FOOD STANDARDS
Australia New Zealand
Te Mana Kounga Kai – Ahitereiria me Aotearoa

Consumer Literature Review for P1049

Consumer value, perceptions and behaviours in relation to carbohydrate and sugar claims on alcoholic beverages

January 2023

Executive summary

Food Standards Australia New Zealand (FSANZ) undertook a rapid systematic review to examine the available evidence on consumer value, perceptions and behaviours in response to carbohydrate and sugar claims on alcoholic beverages. This report outlines the methodological approach to the review, and summarises the available evidence.

Searches of electronic databases and hand-searching were used to identify 12 studies for this review. The review includes peer-reviewed articles published in academic journals as well as grey literature (i.e. unpublished theses, conference papers and research produced by non-governmental agencies). Findings across studies were narratively synthesised.

This review is not without limitations. As little research was available, the review is based on a mix of internationally-based samples and Australian-/New Zealand-based samples. Therefore caution is applied in generalising the findings automatically to Australian/New Zealand populations. However, the fact that the available New Zealand- and Australian-based studies produced results consistent with the internationally-based studies reduces this concern. Studies also varied in quality and differed in methodological approaches, however, general conclusions may be drawn based on the consistency of the findings across studies. The key findings are described below.

Consumer understanding of the nutritional properties of alcoholic beverages

Consumers generally have a poor understanding of the nutritional properties of alcoholic beverages (based on their general knowledge).

Firstly, results from two studies indicate that consumers tend to overestimate the sugar content of alcoholic beverages. This is the case for all types of alcoholic beverages (wine, beer, spirits, cider, 'ready to drink' alcoholic beverages [RTDs]).

Secondly, results from three studies indicate that consumers' ability to estimate the carbohydrate content of alcoholic beverages is also poor, with consumers tending to overestimate the carbohydrate content of beer in particular. The direction of inaccuracy is unclear for other alcoholic beverages (i.e. whether consumers tend to overestimate vs. underestimate).

Thirdly, FSANZ's previous (2021) consumer literature review and meta-analysis found that only a minority of consumers are able to correctly estimate the energy (i.e. kilojoule/calorie) content of alcoholic beverages (pooled proportion of correct estimates across studies = 18% [95% CI: 14-24%]). Consumers are also generally unable to correctly rank the relative energy content of different alcoholic beverages. Consumers tend to underestimate the relative energy content of wine and spirits, and overestimate the relative energy content of beer. Finally, consumers do not understand that the main source of energy in most alcoholic beverages comes from the alcohol itself. Instead, consumers believe that sugar or carbohydrates are the main sources.

Consumer value of carbohydrate and sugar claims on alcoholic beverages

Consumers generally value sugar claims (and sugar information more broadly) on alcoholic beverages.

Results from two studies found that consumers generally feel that 99.9% sugar-free claims on beer are acceptable, and appreciate being presented with "health facts" to be able to make a more informed choice. One additional study found that consumers generally value sugar content information more broadly on alcoholic beverages (whether they think the information should be displayed in a nutrition information panel [NIP] vs. claim format, was not examined in this study).

Consumers may also value carbohydrate claims on alcoholic beverages, however, this evidence is less clear as the results are not generalisable to all types of alcoholic beverages. One international study found that German and USA consumers value low-carbohydrate claims on wine when accompanied with a relatively low alcohol content (9% vs. 14%), whereas UK consumers do not. It is unclear whether the German, USA or UK consumers would value low-carbohydrate claims on wine that does not have a relatively low alcohol content, as this type of wine was not examined in this study.

It is important to note that none of these studies examined the effect of carbohydrate/sugar claims on consumer perceptions of alcoholic beverages. It is therefore unclear whether the participants in these studies had a good understanding of the meaning of the claims (i.e. whether or not the claims caused consumers to make inaccurate assumptions about alcoholic beverages).

Consumer perceptions of carbohydrate and sugar claims on alcoholic beverages

Sugar/carbohydrate claims may cause consumers to make inaccurate assumptions about alcoholic beverages.

Three studies that examined consumer perceptions of carbohydrate claims on beer indicate that consumers may mistakenly perceive low-carbohydrate beer as healthier than low-alcohol strength beer, with some consumers also perceiving low-carbohydrate beer to be healthy in an absolute sense, and mistakenly believing that they "don't need to worry about their weight" when drinking low-carbohydrate beer. This is likely related to the additional finding that consumers do not understand that most of the energy in beer comes from the alcohol itself. Carbohydrate claims on beer may further exacerbate this misconception. However, caution is advised when interpreting these three studies, as they were all of low quality.

A fourth (high quality) study found that sugar claims on ciders and RTDs cause young female adults to mistakenly perceive those beverages as being lower in alcohol. This indicates that sugar claims on ciders and RTDs cause consumers to make inaccurate assumptions about an unrelated drink attribute. It is unclear whether this effect is limited to young female adults.

Consumer behaviours in response to carbohydrate and sugar claims on alcoholic beverages

There is no clear evidence to suggest that sugar and carbohydrate claims on alcoholic beverages affect consumers' level of alcohol intake. However, the presence of a claim may make consumers less likely to exercise, and less likely to change their diet, in order to compensate for the energy from alcoholic beverages.

Results from one study indicate that sugar claims have no effect on young female adults' level of alcohol consumption (as measured by the likelihood of consuming an alcoholic beverage, or the number of drinks intended to be consumed over a two week period). However, there is evidence to suggest that sugar claims may cause young female adults to be *less* likely to modify their food intake or physical activity in order to compensate for the energy from alcoholic beverages. This indicates that sugar claims may encourage consumers to underestimate the contribution of alcohol to energy in the diet. However, this evidence is limited in that consumers' behavioural *intentions* were examined, and it is well known that behavioural intentions do not always lead to actual behaviour change. Secondly, although the observed behavioural effect is small, it is unclear whether providing consumers with energy content information on alcoholic beverages will alleviate this effect, and whether the effect is limited to young female adults. It is also unclear whether sugar claims on alcoholic beverages affects choice among different types of alcoholic beverages, which in turn could also affect energy intake.

Given that consumers report believing both carbohydrates and sugar are likely to cause weight gain and report trying to limit their intake, carbohydrate claims may have similar behavioural effects as sugar claims. However, no study has sufficiently addressed the effect of carbohydrate claims on alcoholic beverages on consumer behaviour.

Contents

Introduction

Under Standard 1.2.7 of the Australia and New Zealand Food Standards Code (the Code), nutrition content claims and health claims about alcoholic beverages containing more than 1.15% alcohol by volume are prohibited, except for nutrition content claims about energy, carbohydrate and gluten. A nutrition information panel (NIP) is required on all alcoholic beverages carrying a nutrition content claim.

In November 2017, the Australia and New Zealand Ministerial Forum on Food Regulation (now the Food Ministers' Meeting (FMM)) discussed sugar claims in relation to alcoholic beverages. The FMM expressed concern that '% sugar free' claims on alcoholic beverages are misleading and that alcohol is being promoted as a healthier choice for consumers when public health advice is to limit alcohol intake. They asked Food Standards Australia New Zealand (FSANZ) to review the matter in relation to Standard 1.2.7.

In response, FSANZ undertook a technical assessment (FSANZ, 2018) to determine whether changes to the Code were required. The technical assessment included consideration of the available evidence regarding consumer perceptions and behaviours in response to carbohydrate and sugar claims on alcoholic beverages. The technical assessment concluded that to regulate claims about sugar differently to claims about carbohydrate could be seen to be inconsistent, particularly in light of the nature of claims currently in the marketplace and the available consumer evidence. This evidence indicated that consumers may make inaccurate assumptions about alcoholic beverages making nutrition content claims about carbohydrate and/or sugar. These assumptions relate to the energy content and the perceived healthiness of alcoholic beverages carrying claims. As a result, Proposal P1049 was prepared to clarify the Code with respect to claims about carbohydrate and sugar claims on alcoholic beverages.

In October 2018, the FMM asked FSANZ to consider mandatory labelling for pregnancy warning labels on packaged alcoholic beverages as a priority, which impacted resources to progress P1049. In 2019, FSANZ was also asked by the FMM to consider energy labelling on alcoholic beverages. Given the interrelationship between energy labelling and carbohydrate/sugar claims on alcoholic beverages, work on P1049 was temporarily paused to allow FSANZ to progress work on energy labelling.

Given the time that has passed since the original technical assessment, FSANZ undertook a literature review to update the evidence-base regarding consumer value, perceptions and behaviours in relation to carbohydrate and sugar claims on alcoholic beverages. The literature review investigated the following four research questions:

1. What do consumers understand about the nutritional properties of alcoholic beverages? In particular, what do they understand about the sugar, carbohydrate and energy content?

2. Do consumers value sugar and carbohydrate claims on alcoholic beverages?

3. Do sugar and carbohydrate claims influence consumer perceptions of alcoholic beverages? In particular, do such claims influence perceived energy content and/or perceived healthiness?

4. Do sugar and carbohydrate claims on alcoholic beverages influence consumer behaviour? In particular, do such claims influence alcohol intake and/or other health-related behaviours (e.g. exercising behaviour)?

This document outlines the methodological approach to the literature review and summarises the evidence that was available to answer each research question.

Methods

Literature search strategy

FSANZ undertook a systematic search for literature on consumer value, perceptions, and behaviours in relation to carbohydrate and sugar claims on alcoholic beverages. Literature was identified by:

- Searching online databases for peer-reviewed studies published between January 2003 and May 2022;
- Searching the FSANZ Behavioural and Regulatory Analysis section reference database;
- Requesting any published and unpublished research relevant to the review from the International Social Science Liaison group (ISSLG)[1];
- Requesting any published or unpublished research relevant to the review from stakeholders (government, alcohol industry, public health and consumer groups);
- Searching references obtained in the process of conducting FSANZ's consumer literature review on energy labelling of alcoholic beverages (both included and excluded studies) (FSANZ, 2021);
- Searching references in FSANZ's original technical assessment (FSANZ, 2018); and
- Searching the reference lists and citing studies of obtained studies.

A total of 11 full-text documents (consisting of 12 unique studies[2]) were included in the literature review. The literature search and screening process was conducted by two officers. More details on the literature search strategy and research review process are available in Appendix 1.

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[1] The ISSLG consists of members from international food regulatory agencies involved in social sciences in food regulation.

[2] One full-text document (Colmar Brunton, 2017) contained two separate studies.

Study quality assessment

The quality of each included study was assessed using a revised version of the Quality Assessment Tool for Studies with Diverse Designs (QATSDD) (Sirriyeh et al., 2012). The QATSDD was chosen because eligible studies were expected to vary in design. The revised QATSDD consists of a total of 14 items (12 items for quantitative or qualitative studies, 14 items for mixed-design studies) that may be broadly categorised into the following themes/quality criteria:

- Theoretical/conceptual framework and research aims;
- Sampling and recruitment methods;
- Procedural details;
- Data collection tools;
- Data analyses;
- Ethics; and
- Strengths and limitations.

Each item is rated according to the degree to which each quality criteria is met: 0 = no mention at all; 1 = very slightly met; 2 = moderately met; 3 = completely met (except for the ethical approval criteria which is rated on a dichotomous scale of 0 or 3). The revised QATSDD is further described in Appendix 2, and a full copy of the revised QATSDD is provided in Table A2.

Based on the revised QATSDD criteria, studies were evaluated as being "low," "medium," or "high" in overall quality. Low quality studies were those that rated poorly on many criteria (i.e. had a total rating of less than 50%[3]), and/or had missing methodological details or inadequately reported results, which made it difficult to have confidence in the findings. Medium quality studies were those that rated poorly on some criteria, but there were no major concerns regarding the methodology or reporting of results, and therefore it was possible to have some confidence in the findings. These studies tended to have total ratings that were greater than 50%, but less than 70%. High quality studies rated highly on most criteria, and there were no concerns regarding the methodology or reporting of results, and therefore it was possible to have a high-level of confidence in the findings. These studies tended to have total ratings that were greater than 70%.

The quality evaluations of each study are reported in Appendix 3, along with an overview of general study characteristics. Study quality assessments were conducted by one officer.

Evidence synthesis

The evidence from each study was collated thematically under the research questions in order to present a narrative overview of the available evidence. Use of

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[3] Total ratings for each study were calculated by summing the ratings of each criteria and dividing this by the maximum possible total rating and multiplying by 100 (as described in Sirriyeh et al., 2012).

meta-analysis was not appropriate given the varied designs and measures used across studies.

The level of confidence in the conclusions drawn for each research question is described using a narrative approach. This is because there is currently no available tool that may be used to quantitatively synthesise confidence in the findings from studies that used diverse designs. However, considerations were given to the general principles of the Grading of Recommendations, Assessment, Development and Evaluations (GRADE) framework (Guyatt et al., 2011) when narratively synthesising confidence in the findings. That is, consideration was given to the quality of the individual studies (as assessed by the revised QATSDD), the consistency of findings across studies, and the directness of the measures (e.g. self-reported hypothetical measures of behaviour lack directness).

Write-up and synthesis was conducted by two officers.

The draft literature review was internally reviewed by FSANZ staff members. The final draft was then externally reviewed by an independent academic with expertise in the behavioural sciences. Peer review comments were considered and incorporated into the final version of the report.

Findings

Overview of study characteristics

12 unique studies (from 11 documents) were eligible for inclusion. Four studies were peer-reviewed articles published in academic journals, and eight were grey literature (i.e. unpublished theses, conference papers and research produced by non-government agencies).

Six studies recruited participants from Australia. No studies recruited participants from New Zealand. The remaining studies recruited participants from the USA (n = 2), Ireland (n = 1), or from multiple countries (from Europe and the USA; n = 3).

Most studies (8/12 = 67%) involved quantitative, cross-sectional surveys. Two studies used qualitative designs (focus groups), one study used a discrete choice experiment, and one study used an experimental design.

Most studies (7/12 = 58%) were of low quality according to the revised QATSDD. Four were of medium quality and one was of high quality. Common reasons for low quality ratings were missing methodological information.

Appendix 3 provides an overview of the characteristics and quality ratings for each study. Studies are grouped in tables by the four overarching research questions of the literature review (consumer understanding about the nutritional properties of alcoholic beverages [Table A3.1], consumer value of claims on alcoholic beverages [Table A3.2], effects of claims on consumer perceptions [Table A3.3], effects of claims on consumer behaviours [Table A3.34]). Note that some studies reported

findings relevant to more than one research question, therefore some studies are repeatedly described across Tables A3.1-A3.4.

Consumer understanding of the nutritional properties of alcoholic beverages

This section examines consumer understanding of the nutritional properties of alcoholic beverages. In particular, it examines consumer understanding of the sugar, carbohydrate and energy content of alcoholic beverages. Few studies examined consumer understanding of the sugar (n = 2) and carbohydrate (n = 3) content, and these studies tended to examine whether participants were able to correctly estimate the sugar and/or carbohydrate content of a range of different alcoholic beverages (in grams, or as a percentage).

Conversely, several studies (n = 22) identified in a recent consumer literature review and meta-analysis completed by FSANZ (FSANZ, 2021) examined consumer understanding of the *energy content* of alcoholic beverages. No further studies relevant to this research question were identified when searching for studies for the current review. Therefore, an overview of the findings from FSANZ (2021) are reiterated in the current review.

In contrast to the studies that measured consumer understanding of the sugar and carbohydrate content, consumer 'understanding' of the energy content was measured in several different ways across these studies. That is, in addition to examining whether participants were able to correctly estimate the energy content of a particular alcoholic beverage in kilojoules or calories, studies also examined whether participants were able to correctly rank the energy content of different alcoholic beverages. Participants in these studies were provided with a list of different alcoholic beverages, and instructed to correctly rank them from highest to lowest in energy content. These studies therefore also examined participants' knowledge of the *relative* energy content of different alcoholic beverages. Studies also assessed whether participants understand that the main source of energy in most alcoholic beverages comes from the alcohol itself.

Overview of key findings

The studies described in this section varied in quality. However, the use of self-reported quantitative data provided a direct measure of consumer understanding across these studies. General conclusions may therefore be made based on the consistency of the findings across studies.

Taken together, the findings indicate that consumers generally have a poor understanding of the nutritional properties of alcoholic beverages (based on their general knowledge).

Firstly, results from two studies (Barber, 2016; Wright et al., 2008) indicate that consumers tend to overestimate the sugar content of alcoholic beverages. This is the case for all types of alcoholic beverages (wine, beer, spirits, cider, 'ready to drink' alcoholic beverages [RTDs]).

Secondly, results from three studies (Bui et al., 2008; GfK, 2014; Wright et al., 2008) indicate that consumers' ability to estimate the carbohydrate content of alcoholic beverages is also poor, with consumers tending to overestimate the carbohydrate content of beer in particular. The direction of inaccuracy is unclear for other alcoholic beverages (i.e. whether consumers tend to overestimate or underestimate).

Thirdly, FSANZ's previous (2021) consumer literature review and meta-analysis found that only a minority of consumers are able to correctly estimate the energy (i.e. kilojoule/calorie) content of alcoholic beverages. Consumers are also generally unable to correctly rank the relative energy content of different alcoholic beverages. Consumers tend to underestimate the relative energy content of wine and spirits, and overestimate the relative energy content of beer. Finally, consumers do not understand that the main source of energy in most alcoholic beverages comes from the alcohol itself. Instead, consumers believe that sugar or carbohydrates are the main sources.

A more detailed description of the studies is provided below, grouped by the type of nutrition information examined (sugar, carbohydrate or energy).

Consumer understanding of the sugar content of alcoholic beverages

Two international studies examined consumer understanding of the sugar content of alcoholic beverages using quantitative surveys. Both studies were of medium quality.

Wright et al. (2008; medium quality) surveyed 325 consumers of alcoholic beverages from the USA. Participants were asked to indicate whether wine, beer, tequila and vodka contain sugar. Table 1 (adapted from Wright et al., 2008) shows the percentage of participants indicating that the beverage contained sugar, split by age group (under 30 vs. over 30 years).

Table 1. Percentage of participants indicating that wine, beer, tequila and vodka contained sugar

	Aged Under 30 (n=126)	Aged Over 30 (n=199)
Wine	74%	69%
Beer	61%**	49%
Tequila	48%**	34%
Vodka	44%	33%

** Statistically significant difference at $p < .05$

As shown in Table 1, a sizable percentage of participants believed that these beverages contain sugar. For beer and tequila, younger adults (those aged under 30 years) were significantly more likely to believe that beer and tequila contain sugar, whereas there were no significant age differences for the other beverages. Given that the sugar content is often low or non-existent in all of these beverages, these findings suggest that consumer understanding of the sugar content of alcoholic beverages

may be limited. However, the study did not measure the amount of sugar that participants believed to be in these beverages.

Barber (2016; medium quality) provides further insight into consumer understanding of the amounts of sugar contained in alcoholic beverages. This study surveyed 392 young adult consumers of alcoholic beverages (aged 18-24 years) from France and the UK. Participants were asked to provide estimates of the sugar content of different alcoholic beverages including red wine, white wine, beer, cider, clear spirits (gin, vodka), dark spirits (whisky, bourbon, rum), and alcopops (i.e. RTD, Smirnoff ice). When compared to objective levels of sugar content in the alcoholic beverages[4], participants greatly overestimated the sugar content for all alcoholic beverages. For beer and spirits in which actual sugar content is often low or non-existent, respondents on average reported that these drinks contain a sugar content of at least 20%. For alcopops, participants overestimated the sugar content with average estimates of at least 50%, while generally these beverages contain less than 10%. For white wine, red wine and cider, participants also overestimated the sugar content with average estimates of at least 20%, while generally these beverages have sugar levels less than 7%.

Consumer understanding of the carbohydrate content of alcoholic beverages

Three international studies examined consumer understanding of the carbohydrate content of alcoholic beverages. All three studies used quantitative surveys. Two were of low quality, and one was of medium quality.

As previously described, Wright et al. (2008; medium quality) surveyed 325 consumers of alcoholic beverages from the USA. In addition to asking participants to indicate whether a range of alcoholic beverages contain sugar, participants were also asked to indicate whether the beverages contain carbohydrates. Table 2 (adapted from Wright et al., 2008) shows the percentage of participants indicating that each beverage contained carbohydrates, split by age group (under 30 vs. over 30 years).

Table 2. Percentage of participants indicating that wine, beer, tequila and vodka contained carbohydrates

	Aged Under 30 (n=126)	Aged Over 30 (n=199)
Wine	79%	70%
Beer	94%	90%
Tequila	65%**	53%
Vodka	61%	52%

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[4] Objective maximum levels of sugar content per 100 ml for alcoholic beverages according to FSANZ AUSNUT Food Nutrient Database: Beer = ≤0.2%; cider = ≤6.9%; red wine = 0%; white wine ≤2.6%; clear spirits = 0.1%; dark spirits = 0.3%; alcopops ≤9.2%.

** Statistically significant difference at p < .05

As shown in Table 2, most participants (52%-94%) believed that the beverages contained carbohydrates. Younger adults (those aged under 30 years) were significantly more likely to believe that tequila contains carbohydrates than older adults (those aged over 30 years), whereas there were no significant age differences for the other beverages. Given that the carbohydrate content is often low or non-existent in all of these beverages[5], these findings suggest that consumer understanding of the carbohydrate content of alcoholic beverages may be limited. However, the study did not measure the amount of carbohydrates that participants believed to be in these beverages.

Further insight into consumer understanding of the amount of carbohydrate contained in alcoholic beverages is provided by Bui et al. (2008) and GfK (2014). In Bui et al. (2008; low quality), 58 undergraduate students in the USA were asked to estimate the amount of carbohydrates (in grams) contained in standard serving sizes of 'light' (i.e. low-carbohydrate) beer, a regular beer, wine and distilled spirits[6]. The authors did not clarify how participants could respond to the question, but it is assumed that participants could respond by selecting one of several response options, based on how the findings are reported. Only a minority of participants were able to accurately identify the amount of carbohydrates contained in each type of beverage (10% of participants selected correct estimates for light beer; 19% for regular beer, 3% for wine, 10% for distilled liquor). In particular, most participants (71%) overestimated the carbohydrate content of regular beer. However, it is not possible to further specify the direction of inaccuracy (i.e. whether participants tended to underestimate or overestimate the carbohydrate content) for the other beverages, given that biased response categories may have been used[7]. Participants in this study also rated how confident they were in their estimates of the carbohydrate content (on a scale from 1 [not confident at all] to 7 [extremely confident]), and level of confidence was consistently low across all beverages (mean ratings ranged from 2.09 to 2.20, below the midpoint of the scale).

In GfK (2014; low quality) a total of 5,395 adults from six European countries[8] were asked to estimate the amount of carbohydrates in 100ml of alcohol-free beer (less than 1% alcohol), 100ml of regular beer (between 4.5% and 5.5% alcohol), 100ml of white wine, 100ml red wine, and 100ml whiskey. Participants were required to select one of several response categories for each beverage. Consistent with findings from

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[5] Objective maximum levels of carbohydrate content per 100 ml for alcoholic beverages according to FSANZ AUSNUT Food Nutrient Database: Beer = ≤2.3%; red wine = 0%; white wine ≤2.6%; tequila = 0.3%; vodka = 0.1%.

[6] The standard serving sizes were: 12 oz for beer; 5 oz for wine; 1.5 oz for distilled liquor.

[7] For all of the beverages (except regular beer), most of the assumed response categories consisted of values that were higher than the correct amount. The finding that participants tended to overestimate the carbohydrate content of these beverages may therefore be explained by the fact that participants were more likely to select a response category that had a higher value than the correct amount due to chance.

[8] The countries were Germany, Poland, Denmark, the Netherlands, Spain and the United Kingdom.

Bui et al. (2008), only a minority of participants were able to accurately identify the amount of carbohydrates contained in each beverage (3% of participants for alcohol-free beer, 8% for regular beer, 3% for white wine, 12% for red wine, 5% for whiskey). The authors acknowledged their use of biased response categories (as in Bui et al., 2008; see also Footnote 7), and therefore they did not report whether participants tended to overestimate or underestimate the carbohydrate content of the beverages.

Taken together, these three studies indicate that consumers have a poor understanding of the carbohydrate content of alcoholic beverages, with evidence from one study (Bui et al., 2008) showing that consumers tend to overestimate the carbohydrate content of beer in particular. However, caution is warranted when interpreting this finding regarding beer, as it is based on one low-quality study.

The direction of inaccuracy is unclear for other alcoholic beverages (i.e. whether consumers tend to overestimate or underestimate the carbohydrate content). Although Wright et al. (2008) found that most consumers believe that wine, beer, tequila and vodka contain carbohydrates, this study did not ask participants to estimate the *amount* of carbohydrates present. It is therefore not possible to conclude whether participants overestimated the carbohydrate content of these beverages based on this one study.

Consumer understanding of the energy content of alcoholic beverages

The recent consumer literature review and meta-analysis completed by FSANZ (2021) found that consumers generally have a poor understanding of the energy content of alcoholic beverages. The review included a mix of international, Australian and New Zealand-based studies of varying quality (n = 22). To reiterate, no further studies relevant to this research question were identified when searching for studies for the current review. Therefore, the findings from FSANZ (2021) are reiterated here.

Firstly, only a minority of consumers are able to correctly estimate the energy content (i.e. number of kilojoules or calories) in alcoholic beverages using their general knowledge (pooled proportion of correct estimates across studies = 18% [95% CI: 14-24%]).

Secondly, consumers are generally unable to correctly rank the energy content of different alcoholic beverages using their general knowledge. Rather, consumers tend to underestimate the relative energy content of wine and spirits. That is, wine and spirits are mistakenly perceived as being lower in energy compared to other alcoholic beverages. Conversely, consumers tend to overestimate the relative energy content of beer. That is, beer is mistakenly perceived as being higher in energy compared to other alcoholic beverages.

Thirdly, consumers are generally unaware that alcohol is the main source of energy in wine, beer, and spirits; instead, they believe that sugar or carbohydrates are the main sources. This is consistent with the previous finding that consumers are unable to accurately rank the energy content of different alcoholic beverages, and, in particular, that the energy content of spirits is relatively underestimated.

Consumer value of carbohydrate and sugar claims on alcoholic beverages

This section reviews evidence relevant to consumer value of carbohydrate and sugar claims on alcoholic beverages. One international, medium-quality study examined consumer value of carbohydrate claims on beer using a discrete choice experiment. Two Australian studies (one low in quality, and one medium in quality) examined whether consumers perceive sugar claims to be acceptable on beer, and one international, low-quality study examined whether consumers want sugar content information more broadly (i.e. not necessarily in the form of a claim) on alcoholic beverages.

Overview of key findings

The studies that examined consumer value of sugar claims on alcoholic beverages varied in quality. However, general conclusions may be made based on the consistency of the findings and the directness of measures.

Taken together, the findings indicate that consumers generally value sugar claims (and sugar information more broadly) on alcoholic beverages. Results from two studies (Colmar Brunton, 2017, Focus groups & Survey) found that consumers generally feel that 99.9% sugar-free claims on beer are acceptable, and appreciate being presented with "health facts" to be able to make a more informed choice. One additional study (Empathy Research, 2016) also found that consumers generally value sugar content information more broadly on alcoholic beverages (whether they think the information should be displayed in a nutrition information panel [NIP] vs. claim format, was not examined in this study).

Consumers may also value carbohydrate claims on alcoholic beverages, however, this evidence is less clear as the results are not generalisable to all types of alcoholic beverages. One international study (Ghvanidze et al., 2017) found that German and USA consumers valued low-carbohydrate claims on wine when accompanied with a relatively low alcohol content (9% vs. 14%), whereas UK consumers did not. It is unclear whether the German, USA or UK consumers would value low-carbohydrate claims on wine that does not have a relatively low alcohol content, as this was not examined in this study.

It is important to note that none of these studies examined the effect of sugar/carbohydrate claims on consumer perceptions of alcoholic beverages. It is therefore unclear whether the participants in these studies had a good understanding of the meaning of the claims (i.e. whether or not the claims caused consumers to make inaccurate assumptions about alcoholic beverages).

A more detailed description of the studies is provided below, grouped by the scope of research (consumer value of carbohydrate claims on wine, sugar claims on beer, and sugar content information on alcoholic beverages more broadly).

Consumer value of carbohydrate claims on wine

One study (Ghvanidze et al., 2017; medium quality) investigated the impact of various product attributes on consumers' wine choices using an online discrete

choice experiment. In this study, 1,872 wine consumers from the USA (n=544), UK (n=549) and Germany (n=799) were required to choose a bottle of wine that they would be most likely to purchase in a store to consume at home. Participants could choose one out of three possible wines, or none of the wines. They made this choice repeatedly across nine different choice sets. The wines differed based on various attributes including alcohol content and/or presence of a carbohydrate claim ("14% alcohol" vs. "9% alcohol" vs. "9% alcohol" and "30% less carbohydrates")[9]. The carbohydrate claim was only ever presented on wines with the relatively low (9%) alcohol content.

For participants in the UK, the presence of a relatively low alcohol content (9%) accompanied by a low-carbohydrate claim was negatively valued (i.e. the presence of this information resulted in participants avoiding selecting those wines). However, this study is limited in that the value of a low-carbohydrate claim was only examined in conjunction with a relatively low alcohol content. It is therefore unclear whether UK participants would value low-carbohydrate claims when alcohol content is not relatively low, as this profile of wine was not examined in this study.

Conversely, the presence of the same information for US and German participants was valued in regards to participant choices of wines. These preferences were also reflected in the finding that participants in the US and Germany were willing to pay more for wine with lower alcohol content (vs. no information), as well as for wine with lower alcohol content and 30% less carbohydrates (vs. no information). Willingness to pay was also higher for wine with the lower alcohol content information accompanied by the low-carbohydrate claim (2.99 USD; 2.83€) than for wine with only the lower alcohol content information (1.85 USD; 2.30€).

Overall this study indicates that US and German participants value low-carbohydrate claims ("30% less carbohydrates") on wine when accompanied with a relatively low alcohol content (9% vs. 14%), whereas UK participants do not. It is unclear whether US, German or UK participants would value a low-carbohydrate claim on wine that does not have a relatively low alcohol content.

Consumer value of sugar claims on beer

Two separate studies from the same paper (Colmar Brunton, 2017) examined consumer acceptability of sugar claims on beer. The first (low quality) study used qualitative focus groups, whereas the second (medium quality) study used a quantitative survey. Both studies were based on Australian samples.

In Colmar Brunton's (2017; low quality) focus groups study, participants were shown an advertisement/poster that says: "99.9% sugar free beer? (on average). Yes,

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[9] Other attributes included price, ecological impact (e.g., produced with minimum chemical emissions), social responsibility (e.g., good working conditions for employees) and health benefits (e.g., pesticide free).

really." The poster also contained the 'Beer the Beautiful Truth' logo[10] on the top left hand corner, and bottles of various Lion-branded beer were shown below.

Participants were asked whether they felt the ad should be allowed to be shown, and to provide reasons for their answer. The authors reported that most participants (proportion not reported[11]) felt that the advert was perfectly legitimate, and appreciated being presented with "health facts" to be able to make a more informed choice. Example quotes included: "Pretty harmless. Just showing a product range showing that its sugar free beer" (Female, aged 18-34 years); "Its educational on sugar levels – especially for diabetics" (Male, aged 60+ years); and "Good for those who are health conscious" (Male, 35-59 years). Whereas some participants (proportion not reported) expressed cynicism, feeling the advert is misleading. Example quotes from these participants included: "It's essentially false advertising. There's still stuff in beer that makes you fat" (Male, aged 18-34 years); "It shouldn't be about sugar, its alcohol" (Female, aged 35-59 years).

The findings from Colmar Brunton's (2017) focus groups were replicated using a (medium quality) quantitative survey based on 1,225 participants representative of the Australian general population by age, gender and location. In this study, participants were presented with the same advertisement shown to the focus groups, and the majority (66%) believed that the advert was acceptable (23% believed it was not acceptable, and 11% responded that they did not know). Of those who did not believe the advert should be permissible (23%), the most common justifications were that the advert is potentially misleading (stated by 62% of those opposing it) and that it offers a therapeutic benefit (stated by 52% of those opposing it)[12].

Consumer value of sugar content information on alcoholic beverages

One study (Empathy Research, 2016; low quality) conducted a quantitative survey of 933 Irish consumers of alcoholic beverages. Participants were provided with a series of statements and were required to indicate the extent to which they agree or disagree[13]. Most participants (68%) agreed that alcohol companies should display sugar content labelling on their products, with some participants (20%) reporting that

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[10] 'Beer the Beautiful Truth' is a campaign that was launched by the beer industry, which highlights nutritional information about beer. See https://www.beerthebeautifultruth.co.nz/

[11] Qualitative studies are not intended to be representative and also tend to have small sample sizes where it is not meaningful to report proportions. Rather, the purpose of qualitative research is to provide a rich understanding of consumers' perceptions, which often restricts the sample size (Pope et al., 2000).

[12] Participants opposing the advert were asked: "Why do you believe the content of the advertisement is not acceptable? Please only select the main reason(s) you think it is not acceptable for this advertisement to be displayed outdoors (for e.g. on a billboard) ". Response options were: The ad suggests that the beer products offer a therapeutic benefit; The ad is appealing to minors; The ad is potentially misleading; The placement of the ad (i.e. outdoor) is unacceptable; It could be seen by minors; The ad is offensive in general; I just don't like this ad; Alcohol advertising in general is unacceptable; Other (please specify); Don't know.

[13] Response options included: Agree strongly, agree slightly, neither, disagree slightly, disagree strongly.

they have looked for this information on the label. However, the authors note that of those who reported looking for sugar content information, it was more likely they were consumers of spirits where sugar can play a role in the form of mixer drinks (proportions not reported). The study also found that 42% of participants indicated that they no longer use soft drinks or energy drinks as mixers in order to reduce the amount of sugar they consume when drinking alcohol. It was also reported that 19% of participants changed their choice of alcoholic beverages to reduce their sugar intake, however, examples of the types of choices were not examined.

Overall, the findings from this study suggest that consumers generally value sugar content information on alcoholic beverages. However, where on alcoholic beverage labels participants looked for sugar related information, and whether they think the information should be displayed in a NIP or claim format, was not examined in this study.

As previously noted, none of the studies described in this overall section examined the effect of carbohydrate/sugar claims on consumer perceptions of alcoholic beverages. This question is further reviewed below.

Consumer perceptions of carbohydrate and sugar claims on alcoholic beverages

Four studies assessed consumer perceptions of carbohydrate and sugar claims on alcoholic beverages. One high quality study used an experimental design, whereas three low quality studies used quantitative surveys. All studies were based on Australian samples.

Overview of key findings

All four studies found evidence to suggest that sugar/carbohydrate claims may cause consumers to make inaccurate assumptions about alcoholic beverages.

The three studies that examined consumer perceptions of carbohydrate claims on beer indicate that consumers may mistakenly perceive low-carbohydrate beer as healthier than low-alcohol strength beer (Victoria Health Promotion Foundation, 2010), with some consumers also perceiving low-carbohydrate beer to be healthy in an absolute sense (Cancer Council Victoria, 2010), and mistakenly believing that they "don't need to worry about their weight" when drinking low-carbohydrate beer (Barrie & Jones, 2011). This is likely related to the additional finding that consumers do not understand that most of the energy in beer comes from the alcohol itself (see the findings section on 'Consumer understanding of the nutritional properties of alcoholic beverages'). Carbohydrate claims on beer may further exacerbate this misconception. However, confidence in these findings is low, given that all three studies were of low quality.

The fourth (high quality) study found that sugar claims on ciders and RTDs caused young female adults (aged 18-35 years) to mistakenly perceive those beverages as being lower in alcohol. This indicates that sugar claims on ciders and RTDs caused consumers to make inaccurate assumptions about an unrelated drink attribute. It is unclear whether the effect is limited to young adult female consumers.

A more detailed description of the studies is provided below, grouped by the type of claim and alcoholic beverage that was examined.

Consumer perceptions of carbohydrate claims on beer

Three studies examined consumer perceptions of low-carbohydrate claims on beer. Two of the studies used a quantitative survey, whereas one study used qualitative focus groups. All three studies were low in quality.

The Victoria Health Promotion Foundation (2010) conducted a quantitative survey of 500 low-carbohydrate beer consumers. Compared to low-alcohol strength beer, 38% of participants believed low-carbohydrate beer to be healthier (36% did not, whereas 26% did not know). When asked which beer they would consume to avoid weight gain, 87% reported they would choose low-carbohydrate beer over low-, mid- or full-alcohol strength beer. The main reasons why participants choose to drink low-carbohydrate beer were that it is less bloating (50%), less fattening (44%), has less kilojoules (37%), tastes better (36%) and is healthier (30%)[14]. These findings indicate that some low-carbohydrate beer consumers may mistakenly perceive low-carbohydrate beer to be healthier, lower in kilojoules and better for weight management than low-alcohol strength beer. This is likely related to the additional finding that consumers do not understand that most of the energy in beer comes from the alcohol itself. Carbohydrate claims on beer may further exacerbate this misconception.

The Cancer Council Victoria (2018) also conducted a quantitative survey of 1,097 Victorians. They reported that 27.8% of the general population believe that low-carbohydrate beer is healthy. This is more than double the percentage of those who believe that full-strength beer is healthy (12.1%). Table 3 shows the percentage of participants in the study who considered each type of beer to be healthy, broken down by various demographic factors. The subgroups with the highest percentage of people who believed low-carbohydrate beer to be healthy were men and those in the oldest age group (50-64 years). However, it is unclear whether these differences among subpopulations are statistically significant.

Table 3. Percentage of people who considered beer to be healthy (adapted from Cancer Council, 2018)

Is it healthy?	General population	Experts*	Gender		Age (years)		
			Men	Women	18-34	35-49	50-64
Low-carb beer	27.8%	4.5%	35%	22%	24%	26%	33%

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[14]For this question, it is assumed that participants were asked why they would choose low-carb beer generally (but not specifically compared to what other type of beverage). However, the exact wording of the question is unclear. It is also unclear what the other response options were a part from those specified as the top five (less bloating, less fattening, has less kilojoules, tastes better, is healthier).

Full-strength beer	12.1%	1.5%	17%	9%	12%	10%	16%

* 'Experts' refers to accredited practicing dieticians and public health nutritionists

Finally, using focus groups, Barrie and Jones (2011) asked 37 undergraduate students whether they had seen any messages in the media about health behaviour trade-offs, what the messages were, and how effective they perceived them to be. Participants spontaneously mentioned advertisements for low-carbohydrate beers, which promoted justification for drinking this type of beer without worrying about weight gain. Example quotes from participants included: "They've got low carb beer so you can drink more of that without worrying about your weight", and "The pure blondes, they're low carbs so they're healthier so you can drink more."

Taken together, findings from these three studies indicate that consumers may mistakenly perceive low-carbohydrate beer as healthier than low-alcohol strength beer (Victoria Health Promotion Foundation, 2010), with some consumers also perceiving low-carbohydrate beer to be healthy in an absolute sense (Cancer Council Victoria, 2010), and mistakenly believing that they don't need to worry about their weight when drinking low-carbohydrate beer (Barrie & Jones, 2011). Although general conclusions can be made based on the consistency of the findings, confidence in the findings is low given that all three studies were low in quality (largely due to missing methodological information).

Consumer perceptions of sugar claims on ciders and RTDs

One study (Cao et al., 2022; high quality) investigated the effect of sugar claims on young females' perceptions of ciders and RTDs.

In this experimental design, female consumers of ciders and RTDs aged 18-35 years were randomly allocated to view ciders and RTDs with either sugar claims (such as "<1g sugar", "zero sugar", "sugar free")[15] or no claims. All beverages also contained identical alcohol content information (4.5% alcohol by volume, 1.2 standard drinks). After viewing a front-of-pack image of the alcoholic beverage with a caption stating the sugar claim (for those in the sugar claim condition) and alcohol content, participants rated the beverages on various attributes. These attributes included: perceived healthiness; perceived suitability as a part of a healthy diet; perceived helpfulness for weight management; perceived harmfulness to health; perceived sugar content; perceived kilojoule/calorie content; and perceived alcohol content. All attributes were rated on a scale from 1 (very low) to 7 (very high).

Compared to the participants who saw the beverage with no claims, participants who saw the beverages with the sugar claims rated the beverages as significantly healthier (M = 3.26 vs. 2.96), more suitable as a part of a healthy diet (M = 3.57 vs. 3.24), better for weight management (M = 3.32 vs. 2.79), less harmful to health (M = 4.02, vs. 3.70), lower in sugar (M = 5.24 vs. 3.46), lower in kilojoules/calories (M =

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[15] Additional claims included: no added sugar; low sugar; reduced sugar; no sugar. No further information was provided to participants regarding the claim (e.g., reduced compared to what?). The researchers used font-of-pack images of RTDs and ciders that are not widely available in Australia in order to minimise the effects of pre-existing product knowledge or preference.

4.53 vs. 3.59), and lower in alcohol content (M = 4.09 vs. 3.77). There was no significant interaction between the claim condition and type of beverage, meaning that the effects of the sugar claims did not differ for RTDs vs. ciders.

It is unclear from these findings whether the sugar claims misled participants about the general healthiness of these beverages per say, as RTDs and ciders with sugar claims may in fact be lower in energy, better for weight management, etc. than RTDs and ciders without these claims. Additionally, the effects on healthiness and weight management attributes were very small (all $\eta^2 < 0.06$[16]). Unsurprisingly, the sugar claims had a large effect on perceived sugar content ($\eta^2 = 0.508$). The sugar claims also had a large effect on perceived kilojoule/calorie content ($\eta^2 = 0.227$), with ratings shifting from just below the midpoint of the scale to just above the midpoint of the scale. This suggests that consumers may expect a low-sugar claim to be accompanied by a reduction in kilojoules/calories. However, a limitation of this study is that the participants were not provided with nutrition information (including energy content information) about the alcoholic beverages. Therefore this research is not generalisable to what consumers would view in a real-world setting, as a NIP is currently required on all alcoholic beverages carrying a nutrition content claim. It is therefore unclear whether these effects would remain significant if participants also viewed a NIP or energy content information about the beverages.

However, it is important to note that the sugar claims also caused participants to perceive the beverages as significantly lower in alcohol content, even though participants were provided with identical alcohol content information across all beverages. Although a small effect ($\eta^2 = 0.027$), this indicates that the sugar claims caused participants to make inaccurate assumptions about an unrelated drink attribute.

Consumer behaviours in response to carbohydrate and sugar claims on alcoholic beverages

Only two studies examined consumer behaviour in response to carbohydrate/sugar claims on alcoholic beverages. One high quality study used an experimental design, whereas one low quality study used a quantitative survey. Both studies sampled participants from Australia.

Overview of key findings

There is no clear evidence to suggest that sugar and carbohydrate claims affect consumers' level of alcohol intake. However, the presence of a claim may make consumers less likely to exercise, and less likely to change their diet, in order to compensate for the energy from alcoholic beverages.

Results from one study indicate that sugar claims have no effect on consumers' level of alcohol consumption (as measured by the likelihood of consuming an alcoholic beverage, or the number of drinks intended to be consumed over a two week period).

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[16] $\eta^2 = 0.01$ indicates a small effect; $\eta^2 = 0.06$ indicates a medium effect; $\eta^2 = 0.14$ indicates a large effect (Cohen, 1988).

However, there is evidence to suggest that sugar claims may cause female consumers to be *less* likely to modify their food intake or physical activity in order to compensate for the energy from alcoholic beverages. This indicates that sugar claims may encourage consumers to underestimate the contribution of alcohol to energy in the diet. However, this evidence is limited in that consumers' behavioural *intentions* were examined, and it is well known that behavioural intentions do not always lead to actual behaviour change (Sheeran & Webb, 2016). Secondly, although the observed behavioural effect is small, it is unclear whether providing consumers with energy content information on alcoholic beverages will alleviate this effect, and whether the effect is limited to females. It is also unclear whether sugar claims on alcoholic beverages affect choice among different types of alcoholic beverages, which in turn could also affect energy intake.

Given that consumers report believing both carbohydrates and sugar are likely to cause weight gain and report trying to limit their intake (International Food Information Council Foundation [IFIC], 2018), carbohydrate claims may have similar behavioural effects as sugar claims. However, no study has sufficiently addressed the effect of carbohydrate claims on consumer behaviour.

A more detailed description of the studies is provided below, grouped by the type of claim and alcoholic beverage that was examined.

Consumer behaviours in response to sugar claims on ciders and RTDs

As previously described, Cao et al. (2022; high quality) employed an experimental design where young adult female consumers of ciders and RTDs were randomly allocated to view ciders and RTDs with either sugar claims or no claims. In addition to rating the beverages on various attributes, participants also indicated how likely they would be to consume the beverage (on a scale from 1 [strongly disagree] to 7 [strongly agree]), and how many serves they would consume if they were available to them over the next two weeks. Participants were also asked three questions that measured how likely they would be to compensate for the energy of the beverage by modifying food intake or physical activity[17]. There was no significant difference in likelihood of consuming the beverage, or the number of serves consumed between the two groups. However, participants in the sugar claim condition were significantly *less* likely to modify their food intake or physical activity to compensate for the energy from the alcoholic beverage (M = 2.52 vs. 2.88, p = 0.01, η^2 = 0.015). There was no significant interaction between the claim condition and type of beverage, meaning that the effects of the sugar claims did not differ for RTDs vs. ciders.

Sugar claims may make consumers less likely to compensate for the energy from alcoholic beverages by countering consumers' overestimation of the sugar content of alcoholic beverages (see section on 'Consumer understanding of the nutritional

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[17] The questions were: "If you drank this product on your next drinking occasion, how likely are you to: a) Eat low calorie, low fat or low sugar foods in one or more meals to make up for the calories in this drink?; b) Exercise more than usual to make up for the calories in this drink; c) Eat less than usual in one or more meals to make up for the calories in this drink?" Responses were collapsed across the three questions to create a single measure of weight-conscious compensatory behaviours for each participant.

properties of alcoholic beverages'). Additionally, the authors note that, although an increase in compensatory behaviours is not necessarily a desirable effect (as such compensatory behaviours are associated with eating disorders; Rahal et al., 2012), these findings do suggest that sugar claims may encourage consumers to underestimate the contribution of alcoholic beverages to energy in the diet. This explanation is consistent with the additional finding that the sugar claims decreased perceived energy content. However, this evidence is limited in that consumers' behavioural *intentions* were examined, and it is well known that behavioural intentions do not always lead to actual behaviour change (Sheeran & Webb, 2016).

Secondly, the size of this effect was small ($\eta^2 = 0.015$), and, as previously stated, participants in this study were not provided with energy content information for the beverages. It is therefore unclear whether the presence of energy content information would mitigate consumers' misperceptions caused by sugar/carbohydrate claims, and subsequently any behavioural effects. Although no study has directly examined the effect of sugar/carbohydrate claims on consumer behaviour in the presence of energy content information, findings from FSANZ's (2021) meta-analysis and systematic review indicate that consumers find energy content information (when presented in numerical format) difficult to interpret. Therefore, energy content information may not mitigate consumers' misperceptions caused by sugar/carbohydrate claims, given that the sugar/carbohydrate information is presented in a format that is easy for consumers to understand (i.e. "low in"), whereas the energy content information is not.

Consumer behaviours in response to carbohydrate claims on beer

As previously described, the Victoria Health Promotion Foundation (2010; low quality) conducted a quantitative survey of 500 low-carbohydrate beer consumers. Fifteen percent of participants said that they consume more beer than they usually would when drinking low-carbohydrate beer because they believe that it is healthier for them than other types of beer. This finding is consistent with Barrie and Jones (2011; low quality), who found that consumers believe that they can drink more low-carbohydrate beer without worrying about their weight, although this study did not directly ask consumers whether they engaged in this behaviour.

These findings are inconsistent with findings from Cao et al. (2022), who found that sugar claims on cider and RTDs have no effect on level of alcohol consumption. It is unclear whether the difference in findings is due to the different samples used (general population vs. young adult females), the different type of claims examined (sugar vs. carbohydrate claims) and/or the different types of beverages examined (beer vs. cider/RTDs). Regardless, given that the Victoria Health Promotion Foundation (2010) study is of low quality (largely due to missing methodological information), confidence in the findings of this study is low. Furthermore, the Victoria Health Promotion Foundation's (2010) non-experimental design is limited in its ability to produce conclusions regarding cause and effect.

Limitations

The purpose of this review was to examine the evidence base regarding consumer value, perceptions and behaviours in response to carbohydrate and sugar claims on alcoholic beverages. The primary relevant demographic for this evidence review is Australian and New Zealand consumers. However, there was little research available that was based on Australian/New Zealand samples. Therefore the review has also included studies based on international samples, which may not generalise to Australian/New Zealand populations. This limitation is of relevance to the conclusions drawn for Research Question 1 (Consumer understanding of the nutritional properties of alcoholic beverages) and Research Question 2 (Consumer value of carbohydrate and sugar claims). However, the fact that the available New Zealand- and Australian-based studies produced results consistent with the internationally-based studies reduces this concern.

Secondly, the studies included in the review varied in quality, and most (58%) were of low quality. The conclusions of this review may therefore change once a higher number of high quality studies become available. Nevertheless, the high degree of consistency in the findings (regardless of quality) and the directness of the measures used across studies increases the overall level of confidence in the findings relating to Research Questions 1-2 (consumer understanding and value), and consumer perceptions of sugar claims on ciders and RTDs.

Conversely, caution is advised when interpreting the findings relevant to consumer perceptions of carbohydrate claims on beer, as all three studies were of low quality, largely due to missing methodological information.

Caution is also advised when interpreting the findings relevant to consumer behaviour, as the two available studies used indirect measures of behaviour (i.e. self-reported behavioural intentions), and behavioural intentions may not necessarily correspond to actual behaviours. Additionally, only one study used an experimental design, which is necessary in order to produce conclusions regarding cause and effect.

The methodological approach of this review is also not without limitations. Firstly, relevant literature was found from searching databases that were available to FSANZ. It is therefore possible that additional relevant literature was missed from other databases. However, this possibility was mitigated by searching for further literature via other sources (i.e. emailing known researchers and stakeholders, and searching the reference lists and citing studies of all obtained studies).

Secondly, it is acknowledged that only one officer screened, extracted data and assessed the quality of each study (i.e. studies were not double-screened or double-coded for reliability purposes). However, this was necessary in order to provide a timely evidence synthesis, and these are commonly used approaches when conducting rapid systematic reviews (Tricco et al., 2015).

Conclusions

This review examined the literature from 2003-2022 on consumer value, perceptions and behaviours in response to carbohydrate and sugar claims on alcoholic beverages. The review is based on 12 unique studies (from 11 documents), which varied in quality and methodology. As little research was available, the review is based on a mix of internationally-based samples and Australian/New Zealand-based samples. Nevertheless, general conclusions may be drawn based on the consistency of the findings across studies. These are grouped by research question below:

Consumer understanding of the nutritional properties of alcoholic beverages

Consumers generally have a poor understanding of the nutritional properties of alcoholic beverages, based on their general knowledge.

Firstly, consumers tend to overestimate the sugar content of all alcoholic beverages. Secondly, consumers' ability to estimate the carbohydrate content of alcoholic beverages is also poor, with consumers tending to overestimate the carbohydrate content of beer in particular. The direction of inaccuracy is unclear regarding the carbohydrate content of other alcoholic beverages (i.e. whether consumers tend to overestimate vs. underestimate). Thirdly, consumers are generally unable to correctly estimate the energy (i.e. kilojoule/calorie) content of alcoholic beverages, or to correctly rank the relative energy content of different alcoholic beverages. They tend to underestimate the relative energy content of wine and spirits, and overestimate the relative energy content of beer. Finally, consumers believe sugar or carbohydrates are the main sources of energy in most alcoholic beverages, rather than the alcohol itself.

Consumer value of carbohydrate and sugar claims on alcoholic beverages

Consumers generally value sugar claims (and sugar information more broadly) on alcoholic beverages.

Consumers generally feel that 99.9% sugar-free claims on beer are acceptable, and appreciate being presented with "health facts" to be able to make a more informed choice. Consumers also generally value sugar content information more broadly on alcoholic beverages (i.e. not necessarily displayed in a claim format). Consumers may also value carbohydrate claims on alcoholic beverages, however, this evidence is less clear.

Consumer perceptions of carbohydrate and sugar claims on alcoholic beverages

Sugar/carbohydrate claims may cause consumers to make inaccurate assumptions about alcoholic beverages.

Consumers may mistakenly perceive low-carbohydrate beer as healthier than low-alcohol strength beer, with some consumers also perceiving low-carbohydrate beer to be healthy in an absolute sense, and mistakenly believing that they "don't need to

worry about their weight" when drinking low-carbohydrate beer. This is likely related to the additional finding that consumers do not understand that most of the energy in beer comes from the alcohol itself. Carbohydrate claims on beer may further exacerbate this misconception. However, these conclusions are tentative because they are based on low quality studies.

One high quality study found that sugar claims on ciders and RTDs cause young female adults to mistakenly perceive those beverages as being lower in alcohol. This indicates that sugar claims on ciders and RTDs may cause consumers to make inaccurate assumptions about an unrelated drink attribute. It is unclear whether this effect is limited to young female adults.

Consumer behaviours in response to carbohydrate and sugar claims on alcoholic beverages

There is no clear evidence to suggest that sugar and carbohydrate claims on alcoholic beverages affect consumers' level of alcohol intake. However, one study found that the presence of a claim may make consumers less likely to exercise, and less likely to change their diet, in order to compensate for the energy from alcoholic beverages. This indicates that sugar claims may encourage consumers to underestimate the contribution of alcohol to energy in the diet.

However, this evidence is limited in that consumers' behavioural *intentions* were examined, and it is well known that behavioural intentions do not always lead to actual behaviour change. Secondly, although the observed behavioural effect is small, it is unclear whether providing consumers with energy content information on alcoholic beverages will alleviate this effect, and whether the effect is limited to young female adults. It is also unclear whether sugar claims on alcoholic beverages affects choice among different types of alcoholic beverages, which in turn could also affect energy intake.

Carbohydrate claims may have similar behavioural effects as sugar claims. However, no study has sufficiently addressed the effect of carbohydrate claims on alcoholic beverages on consumer behaviour.

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Appendices

Appendix 1: Literature review methods

All decisions regarding inclusion/exclusion criteria were made prior to the literature search commencing, except where otherwise stated.

Inclusion criteria

The review included studies that examined:

- Consumer understanding of the nutritional properties (sugar, carbohydrate, energy content) of alcoholic beverages

- Consumer value of sugar and carbohydrate claims regarding alcoholic beverages

- Consumer perceptions of sugar and carbohydrate claims regarding alcoholic beverages

- Consumer behaviours in relation to sugar and carbohydrate claims regarding alcoholic beverages

No restrictions were placed with respect to study type (e.g. experiments, surveys, focus groups, interviews, observational studies), participant characteristics (e.g. age, geographic location, level of alcohol consumption) or specific outcome measures (e.g. hypothetical self-reported measures of alcohol consumption, actual volume of alcohol consumed within a lab setting, etc.). Rather, this information was coded for each study (see 'Data extraction' below). Studies were defined as primary research papers where empirical data were collected/reported. Grey literature was also included.

A recent consumer literature review and meta-analysis completed by FSANZ (2021) is also referred to in the current literature review, given the relevance of this review in relation to the first research question (consumer understanding of the energy content of alcoholic beverages). No further studies relevant to this research question were identified when searching for studies for the current review. Therefore, an overview of the findings from FSANZ (2021) are presented to address this particular research question.

No restrictions were placed on the format of the sugar/carbohydrate claim. That is, studies were included that examined consumer responses to claims that were presented on the label of an alcoholic beverage, on a poster advertising alcoholic beverages, and were provided as a general statement e.g. studies that generally asked participants about "low-carb beer" without showing them a particular type of label/claim.

Studies examining consumer value of sugar/carbohydrate content information on alcoholic beverages in general (i.e. where it is not clear whether participants were

referring to a NIP or claim format[18]) were also included for comprehensiveness, given the limited number of studies that were available to address this question.

Exclusion criteria

Searches were limited to papers available in English and from January 2003. Research was restricted to 2003 onwards because the year 2003 best reflects when the current requirements for nutrition information panels were introduced to Australia and New Zealand (as industry had to comply with these requirements from December 2002). Additionally, low-carbohydrate alcoholic beverages were introduced to the Australian and New Zealand market in the mid-2000's.

Studies examining sugar and carbohydrate claims (or sugar and carbohydrate content information) specifically in relation to non-alcoholic beverages and foods were excluded.

Studies examining consumer perceptions of sugar and carbohydrates more broadly (i.e. not specifically asked in relation to alcoholic beverages) were also excluded from the systematic review. This was necessary to narrow the scope of the review and keep the number of hits manageable. However, given the low quality evidence that was available regarding consumer behaviour in response to carbohydrate claims on alcohol, relevant research assessing consumer perceptions of sugar and carbohydrate more broadly are briefly referred to within the report to provide additional context for interpreting the findings on carbohydrate claims on alcohol (IFIC, 2018; See the 'Overview of key findings' section for the findings on 'Consumer behaviours in response to carbohydrate and sugar claims on alcoholic beverages').

Studies examining consumer perceptions of the general healthiness of alcoholic beverages (beyond that of energy, sugar and carbohydrate information) were excluded.

With the exception of FSANZ (2021) (as noted above), systematic reviews were excluded. However, their reference were used to search for further in-scope studies.

Online database searches

One officer searched and screened for literature included in this review in 2018 (i.e. searched for literature available from 2003-2018). A second officer updated the search in 2022 by searching for literature between 2018 and 2022. The databases and search strings used by the two officers during the different time periods is outlined below.

January 2003 – October 2018:

The following databases were searched:

- BASE

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[18] A nutrition content claim (e.g. "low carbohydrate beer") differs from nutrition content information provided in a NIP which has a numerical format (e.g. carbohydrates: xg per serving; xg per 100 ml).

- Medline with full text
- Academic Search Index
- FSTA – Food Science and Technology Abstracts
- Academic OneFile
- Food Science Source
- Directory of Open Access Journals
- PASCAL Archive
- Journal @ OVID
- Health & Wellness Resource Center
- SocINDEX with full text
- JSTOR Journals
- Australian Public Affairs – Full Text, Science Direct.

Searches were limited to peer-reviewed journal articles in English, using simple Boolean search term combinations. The search strings used were:

- TI (alcohol OR beer OR wine OR spirit OR liquor) AND AB (carb* OR sugar* OR nutri*) AND AB ((perc* OR interpret* OR influenc* OR intent*) OR (know* OR understand*)) NOT (Ferment* OR Bacteria*)[19]

- AB consumer AND AB alcohol AND (sugar OR carbohydrate) AND label

October 2018 – May 2022:

The following six databases were searched via EBSCO Discovery, as these were available through the FSANZ library in 2022:

- Science Direct
- Food Science Source
- FSTA - Food Science and Technology Abstracts
- MEDLINE with Full Text
- SocINDEX with Full Text
- EconLit with Full Text

The searches were limited to peer-reviewed journal articles in English, using simple Boolean search term combinations. The search strings used were similar to the 2003-2018 search strings used above, except that additional 'NOT' terms were added to make the number of hits more refined and manageable. Additional terms were also included to further target studies that examined consumer value, perceptions and behaviour. The terms in bold are those which differed from the 2003-2018 search strings[20]:

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[19] 'TI' indicates that the terms must be in the title of the study. 'AB' indicates that the terms must be in the abstract of the study.

[20] Although these additional search terms were not included in the 2003-2018 search, these search terms were included in FSANZ's consumer literature review on energy labelling of alcoholic beverages. Therefore, any possible studies that may have been missed during the 2003-2018 search

- TI (alcohol* OR beer* OR wine* OR spirit OR liquor) AND AB (carb* OR sugar* OR nutri*) AND AB ((perc* OR interpret* OR influenc* OR intent* **OR behav* OR purchas***) OR (know* OR understand* **OR aware* OR belie***)) NOT (ferment* OR bacteria* **OR "fatty liver" OR "oxidative stress" OR biomarker* OR molecul* OR receptor* or mice OR rat* or ferment***)

- AB consumer* AND AB alcohol* AND (sugar* OR carbohydrate*) AND label*

- TI (alcohol* OR beer* OR wine* OR spirit OR liquor) AND AB (carb* OR sugar* OR nutri*) AND AB **(value* OR seek* OR motivat*)** NOT (ferment* OR bacteria* **OR "fatty liver" OR "oxidative stress" OR biomarker* OR molecul* OR receptor* or mice OR rat* or ferment***)

Other sources/grey literature

To ensure the literature review incorporated a suitably broad range of references, further literature was sought by:

- Searching the FSANZ Behavioural and Regulatory Analysis section reference database.
- Emailing members from the International Social Science Liaison Group (ISSLG) requesting any published or unpublished research relevant to the review.
- Requesting any published or unpublished research relevant to the review from stakeholders (government, alcohol industry, public health and consumer groups)
- Searching references obtained in the process of conducting FSANZ's consumer literature review on energy labelling of alcoholic beverages (both included and excluded studies) (FSANZ, 2021)
- Searching references in FSANZ's original technical assessment (FSANZ, 2018)
- Searching the reference lists of all included studies.
- Searching for studies that have citied any of the included studies (using Google Scholar).

Research review process

The search process initially identified 4,257 potentially relevant documents. References were exported to EPPI-Reviewer Web, a web-based software program for managing and analysing data for literature reviews. Duplicates were removed using EPPI-Reviewer Web duplicate management tools; references allocated a similarity score of at least 0.95 by the software were automatically excluded. Each remaining potential duplicate identified by the software was manually screened and excluded by one officer.

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were likely located by searching through the hits obtained from the energy labelling search (see 'Other sources/grey literature').

Following removal of duplicates, out of scope papers were removed based on title and/or abstract. Finally, documents identified as out of scope on the basis of full-text review were excluded. This resulted in 11 full text documents (consisting of 12 unique studies) being included. As outlined above, studies from 2003-2018 were screened by one officer, whereas studies from 2018-2022 were screened by a second officer. Of the 12 studies included, seven were not included in FSANZ's original (2018) technical assessment.

Figure A1 shows the total number of documents retrieved at various stages of the review process. The information depicted in Figure A1 is based on the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA; Moher et al., 2010).
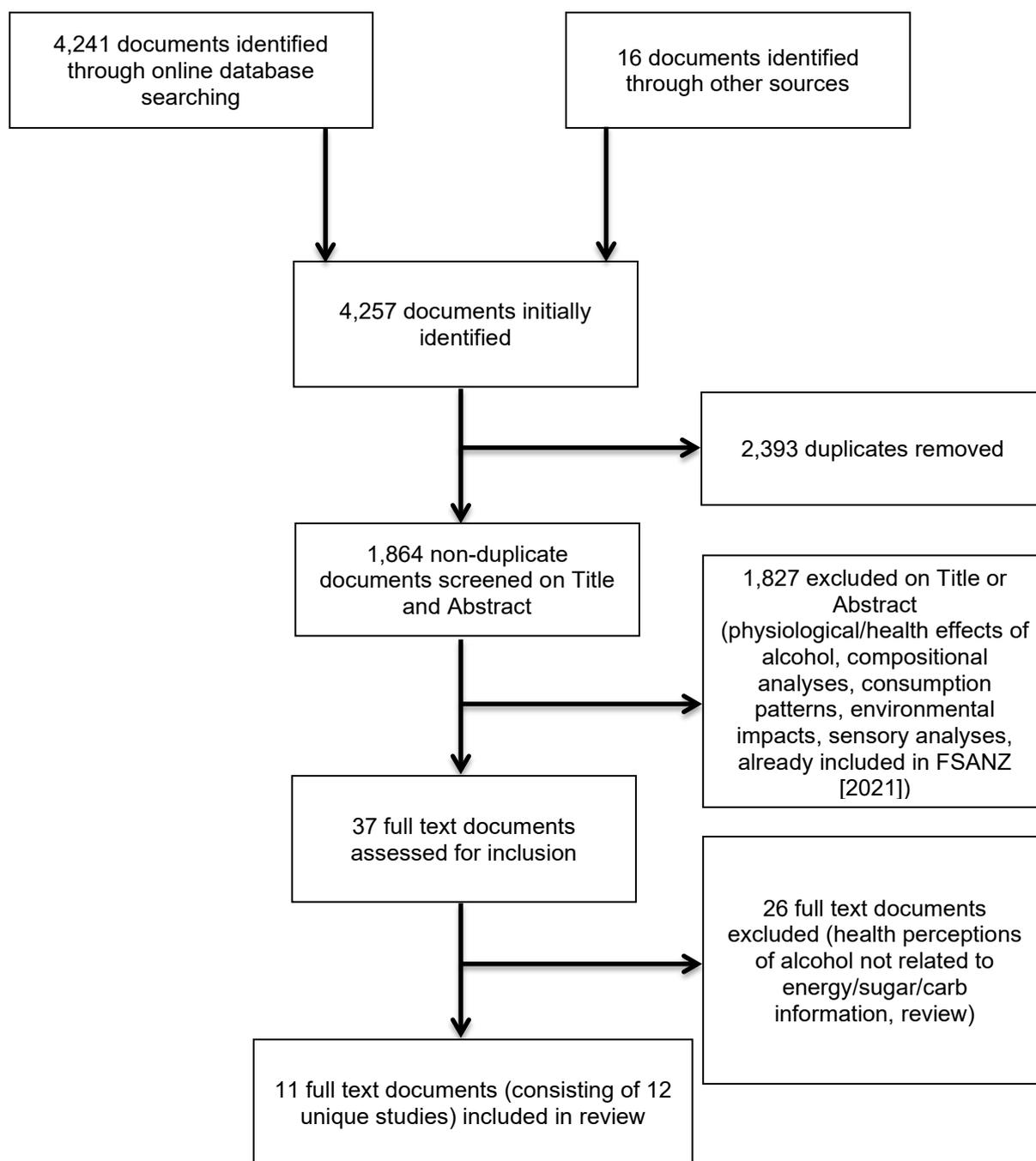
```
┌──────────────────────────────┐        ┌──────────────────────────────┐
│  4,241 documents identified  │        │   16 documents identified    │
│   through online database    │        │    through other sources     │
│          searching           │        │                              │
└──────────────────────────────┘        └──────────────────────────────┘
              │                                        │
              ▼                                        ▼
          ┌──────────────────────────────────────────────┐
          │      4,257 documents initially               │
          │              identified                      │
          └──────────────────────────────────────────────┘
                              │                         ┌──────────────────────────────┐
                              ├────────────────────────▶│  2,393 duplicates removed    │
                              ▼                         └──────────────────────────────┘
          ┌──────────────────────────────┐
          │    1,864 non-duplicate       │       ┌──────────────────────────────────┐
          │ documents screened on Title  │       │ 1,827 excluded on Title or       │
          │        and Abstract          │       │ Abstract                         │
          └──────────────────────────────┘       │ (physiological/health effects of │
                              │                   │ alcohol, compositional           │
                              ├──────────────────▶│ analyses, consumption            │
                              │                   │ patterns, environmental          │
                              ▼                   │ impacts, sensory analyses,       │
          ┌──────────────────────────────┐       │ already included in FSANZ        │
          │    37 full text documents    │       │ [2021])                          │
          │    assessed for inclusion    │       └──────────────────────────────────┘
          └──────────────────────────────┘
                              │                   ┌──────────────────────────────────┐
                              │                   │ 26 full text documents           │
                              ├──────────────────▶│ excluded (health perceptions     │
                              │                   │ of alcohol not related to        │
                              ▼                   │ energy/sugar/carb                │
          ┌──────────────────────────────┐       │ information, review)             │
          │ 11 full text documents       │       └──────────────────────────────────┘
          │ (consisting of 12            │
          │ unique studies) included     │
          │ in review                    │
          └──────────────────────────────┘
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Figure A1: **Number of documents retrieved at various stages of the review process.**

Data extraction

The data extracted from each study included: Study aims, study design, sample characteristics and sampling strategy, summary of data collection methods and analyses, relevant findings, research question(s) addressed relevant to the literature review, information relevant to the quality assessment (see Table A2 in Appendix 2). The data was summarised for each study and is presented in Appendix 3.

Appendix 3 summarises all 12 studies, grouped by the four overarching research questions of the review (consumer understanding about the nutritional properties of alcoholic beverages [Table A3.1], consumer value of claims on alcoholic beverages [Table A3.2], effects of claims on consumer perceptions [Table A3.3], effects of claims on consumer behaviours [Table A3.34). Note that some studies reported findings relevant to more than one research question, therefore some studies are repeatedly described across Tables A3.1-A3.4.

Data extraction was split between two officers.

Appendix 2: Revised QATSDD

The original QATSDD has been shown to produce reliable and valid quality assessments for studies with diverse designs (Sirriyeh et al., 2012). However, recent criticism of the tool suggests there is a need to further define the language used (Fenton et al., 2015). Fenton et al. (2015) suggested that the criteria be further described, with specific examples incorporated for each criterion. The revised version of the QATSDD utilised in the current review therefore further elaborates on the criteria outlined in the original QATSDD tool. Additionally, items that were deemed to be assessing similar criteria were merged for ease of use, and an item assessing ethical approval was also added.

The revised QATSDD consists of a total of 14 items (12 items for quantitative or qualitative studies, 14 items for mixed-design studies). A full copy of the revised QATSDD is in Table A2.

Table A2. Revised Quality Assessment Tool for Studies with Diverse Designs (QATSDD)

Theme	Criteria number	Criteria	0 = Not at all	1 = Very slightly	2 = Moderately	3 = Complete
Research Back ground and Aims	1	Explicit theoretical or conceptual framework. Consider: • Review of previous relevant studies/literature • Rationale for the study and how it links together with the discussion of the results • Application of existing theory (e.g. Theory of planned behaviour, Health motivation theory) or descriptive consideration of key concepts and their inter-relationships	No mention at all.	Reference to broad theoretical basis i.e. some general details – very limited justification for the study and/or very limited discussion of how results related to the literature or theories.	Reference to a specific theoretical basis. i.e. more specific details than rating 1. E.g. strong justification for the study in the introduction based on existing literature or theories, but limited discussion of how the results of the study relate to literature or theories (or vice versa).	Explicit statement of theoretical framework and/or constructs applied to the research. Justifies what the current study will add to the existing body of evidence, with thorough discussion of consistencies/inconsistencies with results from prior studies (theorises possible reasons for inconsistencies/what all results taken together imply about a phenomenon/construct). Note that reference to a theoretical model may not be necessary for an applied study (descriptive consideration of key concepts and their inter-relationships may suffice).
	2	Statement of aims/objectives in main body of report.	No mention at all.	General reference to aim/objective at some point in the report including abstract.	Reference to broad aims/objectives in main body of report.	Explicit statement of aims/objectives in main body of report.
	3	Clear description of research setting. Consider: • Who (specific target population) • What (clear research problem/question being studied in the target population) • Where (where the research took place, e.g. in lab/online/at home, and where participants were from)	No mention at all.	General description of research area and background. Very general target population for research question stated e.g. 'consumers of alcohol'. Most other dot points not covered.	General description of research problem in the target population. Most dot points covered.	Specific description of the research problem and target population in the context of the study. All dot points covered.

		• When (when the research took place) • This criteria is not about a description of the data collection procedure or tools.				
	4	Fit between stated research question and research design. Consider: • Research design e.g. experimental versus cross-sectional designs. This criteria is not about data collection tools. • Experimental designs are appropriate for establishing cause and effect e.g. the effect of labelling on behaviour. Whereas qualitative studies or surveys may be better suited to answer questions regarding consumer perceptions.	No research question/aim/objective stated.	Research design/approach can only address some aspects of the research question.	Research design/approach can address the research question but there is a more suitable alternative that could have been used or used in addition.	Research design/approach selected is the most suitable approach to attempt to answer the research question
Sampling and recruitment	5	Evidence of sample size considered in terms of analysis. Consider: • Discussion of smallest sample cell • Oversampling demographics of interest with low prevalence	No mention at all.	Basic explanation for choice of sample size. Evidence that size of the sample has been considered in study design. E.g. vague reference to other studies without further explanation.	Evidence of consideration of sample size in terms of saturation/information redundancy or to fit generic analytical requirements. E.g. mentions calculations or saturation requirements but the final sample was unable to completely meet these (e.g. necessary sample for main effect has been met but not for subgroup analyses, or numbers approach but don't quite meet the target), or mentions generic	Explicit statement of data being gathered until information redundancy/saturation was reached or to fit exact calculations for analytical requirements. E.g. mentions exact calculations/saturation requirements and these were met.

				sample requirements that may not necessarily generalise to the current study requirements.	
6	Representative sample of target group of a reasonable size Consider: • Online panels may limit ability to achieve a representative sample • Convenience samples may limit ability to achieve a representative sample • Demographic characteristics of the sample – is any subgroup over- or under-represented? E.g. if the aim of the study was to answer a research question regarding participants of various ages, then the sample is not representative if, for example, a very small percentage of the sample were young adults, and the majority were within an older age bracket.	No statement of target group.	Sample is limited but represents some of the target group or representative but very small.	Sample is somewhat diverse but not entirely representative, e.g. inclusive of all age groups, experience but only one workplace. Requires discussion of target population to determine what sample is required to be representative.	Sample includes individuals to represent a cross section of the target population, considering factors such as experience, age and workplace.
7	Detailed recruitment data • Describes the process of recruitment as well as response rates, drop-out rates etc.	No mention at all, or only final N reported.	Minimal recruitment data, e.g. no. of questionnaires sent and no. returned. Or only final N reported plus clear description of recruitment method.	Most recruitment information but not complete account, e.g. full recruitment figures but no information on strategy used. Or clear description of recruitment method and recruitment figures, except one figure missing (e.g. number dropped out and final N reported, but no information on N who declined to participate).	Complete data regarding no. approached, no. recruited, attrition/drop-out data where relevant, method of recruitment.

Procedural details	8	Description of procedure for data collection. Consider: • The order in which participants completed tasks/questionnaires. • Description of the data collection tools e.g. question wording/response options/stimuli given to participants. Note this is different from criteria 9 below which assesses whether the data collection tools were appropriate to use; criteria 8 assesses whether an adequate description was provided of the tools themselves.	No mention at all.	Very basic and brief outline of data collection procedure, e.g. 'using a questionnaire distributed to staff'.	States each stage of data collection procedure but with limited detail, or states some stages in details but omits others.	Detailed description of each stage of the data collection procedure.
Data collection tools **(Quantitative)**	9	Data collection tools justified, reliability and validity assessed. Consider: • Questionnaires, measures and stimuli used • Reliability indicates consistency e.g. if you tested a group of participants at time 1, then tested them again at time 2, the results should be the same/consistent between time 1 and time 2 (test-retest reliability). • Validity indicates that the measurement tool is measuring what it is intended to e.g. use of piloting or statistical assessment of tools where appropriate. • If ratings differ for different tools used, then take an average, e.g. if a measure is a 2, but stimuli are a zero, the rating will be 1.	No mention at all.	Very limited consideration of reliability/validity of data collection tool(s) e.g. generally and accurately explains why the construct to be measured is appropriate, without reference to the actual measurement tool(s) or any reliability/validity assessments. Or vaguely states that the tools were based on a review of the literature without citations or further elaboration.	Some evidence that the reliability/validity of the data collection tool(s) has been considered e.g. based on use in a cited prior similar study but without reference to any reliability/validity assessments. Or some attempt to assess reliability and validity but insufficient (e.g. unsuccessful attempt to establish test-retest reliability but no further action is taken).	Reliability and validity of all major tool(s) has been established. Note that the authors do not need to assess reliability and validity themselves; reporting these based on prior studies may suffice if based on similar populations.
Data collection tools **(Qualitative)**	10	Format and content of data collection tool justified. Consider:	No mention at all	Very limited consideration of quality of data collection tool(s) e.g. generally and accurately explains	Some evidence that the quality of the data collection tool(s) has been considered e.g. based on use in a cited prior similar	Quality of all major tool(s) has been established, e.g. clearly justified based on detailed explanation of a prior study/literature. No concerns regarding leading

				why the topics are appropriate to include in the guide to answer the research question(s), but questions or guide not piloted or used in a prior study. Or vaguely states that the tools were based on a review of the literature without citations or further elaboration.	study without further explanation. No major concerns in terms of leading/biased questions, but could benefit from further consideration or elaboration of the dot points.	or biased questions. Note that if a mixed design study had one minor qualitative component where participants are simply given the opportunity to provide further comments on a construct/topic, e.g. "do you have any further comments about…." Then this may be rated here as a 3, as long as there are no concerns regarding leading/biased questions.
• Questions/schedules/stimuli/guides used for interview/focus groups • How were the questions/guides developed? Based on existing theory/literature? • Previously tested/piloted. • Consideration of leading/biased questions.						
Data analysis **(Quantitative)**	11	Data analysis approach justified and undertaken appropriately Consider: • Do statistical tests match the type of data? • Were multiple tests accounted for to control for type 1 error? e.g. via Dunnett's, Tukey or Bonferroni corrections. However less of a concern if p values are very high anyway (>0.05), or very small (<0.001). • Were confounding variables considered? (e.g. entered as covariates) • Were statistical assumptions acknowledged where relevant? (e.g. multicollinearity for regression, or tests of normality where relevant). Means and SDs are not appropriate for interpreting skewed data (medians and interquartile ranges would provide a more accurate representation of group data in this case) • Proportional data: Fisher's test should be used over Chi square test if low frequencies (n<5 in a group/cell).	No mention at all, or the analytical approach does not even broadly match the type of data.	**Most of the dot points have NOT been considered**, reported on or correctly applied, but the analytical approach broadly matches the type of data. E.g. use of a one-way between-subjects ANOVA is appropriate to analyse multiple group levels of a single independent variable. However correction for multiple testing/statistical assumptions/control for covariates not considered or reported on.	**Most of the dot points have been addressed**. Analysis allows reasonable conclusions to be made from results but could still benefit from further consideration from the list of dot points, (e.g. consideration of statistical assumptions, or additional analyses could provide greater insight). However note that if most points have been addressed, but serious concerns remain that would significantly impact confidence in results (e.g. confounding variables), then the study should not be granted a 2 for this criteria.	All dot points haven been considered where relevant. Method of analysis selected is the most suitable approach, and results are adequately reported to support conclusions.

		• Could the study benefit from additional analyses to provide greater insight? • Results adequately reported to support conclusions e.g. descriptive statistics, p values, etc.				
Data analysis **(Qualitative)**	12	Analytical approach justified and assessment of reliability of analytic process Consider: • Approach to analysis described e.g. grounded theory, thematic coding. • how did they develop codes, themes. • techniques to increase trustworthiness in results e.g. multiple researchers, interrater reliability, member-checking (i.e. returning data to participants to check for accuracy and resonance with their experiences), audit trail, reflexive process, negative case search (i.e. searching for and discussing elements of the data that do not support or appear to contradict patterns or explanations that are emerging from data analysis). • discussion of subjective influences of analysis • Results adequately reported to support conclusions e.g. use of participant quotes.	No mention at all of the approach to analysis	Basic description of approach to analysis (e.g. themes coded from the data vs. use of an existing coding scheme that was developed prior to data collection), but **most of the dot points missing, not considered or incorrectly applied,** i.e. no or limited description of techniques to increase trustworthiness in results, no further details of how codes were developed, missing information when reporting results.	**Most of the dot points have been addressed**. Analysis allows reasonable conclusions to be made from results but could still benefit from further consideration from the list of dot points. E.g. justified description of how themes were coded, but only use of one or two techniques to ensure trustworthiness in results, only a few instances where results could be reported more clearly to support conclusions.	All dot points have been considered where relevant. Method of analysis selected is the most suitable approach. Use of a range of methods to enhance trustworthiness in results, and results are adequately reported to support conclusions.
Ethics	13	Ethics approval	No mention at all.	N/A	N/A	Ethics approval obtained.
Strengths and limitations	14	Strengths and limitations critically discussed?	No mention at all.	Very limited mention of strengths and limitations with omissions of many key issues.	Discussion of some of the key strengths and weaknesses of the study but not complete.	Discussion of strengths and limitations of all aspects of the study including design, measures, procedure, sample & analysis.

Appendix 3: Table of study characteristics and quality assessments

Table A3.1. Studies examining consumer understanding of the nutritional properties of alcoholic beverages (n = 4)

Study	Sampling approach	Participant characteristics	Design/stimuli/measures	Key findings	Quality
Barber (2016)	392 consumers (191 from France, 201 from the UK) Recruited via existing online panel.	Majority reported drinking either one day per week (40.7-63% across gender and nationality) or 2-6 days per week (34-53.8%). Every day was not common (1.7-4.8%). France: 100 females UK: 117 females UK: mean age = 21.1 years (SD = 2.1) France: mean age = 22.5 years (SD = 1.9) Monthly income: < £500 = 49% UK; 42% France. £500-£1000 = 25% UK; 32% France. ≥ £1000 = 25% UK; 25% France. Ethnicity not reported. UK: 54% current students; France: 49% current students (no further information provided. No health information provided.	Quantitative (online) survey. Participants were asked: "In your opinion, how much sugar do the following alcoholic beverages contain: Red wine, white wine, beer, cider, clear spirits (gin, vodka), dark spirits (whiskey, bourbon, rum), alcopops (Smirnoff Ice), an energy drink (Red Bull)." Free response format.	Participants greatly overestimated the sugar content for all alcoholic beverages. The group mean percent sugar estimates for each beverage were: Red wine: UK = 25%; France = 23% (p>0.05) White wine: UK = 26%; France = 24% (p>0.05) Beer: UK = 25%; France = 32% (p>0.05) Cider: UK = 33%; France = 24% (p<0.001) White spirits: UK = 19%; France = 25% (p>0.05) Dark spirits: UK = 24%; France = 40% (p<0.001) Alcopops: UK = 51%; France = 60% (p>0.05)	Medium. Rated poorly on some criteria (e.g. non-representative sample, unclear if participants reported percentage formats or if these were converted). However, full questionnaire provided and clear reporting of results (no major concerns).
Bui et al. (2008)	58 undergraduate students from the USA Recruitment method not reported	85% of participants reported consuming alcohol in the past month. Mean number of drinks consumed for drinkers in the past week = 14 (range = 0-67). 58% female	Quantitative (survey; pilot study). Participants estimated the amount of carbohydrates (in grams) contained in standard-size alcohol beverages (12 oz for beer, 5 oz for wine, and 1.5 oz for distilled liquor). Based on how the results were categorised, it is assumed that the response options were: 0; 1-4; 5-9; 10-19; 20-39; 40-60;	Light beer: 10% of participants provided accurate estimates. Regular beer: 19% provided accurate estimates (71% overestimated, 10% underestimated).	Low. Rated poorly on most criteria. Missing methodological information (response options unclear).

Study	Sampling approach	Participant characteristics	Design/stimuli/measures	Key findings	Quality
		Mean age = 23 years (range = 20-23). Income not reported. Ethnicity not reported. Current undergraduate students enrolled in upper-division business courses No health information provided.	61 or more. However this is not clarified in the paper. Correct answers were: Light beer = 5.8; regular beer = 12.6; wine = 0.8; distilled liquor = 0. Participants also estimated their level of confidence in the accuracy of their estimates using a 7-point scale (1 = not at all confident; 7 = extremely confident).	Wine: 3% provided accurate estimates. Distilled liquor: 10% provided accurate estimates.	Potentially uneven response categories that are confounded with the underestimation/overestimation findings for all beverages (except regular beer).
GfK (2014)	5,395 adults from six countries in the European Union (Germany, Poland, Denmark, the Netherlands, Spain and the United Kingdom). Recruitment method not reported.	Level of alcohol consumption not reported. 49.83% female (averaged across countries) Ages ranged from 18-65 years. Income not reported. Ethnicity not reported. 12-41% university educated (varies by country; DK to ES). No health information provided.	Quantitative (online) survey. Participants were asked: "How many grams of carbohydrates do you think are in the following products?" List of products (all 100mL): Alcohol-free beer (less than 1% alcohol); regular beer (between 4.5% and 5.5% alcohol); white wine; red wine; whiskey. Response categories: 0.0g; 0.1-1.0g; 1.1-2.0g; 2.1-3.0g; 3.1-4.0g; 4.1-5.0g; More than 5.0g; Do not know/not sure. Correct answers were: Alcohol-free beer = >5.0g; regular beer = 3.1-4.0g; white wine = >5.0g; red wine = 2.1-3.0g; whiskey = 3.1-4.0g	Alcohol free beer: 3% of participants provided correct answer; 51% false answer; 46% don't know. Regular beer: 8% correct answer; 47% false answer; 45% don't know. White wine: 3% correct answer; 50% false answer; 46% don't know. Red wine: 12% correct answer; 42% false answer; 46% don't know. Whiskey: 5% correct answer; 47% false answer; 48% don't know.	Low. Rated poorly on most criteria (e.g. no reference to prior literature or theories, non-representative sample, lack of recruitment data, missing procedural information). Uneven response categories that are confounded with underestimation/overestimation findings.
Wright et al. (2008)	325 USA consumers Recruited at commercial breweries at three locations in the USA.	Consume at least 1 alcoholic beverage per year (no further consumption information reported). 50% female. 39% aged 21-30 years, 61% aged 31+ years.	Quantitative (written) survey. Participants were presented with an 11 item list of possible contents found in wine, beer, tequila and vodka and were asked to select which contents are contained in each beverage. Relevant items included sugar and carbohydrates.	Wine: Majority of participants believed that wine contained carbohydrates (79% of those aged under 30; 70% of those aged over 30; non-significant difference) and sugar (74% of those aged under 30; 69% of those	Medium. Rated poorly on some criteria (e.g. non-representative sample, lack of recruitment data). However clear description of measures (no major concerns).

Study	Sampling approach	Participant characteristics	Design/stimuli/measures	Key findings	Quality
		Income not reported. Ethnicity not reported. Level of education not reported. 78% stated that they try to follow a healthy and balanced diet. However 65% also stated that beverage healthiness has little impact on beverage choice.		aged over 30; non-significant difference). Beer: Majority believed that beer contains carbohydrates (94% of those aged under 30; 90% of those aged over 30; non-significant difference). Majority (61%) of those aged under 30 believed that beer contains sugar, whereas 49% of those aged over 30 believed that beer contains sugar (p<0.05) Tequila: Majority believed that tequila contains carbohydrates (65% of those aged under 30; 53% of those aged over 30; p<0.05). Less than half believe that tequila contains sugar (48% of those aged under 30; 34% of those aged over 30; p<0.05). Vodka: Majority believed that vodka contains carbohydrates (61% of those aged under 30; 52% of those aged over 30; non-significant difference). Less than half believe that vodka contains sugar (44% of those aged under 30; 33% of those aged over 30; non-significant difference).	

Note: Additional studies examining consumer understanding of the energy content of alcoholic beverages are summarised in a previous systematic review and meta-analysis (FSANZ, 2021).

Table A3.2. Studies examining consumer value of carbohydrate and sugar claims on alcoholic beverages (n = 4)

Study	Sampling approach	Participant characteristics	Design/stimuli/measures	Key findings	Quality
Colmar Brunton (2017) Focus groups	Australian participants consisting of six focus groups (total number of participants not reported). Recruited from the general community in Brisbane, Sydney and Adelaide. Participants received $70 to cover their time and costs. No further information on recruitment method.	Male and female participants (exact proportions not reported). Aged 18-60+ years. Included people of different income levels (proportions not reported). Included people who spoke English, as well as people who did not speak English (proportions not reported). No further information provided.	Qualitative (focus groups). Participants were shown an advertisement/ poster that says: "99.9% sugar free beer? (on average). Yes, really." The poster also contained the 'Beer the Beautiful Truth' logo on the top left hand corner, and bottles of various Lion-branded beer were shown below. Participants were asked whether they felt the ad should be allowed to be shown, and to provide reasons for their answer.	Most participants (proportion not reported) felt that the advert was perfectly legitimate, and appreciated being presented with "health facts" to be able to make a more informed choice. Example quotes included: "Pretty harmless. Just showing a product range showing that its sugar free beer" (Female, aged 18-34 years); "Its educational on sugar levels – especially for diabetics" (Male, aged 60+ years); and "Good for those who are health conscious" (Male, 35-59 years). Some participants (proportion not reported) expressed cynicism, feeling the advert is misleading. Example quotes from these participants included: "It's essentially false advertising. There's still stuff in beer that makes you fat" (Male, aged 18-34 years); "It shouldn't be about sugar, its alcohol" (Female, aged 35-59 years).	Low. Rated poorly on most criteria. Full discussion guide provided, however, data analytical approach not reported (unclear how themes were coded). Sample size not reported.

Study	Sampling approach	Participant characteristics	Design/stimuli/measures	Key findings	Quality
Colmar Brunton (2017) Survey	1,225 Australians aged 18 years and over. Recruited via existing online panel. Used sampling quotas interlocking age, gender and location.	Nationally representative by age, gender and location. Income (per year): $1-$20,799: 8% $20,800--$41,599: 17% $41,600--$62,399: 16% $62,400--$83,199: 12% $83,200--$103,999: 12% $104,000--$155,999: 13% $156,000--$207,999: 4% $208,000--$259,999: 1% $260,000 or more: 2% No income: 1% Negative income: 0% I prefer not to answer: 15% Majority (77%) speak only English at home (22% reported speaking other languages at home, whereas 2% did not report on this). Ethnicity not reported. 42% university educated. No health information provided.	Quantitative (online) survey. Participants were shown an advertisement/ poster that says: "99.9% sugar free beer? (on average). Yes, really." The poster also contained the 'Beer the Beautiful Truth' logo on the top left hand corner, and bottles of various Lion-branded beer were shown below. Participants were asked "Do you believe **the content of this advertisement is acceptable** to be displayed outdoors (e.g. on a billboard)?" Response options: Yes, it is **acceptable** to display this content outdoors; No, it is **not acceptable** to display this content outdoors; Don't know. Participants who previously indicated that it was not acceptable were asked the follow-up question: "Why do you believe the content of the advertisement is **not acceptable**? Please only select the main reason(s) you think it is not acceptable for this advertisement to be displayed outdoors (for e.g. on a billboard)." Response options (multiple responses allowed): The ad suggests that the beer products offer a therapeutic benefit; The ad is appealing to minors; The ad is potentially misleading; The placement of the ad (i.e. outdoor) is unacceptable; It could be seen by minors; The ad is offensive in general; I just don't like this ad; Alcohol advertising in general is unacceptable; Other (please specify); Don't know.	66% of participants thought the marketing should be permitted, whereas 23% thought it should not be permitted and 11% don't know. The most common reason why participants thought it was unacceptable was that it is potentially misleading (stated by 62% of those opposing it). Some participants also indicated that the advert suggests that the beer products offer a therapeutic benefit (54% of opposers), that it could be seen by minors (49% of opposers), that alcohol advertising in general is unacceptable (41% of opposers) and that the advert is appealing to minors (32% of opposers).	Medium. Rated poorly on some criteria (missing recruitment data, no discussion of theories or prior literature, proportion selecting some response options not reported). However, full questionnaire provided (no major concerns).

| Empathy Research (2016) | 933 Irish consumers.

Recruitment method not reported. | Male and female consumers (exact proportions not reported).

Aged 18+

No further information provided. | Quantitative (survey).

Participants were asked the following questions (ordering of questions unclear):

"Alcohol companies should provide sugar content on the packaging." Response options: Agree; strongly; agree slightly; neither; disagree slightly; disagree strongly.

"Have you ever checked alcohol labels for any of the following?: ABV, calories, units of alcohol, sugar content."

"Where possible, I will try and choose the alcohol with the lowest sugar content." Response options: Agree strongly; agree slightly; neither; disagree slightly; disagree strongly.

"I would choose a different brand of alcohol if I knew it had less sugar." Response options: Agree strongly; agree slightly; neither; disagree slightly; disagree strongly.

"I've stopped using fizzy/energy drinks as a mixer to try and reduce the amount of sugar I consume when drinking." Response options: Agree strongly; agree slightly; neither; disagree slightly; disagree strongly.

"I've changed the type of alcohol I drink to try and reduce the amount of sugar I consume." Response options: Agree strongly; agree slightly; neither; disagree slightly; disagree strongly. | Most participants (68%) agreed that alcohol companies should display sugar content labelling on their products.

20% of participants reported that they have looked for sugar content information on the label of alcoholic beverages. Of those who reported looking for sugar content information, it was more likely they were consumers of spirits where sugar can play a role in the form of mixer drinks (proportions not reported). Females (24%) and those aged 55-64 (26%) were also more likely to check sugar content.

28% of participants reported that they try and choose their alcohol based on the one with the lowest sugar content.

40% reported that they would choose a different brand of alcohol if they knew it contained little sugar.

42% of participants indicated that they no longer use soft drinks or energy drinks as mixers in order to reduce the amount of sugar they consume when drinking alcohol. | Low.

Rated poorly on most criteria.

No recruitment information, limited information about the sample, missing procedural information. |

Study	Sampling approach	Participant characteristics	Design/stimuli/measures	Key findings	Quality
				19% of participants changed their choice of alcoholic beverages to reduce their sugar intake (examples of the types of choices were not examined).	
Ghvanidze et al. (2017)	1,872 consumers of wine from Germany (*n* = 799), UK (*n* = 549) and USA (*n* = 544). Recruited via existing online panel.	Male and female consumers (49.2% female from Germany; 51.3% female from UK, 53.7% female from USA). Aged 18-64+ Income: USA: most prevalent response was $40,000-59,000 per year (22.7% of the sample). 14.8% earned over $100,000. UK: most prevalent response was £20,000-59,999 per year (40.4% of the sample). 3.3% earned over £100,000. Germany: most prevalent response was €20,000-59,999 per year (34.9% of the sample). 4.6% earned over €100,000. Ethnicity not reported. Germany: 24.4% university educated. UK: 39.5% university educated. USA: 51.7% university educated. No health information provided.	Quantitative (online discrete choice experiment). Participants viewed a shelf simulation where they were required to choose a bottle of wine that they are most likely to purchase in a store to consume at home. Participants could choose one out of three possible wines, or none of the wines. They made this choice repeatedly across 9 different choice sets. The wines differed based on various attributes including alcohol content/presence of a carbohydrate claim (14% alcohol vs. 9% alcohol vs. 9% alcohol + 30% less carbohydrates). The carbohydrate claim was only ever presented on wines with the relatively low (9%) alcohol content. Part-worth utilities were calculated for each attribute level using conditional logit model. Marginal willingness to pay was also simulated from the utility estimates.	For participants in the UK, the presence of a relatively low alcohol content (9%) accompanied by a low-carbohydrate claim was negatively valued (part worth utility = -0.385, *p* < 0.05). Conversely, the presence of the same information for US and German participants was valued in regards to participant choices of wines (part worth utilities = 0.468 and 0.401, both *p*s < 0.05). Participants in the US and Germany were also willing to pay more for wine with lower alcohol content (vs. no information), as well as for wine with lower alcohol content + 30% less carbohydrates (vs. no information). Willingness to pay was also higher for wine with the lower alcohol content information accompanied by the claim (2.99 USD; 2.83€) than for wine with only the lower alcohol content information (1.85 USD; 2.30€).	Medium. Rated poorly on some criteria (e.g. missing recruitment data, no discussion of strengths/limitations, some analytical detail missing). However, design of the study is clear and justified based on previous pilot testing, and reporting of results is clear (no major concerns).

Table A3.3 Studies examining consumer perceptions of carbohydrate and sugar claims on alcoholic beverages (n = 4)

Study	Sampling approach	Participant characteristics	Design/stimuli/measures	Key findings	Quality
Barrie and Jones (2011)	37 Australian undergraduate students. Recruitment method not reported.	Male and female participants (exact proportions not reported). No further information provided.	Qualitative (focus groups) Six focus groups: Two groups male only; two female only; two mixed gender. Use of a discussion guide where participants were asked whether they had seen any messages in the media about health behaviour trade-offs, what the messages were, and how effective they perceived them to be.	Participants spontaneously mentioned advertisements for low-carbohydrate beers, which promoted justification for drinking this type of beer without worrying about weight gain. Example quotes from participants included: "They've got low carb beer so you can drink more of that without worrying about your weight", and "The pure blondes, they're low carbs so they're healthier so you can drink more."	Low. Rated poorly on most criteria. Missing methodological information (unclear how themes were coded, sampling approach not reported).

Study	Sampling approach	Participant characteristics	Design/stimuli/measures	Key findings	Quality
Cancer Council Victoria (2010)	1,097 Victorians. Recruitment method not reported.	Aged 18-64 years. No further information provided.	Quantitative (survey) No further information provided.	27.8% of the general population consider low-carb beer to be healthy, whereas 12.1% consider full-strength beer to be healthy. 4.5% of experts (accredited practicing dieticians and public health nutritionists) consider low-carb beer to be healthy, whereas 1.5% consider full-strength beer to be healthy. 35% of men consider low-carb beer to be healthy, whereas 17% consider full-strength beer to be healthy. 22% of women consider low-carb beer to be healthy, whereas 9% consider full-strength beer to be healthy. 24% of those aged 18-34 years consider low-carb beer to be healthy, whereas 12% consider full-strength beer to be healthy. 26% of those aged 35-49 years consider low-carb beer to be healthy, whereas 10% consider full-strength beer to be healthy. 33% of those aged 50-64 years consider low-carb beer to be healthy, whereas 16% consider full-strength beer to be healthy.	Low. Rated poorly on all criteria. No methodological information.

| Cao et al. (2022) | 501 Australian women aged 18-35, who reported consuming cider or RTDs in the past year.

Recruited from an existing online panel. | 58.7% did not exceed low-risk drinking guidelines (i.e. consumed 10 or less standard drinks per average week or 4 or less standard drinks on a single day at least one a month). Mean AUDIT-C score: 4.4 (SD = 2.3).

100% female.

18-35 years of age.

Weekly household income similarly spread across the following categories: ≥$3000; 2500-3000; 2000-25000; 1500-2000; 1000-1500; 500-1000 (ranged from 11-17%). However less common categories were $1-500 (3.2%), nil income (0.6%) and 6.2% preferred not to say.

Ethnicity not reported.

49.5% university educated.

Mean BMI = 25.82 (SD = 5.94). 40.7% of participants were a healthy weight; 2.8% underweight; 19% overweight; 17.8% obesity; 19.8% prefer not to say. | Quantitative (between-subjects experiment)

Participants were randomly allocated to view ciders and RTDs with either sugar claims ("<1g sugar", "zero sugar", "sugar free, "no added sugar", "low sugar", "reduced sugar", "no sugar") or no claims. All beverages also contained identical alcohol content information (4.5% alcohol by volume, 1.2 standard drinks). The researchers used font-of-pack images of RTDs and ciders that are not widely available in Australia in order to minimise the effects of pre-existing product knowledge or preference.

After viewing a front-of-pack image of the alcoholic beverage with a caption stating the sugar claim (for those in the sugar claim condition) and alcohol content, participants rated the beverages on various perceived attributes (on a scale from 1 [very low] to 7 [very high]):
• Healthiness
• Suitability as a part of a healthy diet
• Helpfulness for weight management
• Harmfulness to health
• Sugar content
• Kilojoule/calorie content
• Alcohol content | Compared to the participants who saw the beverages with no claims, participants who saw the beverages with the sugar claims rated the beverages as significantly:
• Healthier (M = 3.26, SD = 1.13 vs. M = 2.96, SD = 1.01, p = 0.002, $\eta2$ = 0.019)
• More suitable as a part of a healthy diet (M = 3.57, SD = 1.17, vs. M = 3.24, SD = 1.18, p = 0.002, $\eta2$ = 0.019)
• Better for weight management (M = 3.32, SD = 1.10, vs. M = 2.79, SD = 1.08, $p < 0.001$, $\eta2$ = 0.057)
• Less harmful to health (M = 4.02, SD = 1.00, vs. M = 3.70, SD = 1.05, p < 0.001, $\eta2$ = 0.024)
• Lower in sugar (M = 5.24, SD = 0.95, vs. M = 3.46, SD = 0.85, $p < 0.001$, $\eta2$ = 0.508)
• Lower in kilojoules/calories (M = 4.53, SD = 0.91, vs. M = 3.59, SD = 0.87, $p < 0.001$, $\eta2$ = 0.227)
• Lower in alcohol content (M = 4.09, SD = 0.98 vs. M = 3.77, SD = 0.96, $p < 0.001$, $\eta2$ = 0.027)
Results were consistent when BMI and food/drink choice motives were statistically controlled for. There were no significant interactions between | High.

Rated highly on most criteria.

Clear methodology and reporting of results with appropriate statistical analysis. |

Study	Sampling approach	Participant characteristics	Design/stimuli/measures	Key findings	Quality
				the claim condition and type of beverage (ps > 0.05).	
Victoria Health Promotion Foundation (2010)	500 low-carbohydrate beer drinkers in Australia. Recruited from an existing online panel.	13% binge drink (no further consumption information provided). 75.5% female. Mean age = 39 years. Income not reported. Ethnicity not reported. 35% university educated. No health information provided.	Quantitative (online) survey. Participants were asked: "'is low-carb beer healthier than other types of beer?" Participants responded Yes/No/Don't Know for each of the following types of beer: healthier than full-strength; healthier than mid-strength; healthier than light-beer. Participants were asked which type of beer they would drink if they wanted to avoid weight gain (response format not reported). Participants were asked to report their main reasons for choosing low-carb beer (exact question wording unclear; multiple responses allowed). Some response options were: its less bloating; its less fattening; it has less kilojoules (calories); it tastes better; its healthier. Unclear what the other response options were (only reported top five).	38% responded yes to low-carb beer being healthier than light beer (36% no; 26% don't know). 71% responded yes to low-carb beer being healthier than full-strength beer (16% no; 13% don't know). 59% responded yes to low-carb beer being healthier than mid-strength beer (22% no; 20% don't know). When asked which type of beer they would drink if they wanted to avoid weight gain, 87% said they would choose low-carb over mid-strength, full-strength or light beer. Participants' top five reasons for choosing low-carb beer were: that it is less bloating (50%), that it is less fattening (44%), that it has less kilojoules (37%), that it tastes better (36%), and that it is healthier (30%).	Low. Rated poorly on most criteria. Missing methodological information (some response formats/question wording not reported, missing procedural detail).

Table A3.4. Studies examining consumer behaviours in response to carbohydrate and sugar claims on alcoholic beverages (n = 2)

Study	Sampling approach	Participant characteristics	Design/stimuli/measures	Key findings	Quality
Cao et al. (2022)	501 Australian women aged 18-35, who reported consuming cider or RTDs in the past year. Recruited from an existing online panel.	58.7% did not exceed low-risk drinking guidelines (i.e. consumed 10 or less standard drinks per average week or 4 or less standard drinks on a single day at least one a month). Mean AUDIT-C score: 4.4 (SD = 2.3). 100% female. 18-35 years of age. Weekly household income similarly spread across the following categories: ≥$3000; 2500-3000; 2000-25000; 1500-2000; 1000-1500; 500-1000 (ranged from 11-17%). However less common categories were $1-500 (3.2%), nil income (0.6%) and 6.2% preferred not to say. Ethnicity not reported. 49.5% university educated. Mean BMI = 25.82 (SD = 5.94). 40.7% of participants were a healthy weight; 2.8% underweight; 19% overweight; 17.8% obesity; 19.8% prefer not to say.	Quantitative (between-subjects experiment). Participants were randomly allocated to view ciders and RTDs with either sugar claims ("<1g sugar", "zero sugar", "sugar free, "no added sugar", "low sugar", "reduced sugar", "no sugar") or no claims. All beverages also contained identical alcohol content information (4.5% alcohol by volume, 1.2 standard drinks). The researchers used font-of-pack images of RTDs and ciders that are not widely available in Australia in order to minimise the effects of pre-existing product knowledge or preference. Participants indicated how likely they would be to consume the beverage (on a scale from 1 [strongly disagree] to 7 [strongly agree]), and how many serves they would consume if they were available to them over the next two weeks Using 7-point 'strongly disagree' to 'strongly agree' Likert scales, participants were also asked: "If you drank [product] next time you were drinking alcohol, how likely are you to..." (presented in a randomised order): a) "eat less than usual in one or more meals to make up for the kilojoules/calories in this drink?" b) "exercise more than usual to make up for the calories in this drink?" c) "eat low calorie, low-fat, or low sugar foods in one or more meals to make up for the calories in this drink"? Responses were collapsed across the three questions (a-c) to create a single measure of weight-conscious compensatory behaviours for each participant.	There was no significant difference in likelihood of consuming the beverage (p = 0.79), or the number of serves consumed (p = 0.86) between the two groups. However, participants in the sugar claim condition were significantly less likely to modify their food intake or physical activity to compensate for the energy from alcohol (M = 2.52, SD = 1.40), compared to participants in the control condition (M = 2.88, SD = 1.56), p = 0.01, $\eta2$ = 0.015. Results were consistent when BMI and food/drink choice motives were statistically controlled for. There were no significant interactions between the claim condition and type of beverage (ps > 0.05).	High. Rated highly on most criteria. Clear methodology and reporting of results with appropriate statistical analysis.

Study	Sampling approach	Participant characteristics	Design/stimuli/measures	Key findings	Quality
Victoria Health Promotion Foundation (2010)	500 low-carbohydrate beer drinkers in Australia Recruited from an existing online panel.	13% binge drink (no further consumption information provided). 75.5% female. Mean age = 39 years. Income not reported. Ethnicity not reported. 35% university educated. No health information provided.	Quantitative (online) survey. Relevant question wording and response option unclear.	15% of participant said they consume more beer than they usually would when drinking the low-carb variety in the belief that it is healthier for them.	Low. Rated poorly on most criteria. Missing methodological information (question wording/response formats not reported, missing procedural detail). Inappropriate design to examine the effect of claims on behaviour.