

## Response ID ANON-JN9Z-F83F-2

Submitted to P1062 - Defining added sugars for claims  
Submitted on 2023-10-07 17:21:55

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The Infant and Toddler Food Research Alliance

What is your position title?

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Have you read the P1062 – Defining added sugars for claims call for submission paper?

Yes

#### Confidential information

All submissions will be published, including redacted versions of confidential submissions. We will not publish material that we accept as confidential. Does your submission contain confidential information?

No. My submission does not contain confidential information.

#### Proposed changes to 'no added sugar(s)' claim conditions

1 FSANZ proposes to continue to set 'no added sugar(s)' claim conditions based on the addition of ingredients to foods (see section 5.2 of the Call for submissions document).

Do you have any comments on this approach?:

The Infant and Toddler Food Research Alliance Strongly disagree.

The Communique from the Food Ministers Meeting on 28th July 2023 noted that Food Ministers discussed:

- the incorporation of a definition of added sugars into the Food Standards Code as a matter of priority, to ensure added sugar claims align with dietary guidelines; and
- the identification of the best way to incorporate information about added sugars into the NIP and on front of package labelling, through appropriate consumer testing.

As part of a staged approach to delivering this work, P1062 does not adequately satisfy the above. It fails to establish a definition of added sugars that ensures relevant claims align with the Australian and New Zealand Dietary Guidelines, and it fails to establish a definition that can be used to quantify added sugars information into the NIP and for front of package labelling. This is because the food components that are necessary to enable these changes are not included in the proposed definition but are instead listed separately in the claim conditions or left out of the proposal entirely. This is of particular concern for infant and toddler foods where several studies (1-3) have demonstrated the use of food components such as fruit juice concentrate, fruit puree concentrate and dried fruits as sweetening components to a range of both baby and toddler foods. This is of concern given the Australian Infant feeding guidelines recommending 'consumption of nutrient-poor foods with high levels of fat/ saturated fat, sugar, should be avoided' for children 12 months and under. The first 1000 days of life from conception through to 24 months of age are particularly crucial for a child's growth and development (4), and childhood dietary habits can influence eating practices in adulthood (5). In Australia, 25% of children aged 2-17 years are either overweight or obese (6), and the prevalence of obesity is especially high among children from culturally and linguistically diverse backgrounds (7). Information on food products needs to be reflective of product content including all food components that contribute to the added energy of a product through sugars.

We acknowledge and support FSANZ in recognising the need to ensure consumers are not misled about the food components set out in the proposed claim conditions (a)(ii)-(ix). However, by not including them in the added sugar definition itself, the utility of the definition is severely restricted, and the outcome undermines the intention of the Food Ministers, which was that the definition of added sugars should be the basis for including added sugar information in the nutrition information panel and in front of pack food labels.

We have two overarching concerns with P1062:

- The definition of added sugar is not comprehensive and not fit for purpose:
  - o FSANZ acknowledges there are certain food components that consumers should not be misled about and therefore should not be eligible to carry a 'no added sugar' claim. We support this premise, however, failing to include the food components set out in claim conditions (a)(ii)-(ix) in the added sugar definition only perpetuates existing confusion about these food components and the health halo that surrounds them. It is also misaligned with the Food Ministers' intent. The alliance is particularly concerned given the vulnerability of parents who seek a 'good choice' in baby or toddler food products and perceive that they are providing a 'healthy' option to their child, when in fact they could be contributing to poor dietary outcomes. There is a need for parents to clearly understand the product they are purchasing contains added sugar components and may not be the best nutritional choice for their child.
  - o With regard to the proposed conditions for 'no added sugar' claims, a number of food components are missing from claim conditions (a)(i)-(ix). More detail on this is discussed in question 2 below. As described above food components such as fruit juice concentrate and fruit puree are regularly used in infant foods as a sweetening agent with impacts on child health outcome(1, 8). Yet these will not be captured in the current proposal.
  - o P1062 was initiated in response to Food Ministers asking for work on P1058 to be staged. A definition must be fit for that purpose also.
- That claim conditions are based on the addition of ingredients to foods – we do not agree with this basis:
  - o 'No added sugar' claims should not be permitted on single ingredient foods that, when added to other foods, would make that food ineligible to display a 'no added sugar' claim (i.e. on fruit juice). This is especially important for infant food pouches and foods that have a single ingredient of puree fruit. More detail on this is discussed in question 6 below.
  - o This is inconsistent with draft claim condition (g) which clearly restricts claims on foods with sugars from processing, rather than solely from the addition to foods.

We strongly support the view that 'No added sugar' claim conditions should simply ensure that no food that

- 1) contains 'added sugars' as defined; OR
- 2) is an 'added sugar' as defined and is sold as a single ingredient food, should be able to carry a 'no added sugar' claim.

1. Brunacci KA, Salmon L, McCann J, Gribble K, Fleming CAJBPH. The big squeeze: a product content and labelling analysis of ready-to-use complementary infant food pouches in Australia. 2023;23(1):656.
2. Scully M, Schmidtke A, Conquest L, Martin J, McAleese AJHPJoA. Commercially available foods for young children (< 36 months) in Australia: An assessment of how they compare to a proposed nutrient profile model. 2023.
3. McCann JR, Russell GC, Campbell KJ, Woods JIJPHN. Nutrition and packaging characteristics of toddler foods and milks in Australia. 2021;24(5):1153-65.
4. Woo Baidal JA, Locks LM, Cheng ER, Blake-Lamb TL, Perkins ME, Taveras EM. Risk Factors for Childhood Obesity in the First 1,000 Days: A Systematic Review. Am J Prev Med. 2016;50(6):761-79.
5. Mikkilä V, Räsänen L, Raitakari OT, Pietinen P, Viikari J. Consistent dietary patterns identified from childhood to adulthood: the cardiovascular risk in Young Finns Study. Br J Nutr. 2005;93(6):923-31.
6. Australian Institute of Health and Welfare. Australia's health 2020: in brief. Australia's health series no. 17 Cat. no. AUS 232. Canberra: AIHW. 2020.
7. Hardy LL, Jin K, Mhrshahi S, Ding D. Trends in overweight, obesity, and waist-to-height ratio among Australian children from linguistically diverse backgrounds, 1997 to 2015. Int J Obes (Lond). 2019;43(1):116-24.
8. Mennella JA, Reiter AR, Daniels LMJAin. Vegetable and fruit acceptance during infancy: impact of ontogeny, genetics, and early experiences. 2016;7(1):211S-9S.

2 FSANZ proposes a food displaying a 'no added sugar(s)' claim must not contain an 'added sugars' as an added ingredient including an ingredient of a compound ingredient. FSANZ proposes defining 'added sugars' for this claim condition (see section 5.2.1.4 of the Call for

submissions document).

Do you have any comments on this approach or the defined added sugars (see below)?:

The Infant and Toddler Food Research Alliance is not supportive of this approach.

A food displaying a 'no added sugar(s)' should simply not contain, or be, 'added sugars' as that term is defined in the regulation. A comprehensive definition of 'added sugar' is required for this purpose.

We do not support that these sugars need to be physically added as an ingredient for claim conditions to apply. As mentioned in question 1 infant and toddler food products that are fruit or vegetable puree alone can equate to 5 times the recommended serve size for fruit intake in a day. This exceeds the recommended in take for infants and children without the sugar being 'added' to the product. Sugars that are created through processing are not physically added for example. In addition, we strongly disagree with the proposed claim condition (c) - foods for sale that are products listed on proposed claim condition (c)(i)(A)-(H) should not be permitted to carry 'no added sugar' claims. See our response to question 6 for more details.

To be fit for purpose and meet the Food Ministers intent, claim condition (c), the definition of 'added sugar', must include:

□ all sugars listed in (a)(i) of the draft variation to the Food Standards Code in CFS Attachment A

Comments on food components listed in condition (c) of the draft variation to the Food Standards Code in CFS Attachment A:

- (c)(i) For completeness we recommend that additional examples are added to the list of examples for condition (c)(i) in section 8 of the Draft Explanatory Statement as follows: lactose in whey powder, isomaltose, sugar alcohols

- (c)(iv) For completeness we recommend that additional examples are added to the 'including' list for condition (c)(iv) as follows: cane sugar, beet sugar, white sugar, granulated sugar, fruit sugar,

- (c)(vii) For completeness we recommend that additional examples are added to list of examples for condition (c)(vii) as follows: high fructose corn syrup, tapioca syrup, maple syrup, rice and rice malt syrup

- (c)(xi)

□ Do not agree that fruit juice should be able to carry a 'no added sugar' claim and the words 'unless the food for sale is fruit juice' should be removed from condition (c)(xi). See our response to question 6 for more details.

□ We strongly recommend that the words 'and concentrated vegetable juices' are added to condition (c)(xi).

- (c)(xii) We strongly recommend that the words 'or vegetable juice' are added to condition (c)(xii) after the words 'deionised fruit juice'

Whilst deionised vegetable juice is not currently used in the food supply, excluding it from the definition will result in an opportunity for this exclusion to be exploited in future.

□ all sugars listed in (a)(ii)-(ix) of the draft variation to the Food Standards Code in CFS Attachment A

□ the following additional sugars:

□ concentrated vegetable juice (as noted in relation to (c)(xi) above). See our additional comments below under 'Vegetable products'.

□ deionised vegetable juice (as noted in relation to (c)(xii) above). See our additional comments below under 'Vegetable products'.

□ whole, cut or chopped dried fruit. See our additional comments below under 'dried fruit'.

□ canned fruit or frozen fruit that contains fruit juice - we do not support the exclusion in condition (a)(iii). Fruit juice should always be considered an added sugar.

□ vegetable juice powder; vegetable powder; vegetable pulp; vegetable puree; concentrated vegetable puree; a blend or combination of any two or more of the fruit or vegetable ingredients listed above. See our additional comments below under 'Vegetable products'.

□ monosaccharides and disaccharides formed or residual from processing, including from hydrolysis and fermentation during the production of a food. See our response to question 7 for more detail.

□ low energy sugars (monosaccharides and disaccharides) listed in subsection S11—2(3) of schedule 11. See our response to question 4 for more details.

**Vegetable products**  
FSANZ considers processed vegetable products, such as vegetable juice, pulps or purées, should not be captured in the claim conditions as they are not discussed in the dietary guidelines as being of public health concern in relation to sugar. We strongly disagree. Infant feeding products such as puree squeeze pouches are often mixed with fruit and sweet vegetables (e.g. pumpkin, carrot and sweet potato). The use of these vegetables as a sweetener replaces bitter vegetables such as broccoli, spinach and other brassica family vegetables that are needed to develop a child's flavour profile. Increased intake of sweet foods in infancy is known to contribute to a sweet taste profile preference (9). Whilst, repeated exposure to savoury/bitter flavours increases their ongoing acceptance (10, 11). With an evolutionary drive for young children to prefer calorie-dense sweet foods and reject bitter (or potentially toxic) foods (9), which is why products blend sweet fruit and vegetables in squeeze pouch products (12-15). Mixing dark green vegetables with sweeter vegetables or fruits or sweeteners derived from fruits (puree concentrate) is common practice and is why vegetables should also be considered. There is no technical or physiological reason to consider that sugar from fruit and vegetable products would be processed differently by the body and therefore they should be treated the same. In FSANZ background paper to P1058 it was consistently recognised that fruits and vegetables should be treated the same and the acknowledgment in P1062 that fruit products are sugars should extend to the equivalent vegetable products. This is consistent with other jurisdictional determinations such as Public Health England (1) and the US Food and Drug Administration (2).

Failure to include vegetable products would see the growth of high sugar vegetable products such as beet juice concentrate which is already in the food supply for the purposes of sweetening.

(1) Swan GE, Powell NA, Knowles BL, Bush MT, Levy LB. A definition of free sugars for the UK. Public Health Nutr. 2018;21(9):1636–8.

(2) Food and Drug Administration. Added Sugars: Now Listed on the Nutrition Facts Label and How Are They Different. New Nutr Facts Label [Internet]. 2020;1–3 [cited 2022 Oct 11]. Available from: <https://www.fda.gov/food/new-nutrition-facts-label/added-sugars-new-nutrition-facts-label>.

**Dried fruit**

We strongly recommend that a clear and precise definition of dried fruit (whole, cut or chopped) is included in the Food Standards Code. Across the processed fruit sector, there are now a number of products on the market that do not represent traditional dried fruit products. These include 100% fruit straps, fruit bites and baked fruit pieces. Baby and toddler foods often include and promote a product as healthy or without sweetening using a dried fruit addition(1).

While these products are technically 100% fruit and therefore eligible to carry 'no added sugar' claims under the proposed changes, these products are highly processed and contain higher levels of sugar than both whole fruit and traditionally dried fruit, a definition of dried fruit should specifically exclude these types of fruit products.

There is mixed evidence on the health impacts and benefits of dried fruit. We feel it important to take a precautionary approach and include dried fruit in a comprehensive added sugars definition. This aligns with dietary guideline recommendations in Australia and New Zealand which recommend these are limited in the diet, due to their very high sugar content and the ease with which they can be overconsumed.

1. Brunacci KA, Salmon L, McCann J, Gribble K, Fleming CAJBPH. The big squeeze: a product content and labelling analysis of ready-to-use complementary infant food pouches in Australia. 2023;23(1):656.

9. Ventura AK, Mennella JAJCOiCN, Care M. Innate and learned preferences for sweet taste during childhood. 2011;14(4):379-84.

10. Forestell CA. Flavor Perception and Preference Development in Human Infants. Ann Nutr Metab. 2017;70 Suppl 3:17-25.

11. Nicklaus S. Complementary Feeding Strategies to Facilitate Acceptance of Fruits and Vegetables: A Narrative Review of the Literature. Int J Environ Res Public Health. 2016;13(11).

12. Moding KJ, Ferrante MJ, Bellows LL, Bakke AJ, Hayes JE, Johnson SLJNT. Nutritional content and ingredients of commercial infant and toddler food pouches compared with other packages available in the United States. 2019;54(6):305.

13. Padarath S, Gerritsen S, Mackay SJN. Nutritional Aspects of Commercially Available Complementary Foods in New Zealand Supermarkets. 2020;12(10):2980.

14. Bakke AJ, Carney EM, Higgins MJ, Moding K, Johnson SL, Hayes JEJA. Blending dark green vegetables with fruits in commercially available infant foods makes them taste like fruit. 2020;150:104652.

15. Moumin NA, Green TJ, Golley RK, Netting MJ. Are the nutrient and textural properties of Australian commercial infant and toddler foods consistent with infant feeding advice? Br J Nutr. 2020;124(7):754-60.

3 FSANZ proposes 'no added sugar(s)' and 'unsweetened' claims are not permitted on foods containing the hexose monosaccharide D-tagatose, as an ingredient, consistent with existing claim conditions in the Code. As D-tagatose is a hexose monosaccharide, it is captured in the definition of 'added sugars' (see section 5.2.2 of the Call for submissions document).

Do you have any comments on this approach?:

The Infant and Toddler Food Research Alliance support that foods containing D-tagatose should not be eligible to carry 'no added sugar' or 'unsweetened' claims. However, we do not think this should be limited to D-tagatose, it should extend to all low energy sugars, and we do not think this should be noted as a separate claim condition. D-tagatose and all other low energy sugars (monosaccharides and disaccharides) listed in subsection S11—2(3) of schedule 11, should be included in the definition of 'added sugar' in condition (c).

4 FSANZ proposes foods containing low energy sugars (mono- and disaccharides), as ingredients, listed in subsection S11—2(3) of Schedule 11 not be permitted to display 'unsweetened' claims (see section 5.2.2 of the Call for submissions document).

Do you have any comments on this approach?:

The Infant and Toddler Food Research Alliance are Supportive.

There should be consistency between 'no added sugar' and 'unsweetened' claims and accordingly, low energy sugars (monosaccharides and disaccharides) listed in subsection S11—2(3) of schedule 11, should be in the 'added sugar' definition and no foods containing low energy sugars should be permitted to make 'no added sugar' claims. See our response to question 3 above.

5 FSANZ proposes a food displaying a 'no added sugar(s)' claim must not contain the fruit products listed below as an added ingredient (including as an ingredient of a compound ingredient). FSANZ proposes to exempt fruit products which are lemon or lime fruit (see section 5.3 of the Call for submissions document).

Do you have any comments on this approach or the fruit products listed?:

The Infant and Toddler Food Research Alliance strongly agree that a food containing the fruit products listed should not be permitted to carry a 'no added sugar' claim and strongly recommend that the vegetable equivalents are treated the same, see our response to question 2. However, we strongly disagree with the mechanism for this.

All food components listed in claim conditions (a)(ii)-(ix), and their vegetable equivalents, should be included in the 'added sugar' definition in claim condition (a)(i) and NOT as separate components for the purpose of the claims criteria, as currently proposed. Please see our response to question 1 for more details on why this is necessary.

Across the food supply, it is observed that foods containing fruit and vegetable sugars are more likely to use 'no added sugar' claims than those that do not contain these sugars. Some of the highest categories for claims use including the following foods that typically utilise a range of fruit ingredients: Fruit purees, Fruit bites, Fruit straps and pressed fruit products; and Baby and toddler foods.

In relation to fruit juice specifically:

□ we strongly recommend that any reference to fruit juice should clearly state this includes blended, reconstituted, full strength and diluted juices

□ we strongly disagree that canned and frozen fruit with added fruit juice should be able to make 'no added sugar' claims. Where fruit juice is added there should be no claim

6 FSANZ proposes a fruit product which is the food for sale (e.g. fruit juice) be permitted to make a 'no added sugar(s)' claim. This includes when the food is sold as a singular fruit (e.g. apple juice) or a blend of different fruits (e.g. blend of fruit juices), providing the food contains no 'added sugars' or other products identified in claim conditions, as added ingredients. A blend or combination of different fruit products (e.g. fruit juice and fruit purée) will not be permitted to make the claim. FSANZ also proposes to clarify that fruit does not include legumes, fungi,

herbs, nuts and spices for the purpose of the claim conditions (see section 5.3 of the Call for submissions document).

Do you have any comments on this approach?:

The Infant and Toddler Foods Research Alliance Strongly disagree.

Allowing fruit products to carry a 'no added sugar' claim when sold as single-ingredient foods but disallowing other products from making the same claim when these fruit products are added to them, gives these foods a health halo and perpetuates consumer beliefs that these fruit products are healthier than they are. It is also inconsistent with both Australian and New Zealand dietary guidelines which recommend limiting fruit juice consumption.

This proposal is also inconsistent with the key outcomes of the FSANZ Consumer Evidence Summary on no added sugar claims which states:

□ 'No added sugar' claims appear to modify consumer perceptions of the food products they are applied to in terms of healthfulness, naturalness and taste. The majority of studies looking at healthfulness perceptions indicate that 'no added sugar' claims increase how healthy consumers perceive food products to be."

□ 'No added sugar' claims were found to have an influence on purchasing decisions in studies relating to toddler and infant foods, fruit beverages and fruit juices."

This evidence clearly shows that allowing 'no added sugar' claims on single-ingredient fruit products will increase how healthy consumers perceive these food products to be. This misinformation is in direct conflict with dietary guideline recommendations that people only consume fruit juice occasionally and in small amounts.

The issue with single-ingredient foods is especially problematic in the case of fruit juices.

The Australian Infant feeding guidelines recommend 'consumption of nutrient-poor foods with high levels of fat/ saturated fat, sugar, should be avoided' for children 12 months and the Australian Dietary Guidelines recommending a 20g serve of fruit per day for children 7-12 months and 150g for 12-2 years. If single-ingredient foods such as fruit juice or single fruit puree baby foods are allowed to carry fruit products to carry a 'no added sugar' parents will be misled that they are providing a 'healthy' option for their child that is in line with the national recommendations. Yet as evidenced from compositional evaluation of baby squeeze pouch foods (1) these products often contain up to 5 times the recommended daily intake for fruit for infants(16). Fruit juices are frequently sold in package sizes of 500mL intended for individual consumption in a single occasion, suggesting that Australians are not consuming fruit juice in line with the Australian Dietary Guidelines - that is, fruit juice be consumed occasionally, in small amounts (i.e. 125mL or half a cup), where fresh, frozen or tinned fruit supply is suboptimal. Despite the assertions of fruit juice producers, this limited concession does not constitute a recommendation for most Australians to drink fruit juice. Consumers often think of juice as a healthy alternative to sugar-sweetened beverages like soft drinks and energy drinks, despite containing similar sugar levels. It is time for fruit juice to lose its health halo. Prohibiting these products from voluntarily displaying 'no added sugar' claims can help to reduce the risk of consumers being misled into thinking these juices are nutritionally equivalent to whole fruit.

'No added sugar' claims on fruit juice would be inconsistent with the New Zealand dietary guidelines state: "Sugary drinks include fruit juice, fruit drinks,26 powdered drinks, cordial, carbonated or fizzy drinks, energy drinks, sports drinks and flavoured waters." The New Zealand dietary guidelines go on to clearly call out that fruit juice a major source of added sugars in New Zealanders' diets. Allowing fruit juice to carry a 'no added sugar' claim would be inconsistent with the intent of these guidelines and would not enable consumers to make choices in line with them.

FSANZ Consumer Evidence Summary highlights how influential 'no added sugar' claims are in relation to fruit juice specifically, noting in relation to specific studies:

□ "These results suggest that 'no added sugar' is important in driving purchases for fruit juices, and is relatively more important than other information about juice processing and formulation." (see page 21 FSANZ Consumer Evidence Summary)

□ "For fruit juice, 'no added sugar' was the most influential factor when compared with other information about juice processing or formulation." (see page 22 FSANZ Consumer Evidence Summary)

Allowing 'no added sugar' claims will also perpetuate consumer misunderstanding about sugars in fruit juice. As highlighted in FSANZ Literature review on consumer knowledge, attitudes and behaviours relating to sugars and food labelling (completed as part of the work on P1058) there is some evidence that consumers underestimate the sugar content of beverages containing fruit, with key points in that paper noting:

□ "Consumers understanding of the sugar content of beverages containing fruit may be poorer than for other beverages. One study found that consumers tend to underestimate the sugar content of beverages containing fruit (but do not underestimate the sugar content of carbonated beverages). Another study found that around a quarter of consumers do not believe that 100% fruit juice contains naturally occurring sugar.

□ Consumers believe that beverages containing fruit are healthier than beverages with a similar sugar content that do not contain fruit.

□ Consumers' perceptions of fruit beverages may be related to consumers' beliefs that fruit is healthy and/or the belief (reported in section 2) that the sugar in fruit is less fattening than sugar in other foods."

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We support the FSANZ proposal that legumes, fungi, herbs, nuts and spices should not be considered fruits for any definition of added sugar or for 'no added sugar' claim conditions

1. Brunacci KA, Salmon L, McCann J, Gribble K, Fleming CAJBPH. The big squeeze: a product content and labelling analysis of ready-to-use complementary infant food pouches in Australia. 2023;23(1):656.

7 FSANZ proposes 'no added sugar(s)' claims are not permitted when the concentration of sugars in the food is increased from the hydrolysis of carbohydrates during food manufacture, except when the sugars concentration in cereal-based plant milks made using hydrolysis is  $\leq 1.5\%$  (and the product otherwise meets claim conditions) (see section 5.3.2 of the Calls for submissions document).

Do you have any comments on this approach?:

The Infant and Toddler Food Research Alliance support FSANZs proposal that foods containing sugars from hydrolysis should not be permitted to make 'no added sugar' claims, however, we do not support:

- (1) the exclusion of other processing techniques from this definition;
- (2) the exemption for products that contain less than  $\leq 1.5\%$  sugars;
- (3) that sugars from hydrolysis are treated differently to other 'added sugars' - these sugars should be 'added sugars' as defined.

1 Processing: We recommend FSANZ adopt a forward-thinking approach for sugars that are produced by processing methods and include all sugars that are produced or residual as a result of any processing method which results in the end product containing more sugars than the original raw ingredients. This should be drafted to capture any existing and new processing techniques, including hydrolysis and fermentation. This would ensure a consistent approach to sugars that are the result of processing and ensure new processes are captured to ensure the 'no added sugar' labelling remains both current and is future proofed.

2 Exemption: We do not support the exemption for foods containing  $\leq 1.5\%$  sugars - any food containing sugars should not be permitted to carry a 'no added sugars' claim. We do not think a threshold to 'level the playing field' between milk alternatives is appropriate. Consumers should be able to rely on a 'no added sugar' claim meaning that there are no added sugars in a product.

3. Definition: The sugars resulting from processing should simply be included in the definition of 'added sugars' not set out in a separate claim condition. A food displaying a 'no added sugar(s)' should simply not contain any 'added sugars'. A comprehensive definition of 'added sugar' is required.

8 FSANZ proposes to maintain the existing condition that a food displaying an 'unsweetened' claim must meet the conditions for a 'no added sugar(s)' claim, noting that the amended 'no added sugar(s)' claim conditions will apply (see section 5.4 of the Call for submissions document).

Do you have any comments on this approach?:

The Infant and Toddler Food Research Alliance are strongly supportive.

We note that all proposed amendments to 'no added sugar' claim conditions in our submission should apply for 'unsweetened' claims also.

9 FSANZ proposes to maintain the existing condition for intense sweeteners, sorbitol, mannitol, glycerol, xylitol, isomalt, maltitol syrup or lactitol. FSANZ proposes a food containing low energy sugars (mono- and disaccharides) listed in subsection S11—2(3) of schedule 11, as an ingredient (including an ingredient of a compound ingredient), not be permitted to display an 'unsweetened' claim (see section 5.4 of the Call for submissions document).

Do you have any comments on this approach?:

The Infant and Toddler Food Research Alliance are strongly supportive of the position that a product containing sweeteners should continue to be unable to carry an 'unsweetened' claim.

Strongly disagree with the terminology used. The phrase "intense sweeteners" is not defined in the Foods Standards Code nor consistently in literature and does capture all sweeteners used in the food supply.

The terminology "non-sugar sweetener" should be used instead and a definition added to the Food Standards Code as per the World Health Organisation definition of this term. This would ensure all low and non-calorie sweeteners are captured within the definition including acesulfame K, aspartame, advantame, cyclamates, neotame, saccharin, sucralose, stevia and stevia derivatives.

See: Use of non-sugar sweeteners: WHO guideline. Geneva: World Health Organization; 2023. Licence: CC BY-NC-SA 3.0 IGO.

10 FSANZ is proposing a two-year transition period to allow producers, manufacturers and importers time to make any required labelling changes for products carrying 'no added sugar(s)' or 'unsweetened' claims to comply with the new claim conditions (see section 7 of the Call for submissions document).

Do you have any comments on this approach?:

The Infant and Toddler Food Research Alliance are very Supportive.

A two year transition period is consistent with previous mandatory labelling changes and with FSANZ cost modelling on a reasonable period to enable industry to update labels within normal cycle of label updates.

## Data and evidence

11 Do you have any data or are you aware of published data on the number of products with 'no added sugar(s)' or 'unsweetened' claims in Australia and/or New Zealand (see data used for this proposal at section 3.1 of the Call for submissions document)?

Yes

If yes, please upload your file here.:

The Big Squeeze BMC Public Health.pdf was uploaded

12 Do you have any evidence or are you aware of published literature on consumer understanding of and responses to 'no added sugar(s)' or 'unsweetened' claims on food products (see evidence used for this proposal at section 3.2 of the Call for submissions report and Supporting Document 1)?

Yes

If yes, please upload your file here.:  
e001241.full.pdf was uploaded

13 Do you have any data or know of any published data on the costs of labelling changes per stock keeping unit or package type (see data used for this proposal at Attachment E to the Call for submissions document)?

No

If yes, please upload your file here:  
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## Additional comments

Comments and other input

Additional comments and input:

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## Feedback

What is your level of satisfaction with using this platform to complete your submission?

Satisfied

Do you have any feedback you would like to provide to FSANZ regarding this new platform?

No

If yes, please provide details.:



# Health-related marketing messages on product labels of commercial infant and toddler food packaging in Australia: a cross-sectional audit

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Merryn J Netting <sup>1,3</sup>

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## ABSTRACT

**Background** Proper nutrition in early childhood is essential to ensure optimal growth and development. Use of 'better-for-you' features on food packaging position products as healthier for children. This study aims to systematically explore the use of better-for-you labelling on infant and toddler food packaging.

**Methods** A cross-sectional audit of health and nutrition claims, text and images used as 'better-for-you' features present on infant and toddler food packaging. Data on infant and toddler food packaging were collected from five large grocery stores in Adelaide, Australia in 2019. The content of 282 unique commercial products (n=215 infant foods, n=67 toddler foods) were analysed for explicit and implicit features positioning them as better-for-you, including health and nutrition claims as well as text and images representing 'natural.'

**Results** At least one feature of better-for-you positioning was identified on all food packaging coded. All products had characteristics coded as 'natural'. Almost one-fifth (17%) of the products included statements in addition to mandatory allergen labelling that their products were 'free from' certain allergens, or gluten. One-third of the labels had statements related to enhancing development of taste, oro-motor skills and other aspects of childhood development. Of the fruit and vegetable-based infant foods displaying a sugar statement suggesting a low sugar content, 85% were sweetened with fruit puree.

**Conclusions** The use of better-for-you features on infant and toddler food packaging is common and pervasive. Allergen-free and developmental claims are being used to position infant and toddler foods as better-for-you. Regulation of toddler food products separately from adult food is required, as is tighter regulation of the appropriate use of sugar and fruit puree statements on infant and toddler food packaging.

## INTRODUCTION

Proper nutrition in early childhood is essential to ensure optimal growth and development. The early complementary feeding period influences longer-term dietary patterns and taste preferences, and poor eating habits can lead to both overnutrition and undernutrition, and non-communicable diseases, such

## What is known about the subject

- There is a mismatch between the nutritional characteristics of commercial infant and toddler foods and infant feeding guidelines. Regulated health and nutrition content claims and non-regulated well-being messaging are commonly used on unhealthy products, contributing to consumers believing these products are 'better-for-you'. Advertising and packaging messages suggesting commercial infant foods are healthier than their nutrient content have been observed in the UK and Taiwan.

## What this study adds

- The use of better-for-you features on infant and toddler foods is common and pervasive. Allergen-free and developmental claims are being used to position infant and toddler foods as better-for-you. Regulation of toddler food products separately from adult food is required, as is tighter regulation of the appropriate use of sugar and fruit puree statements on infant and toddler food packaging.

as obesity and iron deficiency.<sup>1</sup> Infant feeding guidelines promote breast feeding and introduction to a diversity of nutritious complementary foods at around 6 months of age when the infant is developmentally ready.<sup>2</sup>

While home-prepared foods are encouraged, commercial infant and toddler foods are a rapidly expanding market sector now estimated to be worth US\$8 billion per year in the USA alone.<sup>3</sup> We have previously demonstrated a mismatch between the nutritional and textual properties of commercially available infant and toddler foods and national and international infant feeding guidelines.<sup>4</sup> Of particular concern is the rapid expansion in the range and types of toddler 'snack foods', which are mostly highly processed, discretionary foods of poor nutritional value.<sup>4 5</sup>



Additionally, many infant foods come in pouches, which may be consumed by sucking from a spout rather than eating with a spoon. With this mode of feeding, there is a risk of delayed development of essential self-feeding skills and appetite dysregulation.<sup>6</sup>

Most countries have specific regulations for the mandatory labelling requirements for infant foods, including nutritional content. In Australia and New Zealand, this falls under the regulatory jurisdiction of Food Standards Australia New Zealand (FSANZ) with different regulations for infants (4–12 months) and toddlers (over 12 months). Compositional requirements for Foods for Infants are outlined in FSANZ Standard 2.9.2 with specific requirements for iron and vitamin C fortification, restrictions on sodium content and textural requirements for foods produced for infants.<sup>7</sup> Requirements for toddlers are described in the same schedule as for adults, Schedule 4—Nutrition, health and related claims.<sup>8</sup> For toddler foods, this is concerning because toddlers have specific growth and developmental needs that are not addressed in Schedule 4.

Additional to regulated labelling information, manufacturers may use non-regulated marketing messaging on product labels to promote purchase. Non-regulated marketing can include wellness messaging that alludes to a product being healthy or nutritious, or a comparatively healthier option, which are not regulated as health and nutrition content claims.<sup>9</sup> The use of both regulated health and nutrition content claims and non-regulated wellness messaging are commonly used on unhealthy products and can contribute to a ‘health halo’ effect, whereby consumers consider these products to be healthy or ‘better-for-you’.<sup>9 10</sup> Better-for-you labelling features employ explicit and implicit messaging such as text, images, colours or symbols on packaging that claim or imply that a product has health-related benefits or is a healthier option than a non-specified competitor product or even home-prepared options. Packaging and advertising messages suggesting commercial infant foods are healthier than their actual nutrient content indicate have been observed in the UK,<sup>11</sup> and Taiwan.<sup>12</sup> This is of particular concern as foods consumed by infants and toddlers can influence their development, taste preferences and lifelong health.

Here, we describe health and nutrient claims and other better-for-you labelling on infant and toddler foods currently sold in Australia. We take a comprehensive approach in capturing both regulated health and nutrient content claims as well as other marketing on labels that may result in a health halo. Understanding the messaging communicated to parents and caregivers who are purchasing foods for their young children is important to inform future regulatory guidelines for labelling of infant and toddler foods.

## Infant and Toddler Food



**Figure 1** Classification of infant and toddler foods. Meals were divided into main meals, fruit and vegetable first foods, desserts and breakfasts, dry cereals (savory or sweet), or miscellaneous other. Snacks and finger foods were classified as savoury (starch or legume based and with a bland or savoury flavour profile), fruit and vegetable based, or sweet (fruit-flavoured with a sweet flavour profile). Foods were further classified as meals or snacks/finger foods, as per Tedstone *et al*<sup>13</sup> and subcategorised based on Moumin *et al*<sup>4</sup> products with >25% fruit or vegetable ingredients were classified as fruit and vegetable-based finger foods.

## METHODS

We conducted an audit of packaging for infant and toddler foods available in South Australian grocery stores in 2019. We used a convenience sampling method, selecting five large grocery stores representing three nation-wide retailers (Coles, Woolworths and Aldi) along with two independent retailers (Foodland and Drakes). We photographed all infant and toddler food products denoted on the package as suitable for ages 4–24 months sold in the baby food and frozen food aisles. Infant formula was excluded as it is covered by a different set of FSANZ’s regulatory standards.

## Food categorisation

Using information on the package, products were classified as infant foods (4–12 months) or toddler foods (>12 months). Foods were further classified as per Tedstone *et al*<sup>13</sup> and subcategorised based on Moumin *et al*<sup>4</sup> (figure 1).

## Data coding and analysis

A coding framework to capture health and nutrition-related marketing developed by Brownbill *et al*<sup>8</sup> was adapted for infant and toddler food products, using regulated nutrient content claims and general health (claims that imply that the food product has a health-related effect, such as ‘good for baby’s digestion’) and high level health (claims about a nutrient in a food and its relationship to a serious disease, such as ‘wholegrains to reduce risk of heart disease’) claims defined and regulated by FSANZ, and nutrition and health claims. The coding framework comprised 25 categories with 125 individual codes (online supplemental appendix 1). Each product label was coded by two researchers independently for the presence/absence of marketing features. Where there was disagreement, a consensus was reached by discussion with a third team member. To validate the coding of the primary coders, a random sample of 10% was

**Table 1** Health, nutrition and other better-for-you claims in commercial infant and toddler foods

Category/claim	All products N=282		Infant products N=215		Toddler products N=67	
	N	%	N	%	N	%
Allergen free and gluten free	47	16.7	31	14.4	16	23.9
Allergen free claim only	9	3.2	6	2.8	3	4.5
Gluten free claim only	21	7.4	17	7.9	4	6.0
Vegetarian/vegan	22	7.8	15	7.0	7	10.4
Sugar	173	61.3	147	68.4	26	38.8
No added sugar	155	55.0	137	63.7	18	26.9
No concentrates	20	7.1	17	7.9	3	4.5
Natural sugar/sugar from fruit, veg	36	12.8	33	15.3	3	4.5
Sodium	125	44.3	112	52.1	13	19.4
No added salt	120	42.6	111	51.6	9	13.4
Low in salt/sodium	6	2.1	2	0.9	4	6.0
Fat	28	9.9	13	6.0	15	22.4
No added fat/oil/ transfat/low fat	7	2.5	3	1.4	4	6.0
Baked, not fried, air popped	23	8.2	10	4.7	13	19.4
Protein	62	22.0	52	24.2	10	14.9
in text/image	55	19.5	49	22.8	6	9.0
Source of/servings or % protein	33	11.7	25	11.6	8	11.9
Dairy	64	22.7	44	20.5	20	29.9
In text/image	62	22.0	43	20.0	19	28.4
Servings or % dairy	3	1.1	3	1.4	0	0
Fruits	156	55.3	122	56.7	34	50.7
In text/image	155	55.0	122	56.7	33	49.3
Servings or % fruit	17	6.0	17	7.9	0	0
Vegetables	118	41.8	103	47.9	15	22.4
In text/image	108	38.3	95	44.2	13	19.4
Servings or % veg	31	11.0	26	12.1	5	7.5
Grains/cereals	119	42.2	89	41.4	30	44.8
In text/image	114	40.4	86	40.0	28	41.8
Servings or % grain	10	3.5	8	3.7	2	3.0
Superfoods (fruit/veg/grains)	96	34.0	74	34.4	22	32.8
Nutrition	111	39.4	81	37.7	30	44.8
Nutritious, nourishing, wholesome	65	23.0	47	21.9	18	26.9
Contains nutrients, vitamins, minerals, antioxidants	45	16.0	38	17.7	7	10.4
Vitamins (eg, C or B)	34	12.1	29	13.5	5	7.5
Iron	27	9.6	24	11.2	3	4.5
Calcium	12	4.3	11	5.1	*	1.5
Essential fatty acids (eg, DHA)	13	4.6	10	4.7	3	4.5
Fibre	13	4.6	7	3.3	6	9.0
Natural	282	100	215	100	67	100
'Natural'	50	17.7	41	19.1	9	13.4
Pure or raw	34	12.1	26	12.1	8	11.9
Organic/organic symbol	146	51.8	109	50.7	37	55.2
Real/fresh or homemade	63	22.3	46	21.4	17	25.4

Continued



Table 1 Continued

Category/claim	All products N=282		Infant products N=215		Toddler products N=67	
	N	%	N	%	N	%
No additives, preservatives	252	89.4	195	90.7	57	85.1
No chemicals, pesticides, GMO	103	36.5	77	35.8	26	38.8
Images of nature	154	54.6	109	50.7	45	67.2
Good or goodness	<b>90</b>	<b>31.9</b>	<b>71</b>	<b>33.0</b>	<b>19</b>	<b>28.4</b>
Health/wellness claims	<b>49</b>	<b>17.4</b>	<b>32</b>	<b>14.9</b>	<b>17</b>	<b>25.4</b>
High level health	0	0	0	0	0	0
General level health	7	2.5	3	1.4	4	6.0
Health/healthy/wellness	6	2.1	4	1.9	2	3.0
Gut health/happy tummies	31	11.0	22	10.2	9	13.4
Teething claims	12	4.3	7	3.3	5	7.5
Development claims	<b>90</b>	<b>31.9</b>	<b>57</b>	<b>26.5</b>	<b>33</b>	<b>49.3</b>
Help, improve, assist, encourage	13	4.6	11	5.1	2	3.0
Learning/brain/cognition	2	0.9	*	0.5	*	1.5
Self-feeding	42	14.9	26	12.1	16	23.9
Development of tastebuds	48	17.0	39	18.1	9	13.4
Development of jaw, mouth	11	3.9	3	1.4	8	11.9
General growth, development	32	11.3	20	9.3	12	17.9
Adult snack food images*	<b>69</b>	<b>24.5</b>	<b>28</b>	<b>13.0</b>	<b>41</b>	<b>61.2</b>
Sweets, chocolate	7	2.5	2	0.9	5	7.5
Crisps (puffs, straw, popcorn)	24	8.5	13	6.0	11	16.4
Sweet biscuits/cookies	12	4.3	5	2.3	7	10.4
Savoury biscuits/crackers	10	3.5	4	1.9	6	9.0
Snack bars	19	6.7	4	1.9	15	22.4

Bold text represents the overarching claim (eg, 'Sugar' is the overarching claim, with 'No added sugar' sitting below that claim)

\*Products with images of adult snack foods (crackers, cookies, crisps or sweets) on pack were coded.

DHA, Docosahexaenoic acid; GMO, Genetically modified organisms.

cross-checked by a third team member. Due to the large number of sugar-related claims, a sub-analysis of claims on labels of foods with monosaccharide and disaccharide content of added sugars and honey >4 g per 100 g consistent with Standard 2.9.2—7 (3.d) was conducted as a comparator.

### Public and patient involvement

The premise of this study stems from questions one of our authors was asked by patients about better-for-you features on toddler food packaging.

### RESULTS

The packaging of 282 unique commercial products was coded (n=215 infant foods and n=67 toddler foods; table 1). Of the infant meals, main meals were the predominant product type (n=70), followed by desserts and breakfasts (n=46) and mixed fruit and/or vegetable first food purees (n=45) (table 2). Most of the infant meals were presented in 'squeeze pouches' (131 of 161).

Of the toddler foods, 80% were snack foods (extruded puffs flavoured with fruit or vegetable powder, sweet biscuits or rice cakes and fruit and vegetable-containing bars).<sup>4</sup>

All products contained at least one better-for-you feature on the label. The presence of health, nutrition and other better-for-you claims among the study sample are presented in table 1 (infant compared with toddler foods) and table 2 (by food category).

**Nutrition and nutrient-related:** Over one-third of the packaging (39%) promoted positive nutritional qualities. This occurred through general statements that the product was 'nourishing', 'nutritious' or 'wholesome' (23%), and/or that the product contained 'nutrients', 'vitamins', 'minerals' or 'antioxidants' (16%).

**Macronutrients and core food groups:** Products referred to healthy whole foods through descriptors and/or images of fruits (55%), vegetables (42%), grains or cereals (42%), dairy products (23%) and/or protein products (eg, meats, fish, eggs; 22%). One-third of

**Table 2** Infant and toddler better-for-you claims by food category—N (%)

Food category	n	Allergens/ gluten*	Vegetarian/ vegan	Sugar†	Sodium‡	Fat	Protein	Dairy	Fruit	Veg	Grains/ cereal	Super foods	Discretion-ary foods	Natural	Good	Nutrition	Health/ wellness	Develop-mental
<b>Meals</b>																		
Infant meals	182	16 (8.8)	9 (4.9)	126 (69.2)	93 (51.1)	1 (0.5)	50 (27.5)	40 (22.0)	100 (54.9)	88 (48.4)	71 (39.0)	62 (34.1)	5 (2.7)	182 (100)	56 (30.8)	58 (31.9)	13 (7.1)	30 (16.5)
1.Main meals	70	8 (11.4)	2 (2.9)	50 (71.4)	41 (58.6)	1 (1.4)	48 (68.6)	12 (17.1)	11 (15.7)	67 (95.7)	28 (40.0)	24 (34.3)	—	70 (100)	24 (34.3)	17 (24.3)	8 (11.4)	12 (17.1)
2.Fruit and veg first foods	45	1 (2.2)	—	38 (84.4)	31 (68.9)	—	—	—	41 (91.1)	11 (24.4)	—	16 (35.6)	—	45 (100)	11 (24.4)	11 (24.4)	—	9 (20.0)
3.Premade desserts and breakfasts	46	2 (4.3)	—	27 (58.3)	14 (30.4)	—	2 (4.3)	27 (58.7)	40 (87.0)	6 (13.0)	25 (54.3)	21 (45.7)	1 (2.2)	46 (100)	14 (30.4)	10 (21.7)	4 (8.7)	8 (17.4)
4.Dry cereals	16	4 (25.0)	3 (18.8)	6 (37.5)	3 (18.8)	—	—	1 (6.3)	8 (50.0)	3 (18.8)	15 (93.8)	1 (6.3)	4 (25.0)	16 (100)	6 (37.5)	16 (100)	1 (6.3)	1 (6.3)
5.Misc dry pasta (n=4), other (n=1)	5	1 (20.0)	4 (80.0)	5 (100)	4 (80.0)	—	—	—	—	1 (20.0)	3 (60.0)	—	—	5 (100)	1 (20.0)	4 (80.0)	—	—
Toddler meals	13	—	1 (7.7)	2 (15.4)	5 (38.5)	—	6 (46.2)	5 (38.5)	4 (30.8)	6 (46.2)	4 (30.8)	3 (23.1)	2 (5.4)	13 (100)	4 (30.8)	5 (38.5)	4 (30.8)	6 (46.2)
1.Main meals	6	—	—	—	4 (66.7)	—	5 (83.3)	2 (33.3)	1 (16.7)	5 (83.3)	2 (33.3)	—	1 (16.7)	6 (100)	4 (66.7)	4 (66.7)	4 (66.7)	4 (66.7)
2.Fruit and veg first foods	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3.Premade desserts and breakfasts	4	—	1 (25.0)	2 (50.0)	—	—	—	3 (75.0)	3 (75.0)	—	2 (50.0)	3 (75.0)	1 (25.0)	4 (100)	—	—	—	2 (50.0)
4.Dry cereals	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
5.Misc (dry pasta)	—	—	1 (33.3)	1 (33.3)	1 (33.3)	—	1 (33.3)	—	—	1 (33.3)	—	—	—	3 (100)	—	1 (33.3)	—	—
Total infant and toddler meals	195	16 (8.2)	10 (5.1)	128 (65.6)	98 (50.3)	1 (0.5)	56 (28.7)	45 (23.1)	104 (53.3)	94 (48.2)	75 (38.5)	65 (33.3)	7 (3.6)	195 (100)	60 (30.8)	63 (32.3)	17 (8.7)	36 (18.5)
<b>Snack foods</b>																		
Infant finger foods	33	15 (45.5)	6 (18.2)	21 (63.6)	19 (57.6)	12 (36.4)	2 (6.1)	4 (12.1)	22 (66.7)	15 (45.5)	18 (54.5)	12 (36.4)	22 (66.7)	33 (100)	15 (45.5)	21 (63.6)	19 (57.6)	27 (81.8)
7.Savoury finger foods	12	6 (50)	2 (16.7)	9 (75.0)	7 (58.3)	5 (41.7)	2 (16.7)	3 (25.0)	2 (16.7)	6 (50.0)	5 (41.7)	6 (50.0)	9 (75.0)	12 (100)	6 (50.0)	7 (58.3)	8 (66.7)	9 (75.0)
8.Fruit and vegetable based	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
9.Sweet finger foods	21	9 (42.9)	4 (19.0)	12 (57.1)	12 (57.1)	7 (33.3)	—	1 (4.8)	20 (95.2)	9 (42.9)	13 (61.9)	6 (28.6)	13 (61.9)	21 (100)	9 (42.9)	14 (66.7)	11 (52.4)	18 (85.7)
Toddler snack foods	54	16 (29.9)	5 (9.3)	23 (42.6)	8 (14.8)	15 (32)	4 (7.4)	15 (27.8)	30 (55.6)	9 (16.7)	26 (48.1)	19 (35.2)	39 (72.2)	54 (100)	15 (27.8)	24 (44.4)	13 (24.1)	27 (50.0)
7.Savoury finger foods	16	7 (43.8)	1 (6.3)	11 (68.8)	3 (18.8)	8 (50.0)	4 (25.0)	8 (50.0)	—	7 (43.8)	7 (43.8)	5 (31.3)	13 (81.3)	16 (100)	6 (37.5)	6 (37.5)	4 (25.0)	7 (43.8)

Continued

Table 2 Continued

Food category	n	Allergens/ gluten*	Vegetarian/ vegan	Sugar†	Sodium‡	Fat	Protein	Dairy	Fruit	Veg	Grains/ cereal	Super foods	Discretion- ary foods	Natural	Good	Nutrition	Health/ wellness	Develop- mental
8.Fruit and vegetable finger foods	16	1 (6.3)	2 (12.5)	5 (31.3)	2 (12.5)	-	-	2 (12.5)	16 (100)	-	9 (56.3)	8 (50.0)	11 (68.8)	16 (100)	6 (37.5)	5 (31.3)	1 (6.3)	11 (68.8)
9.Sweet finger foods	22	8 (36.4)	2 (9.1)	7 (31.8)	3 (13.6)	7 (31.8)	-	5 (22.7)	14 (63.6)	2 (9.1)	10 (45.5)	6 (27.3)	15 (68.2)	22 (100)	3 (13.6)	13 (59.1)	8 (36.4)	9 (40.9)
Total Infant and toddler snacks	87	31 (35.6)	11 (12.6)	44 (50.6)	27 (31.0)	27 (31.0)	6 (6.9)	19 (21.8)	52 (59.8)	24 (27.6)	44 (50.6)	31 (35.6)	61 (70.1)	87 (100)	30 (34.5)	45 (51.7)	32 (36.8)	54 (62.1)

Bold text represents the total number of infant meals and Toddler meals.

\*Allergens/gluten refers to allergen-free and gluten-free claims.

†Sugar refers to 'no added sugar', 'no concentrates', 'natural sugars' and 'sugar from fruits and vegetables' claims.

‡Sodium refers to 'no added salt' and 'low in salt/sodium'.

products contained descriptors and/or images of fruits, vegetables or grains recognised as 'superfoods' (34%).

**Sugar, salt and fat:** Over half of the products contained statements related to sugar content (61%), more commonly on infant (68%) than toddler foods (39%). Sugar statements mostly took the form of 'No added sugar' claims (55%) but products also referred to containing 'natural sugar' or sugar from fruit and/or vegetables (13%). Thirty-four (12%) products had statements such as 'all sugars are naturally occurring' within the nutritional information panel (NIP). Sugar claims were present on foods with sweet and savoury taste profiles (table 3). Of the fruit and vegetable-based infant foods displaying a sugar statement regarding low sugar content, 85% were sweetened with fruit puree.

Statements related to salt content were common with 44% of the labels stating, 'no added salt' or 'low salt' (52% of infant, 19% of toddler foods). Less common were statements related to fat content: at 10% of products, these tended to be insinuated through using terms such as 'baked' or 'not fried' than a 'no' or 'low' fat claim.

**Natural:** All products had characteristics coded as positioning the product as natural. This most commonly included products stating that they were free from additives or preservatives (89%), but it was also common for products to contain images of nature (55%), and 'organic' statements/symbols (52%).

**Health and wellness:** Of all products coded, 17% displayed a health or wellness better-for-you feature, more commonly observed among toddler (25%) than infant foods (15%). However, very few were regulated general health claims (3%) and none were high level health claims. One in 10 products had a statement related to gut health (eg, 'smile from the inside', 'happy tummies') and a small number claimed to assist with teething (4%).

**Childhood development:** Marketing specifically related to child development was present on one-third (32%) of the food products. This group of statements was more frequently identified on toddler (49%) than infant foods (27%). These claims included statements related to development of taste preferences, self-feeding skills, oromotor skills and general development (see figure 2).

**Dietary restrictions:** Additional to mandatory allergen labelling, 17% of the products included 'free from' allergen or gluten statements. Eight per cent of the products claimed that the product was suitable for vegetarians or vegans.

**Discretionary foods:** Thirty-one per cent (82 of 282) of all foods, including 81% of all toddler foods, were snack or finger foods. Images portraying adult snack foods (eg, bars, protein balls, cookies) were present on 70% (61 of 87) of toddler packaging. Half (44 of 87) had a sugar statement on the label, including 71% (20 of 28) of savoury foods (table 3). A salt statement was present on one-third (31%; 27 of 87) of all snack foods, including 57% of sweet-flavoured infant snack foods (12 of 21). All snack food packaging had 'natural' statements or images, and one-third had 'goodness' statements or



**Table 3** Sugar claims present on infant and toddler foods by food category N (%)

Food category	n	Any sugar claim	Savoury / bland taste profile			Sweet taste profile		
		n (%)	n (%)	g sugars / 100 g median (range)	>4 g sugars / 100 g	n (%)	g sugars / 100 g median (range)	>4 g sugars / 100 g
Infant meals	182	126 (69.2)						
1.Main meals	70	50 (71.4)	48 (96.0)	2.8 (0.8 to 8.5)	7 (14.5)	2 (4.0)	8.7 (6.3 to 11)	2 (100)
2.Fruit and veg first foods	45	38 (84.4)	7 (18.4)	5.6 (1.7 to 9.1)	6 (85.7)	31 (81.5)	11.1 (7.5 to 14.4)	31 (100)
3.Premade desserts and breakfasts	46	27 (58.3)	–	–	–	27 (100)	7.8 (4.9 to 15.8)	27 (100)
4.Dry cereals	16	6 (37.5)	2 (33.3)	0.5 (0.4 to 1.0)	–	4 (66.6)	2.9 (0.5 to 5.2)	2 (50.0)
5.Misc.(dry pasta (n=4), other (n=1)*)	5	5 (100)	4 (80.0)	1.7 (0.3 to 3)	–	–	–	–
Toddler meals	13	3 (23.0)	–	–	–			
1.Main meals	6	–	–	–	–	–	–	–
2.Fruit and veg first foods	–	–	–	–	–	–	–	–
3.Premade desserts and breakfasts	4	2 (50.0)	–	–	–	2 (50.0)	5.3 (5.2 to 5.5)	2 (100)
4.Dry cereals	–	–	–	–	–	–	–	–
5.Misc. (dry pasta)	3	1 (33.3)	1 (33.3)	3.1 (n/a)	–	–	–	–
Total infant and toddler meals	195	128 (65.6)						
Infant snack (finger) foods	33	21 (63.6)	9 (75.0)	3.8 (0.6 to 10.3)	2 (22.2)	12 (57.1)	7.9 (3.6 to 9.9)	11 (92)
Toddler snack foods	54	23 (42.6)	11 (47.8)	2.9 (0.5 to 13)	2 (18.1)	12 (52)	44 (14 to 74.7)	12 (100)
Total infant and toddler snacks	87	44 (50.6)						

Infant and toddler foods with any sugar claim, by category. Categorised by savoury/bland and sweet taste profiles with median (range) of sugars g/100 g as per nutritional information panel, and number of foods with sugar content >4 g per 100 g as per Schedule 4 Standard 2.9.2–7.3 (d) if the monosaccharide and disaccharide content of added sugars and honey is more than 4 g/100 g, the word 'sweetened' must be included on the label.

\*n=1 flavoured tea; not included in table.

images. One-half of all snack foods had statements or images related to general nutrition, and one-third of infant finger foods had statements related to a specific nutrient. Developmental claims were identified in 63% (54 of 87) of all snack foods (table 1).

## DISCUSSION

Parents and caregivers face a barrage of information when deciding which foods to purchase for their infants and toddlers. Our in-depth analysis of the marketing messages on the packaging of a contemporary sample of Australian commercial infant and toddler foods identified better-for-you features on all food packaging audited. We identified 'natural' statements and/or images on all

of these products and half displayed statements related to 'organic' ingredients, even among highly processed foods including extruded snack foods and fruit and vegetable purees in squeeze pouches. This is concerning as, despite the presence of better-for-you features on infant and toddler foods, the nutritional value of commercial infant and toddler foods does not align with feeding guidelines.<sup>4 6 14</sup>

The strengths of our research included the comprehensive sampling of infant and toddler packaging, presented as an age continuum, which extends our description of the nutritional characteristics of Australian infant and toddler foods.<sup>4</sup> While our work builds on previous studies focusing exclusively on Australian toddler foods





**Figure 2** Examples of childhood development better-for-you features present on infant and toddler food labels.

and toddler formula<sup>5</sup> or infant foods in Taiwan<sup>12</sup> and the UK,<sup>11</sup> our analysis cannot determine whether the better-for-you features influence how parents and caregivers perceive the infant and toddler food products. Future research should explore how the packaging of these foods is perceived by caregivers and the influence it has on decisions when feeding their children.

We have identified claims used to position infant and toddler foods as better-for-you not previously described, specifically the use of 'allergen free' and 'gluten free' statements. These statements, additional to mandatory allergen labelling, position foods as safe to consume for individuals with food allergies or coeliac disease. While some parental concern about allergen content of commercial foods has been identified,<sup>15</sup> contemporary infant feeding guidelines encourage regular exposure to food allergens to prevent allergy development, rather than avoidance.<sup>16–18</sup> For those without diagnosed allergies, the emphasis of 'free from allergens' as a healthier food choice may be harmful if the child is consequently not exposed to common allergens in their usual diet.<sup>19</sup>

Developmental claims, purporting to foster the health and development of the child, were identified on infant and toddler foods, extending the observation from infant and toddler formula.<sup>20 21</sup> We identified childhood development claims on half of the toddler foods and one-quarter of infant foods, including claims related to development of taste preferences (eg, 'ideal for babies refusing foods' usually on products containing vegetables mixed with sweeter foods). There is no evidence that consumption of foods displaying such claims is associated with broader taste preferences, or improved development. On the contrary, current evidence suggests that to improve children's liking of vegetables in the first 5 years of life, repeated exposure to a variety of vegetables of different flavours and textures is vital,<sup>22</sup> including

serving plain-vegetables-first approach. In our audit, there were no single vegetable dishes, and most of the vegetable-based foods contained apple or sweet-tasting vegetables, such as carrots and sweet potatoes. Increased parental awareness of the need for repeated exposure to vegetables would create a new opening in the market for manufacturers to develop single vegetable foods scarcely available at present.

Further, development claims around oro-motor skills (eg, 'right texture for chewing which is important for speech development') were commonly observed on toddler snack foods, many of which were highly processed extruded puffs. These foods dissolve easily in the mouth, and as such are unlikely to present a choking hazard. As infants learn to chew and swallow a variety of foods, they should progress from meltable foods to those that are more challenging to chew and swallow.<sup>23 24</sup> However, in this audit many meltable foods were marketed for toddlers who should be learning to consume more challenging foods.

We observed both regulated and non-regulated claims being used in misleading ways. Despite regulation of the term 'no added sugar', this claim is permissible for infant and toddler fruit and vegetable-based puree foods with high free sugars content. Additionally, non-regulated claims suggesting a low sugar content such as 'natural sugars' and 'no concentrates' are frequently used on these products. In our audit, 85% of the fruit and vegetable-based infant foods displayed a sugar statement suggesting a low sugar content, despite being sweetened with fruit puree, consistent with our nutritional survey,<sup>4</sup> and surveys internationally.<sup>11 25–27</sup> One option for food regulators is to classify fruit puree as 'added sugar', similar to fruit juice and concentrates, as per Swan *et al*'s definition that expands the WHO's definition for free sugars to fruit puree and pastes.<sup>28</sup>



Moreover, we observed potentially misleading salt claims in close to half of all products, including in one-third of the sweet infant fruit purees where salt is not expected to be an ingredient. This may mislead parents as the 'no added salt' claim may give the product a health halo, potentially encouraging parents to assume that the product is healthier than it is due to its low sodium content. This misconception is a distinct possibility as focus group work indicates that mothers are mindful of sodium content.<sup>15</sup> Compared with infant snack foods, salt claims were observed less frequently on the toddler snack foods (60% of the savoury and sweet infant snacks, compared with 15% of the toddler snacks) as toddler foods are regulated under the adult nutrition content with a larger (adult) sodium allowance.

While evidence in this area is scant, given the tight regulation of infant formula, parents may incorrectly assume that there is similar regulation of nutritional content of commercial infant and toddler foods (often co-located with infant formula in the retail setting) and that these foods are nutritionally equivalent to (or better than) home cooked foods.<sup>15 29 30</sup> This is particularly an issue for toddler snack foods as they may also be consumed by infants, even though they are labelled for 12 months plu. The regulation of nutritional content and wellness better-for-you features of toddler foods should be separated from adult food products, given the physiological size difference between toddlers and adults and the importance of nutrition in these early years. Understanding the messaging communicated to parents purchasing foods for their babies is important to inform appropriate development of guidelines for labelling of infant and toddler food packaging, and, importantly, the translation of these guidelines into specific advice for parents and other consumers.

## CONCLUSION

Nutrition and wellness better-for-you features are common and pervasive on infant and toddler food labels. We identified allergen-free and developmental claims used to position infant and toddler foods as better-for-you, despite these foods largely being highly processed. Regulation of toddler food products separately from adult food is required, as is tighter regulation of the appropriate use of sugar and fruit puree statements on infant and toddler foods.

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RESEARCH

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# The big squeeze: a product content and labelling analysis of ready-to-use complementary infant food pouches in Australia

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## Abstract

**Background** Encouraging the early development of healthy eating habits prevents diet-related chronic disease. It is well understood that highly processed foods with high amounts of sugars, salt and fats are a risk factor for non-communicable diseases. Commercial baby foods in ready-to-use squeeze pouches emerged in the global food market around 2012. The long-term effects of this now ubiquitous packaging on the quality of infant diets, baby food consumption and marketing are unknown. This study aimed to conduct a rigorous mixed-methods audit of squeeze pouches in Australia to inform product regulation and policy.

**Methods** Nutritional and marketing data were sourced from products available in Australian retailers. Analysis of nutritional content, texture and packaging labelling and serving size was conducted. Pouches were given a Nutrition Profile Index (NPI) score and compared with the Australian Infant Feeding Guidelines. Marketing text was thematically analysed and compared to existing infant nutrition policy around regulation of marketing claims.

**Results** 276 products from 15 manufacturers were analysed, targeting infants from 4+ to 12+ months. Total sugar content ranged 0.8–17.5 g/100 g, 20% (n = 56) of products had added sugars, 17% (n = 46) had added fruit juice, 71% (n = 196) had added fruit puree. Saturated fat content ranged from 0.0 to 5.0 g/100 g, sodium 0.0–69 mg/100 g and dietary fibre 0.0–4.3 g/100 g. Only two products were nutritionally adequate according to a nutrient profiling tool. Marketing messages included ingredient premiumisation, nutrient absence claims, claims about infant development and health, good parenting, and convenience. Claims of 'no added sugar' were made for 59% of pouches, despite the addition of free sugars.

**Conclusions** Squeeze pouch products available in Australia are nutritionally poor, high in sugars, not fortified with iron, and there is a clear risk of harm to the health of infant and young children if these products are fed regularly. The marketing messages and labelling on squeeze pouches are misleading and do not support WHO or Australian NHMRC recommendations for breastfeeding or appropriate introduction of complementary foods and labelling of

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products. There is an urgent need for improved regulation of product composition, serving sizes and labelling to protect infants and young children aged 0–36 months and better inform parents.

**Keywords** Complementary feeding, Infant Young Child Feeding, Infant food regulation

## Introduction

Encouraging the development of healthy eating habits early in life sets individuals on a path towards the prevention of diet-related chronic disease [1, 2]. The first 1000 days of a child's life is a crucial period of early life development, wherein biology, environmental exposures and epigenetic effects that influence the risk of childhood obesity interact [3]. The World Health Organisation (WHO) recommends mothers exclusively breastfeed infants from birth to 2 years with 'complementary feeding' (giving solid foods), in addition to breast milk, to begin around 6 months of age. [4]. The introduction of foods and feeding practices, known as the complementary feeding period (6–24 months), is a developmental window which establishes long-term dietary intake patterns for the child and lays the foundations for nutrition and feeding practices over the life course [5, 6].

During the complementary feeding period, foods need to be age appropriate, nutritious and safe and fed in an adequate amount in a responsive manner [5, 7]. Macronutrients and micronutrients are necessary for appropriate growth and cognitive development in infants, with iron, zinc, phosphorus, magnesium, calcium, and vitamin B6 being particularly important [8].

Consuming foods containing iron is particularly important, as the infant's requirement for iron increases beyond what breastmilk alone can provide after 6 months of age [9]. To ensure a child meets their macro and micronutrients required for growth, UNICEF (2020) global nutrition guidance states that during the complementary feeding period children need to have a daily diet that is diverse, consisting of 5–8 food groups (breastmilk, grains, roots and tubers, legumes nuts and seeds, dairy, animal source proteins, vitamin A rich fruits & vegetables along with other fruits & vegetables). Along with this, UNICEF nutritional guidance recommends avoiding food or drink with low nutrient value and added sugars [7].

Similarly, the Australian Infant Feeding Guidelines [10] state 'that consumption of nutrient-poor foods with high levels of fat/ saturated fat, sugar, and/or salt should be avoided or limited' (pg 5) and no sugars should be added to food for children under 12 months of age [10]. Reasons for this avoidance include that frequent exposure to high sugar foods can have deleterious effects on the infant's dental health and development of taste preferences as well as increase susceptibility to diet-related chronic disease in later life [11–13].

Methods of feeding complementary foods utilised by a parent or carer during the complementary feeding period influences a child's feeding development. Oral motor skill acquisition during this time should include tongue lateralisation, chewing, gagging and swallowing with children being able to then apply these skills to different food textures [2]. Oral motor skills develop in connection with gross and fine motor skills to promote the development of self-feeding using fingers and hands (skills which mitigate future food fussiness during the toddler years) [5]. During this time the infant's taste perceptions are also developing, providing a foundation of taste variety across the spectrum of sweet, bitter, salty and sour [14, 15]. The greater the taste exposure, the more likely a child will accept a diverse diet with bitter vegetables and sweet fruits, forming dietary behaviours that are protective against chronic illness [2, 6, 16].

The complementary feeding period can be challenging for parents and carers who may be unsure about their child's needs and this constitutes an opportunity for commercial complementary food producers [17]. Squeeze pouches (also termed pouch-and-spout packaging or spout pouches) are a plastic retort baby food sachet or pouch with a mushroom-style cap containing pureed foods marketed as suitable for children aged 4 months–5 years [18–20]. Squeeze pouches enable children to consume wet ready-to-use food directly from the packet [21].

Manufacturers of squeeze pouches have targeted the complementary feeding period in Australia with their 'convenience' baby foods [18]. Squeeze pouches are the primary product sold in the Australian baby food market and have contributed to sales worth \$1.2 billion (AUD) [21, 22]. The industry is dominated by five main companies, with the largest market shares held by PZ Cussons (Holdings) Pty Ltd, Heinz Wattle's Pty Ltd and Bellamy's Australia Limited [21].

The increased market share of squeeze pouch baby foods has been driven by changes in the labour market and 'time-poor' parents seeking what they perceive as the healthiest food for their child [21]. The marketing of these products as 'convenient' and 'easy to feed' helps parents make quick decisions about which products to purchase for their infant.

Nutritional composition analysis of squeeze pouch infant food has been undertaken in the US, Germany, Denmark, UK and New Zealand [19, 23–27]. These analyses had a striking common finding, with all pouch products considered high in both total and added or free sugars when compared to other infant and toddler foods

[19, 23–27], with most of the total energy provided from free sugars [24]. Additionally, there was a predominance of apple, pear and sweet vegetable purees in squeeze pouches, and only small amounts of bitter vegetables and grains [25, 26]. Of concern is the finding that squeeze pouches available in New Zealand contained as little as 0.3 mg/100 g of iron, placing infants at risk of iron deficiency if complementary fed exclusively on commercial squeeze pouches [27].

In addition to the nutrient composition of squeeze pouches, there are concerns about the labelling and the marketing of these products to parents. In the USA, the Baby Food Facts Report (2016) found that most infant squeeze pouches do not support recommendations for encouraging healthy eating habits, and the marketing of the pouches is misleading about the true nutritional content of products, including the levels of sweetening [28]. Similarly, in the UK, a report by First Steps Nutrition (2018) found that many product names did not reflect their actual content, with 30% of 188 products analysed failing to mention the main ingredient (e.g. fruit puree) in the product name [26]. Despite the in-depth analyses of infant squeeze pouches products internationally, they have not been analysed within the Australian market. Rigorous analysis of Australian infant squeeze pouches, independent of other ‘infant and toddler foods,’ is particularly important given pouch products form the largest product range in the Australian baby food market [21]. In addition, some squeeze pouch products are marketed and viewed as a ‘whole’ meal for a child, encouraging parents to provide a large portion of their daily nutritional intake from a single product. Consequently, the nutritional composition and delivery of these products is paramount to a child’s nutrition and feeding development.

In Australia, regulation of commercial infant squeeze pouch products is limited. Nutritional content and nutritional content claims of squeeze pouches for sale in Australia have not been researched previously. The aim of this study was to conduct a rigorous mixed-methods product audit of commercial squeeze pouch products in Australia to inform regulation and policy.

## Methods

### Study design

We utilised a mixed-methods assessment of product labels to audit nutritional content and on-pack marketing claims. Quantitative and qualitative data was generated from front and back product labelling. Data was extracted for nutrient composition, marketing claims, recommended age of consumption, recommended serving size, serving mode (via spout or on a spoon), and texture.

### Data collection

Infant squeeze pouch products available between December 2018 and November 2019 were sourced from commercial retailers in Sydney, New South Wales, Australia. Retailers included Woolworths, Coles, Aldi, Big W, IGA, and Chemist Warehouse. These retailers hold approximately 85% of the Australian grocery retail market [29]. Products were photographed to capture the front, back, and side of package text. Internet searches were conducted to cross-check product availability and source products that may not have been available instore. Photographs of the products were entered into an Excel spreadsheet for analysis.

### Inclusion and exclusion criteria

Squeeze pouch products included were pureed, semiliquid foods pre-filled in plastic pouches with a spout and screw cap [21, 24] that were marketed towards infants and toddlers. The recommended age was identified by labelling indicating that the product was suitable for children aged 4+ months, if the product was sold in the baby food aisle, or labelled with images suggesting it was appropriate for infants or toddlers aged 0–36 months, such as toddler cartoon characters (e.g. Peppa Pig™). Squeeze pouch products were excluded from data collection if they were aimed at older children and adults (e.g. packing indicated ‘added protein for muscle gain’) or products without marketing or instructions suggesting their use for infants or toddlers (e.g. squeeze pouch products containing preserved fruits found in the tinned fruit aisle).

### Data extraction

#### Nutritional content assessment

Nutrient composition was copied from the ingredients list and nutritional information panel (NIP) on packaging (expressed as g/100 g) by one researcher (KB). Where nutrient content was not reported by the manufacturer, the product was not excluded from analysis, and individual variables were labelled as missing. To ensure continuity and accuracy of data extracted, the entries were cross-checked and corroborated with information provided on manufacturers’ websites. In addition, the extracted data was intermittently independently reviewed by CF and LS to ensure data quality was upheld.

Nutrition information from each product’s NIP was recorded per 100 g for energy, protein, total fat, saturated fat, carbohydrates, sugars, dietary fibre, sodium (mg) and iron. The adequacy of macronutrients and micronutrients were ascertained using the Nutrient Reference Values recommended by the Australian National Health Medical Research Centre (NHMRC) for infants 0–12 months and children 1–3 years [8]. In addition to nutrient values, product content and labelling were compared



to the Australian National Infant Feeding Guidelines in relation to compliance for age of introduction, texture and suitability of content e.g. recommendations regarding added sugars [10].

In Australia, currently there is no requirement regarding labelling of free sugar content in the nutrition label on packaged foods [30], neither is there a consistent or national definition of what constitutes 'free sugars'. For the purpose of this study, we adopted the definition of free and 'added sugars' used by Public Health England: 'free sugars includes all added sugars in any form; all sugars naturally present in fruit and vegetable juices, purées and pastes and similar products in which the structure has been broken down; all sugars in drinks (except for dairy-based drinks); and lactose and galactose added as ingredients. The sugars naturally present in milk and dairy products, fresh and most types of processed fruit and vegetables and in cereal grains, nuts and seeds are excluded from the definition' [31]. To record and analyse the free sugars in each product we utilised the listed ingredients and observed whether the products were labelled as containing or not containing free sugars. Product total sugar content was determined, in accordance with the Australia New Zealand Food Standards Code (Schedule 4) definitions, with values generated from the NIP [32].

#### **Product classifications**

For analysis, products were grouped according to the manufacturer name e.g. Bellamy's Organic and their primary ingredient food grouping, as listed on the back packaging. The food groupings were guided by the five core foods outlined in Australian Dietary Guidelines (ADG) such as fruit, vegetable, meat, dairy, grain [33]. Product labelling policy in Australia requires ingredients to be listed in order of greatest to least amount [32] and an assumption was made that the order in the ingredients list was accurate. In this paper, we use the language 'main ingredient' in reference to the first listed ingredient.

Products were also classified and grouped by the age recommendation stated on the product label. Age categories on product labels were presented as developmental feeding milestones of 4+ months, 6+ months, 8+ months and 12+ months.

#### **Texture**

Texture was recorded as smooth puree or with lumps according to the packaging description, or as directly visualised through packaging windows (when present).

#### **The Nutrition Profile Index (NPI) score**

The Nutrition Profile Index (NPI) was used to assess the quality of squeeze pouches [34–36]. The Nutrition Profile Index uses a scoring system where points are allocated

for energy, saturated fat, total sugar and sodium, and subtracted for fruit, vegetables, nuts, fibre, and protein. Where specific nutrients were not reported in the nutrient information panel, points were not allocated to the product. For ease of interpretation, scores were adjusted to fit a 0–100 scale, where a score less than 74 denotes poor nutritional quality, a score between 74 and 82 moderate nutritional value, and greater than or equal to 84 is nutritionally adequate [28].

#### **Age appropriateness of product**

Age suitability was assessed independently using the CODEX international food standards that state 'The label should indicate clearly from which age the product is recommended for use. This age shall not be less than six months for any product' [37]. Labelling indicating that products were suitable for infants under 6 months were assessed as not age appropriate. In addition, products targeted at 6+ months were assessed on their product texture and if this was in accordance with the outlined recommendations in the Australian infant feeding guidelines of 'from 6 months of age, infants should be offered purees and then mashed foods, progressing to minced and chopped foods by 8 months most infants can manage 'finger foods' by 12 months' [10]. Product serving sizes were also recorded for each product, described in grams per serve, and servings per package.

#### **Marketing claims**

All on-pack information regarding the product health claims and any additional messaging were recorded. Product claims were compared to Standard 1.2.7 'Nutrition, health and related claims' of the Australia New Zealand (ANZ) Food Standards Code [32]. The accuracy of claims and ingredients listed on the front label were compared to those recorded in the NIP to determine if front of pack information and claims breached the Food Standards Code. Claims were deemed 'regulated' if they complied with general health claims (e.g. contributes to general child development) or high level health claims (e.g. calcium for enhanced bone mineral density) [32], whilst 'unregulated' claims were those regarding taste, convenience, exclusion of elements such as preservatives, natural, organic or other messages relating to product promotion. Additionally, regulated and unregulated claims were thematically analysed from the perspective of how a parent might interpret the claims at the point of purchase. Text on front and back of packaging was utilised for the thematic analysis of all claims combined. For the purpose of this study, we have defined infants (0–12 months) and toddlers (13–36 months).

## Analysis

Statistical analysis of quantitative data was undertaken using Statistical Package for Social Sciences version 25 (SPSS, version 26 IBM corporation, NY). For nutrient content information, median range and distribution were calculated to determine the nutritional range of squeeze pouch products. Data was assessed for normality using the Shapiro-Wilk test. Depending on the distribution, continuous data are reported as mean  $\pm$  standard deviation. Frequency and proportions were determined and compared for each product and age category.

Separate one-way analysis of variance (ANOVA) was used to identify relationships between nutrients (saturated fat, total sugars, sodium per 100 g), and the NPI score grouped in classifications of nutritional value (poor, moderate or adequate) for the target age of the squeeze pouch product (4, 6, 8 or 12 months).

Thematic analysis of qualitative data was utilised to find common themes that manufacturers used on the pouch products as information to consumers. Themes were grouped into sub-themes to further differentiate nuances of coded text for interpretation. Proportions were then calculated to determine frequency of use of the themes on packaging for different age categories.

## Results

### Product nutritional and textual composition analysis

Between December 2018 and November 2019, 276 commercial squeeze pouch products from 15 manufacturers were identified.

#### Overall description of product composition by primary ingredient.

43% (n=119) of pouches were fruit-based, 32% (n=88) dairy-based, 21% (n=59) vegetable-based, 3% grain-based (n=9), and one product's primary ingredient was water.

Only two products were found to be nutritionally adequate according to the NPI scoring system, with 53% (n=146) having poor nutrition (NPI score < 74) and 46% (n=128) of moderate nutritional quality. Pouches with the lowest nutritional quality were dairy-based, with 97% (n=66) of products scoring less than 74, followed by grains with an average NPI score of 71. Vegetable product groupings had the highest NPI score ( $77.9 \pm 3.5$ ) (Table 1).

Dairy-based squeeze pouches had the highest energy ( $366 \pm 64$  kJ/100 g) and saturated fat content of all products ( $2.08 \pm 1.12$  g/100 g). Total sugar of all products ranged from 0.8 to 17.5 (g/100 g). Fruit-based pouches contained an average of  $9.8 \pm 3.1$  g/100 g, and dairy-based pouches contained an average of  $8.0 \pm 3.3$  g/100 g total sugar.

**Table 1** Overall squeeze pouch product nutrient description by primary ingredient

	Average NPI Score (SD)	Poor nutritional quality (NPI < 74) %	Moderate nutritional quality (NPI $\geq$ 74, < 84) %	Nutritionally adequate (NPI $\geq$ 84) %	Energy KJ/100 g (mean $\pm$ SD)	Total Sugar g/100 g (mean $\pm$ SD)	Protein g/100 g (mean $\pm$ SD)	Saturated Fat g/100 g (mean $\pm$ SD)	Sodium mg/100 g (mean $\pm$ SD)	Dietary Fibre g/100 g (mean $\pm$ SD)
Vegetables	$74.4 \pm 3.5$	28.8	67.8	3.39	$239 \pm 48$	$2.8 \pm 1.2$	$2.5 \pm 0.9$	$0.45 \pm 0.46$	$15.1 \pm 9.3$	$1.7 \pm 0.6$
Fruit	$74.4 \pm 3.8$	29.4	70.6	0	$275 \pm 55$	$9.7 \pm 3.1$	$1.1 \pm 1.0$	$0.22 \pm 0.33$	$7.4 \pm 6.8$	$1.7 \pm 0.6$
Dairy	$66.0 \pm 3.8$	97.7	2.3	0	$366 \pm 64$	$8.0 \pm 3.3$	$3.5 \pm 0.9$	$2.08 \pm 1.12$	$41.9 \pm 14.3$	$1.1 \pm 0.8$
Grains	$71.1 \pm 2.5$	77.8	22.2	0	$246 \pm 57$	$2.1 \pm 2.5$	$2.0 \pm 1.2$	$0.22 \pm 0.26$	$10.9 \pm 6.2$	4.3

**Table 2** Overall squeeze pouch product nutrient description by target age group

Product target age (n)	NPI Score (mean ± SD)	Main ingredient vegetable (% of age group) (mean ± SD)	Energy (kJ) (mean ± SD)	Total Sugar (g/100 g) (mean ± SD)	Protein g/100 g (mean ± SD)	Saturated Fat g/100 g (mean ± SD)	Dietary Fibre g/100 g (mean ± SD)	Sodium mg/100 g (mean ± SD)
4+ months (74)	75.2 ± 3.50	12 (16.2)	248 ± 49	8.7 ± 3.6	0.87 ± 0.57	0.22 ± 0.34	1.6 ± 0.69	6.0 ± 6.1
6+ months (110)	71.6 ± 5.72	34 (30.9)	293 ± 77	6.4 ± 3.9	2.3 ± 1.3	1.3 ± 1.2	1.6 ± 0.49	19.8 ± 15.0
8+ months (37)	70.4 ± 4.67	13 (35.1)	289 ± 66	6.4 ± 4.9	2.1 ± 1.1	0.49 ± 0.50	2.1 ± 1.0	18.5 ± 15.7
12+ months (12)	67.8 ± 4.55	0 (0)	345 ± 65	8.4 ± 3.8	2.5 ± 1.2	1.4 ± 0.94	1.4 ± 0.4	23.8 ± 9.83
Not stated (43)	-	-	-	-	-	-	-	-

**Table 3** Free sugar\* content of squeeze pouch products by recommended age

Product target age (n)	Total reported sugar content on label g/100 g (mean ± SD)	Total number of products by age group containing free sugars n (%)	Types of sweeteners used in product composition			
			Fruit Juice ONLY n (%)	Fruit Puree ONLY n (%)	Fruit Juice AND Fruit Puree n (%)	Fruit Puree Concentrate n (%)
4+ months (74)	8.7 ± 3.6	64 (86.5)	0 (0)	54 (73.0)	10 (13.5)	0 (0)
6+ months (110)	6.4 ± 3.9	74 (67.3)	3 (2.72)	61 (55.5)	10 (9.09)	0 (0)
8+ months (37)	6.4 ± 4.9	23 (62.2)	1 (2.70)	14 (37.8)	8 (21.6)	0 (0)
12+ months (12)	8.4 ± 3.8	9 (75.0)	0 (0)	8 (66.7)	1 (8.33)	0 (0)
Not stated (43)	8.6 ± 3.0	31 (72.1)	1 (2.32)	16 (37.2)	11 (25.6)	3 (6.98)

\*Free sugars includes all added sugars in any form; all sugars naturally present in fruit and vegetable juices, purées and pastes and similar products in which the structure has been broken down including all sugars in drinks (except for dairy-based drinks)

Age-Appropriateness of squeeze pouch products

### Description of products by target age group

A large proportion of squeeze pouch products available were targeted at infants aged 6+months (40%, n=110), followed by 4+months (27%, n=74), 8+months (13%, n=37) and 12+months (4%, n=12) (Table 2). A small proportion of pouches did not include a target age group despite packaging or product placement suggesting they were suitable for infants or toddlers (16% (n=43)). Of the pouches targeted at 12+months, none had a vegetable as a primary ingredient (see Table 2). Squeeze pouches with the lowest nutritional quality were targeted at infants 12-months and older, with an average NPI of 67.8 ± 4.55. Squeeze pouches positioned for infants 4+months of age had the highest NPI score, although the median score of 75 still only placed products in a moderate classification for nutritional adequacy.

Squeeze pouches across all age categories were energy dense, with 4+month and 12+months pouches containing between 248 ± 49 and 345 ± 65 kilojoules (kJ) per 100 g. Saturated fat was reported in 187 (67.8%) products, ranging from 0.0 to 5.0 Fat (g/100 g). The targeted age group with the highest amount of saturated fat was 12+months, with a mean of 1.4 ± 0.94 g/100 g. Total sugar content in squeeze pouches for younger infants 4+months was 8.7 ± 3.6 g/100 g and in 12+month squeeze pouches 8.4 ± 3.8 g/100 g. The saturated fat content was different between products for different age groups ( $p < .001$ ) but not total sugar.

### Micronutrients

Sodium content ranged from 0.0 to 69 mg/100 g and was 19.8 ± 15.0 and 23.8 ± 9.83 mg/100 g for 6+month and 12+month pouches, respectively. Sodium was significantly higher in dairy-based products (41.9 ± 14.3 mg/100 g) than vegetable-based products (15.7 ± 9.5 mg/100 g). Manufacturers with the highest average sodium content included The Collective Dairy (61.3 ± 2.4 mg/100 g), Parmalat (46.4 ± 15.4 mg/100 g), Brownes Food Operations (47.3 ± 1.0 mg/100 g), LD&D Australia (44.2 ± 1.2 mg/100 g), and Tamar Valley Dairy (34.6 ± 5.8 mg/100 g). All products were within the sodium guidelines of the ANZ Food Standards Code [32].

No products reported iron content, nor fortification with iron. Of the 68 (24.6%) products that reported calcium content, 65 were dairy-based products and 3 were fruit-based yoghurts. Only 16 meet the daily AI of calcium for the respective age group. The average reported calcium content per 100 g was 162 mg (SD 51.4 mg).

### Free and added sugars

Overall, 72.8% (n=201) of all products contained free sugars. Free sugars were found in 86.5% of squeeze pouches targeted at infants 4+months, mostly in the form of fruit puree (73%) (Table 3). Additionally, 67% of squeeze pouches targeted at children 12+months and 55.5% of squeeze pouches targeted at infants 6+months contained added sugar in the form of fruit puree. Squeeze pouch products with no identified age suitability contained greater amounts of free sugars and contained both

fruit juice and fruit puree (26%) and fruit puree concentrate (7%). Only 9.1% of all products included any bitter or green vegetables (spinach, broccoli) and, where included, these were mixed with free sugars. Products manufactured by Nestle, Only Organic, The Infant Food Co, Parmalat, Aldi, and Coles were especially high in free sugars ( $12.3 \pm 1.1$ ,  $9.5 \pm 4.8$ ,  $8.1 \pm 4.4$ ,  $9.1 \pm 2.5$ ,  $8.4 \pm 4.2$  and  $9.2 \pm 3.3$ , respectively). No products reported added monosaccharides or disaccharides in the ingredients list (including terms such as 'sugar', 'glucose' and 'sucrose').

An age recommendation was provided on 233 (84%) products, with an average of 6 months. However, 26.8% of products were marketed for infants aged 4+ months and consequently in breach of CODEX Standards, as well as encouraging feeding practices against WHO recommendations.

88.8% ( $n=245$ ) of products were categorised as smooth. While all products marketed for infants 6+ months of age were texturally appropriate, only 29.7% ( $n=11$ ) of products marketed for 8+ month-old infants were of an appropriate lumpy texture. All contents of 4+ month squeeze pouches were smooth purees without lumps. Only 55.4% ( $n=153$ ) of product labels recommended feeding the product with a bowl or spoon. Serving sizes were mostly 120 g (70.7%,  $n=195$ ), irrespective of marketed age (Table 4).

## Product labelling and marketing analysis

### Marketing themes

Analysis of packaging found six key marketing themes on front of pack labels: child development, child health, meal replacement, product premiumisation, convenience and good parenting. Product premiumisation promoted the inclusion of ingredients that were organic, natural, and good, for example "well-balanced, varied and nutritious" (Aldi). The front of pack text about general child development focussed on elements such as infant growth, such as "protein for growing bodies" (Parmalat), "vital part of your child's early development" (Aldi), and "strong bones and teeth" (Parmalat). Front of pack labelling also targeted convenience "perfect size to travel with, as you explore the world together on the go" (Smiling Tums, Woolworths) and referred to being a 'good parent'

or has messages seemingly to assuage guilt "Just as good as homemade" (Rafferty's Garden, PZ Cussons). Other marketing messages included the absence of ingredients, for example "no added sugar," "no added salt," "no preservatives," and "no artificial colours." (see Tables 5 and 6).

When the themes and groupings were analysed by age, the most common were unregulated absence claims [32] for example, "no artificial colours, flavours or preservatives" and premiumisation claims based on use of organic ingredients. These claims appeared on all products targeted at age groups 4+ and 6+ months. Regulated messages [32] about 'no added sugar and salt' were also common on products for 4+ and 6+ months, with almost two thirds of these products claiming 'no added sugar' on the front of pack label. ANZ Food Standards Code Schedule 4 [32] regulated general and high-level health claims regarding child development were most common for products targeted at 6+ months, whilst claims relating to child bone health were more common for products targeted at 8+ months. Unregulated claims regarding 'away from home convenience' and 'meal replacement' were made predominantly for products that targeted infants aged 4+ and 6+ months.

### Label analysis and 'mis-information'

There were discrepancies between the product title and actual listed ingredients of some products, with 9.4% of products marketed as containing vegetables only, 35.5% as fruits only, 0.7% as grain products only, and 21.4% as dairy-based products. The remainder were marketed as containing a combination of vegetables, fruits, meat, or grains. Despite 25 (9.1%) products reporting meat as the primary ingredient in the title, none listed meat as the main ingredient on the ingredients list and 22 of these (88%) listed the main ingredient as vegetables. Similarly, 44 (15.9%) products reported vegetables first in their title but only 32 (73%) of those listed a vegetable as the main ingredient. Only 92 (33.3%) squeeze pouch products contained a fruit as the first ingredient in the title, but 119 (43.1%) products listed fruit as the main ingredient.

Only 57 (21%) products were labelled as sweetened, yet 201 (73%) of products had free sugars, 17% ( $n=46$ ) in the form of added fruit juice, and 71% ( $n=196$ ) with added fruit puree. Several products contained more than one form of free sugar, as shown in Table 2. Some products (16.3%,  $n=44$ ) were labelled "no added sugar" or "no sweeteners" despite containing free sugar.

## Discussion

Squeeze pouch products form a large part of the Australian commercial complementary food market for young children aged 4 months to 5 years. Unfortunately, our findings were that most squeeze pouch products for infants and toddlers in the Australian market were

**Table 4** Age and texture appropriateness of products

Target age group (n)	Meets texture guidelines n (%)	Serving size (g) (mean $\pm$ SD)	Serving size 120 g n (%)
4 months (74)	0 (0)	$118.8 \pm 6.0$	71 (95.9)
6 months (110)	110 (100)	$114.6 \pm 14.1$	89 (80.9)
8 months (37)	11 (29.7)	$111.7 \pm 21.0$	31 (83.8)
12+ months (12)	0 (0)	$105.8 \pm 35.5$	4 (33.3)
Not stated (43)	NA	$93.3 \pm 29.4$	0 (0)

**Table 5** Marketing Themes and packaging examples

Themes	Sub themes	Front of Packaging example
<b>General Child Development</b>	<b>Growth</b>	vital part of your child's early development (Mamia Organic, Aldi) Dairy goodness for growing kids (Pauls, Parmalat) Protein for growing bodies (Vaalia, Parmalat)
<b>Child health</b>	<b>Bone Health</b>	calcium for strong bones (Vaalia, Parmalat) strong bones and teeth (Vaalia, Parmalat) contributing to daily intake [calcium] for happy bones (Rafferty's Garden, PZ Cussons)
	<b>Immune System</b>	Rich in vitamin C which helps to support the immune system and the absorption of iron. (Cerelac, Nestle)
	<b>Probiotics</b>	Contains inulin (Farex, Heinz Company) 3 probiotics (Vaalia, Parmalat) live probiotics for some tummy lovin', Billions of live probiotics per pouch. (The Collective Dairy)
	<b>Other</b>	give your tummy some really good lovin' (The Collective Dairy) Vitamin B12 for sustained energy and concentration (Vaalia, Parmalat Australia)
<b>Meal Replacement</b>	<b>Breakfast</b>	Ready to eat breakfast (Farex, Heinz) Brekky to go (Little Kids, Heinz) Yummy breakfast (Smiling Tums, Woolworths) Baby breakfast (Farex, Heinz)
	<b>Complete 'meal'</b>	Yummy meal (Heinz) Perfect for lunch or dinner (Only Organic) Fruit and veggie meal (Smiling Tums, Woolworths)
<b>Premiumisation of product</b>	<b>Premium ingredients used</b>	made with full cream milk for dairy goodness (Heinz) purest 100% dairy (Brownes Dairy) goodness of New Zealand organic whole milk (Only Organic) well-balanced, varied and nutritious... wholesome premium products (Mamia, Aldi)
	<b>Expert development</b>	Exclusive, stringent quality (Mamia, Aldi) developed by our baby food EXPERTS (CUB, Coles)
	<b>High quality and trust</b>	only the best will do (Baby Macro, Woolworths) high quality ingredients (Bellamy's Organic) ensure product quality (Rafferty's Garden, PZ Cussons) loving developed... Products that you can trust (Mamia, Aldi)
	<b>Organic</b>	carefully selected organic ingredients (Heinz) Organic ingredients (multiple brands) Certified organic (multiple brands)
	<b>All 'Natural'</b>	premium, natural, goodness of wholegrains (Rafferty's Garden, PZ Cussons) Carefully selected natural fruit. (Cerelac, Nestle) vegan (Only Organic) no nasties (Bub's Organic, The Infant Food Co) packed with goodness (Vaalia, Parmalat)
<b>Away from home convenience</b>	<b>Eating on the go</b>	perfect to take on your adventures together (Smiling Tums, Woolworths) perfect size to travel with, as you explore the world together on the go (Smiling Tums, Woolworths) enjoy custard wherever you are... home, work or on the go (Pauls, Parmalat)
	<b>School lunches</b>	freeze for lunchboxes (Yoplait, LD&D Australia)
<b>Good parenting</b>	<b>Wanting the best for your child</b>	We know that grown-ups want the best for their babies... (Rafferty's Garden, PZ Cussons) Giving your little ones a pure start to life (Bellamy's Organic)
	<b>Equivalent to 'home-made' products</b>	Just as good as homemade (Rafferty's Garden, PZ Cussons) next best thing to homemade food. (Rafferty's Garden, PZ Cussons)
	<b>Caring for your child</b>	protect and care for your little cub (CUB, Coles) helps your kids feel good on the inside (Vaalia, Parmalat)

inappropriate for use as complementary foods. Most products were nutritionally inadequate with a poor nutrient profile index scoring (only two were considered nutritionally adequate), and were micronutrient deficient (low in iron-rich ingredients and calcium) while being energy dense and high in (free/total) sugars. They were almost uniformly pureed and designed to be fed to children in a way that is developmentally inappropriate.

Serving sizes were too large for infants while the products and commonly labelled as suitable for infants from 4 months, an age at which children should not be eating complementary foods at all. Finally, claims made on these products were commonly false or misleading. Each of these inadequacies has implications for child health and development.



**Table 6** Marketing claims on products categorised by front of pack recommended age

Claims	Product front of pack recommended age (n = total number of products analysed in age grouping)					
	Age not reported (n = 43) n (%)	4 months (n = 74) n (%)	6 months (n = 110) n (%)	8 months (n = 37) n (%)	12 months (n = 12) n (%)	Total (n = 276) n (%)
General Child Development						
General Development*	0 (0)	8 (11)	13 (12)	0 (0)	0 (0)	21 (8)
Child health						
Digestive Health*	0 (0)	0 (0)	1 (1)	5 (14)	0 (0)	6 (2)
Bone Health*	20 (47)	0 (0)	0 (0)	3 (8)	4 (67)	27 (10)
Immune System*	0 (0)	3 (4)	1 (1)	0 (0)	0 (0)	4 (1)
Ingredient Premiumisation and Absence claims						
Premiumisation	19 (44)	41 (55)	51 (46)	1 (3)	1 (8)	113 (41)
Mentions "Organic"	4 (9)	39 (53)	55 (50)	9 (49)	3 (25)	110 (40)
Probiotic	17 (40)	0 (0)	3 (3)	0 (0)	0 (0)	20 (7)
Meal Replacement						
Breakfast	0 (0)	2 (3)	6 (5)	2 (5)	6 (50)	16 (6)
Lunch/dinner	0 (0)	0 (0)	0 (0)	1 (3)	0 (0)	1 (0.3)
Dessert	0 (0)	0 (0)	0 (0)	1 (3)	0 (0)	1 (0.3)
Mentions "meal/mealtime"	1 (2)	13 (18)	17 (15)	0 (0)	1 (8)	31 (11)
Convenience						
Away from home	9 (21)	21 (28)	36 (33)	0 (0)	6 (50)	71 (26)
Good parenting						
Good parenting	0 (0)	33 (45)	38 (14)	1 (3)	0 (0)	72 (26)
Additional absence claims						
Claims "No Added Salt"	0 (0)	51 (69)	53 (48)	17 (47)	0 (0)	121 (44)
Claims "No Added Sugar"	10 (23)	52 (70)	79 (72)	22 (59)	1 (8)	164 (59)
No artificial colours	34 (79)	71 (96)	99 (90)	37 (100)	12 (100)	253 (92)
No artificial flavours	29 (67)	74 (100)	110 (100)	37 (100)	12 (100)	262 (95)
No preservatives	34 (79)	68 (92)	106 (96)	32 (86)	8 (75)	248 (90)

\*regulated claim e.g. "...helps to support the immune system" [32]

### Iron and calcium deficient

No products reported iron content, nor fortification with iron, which is greatly concerning given the important role of iron for child growth and neurological development [38]. With iron stores depleted by 6 months of age, iron-rich foods are a crucial element to first foods at 6 months of age with the recommended daily intake for infants 7–12 months being 11 mg/day or the infant is at risk of iron deficiency (ID) [8]. ID is the most common micronutrient deficiency worldwide and young children are especially at risk due to their rapid growth [38]. Often ID is associated with lower-middle income countries where food insecurity and insufficient access to animal protein or iron-rich foods during infancy can result in immunosuppression, poorer cognitive function and stunting [38]. However, children in Australia and New Zealand who consume high amounts of low iron-rich complementary foods are also at risk of ID [22, 27, 38]. Additionally, calcium is fundamental for musculoskeletal development and growth [39]. Only 68 (24.6%) of products reported calcium content which was predominantly from the dairy-based product group, and of these only 16 met the

daily AI for 7–12 months of 270 mg/day of calcium [8]. Thus, if young infants are fed predominantly squeeze pouch products as complementary foods, they are at risk of micronutrient deficiencies.

### Energy dense

Pouches across all age categories were energy dense, with 4+ month and 12+ month squeeze pouches containing between 248 and 345 kilojoules (kJ) per 100 g. A healthy active infant is recommended to have a daily kJ intake of between 2,500 and 3,500 kJ/per day depending on age [8]. Depending on serving size, a single squeeze pouch may contribute to excessive daily energy intake, if consumed frequently. Several elements contribute to the energy dense nature of pouch products, one being high levels of saturated fats followed by high levels of free sugars [26]. From the current audit, saturated fat was reported in 187 (67.8%) of pouch products, averaging 1.13 g/100 g (SD 1.13, range 0.0–5.0 g/100 g). The targeted age group with the highest amount of saturated fat was 12+ months, with an average of 1.4 g/100 g. With the Australian Infant feeding guidelines recommending 'consumption



of nutrient-poor foods with high levels of fat/ saturated fat, sugar, should be avoided' for children 12 months and under [10], the finding that over half the squeeze pouch products in the Australian commercial baby food market, contain saturated fats and 72.8% contained added sugars should be considered a public health concern.

### High in sugars and sweetening

The research found that total sugar content in products across all ages groups was high. Total sugar was found to be highest in pouches for younger infants (4+months) ( $8.7 \pm 3.6 = \text{g}/100 \text{ g}$ ) and toddlers (12+month) ( $8.4 \pm 3.8 \text{ g}/100 \text{ g}$ ), which is concerning given the Australian Infant Feeding Guidelines recommends children 12 months and under should 'limit the intake of all foods with added sugars and not to add sugars to complementary foods' [10]. Our findings concur with all other national [22, 40] and international (UK, NZ, Denmark, and US)[24–27] commercial infant squeeze pouch and baby/toddler food audits that found squeeze pouch products to be high in total and free sugars. In particular, Katiforis, Fleming [27] found squeeze pouch products to be higher in total sugars when compared to other commercial baby food products not delivered in squeeze pouches.

The current analysis found an alarmingly high proportion of products contained free sugars (72.5%) in the form of added sugar, fruit purees, and fruit juices. Most concerning was 86.5% of pouches for 4+month-old infants contained free sugars, mostly in the form of fruit puree (73%), which could be impactful on long-term eating behaviours and metabolic outcomes [41]. Troublingly, squeeze pouch products that had no age specified, were using greater amounts of free sugars with products containing both fruit juice and fruit puree (26%) and fruit puree concentrate (7%).

Frequency and levels of sweeteners in squeeze pouch products are aided by the lack of a regulatory definition of 'added' or 'free' sugars in Australia [30]. The current ANZ Food Standards Code does not contain a definition of 'added sugar', although it does include criteria for making a claim regarding 'no added sugars' including honey, malt (extract), and concentrated fruit juices. Until a regulatory definition of 'free or added' sugars that encompasses 'all sugars harmful to health' is implemented, it is likely that squeeze pouches will commonly include sweetening agents such as fruit puree, placing young children at risk of long-term poor health outcomes.

Increased intake of sweet foods in infancy is known to contribute to a sweet taste profile preference [14]. In contrast, repeated exposure to savoury/bitter flavours increases their ongoing acceptance [6, 42]. With an evolutionary drive for young children to prefer calorie-dense sweet foods and reject bitter (or potentially toxic) foods [14], and an absence of regulatory oversight, it is not

surprising that the food industry blend sweet fruit and vegetables in squeeze pouch products [22, 25, 43, 44]. Mixing dark green vegetables with sweeter vegetables or fruits or non-nutrient sweeteners derived from fruits (puree concentrate) increases product acceptance due to these evolutionary mechanisms [14, 25, 45].

Additionally, while our audit found 21.4% of all products contained a vegetable as the main ingredient, most were starch-based vegetables (pumpkin, potatoes, sweet potato) which have a relatively sweet flavour profile. Only 9.1% of products included any bitter or green vegetables (spinach, broccoli) and where included these were mixed with free sugars such as fruit puree, fruit puree concentrates and fruit juices. Only one product 'eat your greens' by Heinz had a standalone, non-mixed flavour profile of vegetables without any form of sweetening.

### Puree texture

For optimal feeding development, introduction of complementary foods should have an age-appropriate texture and consistency [5]. Despite this, only 43.8% of products met guidelines for appropriate texture for age. Given that 12-month-old infants should be consuming whole family foods with a variety of textures, all squeeze pouches marketed at this age group fail to meet the textural needs of these infants and compromise the child's feeding development.

### Feeding method and portion size

The impact of energy dense products for infants during the early feeding development window can also be exacerbated with the spout and pouch packaging of squeeze pouches enabling the child to consume large amounts of food in an inappropriate manner in a short period of time [24]. The spout nozzle provides ease of consumption for the child without the need for oral processing such as chewing, or tongue lateralisation, along with the smooth texture of the pouch contents which can be easily squeezed at a rapid rate into the child's mouth [27]. Only 50% of products in the current study contained advice to use a spoon or bowl. No product contained a warning not to squeeze contents directly into the infant's mouth. According to consumer research in the UK, parents commonly allow infants to self-feed directly from the pouch or the parent squeezes food directly from pouch into the infant's mouth [26, 31].

Most pouches in the current audit targeted at ages 4+ to 8+ months contained 120 or more grams per pouch product. In accordance to dietary guidance a child aged 4 months should not be consuming any complementary foods until 6 months of age [4, 10], therefore products that are available with a 120 g serve size are in excess of what a 4 and 6 month old child is required per meal serving [10]. If the child can easily consume food from

the squeeze pouch as discussed above, concern arises surrounding the risk of excess energy intake. Moumin and colleagues (2020) found 20% of commercial squeeze pouch products in Australia categorised as dessert and breakfast products contained two serve sizes per package, rather than a single serve per package, enabling a child to consume two serving sizes of a higher energy dense product at one time. With overall meal size (kcal) shown to be associated with excessive weight gain in young children [46, 47] and the suggestion that large portion sizes contribute to childhood obesity [48], regulation of product serve sizes that are in line with infant feeding guidance are required to prevent the risk of long-term poor metabolic outcomes for children [24].

#### **Inappropriately labelled as suitable for infants from 4 months**

Guidance from the WHO recommends that complementary food products be labelled to discourage their feeding to infants under 6 months. They state that 'complementary foods should include information on not introducing complementary feeding before 6 months of age and not carry messages or contain information which may lead mothers and caregivers to believe that these products are suitable for infants below 6 months of age' [49]. However, 26% of products in the study were labelled as suitable for infants from 4 months, potentially misleading parents to believe the products are suitable for children under 6 months (a 'vital part of your child's early development' in one case) in contravention of international and national guidance. Labelling commercial baby food products as '4 months' or 'from 4 months' has been shown to encourage parents to introduce complementary foods closer to four months than six months [43], displacing important nutrition from breastmilk. In addition to displacing breastmilk feeds, the early introduction of complementary foods risks the use of foods inappropriate for the infant's developmental age. It must be questioned why the Australia and New Zealand Food Standard allows complementary foods to be labelled as appropriate from 4 months of age when the Australian infant feeding guidelines are that they not be introduced until around 6 months.

#### **Misleading claims on packaging**

This study identified that parents are exposed to multiple marketing claims on labelling when considering purchasing squeeze pouch products, with all products included in the audit containing at least one marketing claim. Market messages on front of packet labels included ingredient premiumisation 'organic, natural, good ingredients, well-balanced, varied and nutritious' and product absence messages such as "no added sugar," "no added salt," "no preservatives," and "no artificial colours." Such messages mislead parents by fostering the impression

that the product is 'better for you' than the actual nutritional composition reflects [50, 51]. A review completed by Public Health England [31] found parents perceived products as healthy when front of packet labelling used wording such as 'organic' or 'free from sugar'.

Analysis conducted by Simmonds, Brownbill [50] in Australia found squeeze pouch packaging contained multiple claims on the one packet. Of the multiple claims included, some were regulated and some unregulated - this included the claim of 'no added sugar'. Although regulation does apply to the use of this specific claim in Australia, under the current definition in the ANZ Food Standards Code Schedule 4 [32] products can still contain high amounts of sweetening through use of free sugars, fruit juice concentrate and puree in formulation and use the 'no added sugar' claim, confusing parents on the true content of the product [51].

Parents are further misinformed when front of package labelling does not match the product contents and back of package labelling. For example, we found that despite 25 products reporting meat as the primary ingredient in the title, none listed meat as the main ingredient (particularly concerning given the low iron content of products, as discussed earlier). Similarly, 44 products reported vegetables first in their title but only 32 listed a vegetable as the main ingredient. Thus, in many instances product labels foster the perception that products are rich in iron or fibre from animal source foods or vegetables when this is not the case. When assessing the true free sugar content of products, we found only 21% of products labelled as 'sweetened' but that 72% of products contained free sugars. These products were often labelled as 'no added sugar' despite the high levels of sugars harmful to health in the product, directly misleading parents and carers. However, these nutrient absence claims are a violation of World Health Assembly (WHA) resolutions on ending the inappropriate promotion of foods for infants and young- children, which Australia, as a WHA member, is obliged to implement [49].

Despite complementary foods being intended to supplement breastfeeding, particularly for infants, none of the products we audited contained product messages that promoted breastfeeding and many squeeze products [31] had labels that described the product as a 'whole' meal or meal replacement. This may result in the displacement of breastfeeding if parents believe that the child's nutritional needs are met adequately through the product. The WHO recommends that foods complement the intake of breastmilk up to at least two years of age and that 'messages about complementary foods always include easily understood and clearly visible information on the importance of continued breastfeeding for up to two years or beyond' [49] but such messages are absent in the Australian squeeze pouch market.

## Strengths and limitations

Strengths of our study include the large sample size of commercial infant and toddler squeeze pouch products. The study has provided a comprehensive collection of nutritional and marketing data for these products that was previously unknown. A limitation of the study is the cross-sectional, single time point study design. All product information was collected from December 2018 and November 2019, product reformulation or additional products entering the market after this time point are not included in the analysis. To overcome this limitation ongoing monitoring of commercial pouch and spout products is essential to assessment of the nutritional content and potential impact for infants and toddler feeding development. Additionally, any data that may have been missing from the product nutrient information panels (for example, fibre), were not able to be included in the calculation on the NPI score.

## Conclusion

The current audit demonstrates that commercial infant squeeze spout and pouch products available in Australia are nutritionally poor, high in sugars harmful to a child's health, low in iron, not supportive of healthy development of infant feeding behaviours and labelling of products is misleading for parents. The long-term impact on a child's eating patterns and food acceptance of squeeze pouch products containing sweeteners such as fruit puree that are an inappropriate texture for their age and stage of development is unknown. Further the link between food refusal/fussy eating behaviours and the repeated exposure of pouch products with a sweet taste profile/puree texture is unknown [15, 52]. However, there is a clear risk that if infants are regularly fed these products their health will be harmed. Squeeze pouch products are likely to lead to premature cessation of exclusive breastfeeding if introduced before 6 months of age, resulting in increased vulnerability to infectious disease. In addition, delayed introduction to older infants of food with lumps and 'finger foods' is associated with poor oral motor development, affecting eating and speech. Moreover, high intake of sweet flavour profiles promotes ongoing acceptance of foods rich in free sugars, contributing to diet-related chronic disease extending into late childhood and adulthood. Furthermore, the marketing messages on squeeze pouches are not aligned with recommendations for breastfeeding or appropriate introduction of complementary foods, and appeal to parents through ingredient premiumisation and the promise of convenience at meal-times. Ready-to-use complementary squeeze pouches are an appealing product for parents in terms of convenience, but parents are potentially unaware of the true risk these products pose for their child's health. A decade on from the introduction of squeeze pouch products,

regulatory frameworks have not responded to established evidence on health and feeding impacts for children or kept pace with possible development opportunities in packaging that better support optimal feeding for infants and young children. As the market for commercial infant and toddler foods grows and squeeze products increase there is an urgent need for policy and regulation surrounding product composition, serving size and labelling to better inform parents. To promote the establishment of healthy infant eating patterns and protect the health of children, greater accuracy and accountability is needed in labelling of products marketed for toddlers and children under 12 months of age and improved composition of products is essential during this key period of growth and development.

## Recommendations

Given the growing use of complementary squeeze pouches in Australia for infants and children, there is a need to investigate further the frequency and pattern of use of squeeze pouches and their association with health outcomes. In addition, from a public health perspective to ensure all children can achieve optimal long-term dietary intake and health outcomes the following recommendations are made for the uptake by industry stakeholders and food regulators within Australia and across the globe:

1. Labelling must accurately represent the product's primary ingredients, so parents are not misled at the point of purchase.
2. National food standards need clear definitions of 'added' and 'free' sugars that includes all sugars 'harmful to health'. An upper total threshold limit for all forms of sugars 'harmful to health' needs to be set for commercial infant and young child food products. Free sugar labelling is currently under review by FSANZ [53].
3. Products should not be labelled or marketed for use by infants under 6 months of age, and need to comply with the WHA resolution on ending inappropriate promotion of foods for infants and younger children.
4. Foods in squeeze pouches with a spout for an infant or child older than 7 months need to have textures other than puree, in line with empirical evidence surrounding texture variety for optimal oral motor development. In the absence of a change in packaging, the products need a warning on the label on the front of the pack, stating that the method of feeding via the spout does not support normal infant feeding development and products should be used in this way in a limited manner.

5. Serving size should be standardised and labels should provide guidance for parents on age-appropriate servings.
6. Product reformulation is needed to include iron fortification and a varied flavour profile, with reduced use of concentrated sweetening to ensure children can start their life long nutritional journey with adequate nutrition and a variety of appropriate flavours.

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#### Authors' contributions

**Kaitlyn Brunacci** – Wrote manuscript, collected data, completed data analysis.

**Libby Salmon** – provided extensive guidance through data analysis, contributed to data collection, interpretation of results and contributed to written manuscript.

**Jennifer McCann** – provided guidance through data analysis, interpretation of results and contributed to written manuscript.

**Karleen Gribble** – provided guidance through data analysis, interpretation of results and contributed to written manuscript.

**Catharine A.K. Fleming** – Lead investigator of study and contributed through formulating study question, designed study measures and contributed to writing of manuscript.

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#### Data Availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

#### Competing interests

The authors declare no competing interests.

#### Ethics approval and consent to participate

not applicable.

#### Consent for publication

not applicable.

#### Competing interests

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