



The Science of Fruit Juice
Grove Juice Company
Nutrition & Catering Institute
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Executive Summary

Background

A research project was undertaken with Grove Juice Company over eight weeks. Grove Juice Company is an Australian, family-owned business who is one of the largest fresh fruit processors in the juice category in Australia. The company's goals are to have an evidenced based review of current literature into the health outcomes surrounding fruit juice consumption. The purpose of this project was to increase the marketability of Grove Juice Company current product range within Australia and internationally. The main objectives of the project are to:

- To provide Grove Juice Company with insight into the State, National and International guidelines relating to juice classifications and recommendations.
- To provide Grove Juice with beverage council meeting points for debate and rebuttal.
- To provide Grove Juice with solutions to perceived issues with public perception/health ratings of their juice range.

Methods

The project included a literature review from PUBMED database search collecting health outcome data for paediatric, adolescent, adult and the elderly populations on fruit juice consumption. A comparison of Grove Juice current products within State, National and international guidelines including (where possible) (i) Recommended serving size and frequency by age and gender; (ii) pairing Grove Juice Company products with appropriate (i.e. uncomplicated, low cost, Food Standards Australia New Zealand (FSANZ) approved) accompaniments to create solutions to elevate products category ratings. Several stakeholder meetings were held throughout the lifecycle of the project to discuss the project findings and obtain additional feedback.

Results

The systematic review included meta-analysis, systematic reviews as well as literature reviews published between 2016 to 2021. The overall evidence of fruit juice on health outcomes was inconclusive. Grove Juice Signature range have a health star rating (HSR) of 2.5 to 3.5 out of 5. Grove Juice Signature 100% Orange juice has a HSR of 3.5 out of 5 and the Classic range orange juice from concentrate has a health star rating of 3 out of 5. The Food Standards Australia and New Zealand (FSANZ) Schedule 4 for nutrient content claims allows Grove Juice Signature range to have the nutrient claim 'no added sugar' added to their front of packaging labels. Based on the Australian Dietary Guidelines, there is no limit specified for older adults in the 70+ age group. This age group is also classified as vulnerable due to poor dentition, requiring texture modification and malnutrition, a beverage which contains the vitamins and minerals of fruit and energy would be beneficial. A new marketing campaign would be viable to target residential age care facility (RACF) and food delivery providers with the main target market in this age group such as meals on wheels (MOW).

Conclusion

In the future, further high rigor research methodology clinical trials investigating the consumption of fruit juice on health outcomes in people of difference ages needs to be conducted to provide more conclusive evidence. 100% Fruit shares the same HSR food category as sugar sweetened beverages, the HSR for juice does not accurately represent its beneficial components. The HSR requires to provide separation and clarification between fruit juice and sugar sweetened beverage to provide consumers with a more accurate knowledge when choosing between these food products. Further laboratory tests on Grove Juice products would provide more information on the exact nutrition composition of the juice range and further allow for additional nutrient claims or further availability of nutrient fortification as per FSANZ.

Acknowledgement

The authors would like to thank Marco Leung, Daniel Posterino and Archer Walters who participated in the stakeholder meetings and making the arrangements necessary for the project to be completed. Thank you to the owners, the Estens Family, for their hard work and dedication for making Grove Juice the company it is today. Thank you to all the Grove Juice employees for helping the company achieve the mission and vision. Finally, we like to acknowledge Dr Karen Abbey (CEO of NACi Institute) and Mauritius Professor Sandra Capra (Chairperson NACi) for support throughout the project.

1.0 Introduction

The purpose of this project was to aid Grove Juice Company in increasing the marketability of their current product range within Australian and International markets and to provide an evidenced based guide for the evidence surrounding fruit juice consumption and health outcomes.

The ultimate vision of the company is to enrich people's lives through healthy balanced choices. Having the latest evidence on fruit juice will give credibility, inform decisions and allow Grove Juice to innovate with products, packaging and marketing materials as well as forming a successful method for breaking into a broader range of international markets. Grove Juice has recently received news the health star rating will be changing to a lower health star rating from the previous rating of five out of five, so content with a health focus is of particular interest. As dietitians with a working knowledge of the relevant food standards, *guidelines and* food service industry experience, the role is to inform the strategies of Grove Juice Company to achieve their vision, goals and objectives.

1.1 Background

1.1.1 About Grove Juice

Grove Juice Company is an Australian, family-owned business established in 1969. Starting as a specialized home delivery fruit juice business in Brisbane, Grove Juice Company has grown to be one of the largest fresh fruit processors in the juice category exporting across Australia and Asia. Grove Juice supplies leading supermarkets, cafés, hotels and takeaway shops. The Grove Juice brand has (i) a 100% fruit juice range, made from 100% Australian grown fruit known as the *Signature* range; (ii) the *Premium* range which is a blend of fresh and reconstituted juice; (iii) the *Classic* is a premium pulp-free reconstituted juice available in a range of sizes and flavours. Grove Juice Company also markets products under the Only Juice and Boost brand. All fruit juices at Grove Juice Company are pasteurised and this increases shelf-life, therefore more economical and sustainable.

1.1.2 Fruit juice consumption in Australia

An Australian study, Riley, Hendrie & Baird (2019) reported fruit juice accounted for 5.9% and 9.8% of total sugar as well as 13.4% and 23.4% of vitamin C for Australian adults and children respectively. Fruit juice accounted for 2.6% of total energy in children while fruit juice was not a key contributor to total energy in adults. Despite these figures, fruit juice has recently become target to claims of causing poor health outcomes including tooth decay, obesity and diabetes. Although fruit juice may contain as much sugar as regular soft drink, it provides a valuable source of vitamins and minerals to our diets. It has been systematically reviewed the current evidence to determine the positive and negative health associations of fruit juice consumption.

Based on the estimated sales forecast, provided by Grove, on average consumption is 49ml per person per week of Grove Juice (Refer to Appendix 1). There is a total sale of 65,000,000 of Grove not-from concentrate (NFC) 100% fruit juice. Based on the consumption data of Grove's not from concentrate fruit juice, it shows that on average 2.55L is consumed per person. In comparison, if the Australian population (currently at 25.7 million) consumed 125mL FJ once per week, within the dietary guidelines. Yearly consumption of FJ per person 6.5L. This would result in a total sale of NFC FJ \$167 million.

1.1.3.1 Types of carbohydrates, simple and complex sugars

Sugars are a type of carbohydrate. Carbohydrates can come in mono- (one), di- (two) and poly- (many) saccharides (sugars) depending on the number of 'building blocks' (Refer to Figure 1). Short chain, or simple carbohydrates are monosaccharides and disaccharides. Longer chain sugar molecules, polysaccharides can be considered more 'complex' and require more time to digest therefore typically have a lower Glycaemic Index (GI). This is because sugars are absorbed in the small intestine as the mono-saccharides glucose, galactose or fructose. These are then transported via the portal vein to the liver.

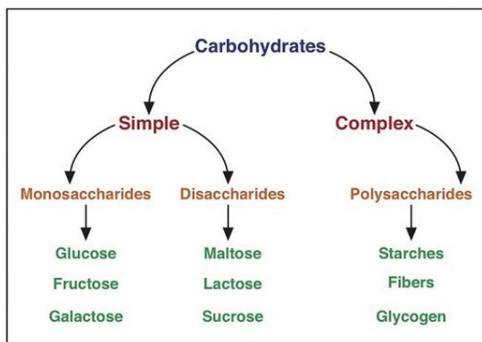


Figure 1. Types of sugars

1.1.3.2 Digestion of juice

Juice 'sugar' is made up of fructose and glucose. Fructose is absorbed differently to the other two monosaccharides (glucose and galactose). It moves via facilitated diffusion to enter the cells lining the small intestine. The absorption of fructose is typically slower than glucose but faster than galactose.

Glucose is absorbed through 'active transport' involving a sodium-potassium pump which activates a symporter to absorb sodium and glucose from the GI tract into the cell, where it then uses facilitated diffusion to exit the cell and pass into the bloodstream where it is transported to the liver via the hepatic-portal vein.

1.1.3.3 Glycaemic index and Glycaemic load

Our cells preferred energy source is glucose, too high blood glucose and too low blood glucose can be dangerous. Our liver and pancreas maintain homeostasis through releasing insulin and glucagon. If the blood glucose level is too high, our pancreas secretes insulin. If our blood glucose drops too low glucagon is released to raise the level.

Protein. Fat and fibre increase the glycaemic index (GI) of a food. As fruit juice has been processed to remove the fibre, the GI is decrease as there is not the fibre component to slow down the absorption. Even with the pulp minimal fibre content remains in fruit juice when compared to whole fruit sources.

GI is a number based off the speed of absorption of the carbohydrate and therefore 'spike' in blood glucose over typically a two-hour time period. Higher GI foods such as white bread will have a sharper 'spike' then a lower GI food such as oats which take longer to digest and gradually increase blood glucose levels (Refer to Figure 2).

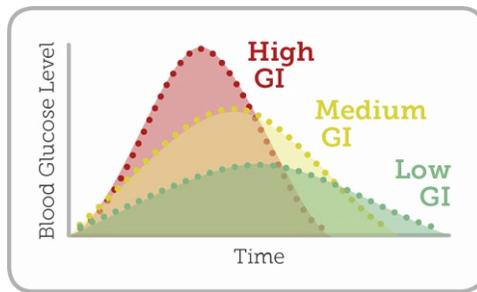


Figure 2. Glycaemic Index Classification

Glycaemic load considers the glycaemic index and the portion of the food. A small portion of a high GI food may have the same glycaemic load as a large amount of low GI food. It is a more practical way to implement maintaining varied and balanced diet without grouping foods as ‘good’ or ‘bad’ as may be misinterpreted by the glycaemic index.

1.1.4 100% Fruit Juice versus Fruit juice from concentrate versus Whole Fruit

100% fruit juice can vary in qualities such as acidity (~pH=3), Brix concentration, Brix: acid ratio, colour and flavour depending on where the fruit is grown and environmental factors (Bates RP, Morris JR, Crandall JP, 2001).

Juice from concentrate is made using a standard Brix concentration to 10 Brix with the addition of preservatives (most likely contributing to negligibly higher sodium content) and fortified with vitamin C (50% more than 100% fruit juice), natural flavours and a natural colour (beta carotene) (Refer to Appendix 2). The reconstituted juice allows for the price to be less as the shipping costs of the concentrate is less due to decreased volume. Vitamin C is a heat sensitive vitamin, therefore, some loss is possible during the concentrate process. Other vitamins, such as beta-carotene (converted to vitamin A in the body) will only be lost if heated to above 100 degrees Celsius which depending on the processing method for concentrating the juice may be unnecessary (Ashurst, 2016).

Whole fruits provide the complete nutritional composition of the fruit including the outer layer (i.e. which is often inedible) and inside flesh. Riley, Hendrie & Baird (2019) speculated that some nutritional composition differences for whole fruits not all nutrients may be readily available for absorption during digestion due to the complex plant cell membrane which encapsulates the flesh in a fruit. On the other hand, it takes around 17 oranges (~4kg oranges) which can cost ~\$16 to produce 2L of fresh orange juice which costs \$6.55 (Refer to Figure 3). Therefore, the amount of fruit juice which is consumed is not possible to achieve through whole fruits in the same amount of time. It is also not affordable to buy the same amount of juice in whole fruits.



Figure 3. Grove whole orange to orange juice diagram. Price analysis from Head of Marketing at Grove Juice.

In terms of whole fruit versus either type of fruit juice, there has been numerous negative health claims which surround fruit juice. These claims have mainly been in terms of overconsumption being more viable when fruits are in a liquid form as it is easier to consume at large quantities versus fruit in whole form which requires continuous mastication and additional time for digestion to reach the same quantity. The nutritional composition between Grove Juice Orange Juice not from concentrate, from concentrate as well as the equivalent in terms of whole oranges of around 230g (Refer to Table 1). This project involved a literature review being conducted to extrapolate the evidence on fruit juice consumption on various health outcomes (positive and negative).

Table 1. Comparison between 100% fruit juice, Fruit Juice from concentrate and Whole Fruit

Nutrients	Grove Signature Orange Juice (100% orange juice) 125ml	Classic range Orange Juice* (99.9% fruit juice) 125ml	Whole Orange, peeled fruit** 230g
Energy (kJ)	219	205	400.2
Protein (g)	0	1.6	2.3
Fat (g)	0	0.1	0
Saturated Fat (g)	0	Less than 0.1	0
Carbohydrate (g)	11.18	10.9	18.9
Total sugars (g)	9.5	10.8	18.9
Added Sugars (g)	0	0	0
Sodium (mg)	<5	10.0	0
Dietary fibre (g)	<0.5	<1.0g	5.5
Vitamin C (mg)	39	75.0	119.6
Potassium (mg)	226	-	437
Folate (ug)	Pending	-	-

*from Concentrate fortified with vitamin C fortified with Vitamin C (300)

**Food composition Database FSANZ (2019)

1.1.5 Fruit Juice versus Sugar Sweetened Beverages

Fruit juice has largely been associated with sugar sweetened beverages (SSB). However, they differ on most aspects of their nutrition composition as well as their recommended intake based on the Australian Dietary Guidelines. SSB include soft drinks, sport drinks, fruit drinks and cordials. Their nutritional composition include fluid, added sugars, artificial/natural flavours and additives with little to no vitamin/minerals present. Mineral waters or sparkling waters with no added used to be categorised with SSB. On the other hand, 100% fruit juice or juice from concentrate nutritional composition include fluid, natural sugar, natural vitamins/minerals (e.g. vitamin C, potassium, folate, antioxidants, phytochemicals). Fruit juice from concentrates are fortified with a defined amount of micronutrients. Fruit juice is included part of the fruit food group category while SSB is part of the Discretionary food list.

Overall, reasoning behind their assumed similarities includes their comparable energy content (Refer to Table 2). Sugar free SSB made with sugar substitutes are lower in energy content than fruit juice or regular SSB. A sugar substitute is a food additive that provides a sweet taste like sugar without the additional energy as sugar substitutes do not have the same composition as normal carbohydrates. These products contain little to no energy or nutrients. Additionally, there is a wide range of fruit juices such as 100% or lower with various production methods (i.e. cold pressed) all which produce variations in their nutrient contents during shelf life.

Table 2. Nutrition Composition of Orange Juice versus Coca-Cola and No sugar Coca-Cola

Nutrients (per 100ml)	Coca-Cola*	No Sugar Coca-Cola*	Orange Juice*
Energy (kJ)	214	0	117
Protein (g)	0	0	0.8
Fat (g)	0.3	0	0
Saturated Fat (g)	0	0	0
Carbohydrate (g)	12.8	0	5.7
Added Sugars (g)	12.8	0	0
Sodium (mg)	2	3	3
Dietary Fibre (g)	0	0	0.3
Vitamin C (mg)	0	0	72
Beta carotene (ug)	0	0	10
Retinol equivalents	0	0	3
Folate (ug)	0	0	53
Calcium (mg)	1	1	7
Potassium (mg)	0	0	152
Phosphorus (mg)	11	10	14
Magnesium (mg)	0	0	8
Caffeine (mg)	10	11	0

**Food composition Database FSANZ (2019)*

1.2 National Standards and Guidelines

1.2.1 Health Star Rating

The Health Star Rating (HSR) is a voluntary front-of-pack labelling system for food labels in Australia which was developed by the Australian, state and territory governments in collaboration with industry, public health and consumer groups. It was established in 2014 and was related to increasing public awareness based on Australia having the highest rates of obesity in the world with 63% of adults and one in four children being overweight or obese during 2014 (OECD June 2014 and Australian Health Survey 11/12).

The HSR system is overseen by the Australia and New Zealand Ministerial Forum on Food Regulation (the Forum), the Food Regulation Standing Committee (FRSC), Health Star Rating Advisory Committee (HSRAC) and a number of committees established for managing, monitoring and implementing the HSR system.

The HSR rates the overall nutritional profile of packaged food products which are then assigned a rating from 0.5 to 5 stars with the higher stars representing the healthier choice. It provides a quick, easy, standard way to compare similar packaged foods. The higher the number of stars, the “healthier” the food product: To be classified as “Occasional” food products and to be included in school canteens, they need to have 3.5 Stars and above.

The HSR separates food products into six food categories (Refer to Table 3). The normal HSR calculator is used for all categories except Category 1. A separate calculator was developed for Category 1 called the ‘French Nutri-Score system’.

Table 3. HSR Food Categories

Category	Food Groups
1	Non-dairy beverages, jellies and water-based ice confections
1D	Milk and Dairy beverages (and alternatives)
2	Foods
2D	Dairy foods (and alternatives)
3	Oils and Spreads
3D	Cheese

Both calculators considers the content of foods in terms of both negative components, that the Australian Dietary Guidelines (ADG) recommend limiting (i.e. energy, saturated fat, sugars, sodium) and positive components that the ADG recommend consuming (i.e. protein, dietary fibre and fruits, vegetables, nuts and legumes).

This French Nutri-Score system was implemented following the HSR system five year review since implementation, which was scheduled in, which was conducted in 2019 by a third party called 'mpconsulting' (Mpcconsulting, 2019). The review was in discussion with a range of food and beverage companies and the findings were presented to the Forum (Refer to Appendix 3). The change was identified as 'Recommendation 5' which distinguished water and mineral waters from other non-dairy beverages (Refer to Figure 4).

Recommendation 5: Changes be made to the way the HSR is calculated for non-dairy beverages, based on adjusted sugars, energy and FVNL points, to better discern water (and drinks similar in nutritional profile to water) from high energy drinks.

Non-dairy beverages contribute 27% of total sugars in Australian diets and 17% of total sugars in New Zealander diets. While the HSRs for sugar-sweetened soft drinks tend to appropriately reflect their limited nutritional value, the HSR System does not encourage consumption of low or sugar free flavoured waters or other drinks that are closer in nutritional value to water. For example, fruit juices with relatively high total sugars content generally receive HSRs of 4 to 5, while unsweetened flavoured waters generally receive HSRs of around 2 (despite having no sugars and being closer in nutritional profile to plain water).

The proposed changes mean that plain waters will have an HSR of 5, unsweetened flavoured waters 4.5, 100% fruit and vegetable juices between 2.5 and 4 (based on their sugars and energy content), diet drinks no more than 3.5 and sugary soft drinks between 0.5 and 2 (based on their sugars and energy content).

Figure 4. Recommendation 5 and explanation from Health Star Rating System Five Year Review Report (2019).

The annual Australia and New Zealand Ministerial Forum on Food Regulation meeting comprises all Australian and New Zealand Ministers responsible for food and the Australian Local Government Association and is chaired by Senator the Hon Richard Colbeck Ministerial Forum includes Ministers from each state. Following the review in 2019, the annual Ministerial Forum in November 2020 provided a request to change this new recommendation and remove 100% Fruit Juice out of Category 1 (Food Regulation; 2020), (Refer to Figure 5, Appendix 3).

Treatment of Fruit and Vegetable Juices under the Health Star Rating System

At the Forum's request, further consideration was given to the treatment of fruit and vegetable juice (no added sugar) and other non-dairy beverages under the HSR system.

The Forum supported a proposal for a minor adjustment to the HSR review calculator to address an anomaly. Diet beverages will now achieve no more than 3.5 stars, as this option best aligns with the intention from the HSR Five-Year Review recommendations and with the Australian and New Zealand dietary guidelines.

The Forum noted the Australian Government Department of Health will provide further advice in relation to adjusting the HSR calculator for 100 per cent fruit and vegetable juices (no added sugar) for discussion at the next meeting, to be held in February 2021.

Figure 5. Treatment of Fruit and Vegetable Juices under the Health Star Rating System decision at the annual Australia and New Zealand Ministerial Forum on 27 November 2020.

The forum provided a further updated in the next meeting on February 2021 and the forum was in favour of the change being declined (Food Regulation, 2021), (Refer to Figure 6, Appendix 3). Therefore, the forum provided beverage companies two years from November 2020 to update their HSR labels using the new calculator.

Health Star Rating Matters

Treatment of Fruit and Vegetable Juices under the Health Star Rating (HSR) system

The Australian Government Department of Health provided further advice in relation to adjusting the HSR calculator for 100 per cent fruit and vegetable juices (no added sugars).

The Forum agreed to maintain the status quo, supporting the implementation of the HSR review calculator for 100 per cent fruit and vegetable juices with no added sugar. The Forum noted the system adequately reflects the variation in sugar content for juices which is important for consumers in assisting in their choice of beverages.

Figure 6. Treatment of Fruit and Vegetable Juices under the Health Star Rating System decision update at the annual Australia and New Zealand Ministerial Forum on 12 February 2021.

Prior to the review, based on the previous calculator, fruit juice was classified with a HSR of five, which is what whole fruits automatically receives. This project calculates the updated HSR of Grove Juice's Signature and Classic range based on the new calculator as well as explains key components in regard to fruit juice based on the new changes made to the HSR system.

1.2.2 The Australian Dietary Guidelines

The purpose of The Australian Dietary Guidelines are a guide for health professionals to inform the health population. The guide stipulates the following aims, to achieve and maintain a healthy weight, be physically active and chose amounts of nutritious foods and drinks to meet energy need, as well as enjoy a variety of nutritious foods from the five food groups every day and drink plenty of water. The five food groups include: 1) breads, cereals and grains; 2) vegetables 3) fruits 4) meats and alternatives 5) milk, yoghurt, cheese and/or alternatives.

1.2.3 The Australian Guide to Healthy Eating

The Australian Guide to Healthy Eating is a food selection guide which visually represents the proportion of the five food groups recommended for consumption each day. Based off the Australian Dietary Guidelines (2013),

the Australian Guide to Healthy Eating provides a visual summary for the general public, the 'plate model' was developed in the same year and replaced the previous visual of the healthy eating pyramid. The same aforementioned five food groups in the Australian Dietary Guidelines above are included in The Australian Guide to Healthy Eating.

1.2.4 Queensland Health Standards for Meals and Menus

The purpose of the *Queensland Health Standards for Meals and Menus* (QHSMM) is to provide the Queensland Health Care sector with a framework to assist menu planning. The framework aims to meet nutrition requirements for most patients. The standards are for use by Food Service Managers and Dietitians in design and assessment of menus and recipes (Queensland Government, 2018).

1.2.5 Food Standards Australia and New Zealand and Food Regulation

The Food Standards Australia and New Zealand (FSANZ) and Food Regulation creates the standards and regulations for labelling laws and health claims. These include but are not limited to definition and classification of food products, vitamin and mineral fortification criteria, nutrient content or health claim criteria and mandatory allergen disclosure on nutrition information panel (NIP). FSANZ creates these standards and regulations to be followed within Australia and New Zealand, however, a separate entity prosecutes parties who do not follow the standards and regulations.

1.2.6 The Australian Beverages Council Limited

The Australian Beverages Council Limited provides guidance on processing, reconstitution, packaging, marketing and labelling of juice products. Technical Guidance for Juice Processing Version 2020 (Australian Beverages, 2020) was used to analyse Grove Juice products. The document includes sections and references to FSANZ, the Codex, and the Australian Competition and Consumer Commission (ACCC).

1.3 International Standards and Guidelines

1.3.1 International beverage bodies, policies and guidelines

International beverage bodies, policies and guidelines were included in this project for indicated countries or continents of interest. The indicated countries or continents included the United States of America (USA), China, South Korea, Singapore, Malaysia and United Kingdom (UK) and Europe. This was to make available a global context of health bodies recommendations regarding juice classification and serving size as well as public messages.

1.3.2 World Health Organisation

The World Health Organisation releases international guidelines for health of the global population. They have a guide for reducing free sugar intake across the life course, in both adults and children.

1.4 Aims and objectives

- To increase consumption and public awareness of the nutritional benefits of Grove Juice products.
- Create new product, increase market share

- Be seen as a promoter of good health and community well-being.

2.0 Methods

2.1 Literature review

The electronic databases PubMed was searched in March 2021 using a combination of Medical Subject Headings (MeSH) terms and text words. Outcomes were not included in the search terms in order to maximise the search results. No filter was applied in the process. Inclusion and exclusion criteria are outlined in Table 4.

Table 4. Study inclusion and exclusion criteria

	Inclusion	Exclusion
Participants	<ul style="list-style-type: none"> • All humans at any age (i.e. infants, children, adolescents, adults, older adults and elderly) • Healthy or with health conditions 	<ul style="list-style-type: none"> • Studies on animals • Studies done in-vitro or in-vivo
Intervention	<ul style="list-style-type: none"> • Fruit juice (all types) • SSB (where fruit juice is explicitly included) 	<ul style="list-style-type: none"> • Non-fruit juice • Whole fruits • Fruit drink
Outcomes	<ul style="list-style-type: none"> • Positive or negative health related outcomes (i.e. not limited to but include biomarkers of chronic diseases, CVD, markers of metabolic syndrome, weight, BMI, blood pressure, BGL, mental health, gut health) 	<ul style="list-style-type: none"> • Non-health related outcomes (i.e. food acceptance, food intake, calorie intake)
Study Design	<ul style="list-style-type: none"> • Meta-Analysis • Systematic Review • Review 	RCTs, non-RCTs, observational cohort studies, case studies, opinion pieces, letters, commentaries, editorials, preclinical and biological studies, poster/conference abstracts only
Language	English	Non-English

Abbreviations: BGL, Blood Glucose Levels; CVD, Cardiovascular Disease; BMI, body mass index; RCT, randomised controlled trials; SSB, Sugar Sweetened Beverage.

Studies were included if they: 1) included human population of any age; 2) compared a fruit beverage (100% fruit juice or from concentrate) with a placebo or control group. Exclusion criteria included studies which: 1) focused on animals, in vitro studies, people diagnosed with cancer; 2) had no control or comparison group; 3) did not report any of the outcomes of interest; 4) were not published in English.

Once duplicates from the initial search results was excluded using EndNote and a web-based systematic review software (Covidence). Studies were screened using Covidence. The initial ‘title/abstract’ screening was conducted independently by a pair of reviewers. If the title and/or abstracts appeared to be relevant, based on the inclusion criteria, the full article was obtained to determine eligibility. Conflicts between reviewers were resolved through discussion. Full text screening was then performed independently by two reviewers and a consensus was reached through discussion. Potential additional studies were identified through snowballing; the reference lists of relevant systematic reviews, narrative reviews and meta-analyses identified in the ‘title/abstract’ screening were searched in addition to the reference list of key papers of interest identified prior to the review.

Data extracted focused on the following parameters: study design, population characteristics, the confounding variables of intervention and comparison groups. A summary of Evidence was created, and studies were then grouped by outcomes.

All results in the literature review were reported as the original studies presented the findings. Studies were grouped by clinical outcomes and the statistical significance of outcomes was synthesized narratively. Other summary effect measures were also included if available in the primary study.

Key health outcomes which were recurrent in the literature review includes positive health benefits from vitamins and mineral content from fruit juice consumption, evidence on dental caries, type II diabetes, weight gain and obesity, metabolic syndrome, cardiovascular disease, gout and uric acid levels, urinary tract infections, oral rehydration in children and sleep.

2.2 National Guidelines

2.2.1 Health Star Rating for Fruit Juice

To calculate the HSR for a food product requires the following 7 steps:

- Step 1: Determine whether the product is eligible for an automatic Health Star Rating.
 - a. Fresh, frozen, or canned fruits (with no additions of sugar, salt or fat) automatically receive a HSR of 5.
 - b. Water and mineral water (with no additions of sugar or salt) automatically receive a HSR of 5.
- Step 2: Determine the HSR food category of the product (Refer to Table 3).
- Step 3: Determine the form in which the product is consumed.
- Step 4 to 7: Calculate the number of stars using the downloadable French Nutri-Score system on Microsoft Excel:
 - 2. The product is assigned HSR baseline points using only energy and total sugars.
 - 3. Then 'HSR modifying points' are then calculated for the 'positive' components of a product.
 - a. Modifying points include 'HSR P points' to represent protein content and,
 - b. The 'HSR V points' to represent the percentage of the product that is fruits, vegetables, nuts and legumes (FVNL) (including coconut, spices, herbs, fungi, seeds and algae) and/or concentrated fruits and vegetables.
 - c. The FVNL content is likely listed as a percentage in the ingredients list.

2.2.2 Australian Dietary Guidelines

The NRVs from the Australian Dietary Guidelines for age, gender and average height and activity level was compared to the nutrition information panel (NIPs) for Grove Juice Company products to determine the %RDI per age group. In addition, the recommended serving size, processing and frequency was of Grove juice products was stipulated.

2.2.3 Australian Guide to Healthy Eating

Fruit juice is not represented as an image on the Guide to Healthy Eating. The Australian Guide to Healthy Eating groups fruit juice under. However, it is stipulated in the Australian Dietary Guidelines that fruit juice falls under

the 'Fruit' food group as it typically contains the same nutrient profile as whole fruit without the fibre (National Health and Medical Research Council, 2019).

2.2.4 Queensland Health Standards for Meals and Menus

Using QHSMM to inform the possible marketing strategies which could be used within Queensland Health Care sector within the framework used to assist in menu planning. The serving size, packaging, accessibility, cost, health outcomes and therapeutic effects of fruit juices were considered in terms of Groves current range and possibility to recommend changes for expansion into the healthcare industry.

2.2.5 Food Standards Australia and New Zealand and Food Regulation

Groves Signature and Classic product range were compared to the FSANZ as well as Food Regulation's standards and guidelines for juice food products.

The main FSANZ documents analysed for Grove Juice products include the following, titled as per FSANZ Food Standards Code:

1. Chapter 1: Introduction and standards that apply to all foods:
 - PART 1.2 Labelling and other information requirements
 - Standard 1.2.1 Requirements to have labels or otherwise provide information
 - Standard 1.2.7 Nutrition, health and related claims
 - Standard 1.2.8 Nutrition information requirements
 - PART 1.3 Substances added to or present in food
 - Standard 1.3.2 Vitamins and minerals
 - Standard 1.3.1 Food additives
2. Chapter 2: Food Standards
 - PART 2.6 Non-alcoholic beverages
 - Standard 2.6.1 Fruit juice and vegetable juice
3. Schedules
 - Schedule 1 RDIs and ESADDIs
 - Schedule 4 Nutrition, health and related claims
 - Schedule 5 Nutrient profiling scoring method
 - Schedule 7 Food additive class names (for statement of ingredients)
 - Schedule 8 Food additive names and code numbers (for statement of ingredients)
 - Schedule 17 Vitamins and minerals

2.3 International Guidelines

The Dietary Guidelines were outlined for countries and continents including the USA, China, South Korea, Singapore, Malaysia and UK and Europe.

The dietary recommendations were compared between the USA Dietary guidelines and the Australian Dietary guidelines.

2.3.1 World Health Organisation

The recommendations related to fruit juice including the rationale from the World Health Organisation are outlined. Grove apple and ginger juice was analysed in terms of WHO's recommendations for sugar intake.

3.0 Results

3.1 Literature Review

A total of 28 meta-analysis, systematic-reviews and narrative review were identified for the literature review (Refer to Figure 7). Studies from the full text screening were excluded for fruit juice being combined as sugar sweetened beverage (n = 8) or for wrong interventions, wrong study design, wrong outcome and or full text not available (n = 49).

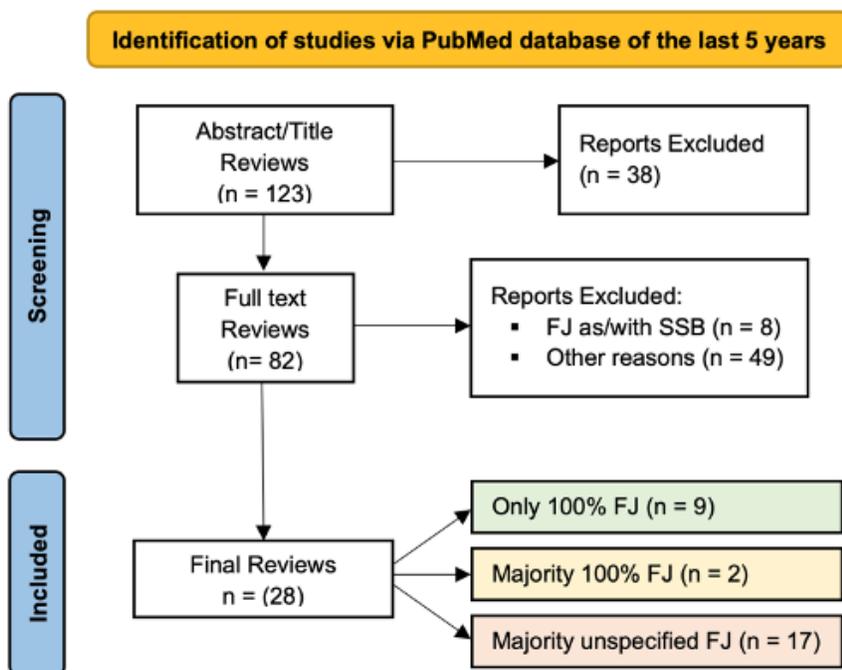


Figure 7. Flow diagram of study selection process and category of fruit juice identified in studies for articles included in this systematic review. Adapted from PRISMA 2020 (Paige et al., 2021) Includes individual comparisons of fruit juice vs. non-fruit juice consumption. Additional records were identified through other sources including searching the reference list of relevant systematic reviews, papers of interest and fruit beverage guidelines. Studies were excluded for wrong interventions, wrong study design, wrong outcome and, full text not available.

Full literature review is found in Appendix 4.

3.2 National Guidelines

3.2.1 Health Star Rating for Fruit Juice

- Step 1: Grove Juice Signature and Classic juice products are eligible for a HSR to be calculated. It also does not fall under any food category which receives an automatic star rating.
- Step 2: fruit juice is classified as Category 1, a non-dairy beverage.
- Step 3: fruit juice is consumed in the same form as it is purchased; it does not need any other food products to be mixed in, prior to consumption.

- Step 4 to 7: the HSR for each juice product was calculated using the calculator (Refer to Table 5).

Table 5. HSR Excel table of results for Grove Juice Signature and Classic juice range.

Company	Energy (kJ/100mL)	Total sugars (g/100mL)	FVNL (%)	Points	HSR Star Points	Health Star Rating
Orange Juice (<i>old</i>)	174	9.1	100.0	2	6 	★★★
Cloudy apple	180	10.3	100.0	3	6 	★★★
Apple ginger Juice	157	8.8	100.0	2	6 	★★★
Mandarin Juice	182	8.3	100.0	3	6 	★★★
Apple, mandarin, passionfruit Juice	197	9.6	100.0	4	5 	★★◇
Five fruits Juice	173	8.5	100.0	2	6 	★★★
Orange Juice <i>NFC (new)</i>	175	7.6	100.0	1	7 	★★★★◇
Orange Juice <i>FC</i>	164	8.6	99.9	2	6 	★★★

The filled in star symbols are counted as 1 star while the outline of a star symbol is referred as half a star. Therefore, the highest star rating is 3.5 stars for NFC 100% fresh orange juice based on the most recent laboratory results while the lowest is for the Apple, mandarin, passionfruit Juice which received only 2.5 stars (Refer to Table 5). The summary of the previous and updated HSR with each juice products NIP information is provided (Refer to Table 6).

Table 6. Summary of Nutritional Information panels and Health Star Rating of Grove Signature and Classic Range

Names	<i>Classic FC</i>	<i>Signature NFC</i>						
	Orange Juice	Orange Juice with pulp (new)	Orange Juice with pulp (old)	Cloudy apple	Apple ginger Juice	Mandarin Juice with pulp	Apple, mandarin, passionfruit Juice	Five fruits Juice
Ingredients	Reconstituted Orange Juice (99.9%), Vitamin C (300), Natural Flavours, Natural Colour (160a), Preservatives (202, 211)	New laboratory test results	100% fresh orange juice	99.9% fresh apple juice, vitamin C	96.9% fresh apple juice, 3% ginger puree, vitamin C	100% mandarin juice	60.9% fresh cloudy apple juice, 35% mandarin juice, 4% passionfruit juice, vitamin C	51.9% fresh cloudy apple juice, 35% fresh orange juice, 7% mango puree, 4% pineapple juice, 2% passionfruit juice, vitamin C
Nutrients (per 100ml)								
Energy (kJ)	164	175	174	180	157	182	197	173
Protein (g)	1.3	-	0.5	Less than 1.0	0.2	0.9	0.6	0.5
Fat – total (g)	0.1	-	0.1	0	0	0.2	0.3	0
- saturated (g)	0.1	-	Less than 0.1	0	0	Less than 0.1	0.1	0
- trans (g)	0	-	0	0	0	0	0	0
Carbohydrate (g)	8.7	8.9	9.4	10.6	9.1	8.3	9.6	8.5
- sugars (g)	8.6	7.6	9.1	10.3	8.8	8.3	9.6	8.5
Sodium (mg)	8.0	-	Less than 5.0	9.0	8.0	2.0	Less than 5.0	5.0
Vitamin C (mg)	60.0	31.2	40	-	-	-	-	-
Fibre (g)	Less than 1.0	<0.5	-	-	-	-	-	-
Folate (ug)	-	Pending	-	-	-	-	-	-
Potassium (mg)	-	180.8	-	-	-	-	-	-
Current Health Star Rating	5 stars	5 stars	5 stars	5 stars	5 stars	5 stars	5 stars	5 stars
New Health Star Rating	3 stars	3.5 stars	3 stars	3 stars	3 stars	3 stars	2.5 stars	3 stars

3.2.2 Australian Dietary Guidelines

ADG groups fruit juice in the fruit category and lists it as limited to ‘occasional’ intake. The definition of occasional is undefined in the ADG. Table seven shows the number of fruit serves per day across the age groups with Children having no serves at <12 months and up to two serves per day from nine years old. It should be noted that fruit juice is specified as containing no-added sugar and must be limited to ½ cup serve occasionally (Refer to Table 7).

Table 7. Summary of Australian Guide to Healthy Eating

Age	Serving of fruit per day	Fruit juice in 1 serve
<12 months	0	125ml or ½ cup*
1-2 years	0.5	
2-3 years	1	
4-8 years	1.5	
9-70+ years**	2	

* the Australian Dietary Guidelines recommends consumption of fruit juice be with no added sugar and limited to occasionally.

**including breast feeding and lactating women

Note: Both genders are included for each age group.

3.2.3 Queensland Health Standards for Meals and Menus

In QHSMM juice is recommended to be 100% fruit juice, the portion size is smaller when compared to AGHE, 100 - 120ml but the frequency is higher: once per day for acute stay adult population (Queensland Government, 2018).

3.2.4 Food Standards Australia and New Zealand and Food Regulation

Overall, various Standards and schedules were examined for Grove Juice products. All relevant Standards and schedules which directly relate to the project objectives and the Grove Juice product range are mentioned below. The Standard and Schedules references each other within their document so an understanding of several documents is required. Additional documents which were examine include but are not limited to *Standard 1.3.2 Vitamins and minerals*, *Standard 1.3.1 Food additives*, *Schedule 1 RDIs and ESADDIs*, *Schedule 5 Nutrient profiling scoring method*, *Schedule 7 Food additive class names (for statement of ingredients)*, and *Schedule 8 Food additive names and code numbers (for statement of ingredients)*.

3.2.4.1 Definition of Fruit Juice

Based on *Standard 2.6.1 Fruit juice and vegetable juice* the following definitions for fruit juice apply.

2.6.1—2 Definitions:

- Fruit juice: juice made from whole fruit.
- Juice: the liquid portion, with or without pulp, obtained from a fruit and in the case of citrus fruit, other than lime, the endocarp only of the fruit; and includes a product that results from concentrating juice and then reconstituting it with water.
- Juice blend: a blend of more than one juice (including a blend of one or more fruit juices and one or more vegetable juices).

2.6.1—3 Requirement for food sold as fruit juice:

- A food that is sold as fruit juice or as the juice of a specified fruit or fruits must be fruit juice or a blend of fruit juices and may contain any of the following additional ingredients of no more than 40 g/kg of sugars or salt.

2.6.1—4 Name and percentage by volume of juices in juice blend:

- For the labelling provisions, the name and percentage of each juice in juice blend is not required for orange juice which contains no more than 10% in total of mandarin juice. The labelling provisions are set out in FSANZ Standard 1.2.1.

Overall, Grove Juice products follow the outlined definitions, they contain no added salt or sugar. The orange juice blends under investigation do not contain over 10% mandarin juice so statement 2.6.1 in the standard does not apply.

3.2.4.2 Nutrient Profiling Score Criterion

Nutrient Profiling Score Criterion (NPSC) is required as per Standard 1.2.7 for labelling as well as part of the conditions to make some nutrient and health claims. Nutrient and Health claims needs to meet NPSC as per as per Standard 1.2.7 and Schedule 4. The NPSC final score represents the current food category that the product should fall under (Refer to Appendix 5).

Table 8. Nutrient Profiling Scoring Criterion as per Schedule 4.

S4—6

Nutrient profiling scoring criterion

For this Code, the *NPSC (nutrient profiling scoring criterion) is:

NPSC		
	Column 1	Column 2
<i>Category</i>	<i>NPSC category</i>	<i>The *nutrient profiling score must be less than ...</i>
1	Beverages	1
2	Any food other than those included in category 1 or 3	4
3	(a) Cheese or processed cheese with calcium content greater than 320 mg/100 g; or (b) edible oil; or (c) edible oil spread; or (d) margarine; or (e) butter.	28

Note With regard to NPSC category 3(a), all other cheeses (with calcium content of less than or equal to 320 mg/100 g) are classified as an NPSC category 2 food.

Grove Juice Signature range 100% Orange Juice on FSANZ online NPSC calculator produced a score of -6 which matched the Category 1, beverages final score of less than 1 criteria (Refer to Table 8, Figure 8). As per Table 8, the column 2 is the final nutrient profiling score which should be achieved in Step 4 as per the food category. The NPSC is required to be calculated when submitting Nutrient or Health Claims

Introduction			Calculate			Log Out		
100% OJ (Signature Range)								
Category 1								
Tuesday, 20 July 2021								
Baseline Points:								
Nutrient Information		Amount Entered	Points earned					
Energy		174	0					
Saturated Fatty Acids		0.0	0					
Sugars		9.1	2					
Sodium		4	0					
Total Baseline Points			2					
Modifying Points:								
		Amount Entered	Points earned					
Non <i>fvnl</i> ingredients		0%	8					
<i>fvnl</i>	Non-concentrated <i>fvnl</i> ingredients	100%						
Concentrated fruit and vegetable ingredients		0%						
Protein		0.5	0					
Dietary Fibre		0	0					
Total Modifying Points			8					
Final Score			-6					
Important								
Check Standard 1.2.7 for conditions that apply for making a health claim.								
Please print this page for your records.								
Start a new calculation			Log out					

Figure 8. Nutrient Profiling Score Criterion score for Grove Juice Signature range 100% Orange Juice (FSANZ, NFSC Calculator, 2021). The NPSC can be calculated when considering submitting a nutrient or health claims. The chosen Category 1 from Step 1 produces a final score of -6 which is less than 1 in the final Step 4.

3.2.4.3 Nutrition Content Claims and Health Claims

Nutrition content claims and health claims are voluntary statements made by food companies on labels and in advertising a food. Claims need to be set out by the *Standard 1.2.7 Nutrition, health and related claims*, *Standard 1.2.8 Nutrition information requirements* and *Schedule 4 Nutrition, health and related claims*.

Nutrient claims are the presence or absence of any of the following: a biologically active substance; dietary fibre; energy; minerals; potassium; sodium; salt; protein; carbohydrate; fat; vitamins; glycaemic index or glycaemic load. An example of a nutrient claim is “good source of vitamin C” and to make that claim the juice requires to contain 120mg of vitamin C per 100g. As per Schedule 4 Nutrition, health and related claims, Grove Juice products do not contain any added sugar (Refer to Table 9). This follows the criteria for claiming ‘no added sugar’ on their product label.

Health claims states a relationship between a food and a health effect. Health claims are separated into three categories, a general, high or very high level health claim. These need to be pre-approved relationships as set out in Schedule 4 or established by a systematic review and be submitted to FSANZ and accepted. When pre-approved relationships are not available, extensive research with systematic reviews showing evidence on the proven health claims as a result of consuming that food product to strongly support the health claim being made. An example of a general health claim is “good source of dietary fibre”, to make this claim a serving size of the food product needs to contain at least 4 g of dietary fibre. This amount for fibre was already pre-defined in Schedule 4. High level health claims are similar to general health claim but refers to a serious disease or a biomarker of a serious disease. A Serious disease refers to a disease, disorder or condition which is generally

diagnosed, treated or managed in consultation with or with supervision by a health care professional. An example of a high level health claim is, “diet high in calcium”, the health effect is to enhances bone mineral density and to make that claim the food must contain no less than 200 mg of calcium/serving.

Table 9. Schedule 4 Nutrient Content Claim Criteria

Conditions for nutrition content claims			
Column 1	Column 2	Column 3	Column 4
<i>*Property of food</i>	<i>General claim conditions that must be met</i>	<i>Specific descriptor</i>	<i>Conditions that must be met if using specific descriptor in Column 3</i>
Sugar or sugars		% Free	The food meets the conditions for a nutrition content claim about low sugar.
		Low	The food contains no more sugars than: (a) 2.5 g/100 mL for liquid food; or (b) 5 g/100 g for solid food.
		Reduced or Light/Lite	The food contains at least 25% less sugars than in the same amount of *reference food.
		No added	(a) The food contains no added sugars*, honey, malt, or malt extracts; and (b) the food contains no added concentrated fruit juice or deionised fruit juice, unless the food is any of the following: (i) a brewed soft drink; (ii) an electrolyte drink; (iii) an electrolyte drink base; (iv) juice blend; (v) a formulated beverage; (vi) fruit juice; (vii) fruit drink; (viii) vegetable juice; (ix) mineral water or spring water; (x) a non-alcoholic beverage.

3.2.4.4 Vitamins and minerals

There are a set number of micronutrients and their maximum levels which can be fortified in a fruit Juice product as outlined in *Schedule 17 Vitamins and minerals* (Refer to Table 10). For example, only 200mg of calcium can be added to fruit juice. It has been confirmed by FSANZ that any micronutrient not specified under the table for Fruit Juice means it is not permitted to be added in (Refer to Appendix 6).

Table 10. FSANZ Schedule 17 Table of Micronutrients Permitted in Fruit Juice

Vitamin or mineral	Maximum claim per reference quantity (maximum percentage RDI claim)	Maximum permitted amount per reference quantity
Fruit juice, vegetable juice, fruit drink and fruit cordial		
<i>All fruit juice and concentrated fruit juice (including tomato juice)</i>		
<i>Reference quantity—200 mL</i>		
Calcium	<u>200 mg (25%)</u>	
Folate	<u>100 µg (50%)</u>	
Vitamin C	(a) blackcurrant juice—500 mg (12.5 times) (b) guava juice—400 mg (10 times) (c) <u>other juice—120 mg (3 times)</u>	
Provitamin A forms of Vitamin A	(a) mango juice—800 µg (1.1 times) (b) pawpaw juice—300 µg (40%) (c) <u>other juice—200 µg (25%)</u>	

3.2.5 The Australian Beverages Council Limited (ABCL)

- The ABCL recommends juice with no added sugar should automatically score 4 stars in the HSR based on its positive contribution to the Australian diet and to help consumers make healthier choices within the beverage category (Australian Beverages Council, 2020), (Refer to Appendix 7).
- The ABCL recommends overall juice consumption to help meet fruit and vegetable requirements (Australian Beverages Council, 2020), (Refer to Appendix 7).
- The ABCL reports that the current proposed changes to the HSR overlook these healthy innovations in the juice category and is a missed opportunity to help consumers make healthier choices in the beverage category.

3.3 International Guidelines and Standards

3.3.1 International Guidelines

The USA guidelines reports that fruit food group intake does include whole fruits and 100% fruit juice (i.e. only 100%). However, at least half of the recommended amount of fruit should come from whole fruits, rather than 100% fruit juice. Adults are recommended to have 1.5 to 2 cup equivalent of fruits per day depending on their overall recommended calorie intake. Children aged 12 to 23 months are recommended to have 0.5 to 1 cup equivalent serves of fruits per day. Children between 12 to 24 months are encouraged to consume whole fruits whenever possible. The guidelines provide a range of 118mL fruit juice (at lower calorie intake level) to no more than 296mL fruit juice (at the highest calorie intake level). Children below 12 months are not recommended to consume any fruit juice.

Japan, Malaysia and Singapore allow 100% fruit juice to be included as part of fruit food group. Singapore recommends 200ml of fruit juice as a serving size. Malaysia dietary guidelines recommends choosing fresh fruits and that fruit juices may not replace more than one serving of fruit however, the serving size is not specified. Japan dietary guidelines includes 100% fruit juice as part of the fruit food group.

Korea dietary guidelines does not recommend consumption of fruit juice as part of their dietary guidelines. The guidelines groups fruit juice with sugar sweetened beverages they also define as Coke, flavoured milk and café mocha. Plain water is recommended while sugar sweetened beverages are not.

China dietary guidelines do not recommend consumption of fruit juice as part of their dietary guidelines (Refer to Table 11).

Table 11. Summary of International Dietary Guidelines

<i>Country of Dietary Guidelines</i>	<i>100% fruit Juice as part of fruit food group (Yes/No)</i>
<i>USA</i>	<i>Yes</i>
<i>UK</i>	<i>Yes</i>
<i>Japan</i>	<i>Yes</i>
<i>Malaysia</i>	<i>Yes</i>
<i>Singapore</i>	<i>Yes</i>

China	No
Korea	No

3.3.2 World Health Organisation

WHO recommends intake of free sugars to be less than 10%, ideally less than 5% of total energy intake (WHO, 2018). Based on Grove Juice Signature Apple and Ginger Juice which based on the nutritional information panel, it provides 157 kJ/100ml. Therefore, a 51-70 years old male, as used in the example calculation, would need to consume 624ml of juice to reach 10% of total energy intake or 312ml to reach 5% of total energy intake. The quantity of 312- 624ml juice is equivalent to 2.5 – 5 serves fruit/day, that is over 2 serves fruit/day as based in the ADG (Refer to figure 9). Therefore, based on the recommendations for fruit juice intake of 125ml according to the ADG, intake of fruit juice is within the WHO recommendations.

EXAMPLE

Male aged 51-70 years old

Height = 1.7m

Physical Activity Level is Moderate activity = 1.6

Estimated energy requirement (EER) (Australian Dietary Guidelines, 2013) = 9800kJ

WHO recommendations of 5 – 10% of EER

10% x EER

10% x 9800kJ

= 980kJ total energy

5% x EER

5% x 9800kJ

= 490kJ total energy

Grove Apple and Ginger Juice = 157kJ/100ml

1 serve fruit juice (Australian dietary Guidelines, 2013) = 125ml fruit juice

To reach 10% of EER

$980\text{kJ}/157 \times 624$ Apple and Ginger Juice = 5 serves fruit juice according to the WHO recommendations

To reach 5% of EER

$490\text{kJ}/157 \times 312\text{ml}$ Apple and Ginger Juice = 2.5 serves fruit juice according to the WHO recommendations

Figure 9. Servings of Juice according to WHO guidelines

4.0 Discussion

4.1 Literature review

Based on the literature review it cannot be concluded that fruit juice leads to weight gain, chronic health conditions (i.e. diabetes, metabolic syndrome) as well as poor dental care. People do not consume only one food solely but rather a mixed diet. There are several confounding variables as health outcomes in people are multi-factorial, and it depends on but not limited to the participants gender, stage of life, body composition (i.e. fat to muscle mass), current medical conditions, comorbidities, hormone fluctuations as well as energy expenditure in terms of total energy input versus their total energy output over time, variety and intake of foods in their diet, active/sedentary lifestyle and physical activity levels. All components need to be accounted for to get a clearer

picture of the health outcomes linked to 100% fruit juice intake. Additionally, timeline of consumption of 100% fruit juice should also be investigated.

Preventative health in terms of providing consumers education on the risk of developing overweight/obesity and chronic health conditions needs to be addressed. This does provide the responsibility of correct intake onto the consumer.

4.1.1 Fruit Juice as Sugar Sweetened Beverage

Fruit juice being classified as an SSB is currently being called into question (refer to Figure 10).

Potential reasons why fruit juice should not be classified as a SSB include:

- Nutritional composition similar to whole fruit than SSB, except the reduction in Pectin (fibre) removed through processing
- Contains micronutrients (i.e. vitamin C, potassium, folate) and phytonutrients (i.e. hesperidin, flavonoids, anthocyanins)
- Lower glycaemic control than SSB,
- 100% orange juice GI = 50 and 100% apple juice GI = 41 versus Coca-Cola GI = 63
- Fruit juice contain polyphenols (i.e. class of antioxidants) which has been shown to slow down post-prandial glucose absorption and flattening post-prandial blood glucose peak
- Juice has increased bioavailability and bio accessibility than whole fruit, possibly due to the reduced cell wall from juice processing and the reduced fibre which would usually inhibit absorption of nutrients.

	<p>Sugar Sweetened Beverages</p> <ul style="list-style-type: none"> • Soft drinks, sport drinks, fruit drinks and cordials • Composition: <ul style="list-style-type: none"> - fluid - added sugars • Little to no vitamin/minerals 	<p>Fruit Juice</p> <ul style="list-style-type: none"> • 100% Fruit Juice or juice from concentrate • Composition: <ul style="list-style-type: none"> - fluid - natural sugar - natural vitamins/minerals (e.g. vitamin C, potassium, folate, antioxidants, phytochemicals) • Concentrates (fortified with defined amount of nutrients) 	
	<p>No Sugar beverages</p> <ul style="list-style-type: none"> • Little to no energy • Little to no nutrients 	<p>Fruit Juice</p> <ul style="list-style-type: none"> • Same as above 	

Figure 10. Sugar Sweetened Beverages versus Fruit Juice

4.1.2 Health Outcomes Applicable to Grove Juice Range

100% fruit juice

- Two systematic Reviews (SMR) found no statistical association with 100% fruit juice with risk of developing Type 2 Diabetes (Xi et al., 2014; D'Elia et al., 2020).
- One SMR found FJ has a significant U-shaped dose-response. 100% fruit juice is association with an increased risk of type 2 diabetes and metabolic syndrome at both very low and excess intakes. Optimal intake of 100% fruit juice: 125mL/d to <175 mL/d while optimal intake of Mixed fruit juice: 125mL/d to <200 mL/d, Maximum protection: 75 - 150 mL vs. SSBs which has linear dose-response at 355 mL/d (Semnani-Azad et al., 2020).

- One SMR found 100% FJ (in excess intake trials) significantly decreased uric acid in healthy adults versus SSBs (in excess intake and substitution trials) significantly increased uric acid ($p < 0.001$; $p < 0.001$) (Ayoub-Charette et al., 2021).

100% Orange juice

- One SMR found no significant effect of OJ on body composition and cardiovascular disease (CVD) risk factors when compared to control group (Alhabeeb et al., 2020). Lowering effects of glucose, total cholesterol, and low-density lipoprotein cholesterol were found significant. This provides evidence of a positive effect of juice not being the cause of obesity, chronic health conditions and CVD.
- 1 Randomized control trial (RCT) found 100% orange juice consumed at 250-750mL daily for 4 to 12 weeks, none reported a statistically significant change in body weight (Ruxton et al, 2020).

Apple Juice

- Apple juice as oral rehydration therapy for children with gastroenteritis (Hartman 2019; Reust, 2016). Three SMR found clinical effectiveness of half-strength apple juice (5ml/2-5min while in hospital) followed by preferred fluids (i.e. milk, regular juice) as rehydration therapy in paediatric patients with minimal dehydration secondary to gastroenteritis (Freige et al., 2020; Hartman et al., 2019; Reust et al., 2016). However, all three SMR were limited to the same RCT (Freige et al., 2020; Hartman et al., 2019; Reust et al., 2016). The RCT had several limitations it therefore limited the applicability of the study (Freedman et al., 2016).

Cranberry

- 1 SMR found effects of cranberry Juice in the prevention of recurrent urinary tract infection (rUTI) in children and adult populations (Khan, Jhaveri, Seed & Arshad, 2019). Authors of studies in adult patients have recommended a daily dose of 300 mL of cranberry juice to achieve a reduction in the incidence of rUTI (Avorn, Monane & Gurwitz, et al. 1994). A paediatric study that showed the effectiveness of cranberry juice used a dose of 5 mL of juice per kilogram of body weight, up to 300 mL, per day for a 6-month period (Salo, Uhari, Helminen, et al.). Cranberry administration significantly reduced systolic blood pressure and body mass index (Salo, Uhari, Helminen, et al, 2012; Pourmasoumi et al., 2020)

4.1.3 Additional Juice options for Grove Juice

Tart Cherry Juice

- Two SMR have found tart cherry juice to be a source of melatonin which significantly improved total sleep time in older adults with chronic insomnia and healthy adults respectively at levels of 30-240ml twice daily ($p < 0.01$; $p < 0.05$) (Pigeonet al., 2010; Howatsonet al., 2012).

Queen Garnet Plum Juice

- A cross-over, randomized, double-blind clinical trial comparing 16 subjects (mean age 65) anthocyanins (type of flavonoid) in 250ml Queen Garnat Plum may reduce cardiovascular risk associated with endothelial dysfunction and inflammatory responses to a typical high fat 'Western' meal when compared to control 250ml apricot juice (do Rosario VA, Chang C, Spencer J, et al., 2021).

Pomegranate

- A systematic review of eight randomised control trials investigated the effectiveness of pomegranate juice on blood pressure (Gbinigie et al., 2017). Two studies reported significant reductions in systolic blood pressure respectively ($p=.002$; $p=.001$) (Asgary et al., 2014; Lynn et al., 2012). Diastolic blood pressure was also significantly lowered in these RCTs ($p=0.38$; 0.001) (Asgary et al., 2014; Lynn et al., 2012). Asgary et al. (2014) used 150mg/day of pomegranate juice and Lynn et al. (2012) used 330ml/day of pomegranate juice. It should be noted that in terms of systolic blood pressure, three studies reported no significant differences between groups, and three studies failed to report between group differences. For diastolic blood pressure, four studies reported no significant between group differences and two studies not report between group differences.

4.2 National Guidelines and Standards

- Including the Health star rating is optional and could be considered to not be included based on the new calculator. All fruit juice competitors are in a similar situation due to sugar and energy content naturally present within fruit juice.
- ADG can substitute as fruit, only 125ml and limit to occasionally. Open to interpretation for 'occasionally'.
- ADG not applicable to acute, elderly or people on specialised diets (i.e. vegan & vegetarian), therefore, limit may not apply
- Fortification of nutrients (Vitamin A, Vitamin C, folate and calcium) may be considered. Further laboratory testing of juice products would be required to establish baseline values and test the change in nutrient content during standard shelf-life.

4.2.1 Health Star Rating

The main difference is that the other five food categories is that the 'HSR baseline points' are identified for not only energy and total sugars but also for saturated fat and sodium content of the product. The products can also receive the 'HSR modifying points' as listed for Category 1 but also have two additional modifying points. The 'HSR F points' which represents the dietary fibre content in the product. The other group included in the modifying points is 'HSR P points' for the protein content in the product. However, the dietary fibre content needs to be over 0.9g to be considered and based on the NIP and laboratory analysis, Grove Juice Signature or Classic range products do not contain over 0.9g and therefore could not include these modifying points. The protein content is also not relevant for fruit juice.

100% NFC Fruit juice or fruit juice from concentrate is classified as Category 1, a non-dairy beverage. This category includes SSB (i.e. soft drinks, fruit drinks). Many SSB have added sugar unlike fresh fruit juice. These two food groups have many opposing aspects and therefore, 100% fresh fruit juice and appropriate juices from concentrates should be moved out of Category 1 and separated from SSB.

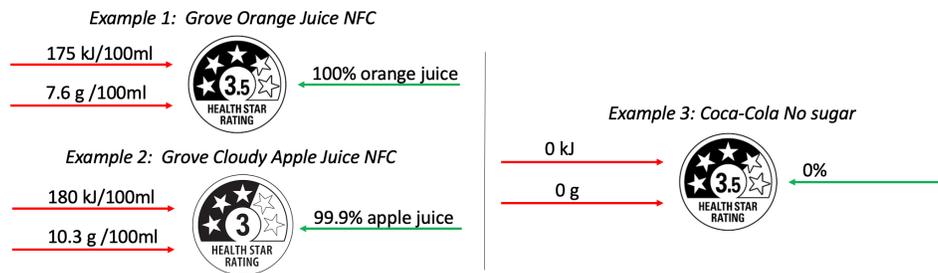


Figure 11. Grove 100% Orange and Apple Juice versus Coca-Cola

It is in agreement that fruit juice should not be 5 HSR as water, mineral waters and whole fruit is within that category. Fruit Juice should be higher than the SSB competitors (refer to Figure 11). There are clear benefits in consuming fruit juice versus regular or no sugar SSB as it contains beneficial micronutrients and fibre.

Groves Juice product range was compared to the standards and regulations to inform recommendations for possible fortification, parameters of what can be done to still remain classified as 'juice' and also to assess eligibility for front of packaging health claims.

4.2.2 The Australian Guide to Healthy Eating

- Includes fruit juice with no added sugar (including reconstituted fruit juice), no percentage provided
- 125ml considered one serve of fruit, must be limit to occasionally
- No set definition of "occasionally"
- Fruit juice classified within 'Fruit' group
- Guideline designed for general, well population
- Fruit juice is not recommended for children <12 months

4.2.3 Queensland Health Standards for Meals and Menus

- In QHSMM juice is recommended to be 100% fruit juice, the portion size is smaller when compared to AGHE, 100 - 120ml but the frequency is higher: once per day for acute stay adult population (Queensland Government, 2018).
- Price per litre of product can be criteria for some food service managers

4.2.4 Food Standards Australia and New Zealand and Food Regulation

- All food sold in Australia and New Zealand must comply with Chapters 1 and 2 of the Food Standards Code.
- The examples of nutrient and health claims provided above are all viable options for juice products depending on their overall NIP. Up-to-date high quality laboratory analysis is required to be conducted by the food company for the products they wish to have claims for.
- As per Standard 1.2.7 Nutrition, health and related claims, the food company also agree that the food being claimed also agree to the following conditions: 1) food that is intended for further processing, packaging or labelling prior to retail sale; 2) will not be delivered to a vulnerable person by a delivered meals

organisation, or, other than a food in a package; 2) will not be provided to a patient in a hospital or a medical institution.

- As per Schedule 4 Nutrition, health and related claims, Grove Juice products do not contain any added sugar therefore will be able to submit a nutrient content claim request for 'no added sugar' on their product labels.
- The 'Getting Your Claims Right' guide available to download from either Food regulations or FSANZ, outlines key information for submitting nutrient content or health claims as well as template submission forms (Implementation Subcommittee for Food Regulation, 2018).
- As per Schedule 17, section 4, page 7, only the listed micronutrients such as Calcium, folate, Vitamin C and Vitamin A and to their maximum level listed can be fortified into fruit juice. No other micronutrients, not mentioned, are allowed to be fortified or added to fruit juice (Refer to Appendix 6).
- As per Schedule 4, section 3, page 5, for nutrient claims under potassium, it states 'Conditions for nutrition content claims', the fortification range is as listed in the Schedule 17, section 4, table for fruit juice. If an amount is otherwise stated for a claim, it still needs to be within the maximum fortification level as stated in Schedule 17 (Refer to Appendix 6).
- Poly-unsaturated fatty acids (PUFA) or Omega 3s, probiotics, prebiotics can be added to fruit juice however if added it needs to be added as part of the ingredients as per labelling standards and if it is to gain a nutrient or health claims, the set criteria and procedures for application needs to be followed. Laboratory analysis may also be required. Based on the standards, some products may lose their original defined food category or product name once other ingredients are added to the original product (Refer to Appendix 6).
- The food company need to provide their own laboratory analysis of all nutrients naturally occurring and those being fortified for the duration and prior to end of shelf life (i.e. on the Best Before/Expiry date) of the product. The products need to be tested with current packaging to replicate shelf life (Refer to Appendix 6).
- The level of nutrients especially micronutrients being listed on the NIP or being claimed for need to be the vitamin or mineral amount on the Best Before/Expiry date and not the original Vitamin/mineral content due to loss of nutrients during shelf life (Refer to Appendix 6).
- All methods for optimisation of nutrients to prevent it from oxidising while on the shelf can be utilised (i.e. darkened packaging) and needs to undergo regular packaging protocols and policy's in place. This also includes other changes to packaging to optimise user experience such as easy to open or size (Refer to Appendix 6).
- Claims or food fortification of products does not include products that are given to vulnerable people, or to be given to people at a hospital or any medical institution as these populations have a much high requirement and need highly fortified product to meet their needs.

4.2.5 The Australian Beverages Council Limited

- The ABCL's recent educational resource on juice states consumption of fruits and vegetables, remains low at 94% of the population not meeting recommended intakes which is based on the Australian Bureau of Statistics (2017). However, it was reported that between 2007–08 and 2017–18, the proportion of the population not meeting the fruit and vegetable guidelines remained about the same, with approximately 49–52% of people not meeting the fruit guidelines while approximately 93–94% did not meet the vegetable guidelines. While the resource does specify the overall low intake, it is however not completely accurate to represent them together when the remaining of the resource is focusing mainly on fruit juice rather than vegetable juice. This error of clarification can cause further disagreement from reviewers in terms of fruit juice.

- Collation the ABCL will be beneficial for increasing marketability as well as public awareness and education on Grove Juice product range.

4.3 International Guidelines and Standards

4.3.1 International Guidelines

Overall, the provided information allows for evidenced based marketing to countries outside Australia. US Guidelines more personalised nutrition approach. Fruit Juice is fairly accepted in US, UK, Japan, Malaysia and Singapore as a substitute intake to fruit to some level. However, intake is still consistent with a more occasional approach to fruit juice.

4.3.2 Australian versus United States of America Dietary Guidelines

A Venn diagram was used to compare and contrast the Australian Dietary Guidelines and US Dietary Guidelines recommendations regarding fruit juice (refer to Figure 12).

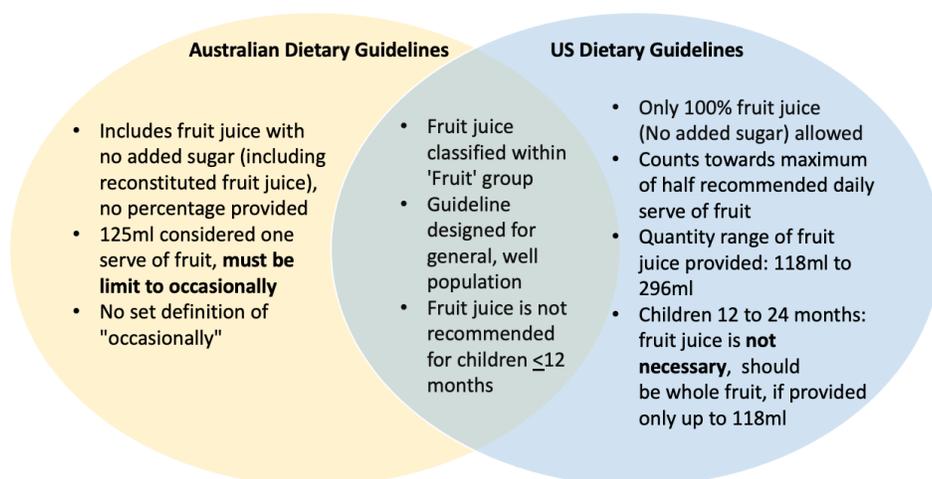


Figure 12. Australian versus United States of America Dietary Guidelines. Provides the key differences and similarities between the two guidelines.

4.3.3 World Health Organisation

WHO recommends intake of free sugars to be less than 10%, ideally less than 5% of total energy intake (WHO, 2015). Fruit Juice is grouped as a 'free sugar' source. Free sugar source is defined as "all sugars added to foods or drinks by the manufacturer, cook or consumer, as well as sugars naturally present in honey, syrups, fruit juices and fruit juice concentrates." (WHO, 2015).

The guideline entitled 'Sugars intake for adults and children' published by WHO. It is designed to provide a benchmark to government bodies. It focuses on intake of free sugars to reduce the risk of non-communicable diseases (adults and children), with a particular focus on the prevention of unhealthy weight gain and dental caries. The calculation based off a male aged 51-70 years equated to 624ml of juice to reach 10% of total energy intake or 312ml to reach 5% of total energy intake. The quantity of 312- 624ml juice is equivalent to 2.5 – 5 serves fruit/day, that is over 2 serves fruit/day as based in the ADG (refer to Figure 10). Therefore, based on the recommendations for fruit juice intake of 125ml according to the ADG, intake of fruit juice is within the WHO recommendations.

The WHO recommendations have grouped fruit juice with other ‘free sugar’ containing foods. The recommendations are reported to be based on analysis of the latest scientific evidence. WHO found from their analysis that adults who consume less sugars have lower body weight and, an association with increased sugar consumption with a weight increase. In Children, the intake of free sugars was associated with higher weight and dental caries.

5.0 Limitations

5.1 Literature review

- Multiple confounding variables present influences the overall results.
 - Unclear specification of types and percentage of juice used in the interventions.
 - Unclear diet history of participants of foods consumed during the intervention period (i.e. high energy foods, high sugar foods, other fruit products).
 - Participants overall energy intake during the intervention period
 - Participants overall nutrient requirements and nutrient intake.
 - Presence of comorbidities, other underlying health conditions, risk factors for the participants
 - Participants physical activity levels.
- Mixed Methodology of studies.
 - Limited high evidence randomised controlled trials, double blind studies.
 - Limited studies with robust methodology.

5.2 National Guidelines and Standards

5.2.1 Health Star Rating

- Category 1 is all beverages that contains sugar which are excluded from Category 1D dairy beverages. Therefore, 100% fruit juice is groups with sports drinks, cordial, jellies, fruit drinks.
- 100% NFC Fruit juice or fruit juice from concentrate are being compared to other SSB products (i.e. soft drinks, fruit drinks) irrespective of their nutritional composition difference apart from total sugar and total energy content.
- While 100% fruit and vegetable juices would score between 2.5 and 4 (based on their sugars and energy content), diet drinks would score no more than 3.5 and sugary soft drinks would continue to score between 0.5 and 2.
- The new system would cause higher HSRs for juices inherently lower in sugars (i.e. grapefruit or lemon juices) and lower HSRs for juices with high sugar content (i.e. apple or pear juices).
- The HSR system and new calculator portrays 100% fruit juice as nothing more than sugar and energy and similar to a soft drink, disregarding fruit juice’s natural sugar composition, micronutrient and phytochemical components which have potential health benefits.
- Consumers may therefore choose no sugar SSB over juice due to the possibility of the higher HSR.
- Based on the HSR system, it encourages the consumption of the no sugar SSB such as No sugar Coca-Cola which receives a HSR of 3.0 over a juice such as Grove’s Signature cold press fresh Apple, mandarin, passionfruit juice which received a HSR of 2.5 (refer to Table 2, 6 and Figure 12).
- Consumers are therefore left further confused on appropriate and healthy choices between non-dairy beverages.

- Based on the Government led initiatives, such as the NSW Healthy School Canteen Strategy which includes a requirement for all 'Occasional' (i.e. discretionary) foods and drinks sold in NSW Government school canteens (with the exception of diet drinks) to have an HSR of 3.5 or above. There are a range of Juices included 100% fruit juices which would no longer be allowed to be provided.
- It states the HSR system, is in line with ADG, where fruit juice is classified under the five food groups 'fruit' category but is recommended to be consumed 'occasionally'. However, pairing fruit juice with SSB is not in line with the ADG which clearly defines SSB as discretionary foods and not part of the core five food groups. The intakes are both "occasionally" however, there is not definition of what occasional is, but based on where they mentioned in the ADG, 100% fruit juice would be considered a superior choice to a SSB.

5.2.2 Guide to Healthy Eating

- Pictorial does not provide specific amounts for each food group for individuals.
- Icons for representing food group limited due to space constraints (note: fruit juice icon not pictured)

5.2.3 ADG

- The 2013 Australian Dietary Guidelines are aspirational. Based on self-reported 24hr recall, 60% of people consumed fruit and fruit products (Australian Health Survey, 2014, reference period 2011-2012 financial year). The self-reported usual serves of fruit eaten per day, 54% met the recommended serves of fruit (Australian Health Survey, 2014, reference period 2011-2012 financial year).
- Designed to promote health and wellbeing and reduce chronic disease risk, are not designed to meet the needs of those with specific medical conditions.
- The minimum and maximum serves refers to the parameters placed on the modelling system.
- ADG does not represent the only way to achieve a nutritious diet. It is possible to meet nutrient requirements following another type of specialized diet, such as a vegan diet.

4.2.4 Food Standards Australia and New Zealand and Food Regulation

- Food fortification of beneficial micronutrients are restricted for fruit juice products. This does not involve products for vulnerable people, or to be given to people at a hospital or any medical institution as these populations have a much high requirement and need highly fortified product to meet their needs.
- Additional beneficial nutrients such as Poly-unsaturated fatty acids (PUFA) or Omega 3s, probiotics, prebiotics can be added to fruit juice however it involves a long process and involves ongoing costs for trial of the project range.
- Due to variances in soil content to oxidation of nutrients within the juice products while on the shelf, the amount of nutrients being tested for the 100% fruit juice range will greatly differ. This has also been confirmed by the Grove Juice team to be occurring depending on the season.
- Ongoing laboratory equipment and chemicals, juice products to test, analysis and interpretation of result requires time and can be a costly process. Depending on Grove Juice current testing facility and testing methods the time and costs will vary.

5.3 International Guidelines and Standards

5.3.1 International Guidelines

Limited information was provided for several countries and cotenants outside Australia. The biggest challenge was the language barrier when navigating the online websites to find the dietary guidelines. Additionally, the dietary guidelines were not in English, so some assumption had to be made based on the pictorials. The solution was doing a literature review or searching Google Scholar for the dietary guidelines for Non-English Speaking background countries. These provided clarification on the background and interpretation of these international dietary guidelines.

Overall, the provided information allows for evidenced based marketing to countries outside Australia. US Guidelines more personalised nutrition approach. Fruit Juice is fairly accepted in US, UK, Japan, Malaysia and Singapore as a substitute intake to fruit to some level. However, intake is still consistent with a more occasional approach to fruit juice.

5.3.2 Australian versus United States of America Dietary Guidelines

- ADG published in 2013, whereas USDG published in 2020
- ADG term 'occasionally' not defined by amount or frequency per age/gender whereas USDG allows for up to half of daily fruit (specific value for number of fruit serves differs given dependant on calorie needs) serves to come from 100% fruit juice (no added sugar).

5.3.3 World Health Organisation

Research was limited to the outcomes of overweight/obesity and related non-communicable diseases for free sugar intake. Fruit juice was grouped together with all other free sugars to determine associational increased risk with a recommendation drawn. Therefore, fruit juice was not looked at individually and was grouped with other foods and beverages which may contain a less beneficial micro-nutrient content.

Furthermore, the guideline is designed to be utilised for populations, however, there are some populations where weight gain would be beneficial. The elderly population with malnutrition, may benefit from fruit juice consumption where there is energy and micronutrient content as a source of hydration, rather than water. There is a need for systematic reviews and meta-analyses relating to fruit juice consumption and other health-related outcomes. The WHO identified that there is a need for longer term (>8 weeks) controlled trials of the effect of free sugars intake on body weight in observational cohort studies as most of the available evidence is from short-term trials (World Health Organisation, 2015).

The limitation of the comparison of 2.5 serves of Grove apple and ginger juice per day being equivalent to 5% of energy intake is made under the assumption that the demographics and anthropometry matches the example used in the equation and that there are no other sources of free sugars in the diet for that day.

6.0 Recommendations

Grove Juice Co.'s Strengths

Grove Juice Co. is a trusted brand with proven reliability and delicious products. The Grove Juice Company has many positive points, which are of value and should be highlighted in marketing material, these include:

- Family own & Australian business
- 100% fruit juice range
- no added sugar, preservatives or artificial flavours in Signature range
- Additional vitamin C added in reconstituted juice exceeding 100% of RDI
- Shipping internationally and established in international markets
- Using Australian grown (where possible)
- Open to new ideas

Recommendations to implement:

Governing bodies

Meet with councils and members of parliament to advocate for fruit juice in an evidence-based way. Evidence informed by need for fruit juice as population surveys showing Australians not meeting the fruit and vegetable intake recommendations so providing source of nutrients in diet, literature review summarising evidence and nutrition analysis tables comparing fruit juice to whole fruit.

- Present work to the Beverage Council to promote fruit juice and explain science
 - Advance and promote 100% juice and no-added sugar juice concentrates
 - Inform science and educate on labelling tools
- Provide the Minister of Health with detail work on the Star Rating System and how it disadvantages 100% fruit juice and no-added sugar concentrate juices when compared to sugar sweetened beverages or artificially sweetened beverages.
- Enhance data being provided to support Star Rating reforms, including advocate for Fruit juice should be removed from Category 1 HSR and into its own category.
- Australian Dietary Guidelines review advocate for fruit juice to remain in 'Fruit' category, specific definition of 'occasionally' for fruit juice in the Australian Dietary Guidelines. Potentially personalized ADG similar to USA.

7.0 Conclusion

From the project several issues have come to the forefront of how juice is perceived. The evidence clearly indicates that 100% and concentrate juices do not contribute to chronic disease when consumed in moderation. The health care standards and labelling tool used in Australia provide mix messages and may contribute confusion to consumers. Therefore, work needs to be undertaken to provide scientific feedback to key committees and governing bodies. There needs to be conciliated marketing and education programs to build a positive, factual fruit juice story.

Grove Juice has a several strengths as a company, promoter of well-being and lead the juice industry

- Australian facilities to process juice and a good family story to tell
- 100% fruit juice range
- Using Australian grown (where possible)
- Growth mindset, open to new ideas and product development
- An invested interested to promote juice and insure a lasting visible industry into the future

The project has demonstrated using science and translating it into practical information can inform how an industry can promote and champion positive health messages to support the manufacturing and production of food products. It provides Grove Juice with an opportunity to be more than a manufacturer, taking a proactive leading role in the wellbeing and health of the community.

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APPENDICES

APPENDIX 1 - Sales forecast for Grove Juice

Draft Sales forecast by Grove Juice

National NFC Sales Litres		
Coles	15,000,000	
Aldi	15,000,000	
WW	15,000,000	
Costco	5,000,000	
Route	15,000,000	
TOTAL	65,000,000	
Asutralian Population	25,500,000	
Yearly per capita consumption of NFC	2.55 Litres	
Weekly per captia consumption of NFC	49.0 mls	
ADG recommends Juice occasioanlly	125.0 mls	
Ocassional serve	1 per week	
Per year equiv per person	6.5 Litres	
Equiv Australian Population NFC consumption	165,750,000 Litres	

Final Sales forecast for Grove Juice

National NFC Sales per Litres		
Coles	15,000,000	
Aldi	15,000,000	
Woolworths	15,000,000	
Costco	5,000,000	
Route	15,000,000	
Total	65,000,000	
Australian Population	25,700,000	people
Annual per capita consumption of NFC	2.55 L	
Weekly per capita consumption of NFC	49 mLs	
ADG recommends 1 serve 100% juice occassionally	125 mL	
Ocassional serve (<i>undefined</i>) <i>presumed weekly</i>	1 per week	
Per year equivilant per person	6.5 L	
Equivilant Australian Population consumption of NFC	167050000 L	

APPENDIX 2 - Email Inquiry to Department of Agriculture on CODEX STAN 247-2005

Subject: RE: GENERAL STANDARD FOR FRUIT JUICES AND NECTARS (CODEX STAN 247-2005) - Inquiry [SEC=UNOFFICIAL]
Date: Monday, 19 July 2021 at 3:33:29 pm Australian Eastern Standard Time
From: Imports
To: Natasha D'Souza
Attachments: image001.png, image002.png, image003.png

Hi Natasha,

Thank you for your email.

I can advise you in relations to the biosecurity import conditions only.

The biosecurity import condition does not stipulate the level and type of aroma and flavours that can be added.

You may find more on the **Fruit and vegetable juices, chilled pulps, purees and pastes, plant oils and plant-based beverages** case on the Department of Agriculture's Biosecurity Import Conditions database ([BICON](#)).

You may also want to refer to the Food Standards Australia New Zealand (FSANZ) to ensure the products meet their requirements.

I hope this information is of use to you. Let us know if you require further assistance.

Kind regards,

Samiya

Technical Officer | Plant Products | T 1800 900 090

Department of Agriculture, Water and the Environment
Plant Import Operations | Plant Division
7 London Circuit, GPO Box 858 Canberra ACT 2601 Australia
awe.gov.au

-



The department acknowledges the traditional custodians of country throughout Australia and their continuing connection to land, sea and community. We pay our respects to traditional custodians, their cultures and elders past and present.

From: Natasha D'Souza <natasha_dso@hotmail.com>
Sent: Monday, 19 July 2021 1:42 PM
To: Imports <Imports@agriculture.gov.au>
Cc: jane jaffe <jane.jaffe@live.com.au>; Karen Abbey <karen@nutcat.com.au>
Subject: GENERAL STANDARD FOR FRUIT JUICES AND NECTARS (CODEX STAN 247-2005) - Inquiry [SEC=UNOFFICIAL]

Good afternoon,

On the **GENERAL STANDARD FOR FRUIT JUICES AND NECTARS (CODEX STAN 247-2005)** document,

I have questions which I hope you can assist me with.

On page 1, on footnote 1 which states "introduction of aromas and flavours are allowed to be restored to the level of these components up to the normal level attained in the same kind of fruit", which is regarding fruit juice from concentrate.

1. Are there any data for commonly depleted aromas and flavours in different juice types?
2. Are there any data for normal levels of aromas and flavours attainable in different fruits?
3. Is this information determined through laboratory testing through the individual manufacturing company?

Additionally, I understand this document is dated from 2005 and is listed with other current Codex standards, is there a tentative date for review of this document?

Thank you in advance for your help!

Kind regards,
Natasha D'Souza

M [0449 915 295](tel:0449915295)
E natasha_dso@hotmail.com

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APPENDIX 3 - Email Inquiry to FSANZ on HSR Five Year Review

Phone call to Belinda was also undertaken to ask additional questions. All answers can be found on this email chain.

Subject: FW: HSR five year review - mpconsulting Inquiry [SEC=OFFICIAL]
Date: Wednesday, 11 August 2021 at 8:55:12 am Australian Eastern Standard Time
From: frontofpack/Health
To: natasha_dso@hotmail.com
CC: jane.jaffe@live.com.au, karen@nutcat.com.au
Attachments: image001.png

Hi Natasha

Thanks for the chat on the phone yesterday.

As promised, here are a few decision points that would help you along in relation to the change to the non-dairy beverages category. The [Reviews tab](#) on the HSR website details the ongoing consultation undertaken by mpconsulting and the Department of Health throughout the review process. Each stage of decision making and testing of new/updated calculators was broadly consulted on. This includes both written consultation and a dedicated video consultation specific to the proposed changes to non-dairy beverages.

- In December 2019 the then Australia and New Zealand Ministerial Forum on Food Regulation ((Forum) now the Food Ministers' Meeting) agreed to change the way the HSR is calculated for non-dairy beverages to better differentiate water and drinks similar in nutritional profile to water from drinks with a high sugar and energy content - this was in response Recommendation 5 of the Health Star Rating Five Year Review.
- At the July 2020 Forum meeting, a proposed policy override for automatic 5 HSR rating for 100 per cent fruit and vegetable juices (no added sugars) was not supported.
- At the 27 November 2020 Forum meeting, a proposed policy override for automatic 4 HSR rating for 100 per cent fruit and vegetable juices (no added sugars) was not supported.
 - The decision not to support was preceded by Ministers having a constructive discussion about the treatment of the broader non-dairy beverages category under the HSR system, which culminated in support for using the Calculator (wherever possible) to maintain the objectivity and integrity of the system.
 - On the basis of maximising the integrity of the system, the Forum requested that the Department of Health provide advice, in relation to adjusting the Calculator for 100 per cent fruit and vegetable juices.
- The Department then developed alternative options to re-scale the HSR calculator for 100 per cent juices (no added sugars) so they score higher HSR ratings.
- Options were considered at the Forum meeting of 12 February 2021.
- The proposed options took into account juice's vitamin and mineral content by adjusting the fruit, vegetable, nut and legume (FVNL) points, and ensures different juices have different HSR ratings to appropriately reflect the differences in sugar and energy content to assist consumers better discern and select healthier options.
- The Forum also supported a proposal for a minor adjustment to the HSR review calculator to address an anomaly with the maximum rating achievable for diet beverages. Diet beverages will now achieve no more than 3.5 stars – an approach that best aligns with the intention from the HSR Five-Year Review recommendations and with the Australian and New Zealand dietary guidelines.
- The change to non-dairy beverages will mean that plain waters will still have an HSR rating of 5 stars, unsweetened flavoured waters 4.5 stars, 100 per cent fruit and vegetable juices between 2 and 4 stars (depending on the juice), diet drinks no more than 4 stars and sugary soft drinks, energy drinks, sports drinks and vitamin waters between 0.5 and 2 stars.

I trust this information is of assistance.

Thanks

Belinda

Front-of-Pack Labelling Secretariat

Population Health Division | Preventive Health Policy Branch
Australian Government Department of Health
T: 1800 099 658 | E: frontofpack@health.gov.au
GPO Box 9848 (MDP 707), Canberra ACT 2601

The Department of Health acknowledges the traditional owners of country throughout Australia, and their continuing connection to land, sea and community. We pay our respects to them and their cultures, and to elders both past and present.

From: Natasha D'Souza <natasha_dso@hotmail.com>
Sent: Monday, 9 August 2021 1:35 PM
To: FoodRegulationSecretariat <FoodRegulationSecretariat@health.gov.au>; frontofpack/Health <frontofpack@health.gov.au>
Cc: Karen Abbey <karen@nutcat.com.au>; jane jaffe <jane.jaffe@live.com.au>
Subject: HSR five year review - mpconsulting Inquiry

REMINDER: Think before you click! This email originated from outside our organisation. Only click links or open attachments if you recognise the sender and know the content is safe.

Good afternoon,

I am inquiring regarding any information that is available regarding disclosure of the **mpconsulting**, who was engaged to undertake the independent review of the HSR which was carried out after five years of implementation?

As outlined in The Australia and New Zealand Ministerial Forum on Food Regulation response to the Health Star Rating System five year review, December 2019 document.

Thank you in advance for your help!

Regards,

Natasha D'Souza

Accredited Practicing Dietitian
MDietS, BHSc (Nutrition)

M [0449915295](tel:0449915295)

E natasha_dso@hotmail.com

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APPENDIX 4 - Literature Review Full Table

Table 12. Eight reviews which analysed 100% fruit juice

Author, (Year)	Study design, Population size (N), Study/ Population characteristics, Gender, Age (range)	Intervention and Comparison	Outcomes	Results
Ayoub-Charette et al., 2021	<p>Systematic review</p> <ul style="list-style-type: none"> N = 2763 RCTs and non-RCTs Predominately healthy adults (some with health conditions) Age: 15 - 63 years old 	<p>Overall, 9 food sources: SSBs, sweetened dairy, fruit drinks, 100% fruit juice, fruit, dried fruit, sweets and desserts, added nutritive sweetener, and mixed sources.</p> <p>Intervention periods \geq 7 days</p> <p>Total studies</p> <ul style="list-style-type: none"> 100% FJ in addition (21% excess energy) trials (n=327; trials = 8) SSBs in addition (24% excess energy) trials (n=375; trials = 13) SSBs in 9 substitution trials (n=279; trials = 9) SSBs in subtraction trials (n=213; trials = 4) 	<ul style="list-style-type: none"> Change in fasting serum or plasma uric acid levels 	<p>100% FJ overall changes from baseline (or end differences)</p> <p>Addition trials:</p> <ul style="list-style-type: none"> statistically significant decrease in uric acid levels (0.42mg/dL, $p < 0.001$; 95% CI = 0.24 to 0.59) <p>SSBs overall changes from baseline (or end differences)</p> <p>Addition trials:</p> <ul style="list-style-type: none"> statistically significant increase in uric acid levels (0.43mg/dL, $p < 0.001$; 95% CI =0.23 to 0.63). <p>Substitution trials:</p> <ul style="list-style-type: none"> statistically significant increase in uric acid levels (0.42mg/dL, $p < 0.001$; 95% CI=0.24 to 0.59). <p>Subtraction trials:</p> <ul style="list-style-type: none"> non-significant increase in uric acid levels (0.09mg/dL, $P=0.45$; 95% CI = -0.14 to 0.32)
Tadros et al., 2021	<p>Narrative systematic review</p> <ul style="list-style-type: none"> N = 751 Total studies (n = 20): RCT (n=16), non-RCT (n=3), or crossover trials (n=1). healthy adults (n=14), adults with cardiovascular risk factors (n=5), or adults with chronic hepatitis C (n=1) Age: >18 years old 	<p>Intervention vs. placebo (n=17) or Intervention vs. control (n=3),</p> <p>Overall, effect of hesperidin within 100% OJ.</p> <p>Intervention group</p> <p>Dose: 100-767ml/day OJ</p> <p>Types of OJ used:</p> <ul style="list-style-type: none"> Regular OJ (n=14) Red OJ (n=1) Blood OJ (n=2) High flavonoid (HF) OJ (n=2) High polyphenol concentration (HPJ) OJ (n=1) <p>Duration: 1 day to 31 weeks</p>	<p>Chronic diseases markers</p> <ul style="list-style-type: none"> Neurological conditions CVD Inflammation 	<p>Unclear evidence. Nil p-value stated.</p>
Ho et al., 2020	<p>Narrative review</p> <ul style="list-style-type: none"> N value not specified Total studies (n = 75): RCTs 	<p>Effect of 100% FJ on multiple health outcomes: CVD (n = 34); Neurological conditions (n = 19); Obesity and diabetes (n = 7); Exercise performance (n = 15)</p>	<p>Chronic diseases markers</p> <ul style="list-style-type: none"> CVD Neurological conditions 	<p>Overall, ~2.5 - 6 cups 100% juice would be needed to meet the required polyphenol (726 mg/day) dose which has been shown for CVD improvements.</p>

			<ul style="list-style-type: none"> • Markers of Obesity • Markers of diabetes • Exercise performance 	Increase intake of polyphenol dense juices to have greater positive health benefits: Concord grape juice and blueberry juice
Fardet et al., 2019	<p>SR and MA</p> <ul style="list-style-type: none"> • Total studies (n = 10): Pooled analyses and meta-analyses of longitudinal studies, prospective studies and RCTs • Age: Children aged 3 years old to older adults aged >65 years old 	Effect of whole fresh fruits (n = 3), canned fruits (n = 1), fruit juices (n = 7), sweetened fruit juices (not classified as SSBs) (n = 1).	<ul style="list-style-type: none"> • All-cause mortality • risk of chronic disease (i.e. obesity, Type 2 diabetes, HOMA-IR) • changes in metabolic regulation (weight change) 	<ul style="list-style-type: none"> • High consumption of canned fruit and sweetened fruit juice is positively associated with the risk of all-cause mortality and type 2 diabetes, respectively. • High consumption of 100% fruit juice is associated with a significantly higher risk of weight gain and a higher HOMA-IR index. • Xi et al (2014) found sweetened fruit juice consumption was associated with a significantly increased risk of type 2 diabetes by compared with 100% fruit juice consumption (28%, P = 0.184)
Auerbach et al., 2018	<ul style="list-style-type: none"> • Systematic review on health outcomes of 100% fruit juice consumption. • Total studies (n=10) • Two studies mixed meta-analysis of 100% FJ and SSB (re-analysed to separate findings) • Nil specific population, comparison or predetermined outcomes listed 	<ul style="list-style-type: none"> • Nil specific population predetermined in review PICO. Population varied by individual studies. Overall, review included adults and children. • Nil specific comparison predetermined in review PICO. Variations included comparison between 100% fruit juice i) consumed at </> specific quantities; ii) whole fruit or highest and lowest quartiles of consumption 	<ul style="list-style-type: none"> • Changes in Glucose homeostasis , lipid concentrations and blood pressure • Tooth decay • Change in liver enzymes • Weight gain • Diabetes • Cardiovascular disease 	<p>Note: no p values listed</p> <ul style="list-style-type: none"> • Changes in Glucose homeostasis (n=1), lipid concentrations (n=1) and blood pressure (n=1) (review lists no effect in adults, limited evidence* (P=<0.05)) • Tooth decay (n=1)(review lists moderate evidence*, see Salas, Nascimento, Vargas-Ferreira et al., 2015 for more detail) • Change in liver enzymes (n=1) (no effect in adults, evidence grading not assigned) • Weight gain (n=4) (small adverse association in adults, no clinically significant association in children, moderate evidence*) • Diabetes (n=2) (possible small adverse association in adults, moderate evidence*) • Cardiovascular disease (n=3) (review reported inconsistent results ; possible protective association between citrus juice and isch stroke, limited evidence*) <p>*according to USDA Nutrition Evidence Library Grading Guidelines</p>
Auerbach et al., 2017	<ul style="list-style-type: none"> • Meta-analysis of 8 prospective cohort studies • Children aged 1-18 years (n = 34 470 individual children) 	<ul style="list-style-type: none"> • Of the eight studies included, study size ranged from 244 - 14 918 subjects • Follow-up duration ranged from 6 months to 10 years 	<ul style="list-style-type: none"> • Weight gain 	<p>Limitations: All observational studies; studies differed in exposure assessment and covariate adjustment</p> <ul style="list-style-type: none"> • Consumption of 100% fruit juice is associated with a small amount of weight gain in children ages 1 to 6 years that is not clinically significant, and is not associated with weight gain in

		<ul style="list-style-type: none"> Studies used either food records (n = 3) or food frequency questionnaires (n = 5) to assess diet All included studies distinguished between 100% fruit juice and fruit drinks containing <100% fruit drinks. 		children ages 7 to 18 years. More studies are needed in children ages 1 to 6 years.
Crowe-White et al., 2016	<ul style="list-style-type: none"> Systematic review (n=22) Children (aged 2-18 years) 	<ul style="list-style-type: none"> Cross-sectional (n=12) Prospective cohort studies (n=8) Retrospective cohort design (n=1) time-series study(n=1) Study designs and methodologies for evaluating 100% fruit juice intake and outcomes varied greatly, several assumptions and limitations were associated with this review, and hence with the conclusions that were drawn. 	<ul style="list-style-type: none"> Weight gain 	<ul style="list-style-type: none"> Overall, the evidence did not support an association between 100% fruit juice consumption and weight status or adiposity in children after controlling for total energy intake and other covariates.
Rampersaud et al., 2017	<ul style="list-style-type: none"> Review 	<ul style="list-style-type: none"> 100% citrus juice 	<ul style="list-style-type: none"> Nutritional contribution Dietary benefits Anthropometric measures 	<ul style="list-style-type: none"> Moderate amounts of OJ or GJ can be recommended for children, adolescents, and adults without detrimental effects on weight, provided intakes are balanced with respect to the total diet and physical activity levels. A review of the research suggests that including moderate amounts of citrus juice as part of a healthy diet and lifestyle can help meet several DGA recommendations related to the intake of key nutrients, choosing nutrient-dense foods and beverages, and improving fruit intake as a complement to whole fruit
Two reviews which analysed majority 100% fruit juice				
Author, (Year)	Study design and Population	Intervention and Comparison	Outcomes	Results
Liska et al., 2019	<ul style="list-style-type: none"> Systematic review No restrictions were set for age, sex, geographic location, or socioeconomic status 	Not following set PICO. Some studies control against milk or water.	Dental health	<ul style="list-style-type: none"> The existing evidence on 100% fruit juice intake and caries and tooth erosion are not conclusive. Overall, prospective cohort studies in children and adolescents found no association between 100% fruit juice intake and tooth erosion or dental caries, but, RCT data in adults suggests that 100% fruit juice could contribute to tooth erosion and dental caries. The RCT data was from small, short-term studies that utilised intra-oral devices generally devoid of normal plaque or saliva action, and generally employed conditions that are not reflective of normal juice consumption.

Frantsve-Hawley et al., 2017	<ul style="list-style-type: none"> • Systematic review • Total studies (n=38) • RCT (n=1) and cohort studies (n=37) • Children (aged <12 years) 	100% fruit juice vs SCB (sugar containing beverages) vs control	Central adiposity	<ul style="list-style-type: none"> • Results of these studies were mixed, majority demonstrated a statistically significant positive association between SCB consumption and total adiposity and central adiposity (in children <12 years). $P = 0.0052$ (two-tailed). • Studies assessing 100% fruit juice consumption only with either total adiposity or central adiposity did not support an association. $P = 0.0352$ (two tailed) • Among children <5 years, at baseline, no studies examined central adiposity, but nearly all studies examining SCBs and total adiposity, and a majority examining only fruit juice consumption, demonstrated a statistically significant positive association. • Among the studies for children (<12 years) that controlled for total energy intake (n=13), the association was significant for SCB consumption and total adiposity in children at baseline results of the two-tailed sign test for these studies, $P = 0.0052$ (two-tailed). • Our results support a statistically significant positive association between SCBs and total and central adiposity among children under age 12 years. • This association is most consistent for total adiposity among children <5 years. • Results for 100% fruit juice only suggest differences by age, as most studies among those <12 years were negative but most among those <5 were positive.
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Abbreviations: SSBs; sugar sweetened beverages, FJ; Fruit juice, HOMA-IR; Homeostatic Model Assessment for Insulin Resistance,

Table 12(continued) reviews which analysed majority unspecified fruit juice

Reviews which analysed majority unspecified fruit juice				
Author, (Year)	Study design and Population	Intervention and Comparison	Outcomes	Results
Gratwicke et al., 2021	Narrative Review <ul style="list-style-type: none"> • N value unspecified • RCTs, observation studies, case studies, and case reports 	Overall, Multiple RCTs trailing carbohydrate meals, cherry juice or nutritional supplements. Included studies (n = 2) <ul style="list-style-type: none"> • 2 RCTs which trialled tart cherry Juice (Montmorency cherry) (Refer to RCT Table on Howatson al., (2012) and Pigeon al., (2010). 	Sleep quality and sleep Quantity <ul style="list-style-type: none"> • Total sleep time (TST) • Sleep efficiency (SE) • Sleep onset latency (SOL) 	Intervention vs. placebo <ul style="list-style-type: none"> • Howatson al., (2012) and Pigeon al., (2010) found statistically significant increase in TST respectively ($\uparrow 39.0$, $p \leq 0.05$; $\uparrow 29.3$ min, $p \leq 0.01$) • Pigeon al., (2010), found statistically significant increase in SE ($\uparrow 3.7\%$, $p \leq 0.05$); and decline in SOL ($\downarrow 3.6$ min, $p \leq 0.01$) and decline in WASO ($\downarrow 16.8$ min, $p \leq 0.01$). • Howatson al., (2012) found no significant increase in SE and no significant decline in SOL.

	<ul style="list-style-type: none"> Elite athletes, semi-elite athlete or healthy adults cohorts 		<ul style="list-style-type: none"> Wake after sleep onset (WASO) 	<ul style="list-style-type: none"> Howatson al., (2012) found a non-significant decline in WASO, but was reported as not related.
Ruxton et al., 2021	<p>Review</p> <ul style="list-style-type: none"> N value unspecified SR, MA, RCTs and prospective observational studies (when SR, MA or RCTs were not available) Age: All ages 	<ul style="list-style-type: none"> Effect of 100% FJ on multiple health outcomes: Type 2 Diabetes; Glycaemic Control; Obesity and Excess Weight Gain; Cardiovascular Health; and Cognitive Function 	<ul style="list-style-type: none"> Multiple outcomes per study 	<ul style="list-style-type: none"> Refer to results for reviews on 100% FJ: Ho et al., (2020); Auerbach et al., (2017); Auerbach et al., (2018); and Crowe-White et al., (2017). Refer to results for reviews on majority unspecified fruit juice: Alhabeeb et al., (2020); Zurbau et al., (2020); Semnani-Azad et al., (2020); Crowe-White et al., (2016); and Imamura et al., (2016).
Alhabeeb et al., 2020	<p>SR and MA</p> <ul style="list-style-type: none"> N value not specified Total studies (n = 10): RCTs Healthy / overweight / obese adults (n = 6); have metabolic syndrome or at risk of CVD (n = 2); have hepatitis C (n = 1); have hypercholesterolemic and normocholesterolemic profiles (n = 1) Brazil (n = 6), Italy (n = 1), United Kingdom (n = 1), China (n = 1), and France (n = 1). 	<p>Intervention vs. Placebo</p> <p>Percentage of OJ unspecified Only one study specified OJ as 100%.</p> <p>Intervention Group (n = 7) Dose: 250–750ml/day OJ</p> <p>Placebo Group Dose: 250–750ml/day similar appearance as OJ</p> <p>Duration: 1 to 13 weeks</p>	<p>Body composition</p> <ul style="list-style-type: none"> Body weight BMI WC Fat mass Lean body mass <p>CVD risk factors</p> <ul style="list-style-type: none"> Total cholesterol level LDL-C level HDL-C level Triglycerides level Glucose level Insulin level HOMA-IR level CRP levels 	<p>Intervention vs. Placebo</p> <ul style="list-style-type: none"> No significant effect of OJ on body composition values and CVD risk factors.

	<ul style="list-style-type: none"> Age: 18 to 65 years old 			
Freige et al., 2020	<p>Summary with critical appraisal</p> <ul style="list-style-type: none"> Health technology assessments, SRs, RCTs and non-RCTs Children at risk of, mild to moderate dehydration from any cause Age: < 18 years old , or 	<p>Refer to RCT table on Freedman et al., (2016).</p> <p>Control/Placebo Group Oral rehydration solutions (e.g., electrolyte solutions, Pedialyte).</p> <p>Intervention group Drink of choice, preferred beverages, juices, water or milk.</p>	<ul style="list-style-type: none"> Clinical effectiveness Change in hydration levels Need for intravenous fluids Admission to hospital Re-presentation to emergency room Change in symptoms Safety or harms Hyponatremia 	Refer to RCT table on Freedman et al., (2016).
Pereira et al., 2020	<p>Review</p> <ul style="list-style-type: none"> N value unspecified Total studies (n = 8) randomized, placebo-controlled and double-blind studies Age: Losso et al., (2017) ≥ 50; Howatson al., (2012) 26.6 ± 4.6; Pigeon al., (2010): 71.6 ± 5.4 	<p>Refer to RCT Table on Losso et al., (2017), Howatson al., (2012) and Pigeon al., (2010).</p> <p>Overall, effect of 3 food sources of melatonin: milk (n = 4), cherry juice (n = 3) or whole cherries (n = 1).</p> <p>Included studies (n = 3) 3 RCTs which trialed tart cherry Juice (Montmorency cherry)</p> <p>Duration:</p> <ul style="list-style-type: none"> 7 day (n = 1) 14 days (n = 2) 	<p>Sleep quality and sleep Quantity</p> <ul style="list-style-type: none"> Total sleep time (TST) Sleep efficiency (SE) Sleep onset latency (SOL) Wake after sleep onset (WASO) 	<p>Intervention vs. placebo</p> <ul style="list-style-type: none"> Two RCTs, Losso et al., (2017) and Howatson al., (2012) found statistically significant increase in TST respectively ($\uparrow 84.0$ min ± 61.7, $P = 0.018$; $\uparrow 39.0$ min, $p \leq 0.05$. [95% CI = 14.7–63.6]). Pigeon al., (2010), found significant decline in WASO ($\downarrow 16.8$ min, $p \leq 0.01$). Three RCTs found non-significant effect on SE and SOL. Losso et al., (2017) and Howatson al., (2012) found non-significant effect on WASO. <p>Intervention Baseline to end of treatment</p> <ul style="list-style-type: none"> Howatson al., (2012) found statistically significant increase in TST (34.0, $p \leq 0.05$; 95% CI = 15.2–39.7) Pigeon al., (2010), found statistically significant increase in TST ($\uparrow 29.3$ min, $p \leq 0.01$); increase in SE ($\uparrow 3.7\%$, $p \leq 0.05$); and decline in SOL ($\downarrow 3.6$ min, $p \leq 0.01$)
Semnani-Azad et al., 2020	<p>SR and MA</p> <ul style="list-style-type: none"> Total studies (n = 13): cohort studies Adults free of metabolic syndrome 	<p>Effect of multiple food sources: SSB (n = 6), 100% fruit juice (n = 1), mixed fruit juice (n = 2), yogurt (n = 3), fruit (n = 3), confectionary (n = 2).</p> <p>Included studies (n = 6)</p> <ul style="list-style-type: none"> SSB (n = 5) 	<ul style="list-style-type: none"> Incident metabolic syndrome 	<p>Juice</p> <p>100% fruit juice (n = 1) and mixed fruit juice (n = 2) indicate U-shaped, significant, nonlinear dose-response association with incident of metabolic syndrome at moderate doses:</p> <ul style="list-style-type: none"> 100% fruit juice protective association at 125 mL/d (Risk ratios = 0.77; 95%CI = 0.61-0.97). No protective association after 175 mL/d.

		<ul style="list-style-type: none"> SSB, 100% fruit juice and Mixed fruit juice (n = 1) Mixed fruit juice (n = 1) 		<ul style="list-style-type: none"> Mixed fruit juice protective association at 125mL/d (Risk ratios = 0.58; 95%CI = 0.42-0.79). No protective association after <200 mL/d. Curve suggests maximum protection at 75 to 150 mL. <p>SSBs</p> <ul style="list-style-type: none"> SSBs has adverse linear non-significant dose-response for 355 mL/d (Risk ratios = 1.14; 95%CI = 1.05-1.23) <p>P-values not stated.</p>
Zurbau et al., 2020	<p>SR and MA</p> <ul style="list-style-type: none"> N = 4,031,896 Total studies (n = 81): Prospective Cohort Studies 	Overall, whole fruit, whole vegetables, fruit and vegetable juice and fruit juice.	<ul style="list-style-type: none"> Incidence of coronary heart disease Coronary heart disease mortality Stroke incidence 	<p>FJ consumption associated with a greater reduction in stroke mortality risk reductions in heart disease mortality</p> <ul style="list-style-type: none"> Non-significant linear and cubic-spline dose-response relation between increasing fruit juice intake and incidence of coronary heart disease by servings/day (RR: 0.95, p = 0.199; 95% CI = 0.87 – 1.03) Non-significant linear and cubic-spline dose-response relation between increasing fruit juice intake and coronary heart disease mortality by servings/day (RR: 0.58, p = 0.053; 95% CI = 0.33 – 1.01) Joshiyura (1999), Joshiyura (1999) and Scheffers (2019) found a significant overall effect of fruit juice on stroke incidence (RR: 0.82, P = 0.04, 95% CI = 0.68 - 0.99).
English et al., 2020	<p>SR</p> <ul style="list-style-type: none"> Total studies (n = 49): RCTs (n = 17), RCT with crossover design (n = 1), non-RCT (n = 1), prospective cohort (n = 30) Adults who were generally healthy full-term infants fed human milk, infant formula, or both. Age: Infants 0–12 months old to older adults (> 80 years old) 	<p>Effect of types and amounts of complementary foods and beverages consumed vs. body composition.</p> <p>Intervention Group</p> <ul style="list-style-type: none"> Types and amounts of complementary foods and beverages <p>Comparator Group</p> <ul style="list-style-type: none"> Different types and amounts of complementary foods and beverages 	<ul style="list-style-type: none"> Body composition outcomes 	<ul style="list-style-type: none"> Not enough evidence to determine the relationship between juice intake and health outcomes in infants and children (i.e., growth, size, and/or body composition)
Hartman et al., 2019	Refer to RCT table (see Freedman et al., 2016)			

Khan A et al., 2019	<ul style="list-style-type: none"> Narrative literature review Studies contained paediatric and adult populations 	<ul style="list-style-type: none"> Not following set PICO with literature review. Intervention of 'cranberry juice' not specified 	<ul style="list-style-type: none"> Urine samples collected for markers of UTI 	<ul style="list-style-type: none"> Authors concluded that cranberry products modestly reduced the incidence of rUTI in children with normal urinary anatomy. From trials reviewed (n=8) cranberry juice or products for rUTI prophylaxis in healthy children or infants, 50% found a significant reduction in the incidence of rUTI Note: limitation is most of these trials included <50 patients. However, 1 study enrolled 263 children (aged 1-16 years) with normal urinary anatomy or grade I or II VUR. And found total number of UTI episodes per year was significantly lower in the cranberry group than in the placebo group, but the proportions of children who had >1 recurrence were the same. Authors of studies in adult patients have recommended a daily dose of 300 mL of cranberry juice to achieve a reduction in the incidence of rUTI A pediatric study that showed the effectiveness of cranberry juice Times New Roman ice used a dose of 5 mL of juice per kilogram of body weight, up to 300 mL, per day for a 6-month period
Pepin et al., 2019	<ul style="list-style-type: none"> Review 	<ul style="list-style-type: none"> Sugar-sweetened beverage consumption to adverse effects on metabolic risk factors 	<ul style="list-style-type: none"> Dyslipidaemia (n=11) Insulin resistance (n=6) 	<ul style="list-style-type: none"> Not enough evidence on the effect of fruit juice versus SSB intake on health outcomes in adults to shape accurate public health guidelines
Rocha et al., 2019	Refer to RCT table (Wilson et al., 2008) and (Shidfar et al., 2012)			
Vendrame et al., 2019	<ul style="list-style-type: none"> Review Human intervention trials (n=66). Single dose studies (n=14) and long term studies (n=52) 	<ul style="list-style-type: none"> Testing the effects on blood pressure of purified anthocyanins (ACN) or ACN-rich extracts, or whole berries, berry juices, powders, purees and whole phenolic extracts, from berries that are rich in ACN and have ACNs as predominant bioactives 	<ul style="list-style-type: none"> Blood pressure 	<ul style="list-style-type: none"> A consistent number of studies documented a significant blood-pressure-lowering activity related to ACNs and ACN-rich berry consumption, suggesting that an effect indeed exists Authors suggest mixed results in effectiveness are due to differences in baseline characteristics of the population
Gbinigie et al., 2017	<ul style="list-style-type: none"> Systematic review of randomized clinical trials 8 RCTs comprising 619 participants People >30 yo. Duration of studies varied 	<ul style="list-style-type: none"> The studies varied in their reporting quality, and compared pomegranate juice or capsules with a control. 	<ul style="list-style-type: none"> Systolic blood pressure Diastolic blood pressure 	<ul style="list-style-type: none"> Weak evidence for pomegranate juice lowering blood pressure. <p>Systolic blood pressure</p> <ul style="list-style-type: none"> Two studies reported significant reductions in systolic blood pressure favouring pomegranate: p = .002 and p < .001 respectively; 3 studies reported no significant differences between groups; and 3 studies failed to report between-group differences. <p>Diastolic blood pressure</p> <ul style="list-style-type: none"> Two studies reported significant reductions in diastolic blood pressure favouring pomegranate: p = .038, p < .001, respectively; 4 studies

	from two weeks to 18 months			reported no significant between-group differences; and 2 studies did not report between group differences.
Hebden et al., 2017	<ul style="list-style-type: none"> Literature review 1997-2014 RCTs (n=11) and prospective cohort studies (n=6) 	<ul style="list-style-type: none"> Fruit intake vs. fruit juice The studies varied in juice type and data collection methods 	<ul style="list-style-type: none"> Weight gain 	<ul style="list-style-type: none"> Consumption of whole fruit was found to contribute to a reduced risk for long-term weight gain in middle-aged adults. Experimental trials suggest this beneficial effect of whole fruit is mediated by a reduction in total energy intake. Fruit juice, however, had an opposing effect, promoting weight gain over the long term.
Crowe-White et al., 2017	<ul style="list-style-type: none"> A systematic review of the literature (n=10) published between 1995 and 2013 Including healthy, free-living adults ≥18 years and seniors Males and females included 	<ul style="list-style-type: none"> 100% fruit juice vs. variations within control group (e.g. change in dosage, placebo) nil set PICO 	<ul style="list-style-type: none"> markers of antioxidant/oxidant status Markers of blood lipid levels 	<ul style="list-style-type: none"> Weak evidence from five studies suggests that one or more blood lipid measures may be positively influenced by consumption of 100% FJ. Heterogeneity in study methodology including biomarkers, 100% FJ type, dosage, and intervention duration precludes the ability to make evidence-based recommendations regarding a specific dose-duration-juice effect.
Imamura et al., 2016	<ul style="list-style-type: none"> Systematic review and meta-analysis Prospective studies of adults without diabetes, published until February 2014. 17 cohorts (38 253 cases/10 	<ul style="list-style-type: none"> Comparison of onset of type two diabetes and consumption of SSB, artificially sweetened beverages and fruit juice 	<ul style="list-style-type: none"> Associated incidence of type 2 diabetes for SSB, artificially sweetened beverages and fruit juice 	<p>Sugar Sweetened Beverages</p> <ul style="list-style-type: none"> Higher consumption of sugar sweetened beverages was associated with a greater incidence of type 2 diabetes, by 18% per one serving/day (95% confidence interval 9% to 28%, I(2) for heterogeneity = 89%) and 13% (6% to 21%, I(2) = 79%) before and after adjustment for adiposity <p>Artificially Sweetened beverages</p> <ul style="list-style-type: none"> For artificially sweetened beverages, 25% (18% to 33%, I(2) = 70%) and 8% (2% to 15%, I(2) = 64%) <p>Fruit juice</p> <ul style="list-style-type: none"> For fruit juice, 5% (-1% to 11%, I(2) = 58%) and 7% (1% to 14%, I(2) = 51%)

	126 754 person years).			Note1: Paper points out potential for 'fruit juice' misclassification. Note 2: Authors identified that artificially sweetened beverages and fruit juice association with type two diabetes were likely to involve bias. Note 3: This purely an association, authors conclude under assumption of causality, consumption of sugar sweetened beverages over the years may be related to cases of new onset diabetes.
Reust et al., 2016	Refer to RCT table (see Freedman et al., 2016)			

Abbreviations: CVD; Cardiovascular disease, HOMA-IR; Homeostatic Model Assessment for Insulin Resistance, OJ; orange juice, RCT; Ramdonised controlled trials, Systematic review; SR, Meta-analysis; MA

Table 12 (Continued) RCT and non-RCT studies from final reviews

Author, (Year)	Study design and Population	Intervention and Comparison	Outcomes	Results
Freedman et al., (2016) referenced in Freige et al., 2020, Reust CE, Stevermer JJ, Jarrett JB et al., (2015) and Hartman S, Brown E, Loomis E, et al., (2021)				
Freedman et al., 2016	<ul style="list-style-type: none"> Randomized, single-blind noninferiority trial Conducted between the months of October and April during the years 2010 to 2015 in a tertiary care paediatric emergency department Emergency department in paediatric hospital in (Toronto, Onterio) Canada, aged 6-60 months old, with minimal dehydration requiring oral rehydration 	Half strength apple juice, diluted with water (n=323) vs. apple-flavoured electrolyte maintenance solution (n=324)	<p>Primary outcome</p> <ul style="list-style-type: none"> Treatment 'failures'* defined by any of the following occurring within 7 days of enrolment: <ul style="list-style-type: none"> Intravenous rehydration; Hospitalisation; Subsequent unscheduled physician encounter; Protracted symptoms Crossover; and 3% or more weight loss; or significant dehydration at in-person follow-up <p>*Non-inferior margin was defined by researchers as 7.5% difference between groups</p> <p>Secondary outcomes</p> <ul style="list-style-type: none"> Intravenous rehydration Hospitalisation Frequency of diarrhea Frequency of vomiting 	<p>treatment failure</p> <ul style="list-style-type: none"> Apple juice/preferred fluids 16.7% (54/323; 95% CI, 12.8%-21.2%) treatment failure Electrolyte maintenance solution group 25.0% (81/324; 95% CI, 20.4%-30.1%) treatment failure Difference between groups, -8.3%; 97.5% CI, -∞ to -2.0, The null hypothesis was that “the probability of treatment failure in the apple juice/preferred fluids group was at least 7.5% higher than that in the electrolyte maintenance solution group” (p= <0.001), therefore reject the null hypothesis, no conclusions can be drawn from this study as further studies are needed.

	therapy for gastritis			
Salas, Nascimento, Vargas-Ferreira, et al., (2015) referenced in				
Salas, Nascimento, Vargas-Ferreira, et al., 2015	<ul style="list-style-type: none"> • Meta-analysis of observational studies • Children, teenagers and young adults aged 8-19 years old 	<ul style="list-style-type: none"> • Frequency of consumption and tooth erosion 	<ul style="list-style-type: none"> • Tooth erosion 	<ul style="list-style-type: none"> • Fruit juices significantly increased risk of tooth erosion in children and adolescents (p=0.03) with carbonated drinks having a greater risk of tooth erosion (p = 0.001)
Losso et al., 2017 referenced in Pereira et al., (2020)				
Losso et al., 2017	<p>Randomised, double-blind, placebo-controlled, balanced, crossover study Pilot study</p> <p>N = 8</p> <p>Adults with clinically diagnosed insomnia (otherwise healthy)</p> <p>Age: 68 (±9.2)</p>	<p>Intervention (N =) vs. placebo (N =)</p> <p>Intervention group Dose: 240 mL of cherry juice</p> <p>Placebo group Dose: 240 mL of vapor-distilled water, fructose, dextrose, and lemon powder</p> <p>Timing: morning and 1-2 hr prior to bed.</p> <p>Duration: 14 days.</p>	<ul style="list-style-type: none"> • Total sleep time (TST) • Sleep efficiency (SE) • Sleep onset latency (SOL) • Wake after sleep onset (WASO) • Stage REM latency • Number of awakenings 	<p>Intervention vs. placebo</p> <ul style="list-style-type: none"> • Statistically Significant increase in TST in cherry juice trial vs. placebo (84 min ± 61.7, P = 0.0182) • Statistically significantly increase in habitual sleep efficiency in cherry juice trial vs. placebo (0.5 ± 0.5, P = 0.0331) • Non-significant effect on SE, SOL, WASO Stage REM latency or number of awakenings. • Non-significant difference in sleep duration, the Insomnia Severity Index, the Epworth Scale, or in the Beck Depression Inventory.
Howatson et al., (2012) referenced in Gratwicke et al., (2021) and Pereira et al., (2020)				
Howatson et al., 2012	<p>Randomised, double-blind, placebo-controlled, crossover design</p> <p>N = 20</p> <p>Healthy adults</p> <p>Age (mean): 26.6 years old.</p>	<p>Intervention (N = 20) vs. placebo (N = 20)</p> <p>Placebo group Dose: 30 mL mixed fruit cordial (containing < 5% fruit) with 200 mL water, contained no melatonin or anthocyanins and a trace of vitamin C.</p> <p>Intervention group Dose: 30 mL of tart Montmorency cherry concentrate (Cherry Active, Sunbury, UK) with 200 mL water Cherry juice had 42.61g/30 mL melatonin, leading to an intake of 85.2 g/day of melatonin.</p>	<ul style="list-style-type: none"> • Total urinary melatonin content • Total sleep time (TST) • Sleep efficiency (SE) • Sleep efficiency total (SET) • Sleep onset latency (SOL) 	<p>Intervention vs. placebo</p> <ul style="list-style-type: none"> • Cherry juice trial was significantly greater by 39.0 mins in TST versus placebo (419 min (±22) vs. 380 min (±49), p ≤ 0.05; 95% CI = 14.7–63.6). • Statistically significant increase in SET by 4.9%, (82.3 % (±3.6) vs. 77.4 % (±8.5), p ≤ 0.01; 95% CI = 0.5–9.4). • No significant effect on SE and SOL. <p>Intervention baseline to 7 days</p> <ul style="list-style-type: none"> • Significantly elevated total melatonin content (P < 0.05). • Statistically significantly increase in TST by 34.0 min (419 (±22) vs. 385 (±30), p ≤ 0.05; 95% CI = 15.2–39.7). • Statistically significantly increase in SET by 5.5% (82.3 (±3.6) vs. 76.8 (±6.9), p ≤ 0.01; 95% CI = 2.1–7.5).

		<p>Timing: 30 min post-wake and 30 min pre-bed</p> <p>Duration: 7 days</p>		<p>Placebo baseline to 7 days</p> <ul style="list-style-type: none"> No significance in total melatonin content No significance in TST, SE, SET or SOL.
Pigeon et al., (2010) referenced in Gratwicke et al., (2021) and Pereira et al., (2020)				
Pigeon et al., 2010	<p>Randomized, double-blind, crossover design Pilot study</p> <p>N = 16</p> <p>Older adults with chronic insomnia (otherwise healthy)</p> <p>Age: ≥65 years old.</p>	<p>Intervention (N = 15) vs. placebo (N = 16)</p> <p>Intervention group</p> <ul style="list-style-type: none"> Dose: 240 mL of tart Montmorency cherry juice blend (CherryPharm, Inc., Geneva, NY, USA) <p>Placebo group</p> <ul style="list-style-type: none"> Dose: 240 mL placebo juice <p>Timing: 8:00–10:00am and 1–2 hrs prior to bed</p> <p>Duration: 14 days</p>	<p>Sleep continuity</p> <ul style="list-style-type: none"> Total sleep time (TST) Sleep efficiency (SE) Sleep onset latency (SOL) <p>Insomnia severity</p> <ul style="list-style-type: none"> Wake after sleep onset (WASO) 	<p>Intervention vs. placebo</p> <ul style="list-style-type: none"> Statistically significantly declined time for WASO (Δ 16.8 min, p < 0.01) No significant improvements were observed for TST, SE or SOL <p>Intervention baseline to 14 days</p> <ul style="list-style-type: none"> Statistically significantly increased TST (Δ 29.3 min, p < 0.01) Statistically significantly increased SE (Δ 3.7%, p < 0.05) Statistically significantly declined SOL (Δ 3.6 min, p < 0.01) <p>Placebo baseline to 14 days</p> <ul style="list-style-type: none"> No significant improvements were observed for TST, SE, SOL or WASO.
Wilson et al., (2008) referenced in Rocha et al., (2019)				
Wilson et al., (2008)	<ul style="list-style-type: none"> Cross over RCT Participants (n=12) 50% male, 50% female Mean age: 68.3 years Mean BMI: 34.7kg/m² Mean Blood Glucose: 126.1mg/dL Mean HbA1c: 6.7% 	<ul style="list-style-type: none"> Single day trial, acute response, 1-week wash out period Normal calorie cranberry juice (240 mL) vs. Normal calorie control (240 mL) Low calorie cranberry juice (240 mL) vs Low calorie control (240 mL) 	<ul style="list-style-type: none"> Postprandial glucose Postprandial insulin 	<ul style="list-style-type: none"> The low-calorie cranberry juice (19 kcal/240 mL) was associated with lower glycaemic response than the consumption of a normal calorie dextrose sweetened cranberry juice (130 kcal/240 mL) However, blood glucose concentration responses were similar when the response obtained after both juices was compared to the one obtained after their controls (normal calorie control and low-calorie control, respectively)
Shidfar et al., (2012) referenced in Rocha et al., (2019)				

<p>Shidfar et al., (2012)</p>	<ul style="list-style-type: none"> • Double-blind, parallel, randomized, placebo controlled • Participants (n=58) 100% male • Mean Age: 54.8 years • Mean BMI: 28.8 kg/m² • Mean Glucose: 137.9 mg/dL • HbA1c: < 9% 	<ul style="list-style-type: none"> • Cranberry juice (240 mL) vs. Placebo (mineral water with strawberry flavour) (240 mL) • 12 week duration 	<ul style="list-style-type: none"> • Serum samples from venous blood • Fasting Glucose 	<ul style="list-style-type: none"> • There were significant decrease in serum glucose and apoB (P>0.05 and P>0.01, respectively) and significant increase in serum apoA-1 and PON-1 activity (P>0.05 and P<0.01, respectively) at the end of study in CJ group compared with control group. In CJ group at the end of study, there were significant decrease in serum glucose and apoB (P<0.01 and P<0.01, respectively) and significant increase in serum apo A-1 and PON-1 activity (P<0.01 and P<0.01, respectively) compared with initial values. In CJ group, there was no significant change in Lp(a) at the end of study compared with initial values and also compared with control group.
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APPENDIX 5 - Nutrient Profiling Score Criterion Calculator

Introduction Calculate Log Out

Determine the NPSC category of your food:

Category 1

Beverages

Category 2

Food other than those included in category 1 or 3.

Category 3

Cheese or processed cheese with calcium content greater than 320 mg/100 g;*

- edible oil;
- edible oil spreads;
- margarine; and
- butter.

* All other cheeses (with calcium content less than or equal to 320 mg/100 g) are classified as a category 2 food.

Back Next

Introduction Calculate Log Out

100% OJ (Signature Range)		
Category 1		
Tuesday, 20 July 2021		
Baseline Points:		
Nutrient Information	Amount Entered	Points earned
Energy	174	0
Saturated Fatty Acids	0.0	0
Sugars	9.1	2
Sodium	4	0
Total Baseline Points		2
Modifying Points:		
	Amount Entered	Points earned
fvl	Non fvl ingredients	0%
	Non-concentrated fvl ingredients	100%
	Concentrated fruit and vegetable ingredients	0%
Protein	0.5	0
Dietary Fibre	0	0
Total Modifying Points		8
Final Score		-6
Important		
Check Standard 1.2.7 for conditions that apply for making a health claim.		
Please print this page for your records.		
Start a new calculation Log out		

NPSC Category (see Step 1)	Final Score (see Step 4)
Category 1	less than 1
Category 2	less than 4
Category 3	less than 28

(FSANZ, NFSC Calculator, 2021)

APPENDIX 6 - Email Inquiry to FSANZ on food fortification, nutrient and health claims

Subject: Schedule 1, Schedule 4, Schedule 17 Inquiry
Date: Thursday, 29 July 2021 at 3:42:04 pm Australian Eastern Standard Time
From: Natasha D'Souza
To: codeinquiry@foodstandards.gov.au
CC: Karen Abbey, jane jaffe

Good afternoon,

I hope you can assist me with the following questions and clarifications regarding these three documents in regards to 100% fruit juice and juice from concentrate:

- Schedule 1 RDIs and ESADDIs
- Schedule 4 Nutrition, health, and related claims and
- Schedule 17 Vitamins and minerals

1. In the table in section S17—4, page 7, under 'Fruit juice, vegetable juice, fruit drink and fruit cordial'.

It only lists Calcium, folate, Vitamin C and Vitamin A.

Because it does not list Vitamin D, Potassium or other vitamin/minerals, are fruit juice products able to be fortified with Vitamin D or Potassium?

If yes, how much can be fortified?

- S4—3, page 5, 'Conditions for nutrition content claims', it states for Potassium
 - *The nutrition information panel indicates the sodium and potassium content.*
- S4—5, page 28, 'Conditions for permitted general level health claims', it states for Potassium
 - *The food contains no less than 200 mg of potassium/serving.*
- S4—3, page 8, 'Vitamin or mineral (not including potassium or sodium)', it mentions the following under Column 2 'General claim conditions that must be met':
 - *The vitamin or mineral is mentioned in Column 1 of the table to section S1—2 or S1—3; and*
 - *(b) a serving of the food contains at least 10% *RDI or *ESADDI for that vitamin or mineral; and*
 - *(c) a claim is not for more of the particular vitamin or mineral than the amount permitted by section 1.3.2—4 or 1.3.2—5; and*
- In S1—2, Vitamin D RDI is listed as 10 µg cholecalciferol in Column 3, is Column 3 referring to the general population?
- However, in section 1.3.2—4, it states
 - *(b) the vitamin or mineral is listed in relation to that type of food in section S17—4;*

Section 1.3.2—4, seems to imply that other vitamin and minerals that are not stated in S17—4 for each food type, are not permitted.

2. Similarly, to the above question, regarding nutrients (not under vitamins/minerals) which can Poly-unsaturated fatty acids (PUFA) or Omega 3s, probiotics, prebiotics be added to fruit juice?

For PUFA or Omega 3s, based on S4—5, it sounds like it cannot be added, as the 'reference food' would need to be the original product which originally contains PUFA/omega 3s content.

For pre- and pro-biotics, is there any document which state food standards for added these nutrients to food products?

3. With an understanding that any claims being made, or NIPs needs to state the nutrient content of the vitamin/mineral at the level it would be at on the Best Before/Expiry date and not the original Vitamin/mineral content, due to the nutrients being oxidised over time.

Are there procedures on calculating the correct nutrient in the product at a Best Before/Expiry date?

When products have been made to have an extended shelf life, and there Best Before/Expiry date are in years compared to days/months, Is there anything else which needs to be considered to ensure optimisation of nutrients to prevent it from oxidising while on the shelf (i.e. darkened packaging) and any FSANZ documents which can be referred to for this?

-

I sincerely thank you for your time and help in my inquiries!
Could I please request a call back on 0449 915 295.

Regards

Natasha D'Souza

Accredited Practicing Dietitian

MDietS, BHSc (Nutrition)

M [0449 915 295](tel:0449915295)

E natasha_dso@hotmail.com

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Received a phone call from FSA NZ in response to the questions. Outcome of discussion provided over the phone are mentioned below as well as in the report.

1. As per Schedule 17, section 4, page 7, only the listed micronutrients such as Calcium, folate, Vitamin C and Vitamin A and to their maximum level listed can be fortified into fruit juice. No other micronutrients, not mentioned, are allowed to be fortified or added to fruit juice.
2. As per Schedule 4, section 3, page 5, for nutrient claims under potassium, it states 'Conditions for nutrition content claims', the fortification range is as listed in the Schedule 17, section 4, table for fruit juice. If an amount is otherwise stated for a claim, it still needs to be within the maximum fortification level as stated in Schedule 17.
3. Poly-unsaturated fatty acids (PUFA) or Omega 3s, probiotics, prebiotics can be added to fruit juice however if added it needs to be added as part of the ingredients as per labelling standards and if it is to gain a nutrient or health claims, the set criteria and procedures for application needs to be followed. Laboratory analysis may also be required. Based on the standards, some products may lose their original defined food category or product name once other ingredients are added to the original product.
4. The food company need to provide their own laboratory analysis of all nutrients naturally occurring and those being fortified for the duration and prior to end of shelf life (i.e. on the Best Before/Expiry date) of the product. The products need to be tested with current packaging to replicate shelf life.
5. The level of nutrients especially micronutrients being listed on the NIP or being claimed for need to be the vitamin or mineral amount on the Best Before/Expiry date and not the original Vitamin/mineral content due to loss of nutrients during shelf life.
6. All methods for optimisation of nutrients to prevent it from oxidising while on the shelf can be utilised (i.e. darkened packaging) and needs to undergo regular packaging protocols and policy's in place. This also includes other changes to packaging to optimise user experience such as easy to open or size.

APPENDIX 7 – Australian Beverage Council Educational Resource on Juice



Fast Facts on Juice: The role of juice in the Australian diet and implications for the HSR review

Background

The Australian Dietary Guidelines (ADG) recognise the positive contribution juice (no added sugar) makes to a healthy dietary pattern and its role in helping many Australians meet their recommended daily fruit serves.

Juice is included in the 'core food' fruit recommendations:

125mL of fruit juice with no added sugar can be included as a serve of fruit "occasionally"

Yet, the proposed Health Star Rating system (HSR) communicates the contrary, with juice scoring as low as 2.5 stars, signalling to consumers that juice is not a healthier choice.

As the ADG were developed over seven years ago, the Australian Beverages Council Limited (ABCL) commissioned a research dossier in September 2020 to address this challenge by collating the latest evidence related to juice consumption in Australia and its contribution to the Australian diet. This briefing sheet summarises the key findings to provide direction to inform further discussions on the proposed HSR for juice.

Table 1: Proposed Health Star Ratings for foods/drinks in the 'fruit' group compared to Australian Dietary Guideline position

	MINIMUM STARS	HSR Position*	ADG Position
Whole fruit 150g		Core (≥3.5)	Core Food
Dried fruit 30g		Core (≥3.5)	Core Food (Included in fruit recommendations)
Juice (no added sugar) 125mL		Discretionary (<3.5)	Core Food (Included in fruit recommendations)

* Note this cut-off of 3.5 has been widely used by researchers and state health departments (Crino, et al 2018) (Jones, Rådholm and Neal 2018) (Dunford, Thomas and Wu 2015)

Key messages

Juice makes a significant contribution to micronutrient intakes of consumers:

- 57% to vitamin C intake
- 17% to folate intake
- 14-16% to potassium intake

Juice makes a relatively low contribution to energy and sugar intakes of the:

- | | |
|-----------------------|----------------------|
| Population | Consumers |
| ● 1% of energy | ● 5% of energy |
| ● 3.5% of total sugar | ● 20% of total sugar |
| ● 0% of added sugar | ● 0% of added sugar |

Juice makes a significant contribution to micronutrient intakes of juice consumers, while making small contributions to energy and sugar intakes.

Juice consumption is declining, at the same time fruit and vegetable consumption remains low with 94% of the population not meeting recommended intakes.

Juice consumption is associated with multiple markers of a healthy diet, including total diet quality score, lower discretionary food intake and higher vegetable intake.

Juice provides a positive contribution to a healthy dietary pattern, consistent with the dietary guidelines where juice is included in the 'core food' fruit recommendations.

Recommendation:

The ABCL recommends juice with no added sugar should automatically score 4 stars in the HSR based on its positive contribution to the Australian diet and to help consumers make healthier choices within the beverage category.

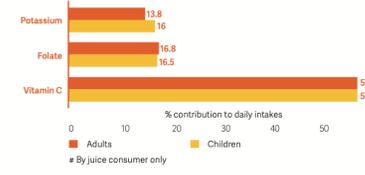
What's the role of juice in the Australian diet?

This latest evidence confirms the ADG position that juice is part of the 'core food' fruit group and can make a positive contribution to the Australian diet and is associated with markers of healthy diets. Most of the data presented in this document is based on the secondary analysis of the 2011-12 National Nutrition and Physical Activity Survey (NNPAS) which is the latest comprehensive government research on Australia's population dietary and nutrient intakes.¹

Key findings

Juice contributes to essential micronutrient intakes

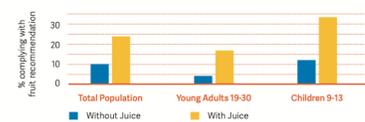
Figure 1: Contribution of juice to consumer's nutrient intakes^{1,2}



Juice helps Australians meet their daily fruit needs

94% of Australians are still not eating enough fruit and vegetables.³

Figure 2: Compliance with the ADG fruit recommendation, with and without juice considered as a serve of fruit.⁴



Juice consumption can help Australians to achieve their recommended intake of fruit as per the ADG, as fruit and vegetable consumption remains low.

Juice contributes a small amount to energy and sugar intakes⁵

Table 2: Juice's contribution to energy and sugar intakes⁵

Description	Total Population	Children (2-18 years)	Adults (>18 years)
Contribution to total energy (kJ) intake	1%	5.3%	5.2%
Contribution to total sugar intake	3.5%	20.2%	20.5%
Contribution to added sugar intake	0%	0%	0%

Juice consumption is associated with markers of a healthy diet like a higher diet quality score and lower discretionary food intakes

For both children and adults, consumers of fruit juice had a higher diet quality score indicating:

- ↑ higher compliance with the ADG (+5.5/100 points)
- ↓ lower intake of energy from discretionary foods (-3% energy)
- ↑ higher vegetable intake (0.1 serves more for children and 0.3 serves more for adults)⁶

Juice category evolving in an even healthier direction

- Over the last decade, there has been lots of innovation in line with consumer trends to provide plenty of nutritious choices.⁷
- Juice category includes a wide range of beverages: ambient and chilled juices, vegetable juices, fruit and vegetable blends diluted juices and many reduced and lower-sugar options.
- Future trends are likely to include fruit and vegetable blends that feature exotic herbal and functional ingredients such as ginger, turmeric, and mint. Other novel juice products likely to grow include functional juice shots/tonics and coconut-water based juices.

The current proposed changes to the HSR overlook these healthy innovations in the juice category and is a missed opportunity to help consumers make healthier choices in the beverage category.

The ABCL recommends juice with no added sugar should automatically score 4 stars in the HSR based on its positive contribution to the Australian diet and to help consumers make healthier choices within the beverage category.

References
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² Riley, M. D., Hendrie, G. A., & Baird, D. L. 2019. "Drink Choice is Important: Beverages Make a Substantial Contribution to Energy, Sugar, Calcium and Vitamin C Intake among Australians." Nutrients 13(9).
³ Australian Bureau of Statistics. 2017. National Health Survey, First results. <https://www.abs.gov.au/australian-bureau-of-statistics/health/health-conditions-and-risk/national-health-survey-first-results/latest-release>.
⁴ Australian Beverages Council. 2019. Growing for the Future. <https://www.australianbeverages.org/growing-for-the-future/>.

