping for children or grandchildren. This contrasted with nutrients such as fat, which were much more salient when shopping for oneself. Compared to other sugar related claims, 'no added sugar' was ranked second of three claims.

In Australian research, parents who were partnered were more likely to be 'very likely' or 'extremely likely' to purchase ready-made products because of a 'no added sugar' claim, compared to sole parents. However, there were conflicting results around whether those with lower or higher education were more likely to be influenced by 'no added sugar' claims. In Australian research, parents with lower levels of education were more influenced by 'no added sugar' claims. However in the US, parents with four or more years in college placed significantly more importance on no added or less sugar claims than those with two or less years college or high school education. It is challenging to definitively identify the reasons for this inconsistency, but it may be driven by the different sample countries, the different product types (infant and baby food vs fruit beverages) or differences in result reporting, with the US results relating to both 'no added' and 'less sugar' claims.

Conclusion

Acknowledging its limitations, the findings of the literature review suggest there is significant variation and uncertainty in consumer understanding of whether particular ingredients are 'added sugars' and whether they are prohibited on foods bearing a 'no added sugar' claim. For example of the 40 ingredients tested across six studies, only six ingredients were considered to be 'added sugar' by more than two thirds of participants in at least two studies, and consumer perceptions of ingredients like honey and fructose varied by up to 65%. Several studies identified that some consumers perceive ingredients that are not currently prohibited in foods making 'no added sugar' claims to be added sugar. For example, between 22% and 65% perceived fruit juice to be added sugar, while 42% - 55% perceived fruit paste, 45% - 55% perceived fruit puree, and 37% - 50% perceived dried fruit to be sugar when added to another food. Other studies identified that consumers may perceive ingredients seen as 'natural', such as fructose or lactose, as being inherent rather than added to a food. In one German study, very high proportions of consumers thought that artificial sweeteners were prohibited in products bearing 'no added sugar' claims.

The review also identified that that 'no added sugar' claims may not be well understood by some consumers. Between 4% and 50% of consumers believed that a 'no added sugar' claim meant that the product could not contain any sugar, while between 34% and 91% of consumers interpreted a 'no added sugar' claim to mean that the product has reduced sugar. One German experiment found that 'no added sugar' claims only reduced consumers' estimations of sugar content for chocolate and ketchup, suggesting that this effect may differ by product type. The understanding of 'no added sugar' claims to mean the food contains no sugar was more common for New Zealanders of non-European ethnicity (including Māori, Pacific and Asian), while in Australia, the misunderstanding occurred for between 17% and 29% of participants even when total sugar information was provided on the back-of-pack.

'No added sugar' claims appear to modify consumer perceptions of the food products that they are applied to. The majority of studies looking at healthfulness perceptions indicate that 'no added sugar' claims increase how healthy consumers perceive food products to be. One New Zealand study further investigated the potential for 'no added sugar' claims to mislead consumers about the overall healthiness of a product, and found that over one third (36%) of participants believed that cereals with a 'no added sugar' claim were definitely healthy. This health halo was significantly worse for low-income and lower-educated groups as well as those of non-European ethnicity, with 61% of Māori, 66% of Asian and 53% of Pacific participants believing a 'no added sugar' claim meant that the food was definitely healthy. A small number of studies also indicated that 'no added sugar' claims may make consumers perceive food products to be more natural but less tasty.

'No added sugar' claims were found to have an influence on purchasing decisions in studies relating to toddler and infant foods, fruit beverages and fruit juices. However, the relative importance of the claim compared to other claims or product attributes depended on the product and the other attributes tested. Rankings ranged from being the most influential attribute for fruit juice when compared to other processing or formulation information, to ninth of 21 attributes related to 'better for you' frozen desserts. For infant and toddler foods, 'no added sugar' claims were less influential compared to claims such as 'natural/natural ingredients' and 'made with real fruit and vegetables', ranking sixth of eight claims. For fruit beverages 'no added sugar' or 'less sugar' claims were rated third of nine attributes, behind claims that were particularly relevant to fruit beverages, such as '100% juice' and 'a good source of vitamin C'. In this study, caregivers who believed that 'no added sugar' or 'less sugar' were important product features served sweetened fruit beverages (fruit drinks and flavoured water) significantly less frequently. In one study from the UK that did not consider a specific food product, 'no added sugar' remained relatively influential (consistently ranked

second of 14 attributes) irrespective of whether someone was shopping for themselves or shopping for children or grandchildren.

Overall, the claim appears to be sought out and utilised by 40%-60% of consumers. However, the influence of 'no added sugar' claims may differ according to certain demographics. In Australian research, parents who were partnered were more likely to purchase toddler and infant food products because of a 'no added sugar' claim compared to sole parents. However, there were conflicting results around whether those with lower or higher education were more likely to be influenced by 'no added sugar' claims.

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Appendix 1 – Methods

Search Strategy

Nineteen online databases were searched via EBSCO Discovery, Elsevier and Web of Science (available through the FSANZ library):

- Science Direct
- Food Science Source
- Food Science and Technology Abstracts
- MEDLINE
- SocINDEX
- EconLit
- KCI-Korean Journal Database
- Preprints Citation Index
- SciELO Citation Index
- Ebsco Complementary Index
- EBSCO Supplemental Index
- Web of Science Core Collection:
 - Science Citation Index Expanded
 - Social Sciences Citation Index
 - Arts & Humanities Citation Index
 - Science
 - Social Science & Humanities
 - Emerging Sources Citation Index
 - Current Chemical Reactions
 - Index Chemicus

Online database searches were undertaken using the following search term combination: “no added sugar*” AND “label*”. Searches were undertaken in August 2023. Searches were limited to peer-reviewed papers or pre-prints available in English and published from 2003 to 2023. 2003 was adopted as the lower limit of the search to align with the previous FSANZ literature reviews on sugar (FSANZ 2017) and added sugar (FSANZ 2022).

To ensure the literature review incorporated a suitable range of references, further literature was sought by hand-searching:

- Google scholar – first 100 results from search “no added sugar”
- Studies included in FSANZ 2017 and 2022 literature reviews on sugar and added sugar.

Three confidential reports previously provided to FSANZ by stakeholders also contained relevant information.

Due to the time available, reference lists and studies citing the identified research were not checked. As such, this rapid review is not considered to be systematic, and may not be a comprehensive overview of all evidence relating to consumer understanding and responses to ‘no added sugar’ claims.

Review Process

The online database searches identified 158 potential articles, which were screened for inclusion based on title and abstract and full text. The database searches, Google Scholar results and screening of previous literature reviews resulted in a total of 19 articles, of which nine were captured by previous reviews (FSANZ 2017; FSANZ 2022). Three articles had been previously provided to FSANZ in confidence by stakeholders. The screening process

and evidence synthesis was undertaken by three FSANZ social scientists, and peer reviewed internally.

Appendix 2 – Overview of Included Studies

Study	Country	Method	Participants	RQ1	RQ2	RQ3
Chein et al. 2018	Taiwan	Quantitative survey	940 (100% female)	1.2	2.1,2.2	
Chen et al. 2020	Taiwan	Mixed method focus groups and survey	122 (70% female)	1.2		
Choi et al. 2022	United States	Quantitative survey	1,763			3.2
Drewnowski et al. 2010	United States	Quantitative survey	320 (78% female)		2.1	
EFSA 2022	European Union, Norway and Iceland	Quantitative survey	7,469 (51% female)	1.1,1.2		
Ehrecke et al. 2022	Germany	Quantitative survey	469 (72% female)	1.1, 1.2	2.1	3.1
FSANZ 2006	Australia and New Zealand	Quantitative survey	1,007 (50% female)	1.2		
Gascoyne et al. 2020	Australia	Quantitative survey	638 (68% female)			3.2
Gorton et al. 2010	New Zealand	Quantitative survey	1,525 (72% female)	1.2	2.1	
Jurkenbeck et al. 2022	Germany	Quantitative survey	1,614 (51% female)		2.1	
Martins et al. 2020	Brazil	Quantitative survey	369 (75% female)			3.2
McCann et al. 2022	Australia	Quantitative survey	207 (98% female)		2.1	
Morley & Ilchenko 2022	Australia	Quantitative survey	2,332	1.1	2.1	

Study	Country	Method	Participants	RQ1	RQ2	RQ3
			(representative % female)			
Nuss et al. 2020	Australia	Quantitative survey	2,062 (51% female)	1.1		
Patterson et al. 2012	United Kingdom	Mixed methods focus groups and survey	4 focus groups, 9-10 participants (100% female) 367 survey (84% female)	1.1, 1.2	2.3	3.1, 3.2
Prada et al. 2020	Portugal	Quantitative survey	1,010 (77% female)	1.1		
Prada et al. 2021	Portugal	Quantitative survey	406 (80% female)		2.1, 2.3	
Sipple et al. 2022	United States	Quantitative survey	1,051 (78% female)		2.1	3.2
Tierney et al. 2017	United Kingdom	Quantitative survey	445 (77% female)	1.1		