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Added-value avocado products: Evaluation of compositional data for potential nutritional claims

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Plant & Food Research: Lincoln

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This project is part of a BPA project on avocado led by Callaghan Innovation. This report covers two aspects of the project:

1. A literature survey on health benefits of avocado flesh that could inform possible future health claims for the flesh powders. This will also be used to determine intake amounts required to achieve the required concentrations of nutrients to meet a claim or achieve the recommended daily intake (RDI) and to avoid excessive intake of particular nutrients.
2. Interpretation of the analytical results for avocado flesh powder and determination of the possible claims allowable for specified nutrients under Food Standards Australia New Zealand (FSANZ) regulations.

There is a large amount of information in the literature on the composition of avocado and in some cases specifically 'Hass' avocado. Based on the composition of 'Hass' avocado in the New Zealand Food Composition Database (NZFCD) there are a number of nutrients present at claimable concentrations: dietary fibre, folate, vitamin B6, niacin, pantothenic acid, potassium and E. In addition to nutrients there are a range of phytochemicals present in avocado including: carotenoids (e.g. lutein), phenolics (e.g. quercetin, phenolic acids, p-coumaric and caffeic and their derivatives), phytosterols (e.g. beta-sitosterol, stigmasterol, campesterol, avenasterol) and chlorophyll. Unlike the nutrients, these compounds do not have RDIs and in most cases there are not pre-approved health claims that can be made for them. One exception is the phytosterols, which have claims for reducing blood cholesterol and reducing dietary and biliary cholesterol absorption. However, a food must contain a minimum of 0.8 g total plant sterol equivalents per serving but the concentrations of phytosterols in fresh avocado are much lower than this.

Based on the analysis conducted by AsureQuality a number of possible nutrient content claims are possible for Freeze-Dried Hass Avocado Flesh Powder. The exact claims will depend on the serving size but as an example if the serving size is 27.5 g of freeze-dried powder (equivalent to ~85 g fresh weight) the nutrient content claims that could be made are:

- Good source of dietary fibre
- Source of niacin
- Good source of vitamin B6
- Source of vitamin C
- Source of vitamin E
- Source of copper

A minimum serving size of 16 g is recommended otherwise claims for vitamins C and E drop off. Larger serving sizes could result in other claims possible but then the fat content and contribution gets very high. Even at a serving size of 27.5 g the powder contributes 26% of the recommended daily intake of fats. Based on the NZFCD data for fresh avocado it is likely that potassium and folate would be claimable in the avocado powder, but were not measured. It would be worth measuring these components to extend the number of possible claims.

As part of the project, Callaghan Innovation also carried out supercritical extraction of the freeze-dried flesh powder to defat it. The solvents used (supercritical CO_2, propane, dimethyl ether) extract most or all lipid-soluble compounds including the oil but no fibre, protein, B-vitamins and related compounds or minerals. Unfortunately no detailed compositional analyses of the defatted powders have been carried out. This will be worth doing, as with the removal of the fat will mean a concentration of the other components, and in turn meaning a smaller serve size may deliver the same nutritional value. However, it will also be important to check if the nutrients more sensitive to degradation, such as vitamin C, are retained. Lipid soluble components, like vitamin E, will presumably be lost with the oil.

To make health claims, a food must meet the Nutrient Profiling Scoring Criteria (NPSC). The Freeze-Dried Hass Avocado Flesh Powder has a nutrient profiling score of 2, which is under the 4 required for a food to be eligible to make pre-approved health claims. There is a significant list of possible pre-approved health claims that can be made for the Freeze-Dried Hass Avocado Flesh Powder. These claims fall under a wide diversity of overarching health areas:

- Digestive health
- Brain and nervous system
- Energy & metabolism (including reducing tiredness & fatigue)
- Skin
- Growth & development in children
- Heart & circulation
- Immune function & inflammation
- Hormonal function
- Joint health
- Cell & tissue growth
- Bone health
- Prevention oxidative damage (antioxidant)
- Oral health.

Some of these health areas are supported by multiple nutrients and these may offer the best opportunities for making claims.

In conclusion, there are a significant number of options for making nutrient content and pre-approved health claims for the Freeze-Dried Hass Avocado Flesh Powder under FSANZ regulations. Many of these claims align with the body of scientific evidence in the literature.

1 Project background

1.1 Aims

This project is part of a BPA project on avocado led by Callaghan Innovation. This report covers two aspects of the project:

1. A literature survey on health benefits of avocado flesh that could inform possible future health claims for the flesh powders. This will also be used to determine intake amounts required to achieve the required concentrations of nutrients to meet a claim or achieve the recommended daily intake (RDI) and to avoid excessive intake of particular nutrients.
2. Interpretation of the analytical results for avocado flesh powder and determination of the possible claims allowable for specified nutrients under Food Standards Australia New Zealand (FSANZ) regulations.

1.2 Regulatory framework for making nutrition content and health claims

Nutrient content and health claims are voluntary statements that refer to a relationship between a food and a component or health benefit. Claims are classified into nutrition content claims, general level health claims and high-level health claims. The Ministry of Primary Industries provides the following definitions:

- A nutrition content claim states how much of a nutrient or substance is in a food. Examples might be, 'a good source of vitamin C' or 'gluten-free'.
- A general level health claim links a food product to a health effect that relates to general health and wellbeing. An example might be ‘Calcium is good for strong bones’.
- A high-level health claim identifies products that can protect against a serious disease or a risk factor for a serious disease. An example might be ‘Diets high in calcium and vitamin D may reduce the risk of osteoporosis’.

FSANZ regulations dictate what nutrient content and health claims can be made on food in New Zealand and Australia. There are three particularly important schedules under the Australia New Zealand Food Standards Code:

- Schedule 1 — RDIs and ESADDIs (Food Standards Australia New Zealand 2018a);
- Schedule 4 — Nutrition, health and related claims (Food Standards Australia New Zealand 2017a);
- Schedule 12 — Nutrition information panels (Food Standards Australia New Zealand 2017b).

To determine the significance of nutrients and apply pre-approved health claims it is important that nutrients are expressed on a percent recommended dietary intake (RDI) or Estimated Safe and Adequate Daily Dietary Intakes (ESADDI) per serve basis. In most cases, vitamins and minerals can be claimed as a source at 10% RDI and a good source at 25% RDI/ESADDI per serve (as specified by

FSANZ 2017a). The exception is potassium where 200 mg must be present in a serve to claim. Dietary fibre is claimable as a source at 2 g per serve and protein at 5 g per serve. Selected other nutrients also have thresholds for claims.

In Schedule 4 of the Food Standards Code (Food Standards Australia New Zealand 2017a) there is a list of pre-approved health claims that can be used when nutrients meet the prescribed concentrations. To use pre-approved health claims, foods must also meet the Nutrient Profiling Scoring Criterion (NPSC). The NPSC is a nutrient profiling system used to determine whether a food is suitable to make a health claim, based on its nutrient profile. Further details on the NPSC can be found in 'Short guide for industry to the Nutrient Profiling Scoring Criterion' (Food Standards Australia New Zealand 2016). The NPSC takes into account the energy, saturated fat, sodium and sugars content of the food, along with certain ingredients such as fruit and vegetables and, in some instances, dietary fibre and protein. Points are allocated based on 100 g or 100 mL of the food (based on the units used in the nutrition information panel, NIP). The profiling score can be calculated using FSANZ's Nutrient Profiling Scoring Calculator (Food Standards Australia New Zealand 2021).

To make health claims (either on pack or on associated promotional material, including websites), certain information is required by law:

- NIP displaying the nutrient content of the product, including any nutrients for which claims are made;
- Appropriately worded nutrient content and health benefit claims that link the nutrient(s) present in the food (e.g. vitamin C) at relevant levels (≥10% RDI/serve) with a health benefit (e.g. x is a good source of vitamin C to support a healthy immune system);
- Where appropriate, dietary context claims (e.g. when consumed as part of a diet low in saturated fatty acids).

The other requirements of a food label must also be met, including ingredient list and allergens (for more details see: https://www.mpi.govt.nz/dmsdocument/2965-a-guide-to-food-labelling).

In addition to the utilisation of the pre-approved claims it is possible to self-substantiate a new health claim. To self-substantiate a health claim, a large amount of scientific evidence is required to back it up and it must meet the requirements of schedule 6 of the Food Standards Code (Food Standards Australia New Zealand 2015). MPI has also provided a guidance document to help when wanting to make a claim (Ministry for Primary Industries 2016).

It is important to note that as per FSANZ regulations (Food Standards Australia New Zealand 2018c) nutrition content and health claims must not:

- *refer to the prevention, diagnosis, cure or alleviation of a disease, disorder or condition (section 1.2.7—8)*
- *compare a food with a product that is considered to be for, or be taken for therapeutic use, whether because of the way in which the product is presented or for any other reason (section 1.2.7—8)*
- *compare the vitamin or mineral content of one food with another food (section 1.2.7—9) unless allowed elsewhere in the Food Standards Code.*

2 Literature review

This report provides a summary of the findings and further details are provided in the spreadsheet 'BPA Avocado Literature Review'. Appendix 1 provides a list of the key papers found in the literature review.

2.1 Composition data

2.1.1 Nutrients

There is a large amount of information in the literature on the composition of avocado and in some cases specifically 'Hass' avocado. For the simplicity of this report only New Zealand data for the 'Hass' cultivar from the NZFCD are provided here. Further details on avocado composition are provided in the spreadsheet 'BPA Avocado Literature Review'. In some cases there is consistency in nutrient composition across data from various different sources. However, for some other nutrients there is considerable variation in concentrations. For example, vitamin C varied in concentrations from less than 1 mg up to 24 mg per 100 g fresh weight (FW) in the USDA database (U.S. Department of Agriculture, Agricultural Research Service 2021). There could be a range of explanations for this including growing location, season, analytical method and sample preparation (vitamin C is particularly prone to loss). Folate plus vitamin B6 and E were other key nutrients of nutritional relevance in avocado that also showed significat variation in concentrations across the wider literature.

The composition of New Zealand grown 'Hass' avocado is provided in Table 1. In order to be able to make direct comparison with the data for the freeze-dried avocado flesh powder in this project, data are provided on a dry weight (DW) basis as well as FW. Data were available for both early and late season fruit as well as the average. Based on these data there are a number of nutrient content claims that are possible for avocado at a 85 g serving size (Figure 1):

- Good source of dietary fibre
- Good source of folate
- Good source of vitamin B6
- Source of niacin
- Source of pantothenic acid
- Source of potassium
- Source of vitamin E.

Table 1. Composition of 'Hass' avocado as provided in the New Zealand Food Composition Database (New Zealand Food Composition Database 2019). Concentrations are expressed on both a fresh weight (FW) and dry weight (DW) basis, with the later calculated from the moisture content.

Component	Unit	Values per 100 g FW			Values per 100 g DW		
		Hass, late season	Hass, early season	Hass, average	Hass, late season	Hass, early season	Hass, average
		L1157	L1158	L1159	L1157	L1158	L1159
Proximates							
Water	g	61.2	74	67.6	0	0	0
Dry matter	g	38.8	26	32.4	100	100	100
Ash	g	3.8	1.1	2.5	9.8	4.2	7.7
Energy, FSANZ total metabolisable[a]	kJ	1080	750	912	2784	2885	2815
Energy, FSANZ total metabolisable[b]	kJ	1070	761	917	2758	2927	2830
Protein	g	2	1.5	1.8	5.2	5.8	5.6
Fat, total	g	26.7	18.7	22.7	68.8	71.9	70.1
Fat, saturated	g	4.05	2.61	3.33	10.4	10.0	10.3
Available carbohydrate (sugars + starch)	g	0.1	0.1	0.1	0.3	0.4	0.3
Available carbohydrate (by difference)	g	0	0.7	0.3	0.0	2.7	0.9
Total sugars	g	0	0	0	0.0	0.0	0.0
Starch	g	0.1	0.1	0.1	0.3	0.4	0.3
Dietary fibre	g	6.3	4	5.1	16.2	15.4	15.7
Proximates, sum	g	100.1	99.4	99.8	100.3	97.7	99.4
Vitamins							
Biotin	µg	0	0	0	0	0	0.0
Folate	µg	118	100	109	304	385	336
Niacin (B3)	mg	2.59	2.33	2.46	6.68	8.96	7.6
Pantothenic acid	mg	1.0	0.8	0.9	2.6	3.1	2.8
Riboflavin (B2)	mg	0.16	0.14	0.15	0.41	0.54	0.46
Thiamin (B1)	mg	0.05	0.00	0.03	0.13	0.00	0.09
Vitamin A, retinol equivalents	µg	12	16	14	31	62	43
Vitamin B6	mg	0.69	0.56	0.63	1.78	2.15	1.94
Vitamin B12	ug	0	0	0	0	0	0
Vitamin C	mg	1.9	3.5	2.7	4.9	13.5	8.3
Vitamin D	µg	0	0	0	0	0	0
Vitamin E	mg	1.65	1.66	1.66	4.25	6.38	5.12
Vitamin K	µg	5	0	6.9	13	0	21
Minerals							
Calcium	mg	8	11	10	21	42	31
Copper	mg	0.25	0.22	0.24	1	1	1
Iodine	µg	1.5	0	0.75	4	0	2
Iron	mg	0.8	0	0.4	2.1	0.0	1.2

Component	Unit	Values per 100 g FW			Values per 100 g DW		
		Hass, late season	Hass, early season	Hass, average	Hass, late season	Hass, early season	Hass, average
		L1157	L1158	L1159	L1157	L1158	L1159
Magnesium	mg	28	28	28	72	108	86
Manganese	mg	0.155	0	0.172	0.399	0.000	0.531
Phosphorus	mg	44	47	46	113	181	142
Potassium	mg	600	440	520	1546	1692	1605
Selenium	µg	0.9	0	0.5	2.3	0.0	1.5
Sodium	mg	10	13	12	26	50	37
Zinc	mg	0.68	0.48	0.58	1.75	1.85	1.79

[a] Calculated using FSANZ methodology (Food Standards Australia New Zealand 2018b) including accounting for dietary fibre and measured available carbohydrates (starch + sugar)
[b] Calculated using the same FSANZ formula but available carbohydrate by difference (100 – moisture – ash – protein – fat - dietary fibre)
Abbreviation: FSANZ = Food Standards Australia New Zealand

Food details

Avocado, Hass, New Zealand

FCDB food ID	L1159
Scientific name	*Persea americana*
Food group	Fruit
Serving Size	85 g Update Reset
Recommended Serving Size	1/2 avocado = 85 g

select component set to display

Potential Nutrient Claims

print this page save as CSV

If data is to be used for food labelling it is your responsibility to ensure you comply with FSANZ labelling requirements.
The potential nutrient claims provided here are based on conditions specified by FSANZ as at 1 June 2018. We make no assurances of legal compliance and should you intend making any claim on labels, promotional material or elsewhere it is your sole responsibility to ensure you meet current regulatory requirements.

* Percentage daily intakes are based on an average adult diet of 8700 kJ as specified by FSANZ.
▪ denotes no data available

NUTRIENT	UNIT	QUANTITY PER SERVE	%DI* PER SERVE	QUANTITY PER 100 g	POTENTIAL CLAIM
NIP					
Energy, FSANZ	kJ	776	9 %	912	
Protein	g	1.5	3 %	1.8	
Fat, total	g	19.3	28 %	22.7	
Fat, saturated (SFA)	g	2.83	12 %	3.33	
Carbohydrate, available	g	0.1	0 %	0.1	
Sugars, total	g	0.0	0 %	0.0	Sugar - low, Sugar - % free
Dietary fibre	g	4.4	15 %	5.1	Good source
Sodium	mg	10	0 %	12	
OTHER POTENTIAL CLAIMABLE					
Folate	µg	92	46 %	109	Good Source
Potassium	mg	442		520	Source
Niacin (vitamin B3)	mg	2.09	21 %	2.46	Source
Pantothenic acid (vitamin B5)	mg	0.77	15 %	0.90	Source
Vitamin B6 (pyridoxal phosphate)	mg	0.54	33 %	0.63	Good Source
Vitamin E (tocopherols)	mg	1.41	14 %	1.66	Source

Figure 1. Potential nutrient content claims for ‘Hass’ avocado as extracted from the New Zealand Food Composition Database (New Zealand Food Composition Database 2019).

2.1.2 Phytochemicals

In addition to nutrients there are a range of phytochemicals present in avocado (Bhuyan et al. 2019; Campos et al. 2020; Dreher & Davenport 2013; Duarte et al. 2016; Jimenez et al. 2020; Ranade & Padma 2015; Vivero et al. 2019). These include:

- carotenoids (e.g. lutein)
- phenolics (e.g. quercetin, phenolic acids, *p*-coumaric and caffeic and their derivatives)
- phytosterols (e.g. beta-sitosterol, stigmasterol, campesterol, avenasterol)
- chlorophyll.

Unlike the nutrients, these compounds do not have RDIs and in most cases there are not pre-approved health claims that can be made for them. One exception is the phytosterols, which have claims for reducing blood cholesterol and reducing dietary and biliary cholesterol absorption. However, a food must contain a minimum of 0.8 g total plant sterol equivalents per serving (Food Standards Australia New Zealand 2017a). The concentrations of phytosterols in fresh avocado are much lower than this (Campos et al. 2020).

For further details on the phytocvhemical composition refer to the spreadsheet ‘BPA Avocado Literature Review’.

2.2 Health benefits

There is a significant body of literature reporting a range of health benefits of avocado (reviewed in Bhuyan et al. 2019; Caldas et al. 2017; Campos et al. 2020; Comerford et al. 2016; Dreher & Davenport 2013; Duarte et al. 2016; Jimenez et al. 2020; Mahmassani et al. 2018; Tramontin et al. 2020; Vivero et al. 2019). The health effects reported from *in vitro* and animal studies include:

- antioxidant activity
- anti-inflammatory activity
- anticancer activity (e.g. cytotoxic, induce cell cycle arrest, inhibit growth, and induce apoptosis)
- antimicrobial activity (antibacterial, antifungal)
- antiviral activity (e.g. inhibition of replication)
- cardioprotective (reducing low-density lipoprotein (LDL) and plasma cholesterol levels)
- hepatoprotective
- neuroprotective
- improved glucose tolerance, glucose utilization, and insulin sensitivity
- inhibitory effects on platelet aggregation.

Although some of these benefits may be attributed to nutrient composition others may be due to phytochemicals present. These modes of action/health effects also do not always align with claims possible under the FSANZ pre-approved claims list. Antioxidant claims have proved particularly controversial in recent years, although antioxidant/radical scavenging claims are possible for some selected nutrients (e.g. vitamins C & E). Some claims are not possible under FSANZ regulations.

For example, claims cannot be therapeutic, i.e. must not refer to the prevention, diagnosis, cure or alleviation of a disease (e.g. can't claim to cure or prevent cancer). However, risk reduction claims may be possible but would require substantive evidence and a clear link to composition.

In addition to *in vitro* and small animal studies, there have been a number of human studies with avocado (either intervention trials or epidemiological studies). These include mainly effects on heart health but also impacts on supporting weight management and managing diabetes.

- An avocado enriched diet was shown to promote heart health lipid profiles in women, decreasing total cholesterol as well as apolipoprotein and LDL-cholesterol (Colquhoun et al. 1992).
- Partial replacement of other dietary fats with avocado in the diet of patients with non-insulin-dependent diabetes mellitus improved the lipid profile favourably (reducing total cholesterol and triacyglycerol (TG)) and maintained an adequate glycaemic control (Lerman-Garber et al. 1994).
- Addition of avocado to the diet decreased total cholesterol and LDL-cholesterol but increased high-density lipoprotein (HDL)-cholesterol and TG and body weight (Díaz et al. 2004, cited in Caldas et al. 2017).
- Avocado increased serum lipoperoxidation and decreased platelet aggregation (Madrigal et al. 2008, cited in Caldas et al. 2017).
- Avocado decreased LDL-cholesterol, HDL-cholesterol, total cholesterol and TG (Vázquez et al. 2009, cited in Caldas et al. 2017).
- There appear to be potential beneficial anti-inflammatory and vascular health effects (e.g. inhibition of vasoconstriction) of ingesting 'Hass' avocado with a hamburger patty (Li et al. 2013).
- Avocados have beneficial effects on cardio-metabolic risk factors (e.g. cholesterol lowering) that extend beyond their heart-healthy fatty acid profile (Wang et al. 2015).
- The consumption of avocado within an energy-restricted diet does not compromise weight loss when substituted for 30 g of mixed dietary fat (Pieterse et al. 2005, cited in Caldas et al. 2017).
- Daily addition of avocados to a habitual diet showed a beneficial effect on total cholesterol and body weight control (Grant et al. 1960, cited in Dreher & Davenport 2013).
- Avocado enriched diets can help avoid potential adverse effects of low-fat diets on HDL-cholesterol and triglycerides (Alvizouri-Munoz et al. 1992, cited in Dreher & Davenport 2013).
- Diets rich in avocados appear to help manage hyper-cholesterolemia (Carranza et al. 1995, cited in Dreher & Davenport 2013).
- Avocado-enriched diets had significantly improved lipoprotein and/or triglyceride profiles in normal and hyper-cholesterolemic subjects (Lopez Ledesma et al. 1996, cited in Dreher & Davenport 2013).
- Vegetarian diets with avocados promote healthier lipoprotein profiles than low-fat and vegetarian diets without avocados (Carranza-Madrigal et al. 1997, cited in Dreher & Davenport 2013).
- Daily avocado intake improved attentional inhibition and increased serum lutein concentrations among overweight and obese adults (Edwards et al. 2020). The cognitive benefits were independent of changes in lutein concentrations.
- Habitual consumption of avocados may reduce adult weight gain, but is attenuated by differences in initial Body Mass Index (BMI) values (Heskey et al. 2019).

- Higher intakes of dietary monounsaturated fatty acids (MUFA) were inversely related to prostate cancer with the principal source of dietary MUFA being avocado intake (Jackson et al. 2012).
- Avocado consumption is associated with improved overall diet quality, nutrient intake, and reduced risk of metabolic syndrome (Fulgoni et al. 2013).
- The addition of avocado to lunch can influence post-ingestive satiety over a subsequent 3- and 5-hour period in overweight adults and lowered blood insulin (Wien et al. 2013).
- Consumption of lipid-rich avocado enhanced the absorption of beta-carotene and enhanced its conversion to vitamin A (Kopec et al. 2014).
- Avocado intake improved memory, spatial working memory and sustained attention as well as macular pigment density (Scott et al. 2017).
- Avocado intake may have an effect on gut hormone concentrations and have a role in energy balance and weight management (Haddad et al. 2018).
- Replacing carbohydrate components with avocados in a meal improved flor mediated vasodilation, a measure of endothelial function, and improved glycaemic and lipoprotein profiles in overweight/obese adults (Park et al. 2018).
- The ingestion of a phytonutrient-poor food and its individual fat/protein or sugar components increased plasma oxidative activity; however, this was not observed after ingestion of a kilojoule-equivalent of avocado (Khor et al. 2014).
- An avocado enriched diet decreased body weight and BMI (Pieterse et al. 2003, cited in Tabeshpour et al. 2017).
- Adding avocado to salad and salsa can significantly enhance carotenoid absorption, which was attributed primarily to the lipids present in avocado (Unlu et al. 2005).
- One avocado a day in a heart-healthy diet decreased oxidised LDL in adults who were overweight or obese (Wang et al. 2020).
- Avocado pulp improved cardiovascular and autonomic recovery after exercise (Sousa et al. 2020).
- Avocado consumption may help manage dyslipidemia in adults who are overweight or obese (Hannon et al. 2020). However, effectiveness may differ by genetic profile.

However, there will be challenges using this data to develop a self-substantiation dossier for a processed product, although they could be used for supporting evidence. There are a number of reasons for this. There may be compositional differences between the avocado in these studies and the final BPA product, the amount consumed may be unrealistic (e.g. addition of 200+ grams of avocado to the daily diet has been used in some studies). Probably the most significant is the product format. The majority of trials have been undertaken with fresh avocado fruit and thus any new claim for a powder product would require further evidence from human clinical trials.

3 Composition data and claims

3.1 Composition data

The composition data was provided by Callaghan Innovation with the analytical work completed by AsureQuality. The data for the Freeze-Dried Hass Avocado Flesh Powder is summarised in Table 2 and further details are provided in Appendix 2 (noting only the flesh powder is the focus of this report). It is of note that the proximate sum for both the flesh powder (and the starch from the stone) do not add to 100%. This could be due to analytical issues or because some components are not being accounted for in the analysis. However, the data in the NZFCD has proximate totals close to 100% so it seems unusual that such a large difference unless the processing caused some modification.

Table 2. Composition of Freeze-Dried Hass Avocado Flesh Powder.

	Unit	per 100 g	per 16 g serve	%RDI/ ESADDI per serve	per 28 g serve	%RDI/ ESADDI per serve
Proximates						
Water	g	1.2	0.2		0.3	
Dry matter	g	98.8	16.0		27.2	
Ash	g	5.6	0.9		1.5	
Energy, FSANZ total metabolisable[a]	kJ	2619	424	5%	721	8%
Energy, FSANZ total metabolisable[b]	kJ	2752	446	5%	758	9%
Protein	g	4.4	0.7	1%	1.2	2%
Fat, total	g	65.1	10.5	15%	17.9	26%
Fat, saturated	g	nr[c]				
Available carbohydrate (sugars + starch)	g	0.9	0.1	0%	0.2	0%
Available carbohydrate (by difference)	g	8.8	1.4	0%	2.4	1%
Total sugars	g	0.9	0.1	0%	0.2	0%
Starch	g	nr			0.0	
Dietary Fibre	g	14.9	2.4	8%	4.1	14%
Proximates, sum	g	92.1	14.9		25.4	
Vitamins						
Biotin	µg	nr				
Folate	µg	nr				
Niacin (B3)	mg	5.19	0.84	8%	1.43	14%
Pantothenic acid	mg	1.44	0.23	5%	0.40	8%
Riboflavin (B2)	mg	0.32	0.05	3%	0.09	5%
Thiamin (B1)	mg	nr				
Vitamin A, retinol equivalents	µg	<3	0.00	0%	0.00	0%
Vitamin B6	mg	1.59	0.26	16%	0.44	27%
Vitamin B12	ug	nr				
Vitamin C	mg	25.7	4.16	10%	7.08	18%
Vitamin D	µg	nr				
Vitamin E	mg	6.52	1.06	11%	1.80	18%

	Unit	per 100 g	per 16 g serve	%RDI/ ESADDI per serve	per 28 g serve	%RDI/ ESADDI per serve
Vitamin K	µg	nr				
Minerals						
Calcium	mg	30	4.86	1%	8.26	1%
Copper	mg	2	0.32	11%	0.55	18%
Iodine	µg	nr				
Iron	mg	2.1	0.34	3%	0.58	5%
Magnesium	mg	75	12.15	4%	20.66	6%
Manganese	mg	0.49	0.08	2%	0.13	3%
Phosphorus	mg	nr				
Potassium	mg	nr				
Selenium	µg	nr				
Sodium	mg	47	7.61	0%	12.94	1%
Zinc	mg	1.9	0.31	3%	0.52	4%

[a] Calculated using FSANZ methodology (Food Standards Australia New Zealand 2018b) including accounting for dietary fibre and measured available carbohydrates (starch + sugar)
[b] Calculated using the same FSANZ formula but available carbohydrate by difference (100 – moisture – ash – protein – fat - dietary fibre)
[c] Total fatty acids reported only total 56.7 g/100 g yet total fat is 65.1 g/100 g therefore there is over 8 g of fatty acids not accounted for (see Table 3 for detailed fatty acid composition).
Key:
Source = 10-25% RDI/ ESADDI for vitamins and minerals (or potassium >200 mg); fibre claimable at 2 g per serve (=6.7% RDI)
Good source = >25% RDI/ ESADDI; fibre claimable at 4 g per serve (=13% RDI)

Abbreviations: ESADDI = Estimated Safe and Adequate Daily Dietary Intakes; FSANZ = Food Standards Australia New Zealand; nr = not reported; RDI = Recommended Dietary Intake

In addition to the nutrients above, detailed amino acid and fatty acid composition was provided. Protein content is not particularly high and it is unlikely that the amino acid composition is of any particular significance. Fatty acid composition is provided in Table 3. It is important to note that total fatty acids reported only total 56.7 g/100 g yet total fat is 65.1 g/100 g. Therefore there is over 8 g of fatty acids not accounted for. The data from the NZFCD provides an indication of the 'missing' fatty acids (noting that for that data there is also a proportion of fatty acids 'missing').

Table 3. Fatty acid composition of the Freeze-Dried Hass Avocado Flesh Powder and comparison with New Zealand Food Composition Database data (New Zealand Food Composition Database 2019).

Component	Freeze-Dried Hass Avocado Flesh Powder	NZFCD Hass Avocado, L1159	
	g/100 g	g/100 g FW	g/100 g DW
Fat, total	65.1	22.70	70.14
Fatty acid 12:0	nr	0.00	0.00
Fatty acid 14:0	nr	0.01	0.03
Fatty acid 16:0	10.23	3.18	9.83
Fatty acid 16:1	4.45	1.33	4.11
Fatty acid 17:0	nr	0.01	0.04
Fatty acid 18:0	0.27	0.08	0.26
Fatty acid 18:1 omega-7	nr	1.11	3.43
Fatty acid 18:1 omega-9	32.96	12.40	38.32
Fatty acid 18:2 omega-6	8.43	2.91	8.99

Component	Freeze-Dried Hass Avocado Flesh Powder	NZFCD Hass Avocado, L1159	
Fatty acid 18:3 omega-3	0.4	0.19	0.57
Fatty acid 20:0	nr	0.01	0.03
Fatty acid 20:1 omega-9	nr	0.04	0.12
Fatty acid 20:2 omega-6	nr	0.01	0.02
Fatty acid 20:4 omega-6	nr	0.01	0.02
Fatty acid 22:0	nr	0.02	0.06
Fatty acid 22:1 omega-9	nr	0.00	0.01
Fatty acid 22:2 omega-6	nr	0.00	0.00
Fatty acid 23:0	nr	0.00	0.00
Fatty acid 24:0	nr	0.01	0.03
Fatty acid 24:1	nr	0.00	0.00
Total fatty acids	56.74	21.32	65.88

Abbreviations: nr = not reported

Table 4 shows the composition data for the Freeze-Dried Hass Avocado Flesh Powder compared with the data in with New Zealand Food Composition Database (New Zealand Food Composition Database 2019) converted to a DW basis. Some of the components are present at similar concentrations but in other cases there are significant differences. Fat content was lower in the powder but from the other data in the NZFCD it can be seen that fat content varies depending on time of harvest – fat is higher in late season fruit than early season (Table 1). On the other hand vitamin C was much higher in the Freeze-Dried Hass Avocado Flesh Powder. There could be a number of reasons for this including seasonal variation or analytical method (there has been a change to the vitamin C method used by AsureQuality recently). This means a content claim is possible for the vitamin C in the freeze-dried powder where it is not possible for the fresh avocado based on the NZFCD data. Pantothenic acid was significantly lower in the freeze-dried powder, meaning the claim possible for fresh avocado cannot be applied to the powder.

Table 4. Comparison of the composition of the Freeze-Dried Hass Avocado Flesh Powder with New Zealand Food Composition Database data (New Zealand Food Composition Database 2019).

Component		Freeze-Dried Hass Avocado Flesh Powder per 100 g	NZFCD Hass Avocado L1159 per 100 g DW
Proximates			
Water	g	1.2	0
Dry matter	g	98.8	100
Ash	g	5.6	7.7
Energy, FSANZ total metabolisable[a]	kJ	2619	2815
Energy, FSANZ total metabolisable[b]	kJ	2752	2830
Protein	g	4.4	5.6
Fat, total	g	65.1	70.1
Fat, saturated	g	nrc	10.3
Available carbohydrate (sugars + starch)	g	0.9	0.3
Available carbohydrate (by difference)	g	8.8	0.9
Total sugars	g	0.9	0.0
Starch	g	nr	0.3

Component		Freeze-Dried Hass Avocado Flesh Powder per 100 g	NZFCD Hass Avocado L1159 per 100 g DW
Dietary Fibre	g	14.9	15.7
Proximates, sum	g	92.1	99.4
Vitamins			
Biotin	µg	nr	0.0
Folate	µg	nr	336
Niacin (B3)	mg	5.19	7.6
Pantothenic acid	mg	1.44	2.8
Riboflavin (B2)	mg	0.32	0.46
Thiamin (B1)	mg	nr	0.09
Vitamin A, retinol equivalents	µg	<3	43
Vitamin B6	mg	1.59	1.94
Vitamin B12	ug	nr	0
Vitamin C	mg	25.7	8.3
Vitamin D	µg	nr	0
Vitamin E	mg	6.52	5.12
Vitamin K	µg	nr	21
Minerals			
Calcium	mg	30	31
Copper	mg	2	1
Iodine	µg	nr	2
Iron	mg	2.1	1.2
Magnesium	mg	75	86
Manganese	mg	0.49	0.531
Phosphorus	mg	nr	142
Potassium	mg	nr	1605
Selenium	µg	nr	1.5
Sodium	mg	47	37
Zinc	mg	1.9	1.79

[a] Calculated using FSANZ methodology (Food Standards Australia New Zealand 2018b) including accounting for dietary fibre and measured available carbohydrates (starch + sugar)
[b] Calculated using the same FSANZ formula but available carbohydrate by difference (100 – moisture – ash – protein – fat - dietary fibre)
Abbreviations: DW = Dry Weight; FSANZ = Food Standards Australia New Zealand; nr = not reported

As part of the project, Callaghan Innovation also carried out supercritical extraction of the freeze-dried flesh powder to defat it. The solvents used (supercritical CO_2, propane, dimethyl ether) extract most or all lipid-soluble compounds including the oil but no fibre, protein, B-vitamins and related compounds or minerals. Unfortunately no detailed compositional analyses of the defatted powders have been carried out. This will be worth doing, as with the removal of the fat will mean a concentration of the other components, and in turn meaning a smaller serve size may deliver the same nutritional value. However, it will also be important to check if the nutrients more sensitive to degradation, such as vitamin C, are retained. Lipid soluble components, like vitamin E, will presumably be lost with the oil.

3.2 Nutrient content claims

For the freeze-dried flesh, data have also been expressed per serve and the percentage RDI/ESADDI per serve (Table 2). Two different scenarios are presented here. For one option the serve has been calculated to be equivalent to 50 g fresh weight of avocado – this equates to 16.2 g of the dried powder. For the second option an amount equivalent to 85 g of fresh avocado has been used – this equates to 27.5 g of dried powder. The spreadsheet provided with this report 'BPA Avocado Analytical Data' is set up so that adjustments can be made to the serving size and the RDIs/ESADDIs are all automatically recalculated.

Based on a serve of 16.2 g of freeze-dried powder (equivalent to ~50 g fresh weight) the nutrient content claims that could be made are:

- Source of dietary fibre
- Source of vitamin B6
- Source of vitamin C
- Source of vitamin E
- Source of copper.

If the serving size is 27.5 g of freeze-dried powder (equivalent to ~85 g fresh weight) the nutrient content claims that could be made are:

- Good source of dietary fibre
- Source of niacin
- Good source of vitamin B6
- Source of vitamin C
- Source of vitamin E
- Source of copper.

Larger serving sizes could result in other claims possible but then the fat content and contribution gets very high. Even at a serving size of 27.5 g the powder contributes 26% of the recommended daily intake of fats.

Based on the NZFCD data for fresh avocado (Figure 1) it is likely that potassium would be claimable in the avocado powder but it was not measured. Folate was also at a claimable concentration in the fresh avocado but not determined in this study. Although folate is a more sensitive nutrient, the fact that the freeze-dried powder still had a high vitamin C content indicates losses may not be significant. It would be worth measuring these components to extend the number of possible claims.

3.3 Health claims

In order to make health claims a food must meet the NPSC. The final nutrient profiling score is assessed against the criterion provided in section S4—6 of Schedule 4 (Food Standards Australia New Zealand 2017a). Accordingly, to meet the NPSC the following nutrient profiling scores must be achieved:

NPSC Category	Final Score
Category 1: Beverages	<1
Category 2: Any food other than those included in Category 1 or 3	<4
Category 3: Cheese, edible oil/oil spread, margarine, butter.	<28

The freeze-dried avocado powder falls under category 2. Plugging in the compositional data into the calculator (http://archive.foodstandards.gov.au/consumerinformation/nutritionhealthandrelatedclaims/nutrientprofilingcalculator/index_code.cfm) a nutrient profiling score of 2 was arrived at (Figure 2). Note that the saturated fatty acid value is an estimate. This is under 4 and thus the powder is eligible to make pre-approved health claims. If the powder is to be used as an ingredient in other products then the eligibility to make claims will depend on the NPSC for that product. It is important to note that the score is calculated on a per 100 g basis and not per serve. Despite the powder having a relatively high energy and fat content and scoring high baseline points this is offset by the fact that it scores high modifying points due to it being a fruit/vegetable powder, has a high dietary fibre content and contains some protein.

Baseline Points:			
Nutrient Information		***Amount Entered***	***Points earned***
Energy		2619	7
Saturated Fatty Acids		10.5	10
Sugars		0.9	0
Sodium		47	0
Total Baseline Points			**17**
Modifying Points:		**Amount Entered**	**Points earned**
fvnl	Non *fvnl* ingredients	0%	8
	Non-concentrated *fvnl* ingredients	0%	
	Concentrated fruit and vegetable ingredients	100%	
Protein		4.44	2
Dietary Fibre		14.9	5
Total Modifying Points			**15**
Final Score			**2**

Figure 2. Screenshot of the nutrient profiling score for Freeze-Dried Hass Avocado Flesh Powder determined using Food Standards Australia New Zealand's Nutrient Profiling Scoring Calculator (http://archive.foodstandards.gov.au/consumerinformation/nutritionhealthandrelatedclaims/nutrientprofilingcalculator/index_code.cfm).

The possible pre-approved health claims that can be made for the Freeze-Dried Hass Avocado Flesh Powder are listed in Table 5 (noting that although the claims for folate and potassium are listed testing is required to ascertain if they can actually be made).

Table 5. Possible pre-approved health claims for Freeze-Dried Hass Avocado Flesh Powder permitted under Schedule 4 — Nutrition, health and related claims (Food Standards Australia New Zealand 2017a).

Nutrient	Thresholds for claims	Health effect	Map to generic health area
Dietary fibre	2 g per serve	Contributes to regular laxation	Digestive health
Folate[a]	10% RDI per serve	Necessary for normal blood formation	Heart & circulation
		Necessary for normal cell division	Cell & tissue growth
		Contributes to normal growth and development in children	Growth & development in children
		Contributes to maternal tissue growth during pregnancy	Pregnancy
		Contributes to normal amino acid synthesis	Cell & tissue growth
		Contributes to normal homocysteine metabolism	Heart & circulation
		Contributes to normal psychological function	Brain and nervous system
		Contributes to normal immune system function	Immune function & inflammation
		Contributes to the reduction of tiredness and fatigue	Tiredness & fatigue
Niacin (B3)	10% RDI per serve	Necessary for normal neurological function	Brain and nervous system
		Necessary for normal energy release from food	Energy & metabolism
		Necessary for normal structure and function of skin and mucous membranes	Skin
		Contributes to normal growth and development in children	Growth & development in children
		Contributes to normal psychological function	Brain and nervous system
		Contributes to the reduction of tiredness and fatigue	Tiredness & fatigue
Vitamin B6	10% RDI per serve	Necessary for normal protein metabolism	Energy & metabolism
		Necessary for normal iron transport and metabolism	Energy & metabolism
		Contributes to normal growth and development in children	Growth & development in children
		Contributes to normal cysteine synthesis	
		Contributes to normal energy metabolism	Energy & metabolism
		Contributes to normal functioning of the nervous system	Brain and nervous system
		Contributes to normal homocysteine metabolism	Heart & circulation
		Contributes to normal glycogen metabolism	Energy & metabolism
		Contributes to normal psychological function	Brain and nervous system

Nutrient	Thresholds for claims	Health effect	Map to generic health area
		Contributes to normal red blood cell formation	Heart & circulation
		Contributes to normal immune system function	Immune function & inflammation
		Contributes to the reduction of tiredness and fatigue	Tiredness & fatigue
		Contributes to the regulation of hormonal activity	Hormonal function
Vitamin C	10% RDI per serve	Contributes to iron absorption from food	Energy & metabolism
		Necessary for normal connective tissue structure and function	Joint health; Cell & tissue growth; Bone health
		Necessary for normal blood vessel structure and function	Heart & circulation
		Contributes to cell protection from free radical damage	Prevention oxidative damage (antioxidant)
		Necessary for normal neurological function	Brain and nervous system
		Contributes to normal growth and development in children	Growth & development in children
		Contributes to normal collagen formation for the normal structure of cartilage	Joint health
		Contributes to normal collagen formation for the normal structure of bones	Bone health
		Contributes to normal collagen formation for the normal function of teeth	Oral health
		Contributes to normal collagen formation for the normal function of gums	Oral health
		Contributes to normal collagen formation for the normal function of skin	Skin
		Contributes to normal energy metabolism	Energy & metabolism
		Contributes to normal psychological function	Brain and nervous system
		Contributes to the normal immune system function	Immune function & inflammation
		Contributes to the reduction of tiredness and fatigue	Tiredness & fatigue
Vitamin E	10% RDI per serve	Contributes to cell protection from free radical damage	Prevention oxidative damage (antioxidant)
		Contributes to normal growth and development in children	Growth & development in children
Copper	10% ESADDI per serve	Contributes to normal connective tissue structure	Joint health; Cell & tissue growth; Bone health
		Contributes to normal iron transport and metabolism	Energy & metabolism
		Contributes to cell protection from free radical damage	Prevention oxidative damage (antioxidant)
		Necessary for normal energy production	Energy & metabolism
		Necessary for normal neurological function	Brain and nervous system
		Necessary for normal immune system function	Immune function & inflammation

Nutrient	Thresholds for claims	Health effect	Map to generic health area
		Necessary for normal skin and hair colouration	Skin; Hair & nails
		Contributes to normal growth and development in children	Growth & development in children
Potassium[a]	200 mg per serve	Necessary for normal water and electrolyte balance	Hydration
		Contributes to normal growth and development in children	Growth & development in children
		Contributes to normal functioning of the nervous system	Brain and nervous system
		Contributes to normal muscle function	Physical performance

[a] these are listed on the basis of being possible claims extrapolating the information from fresh avocado and testing is required to confirm if it is possible to use
Abbreviations: ESADDI = Estimated Safe and Adequate Daily Dietary Intakes; FSANZ = Food Standards Australia New Zealand; RDI = Recommended Dietary Intake

4 Conclusions

There is a significant body of literature reporting a range of health benefits of avocado. The health effects reported from *in vitro* and animal studies include: antioxidant, anti-inflammatory, anticancer, antimicrobial and antiviral activities; cardioprotective; hepatoprotective; neuroprotective; improved glucose tolerance, glucose utilization, and insulin sensitivity; and inhibitory effects on platelet aggregation. In addition to *in vitro* and small animal studies there have been a number of human studies with avocado (either intervention trials or epidemiological studies). These include mainly effects on heart health but also impacts on supporting weight management and managing diabetes. However, under FSANZ regulations it would not be possible to make health claims without further clinical study.

Based on the analysis conducted by AsureQuality a number of possible nutrient content claims are possible for Freeze-Dried Hass Avocado Flesh Powder. The exact claims will depend on the serving size but as an example if the serving size is 27.5 g of freeze-dried powder (equivalent to ~85 g fresh weight) the nutrient content claims that could be made include dietary fibre, niacin, vitamin B6, vitamin C, vitamin E and copper. A minimum serving size of 16 g is recommended, otherwise claims for vitamins C and E drop off. Larger serving sizes could result in other claims possible but then the fat content and contribution gets very high. Based on the NZFCD data for fresh avocado it is likely that potassium and folate would be claimable in the avocado powder but were not measured. It would be worth measuring these components to extend the number of possible claims.

The Freeze-Dried Hass Avocado Flesh Powder has a FSANZ nutrient profiling score of 2, which is under the 4 required for a food to be eligible to make pre-approved health claims. There is a significant list of possible pre-approved health claims that can be made for the Freeze-Dried Hass Avocado Flesh Powder. These claims fall under a wide diversity of overarching health areas including digestive health; brain and nervous system; energy & metabolism (including reducing tiredness & fatigue); skin; growth & development in children; heart & circulation; immune function & inflammation; hormonal function; joint health; cell & tissue growth; bone health; prevention oxidative damage (antioxidant); and oral health. Some of these health areas are supported by multiple nutrients and these may offer the best opportunities for making claims.

In conclusion, there are a significant number of options for making nutrient content and pre-approved health claims for the Freeze-Dried Hass Avocado Flesh Powder under FSANZ regulations. Many of this claims align with the body of scientific evidence in the literature.

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Appendix 2: Detailed composition of the avocado products

AsureQuality Kaitiaki Kai

AsureQuality Limited | 131 Boundary Road | Blockhouse Bay | Auckland 0600 | New Zealand
PO Box 41 | Auckland 1140 | New Zealand
t. 00 64 9 626 8200 | e. VLabAuckland@asurequality.com | w. www.asurequality.com

Certificate of Analysis

Submission Reference: Avocado Products
Final Report

Kirill Lagutin
Callaghan Innovation
PO Box 30-144
Lower Hutt
Wellington 5040
New Zealand

PO Number: 111807

Report Issued: 12-Jan-2021 **AsureQuality Reference:** 20-356741 **Sample(s) Received:** 24-Dec-2020 07:15

Testing Period: 29-Dec-2020 to 12-Jan-2021
Date of analysis is available on request.

Sampled By: Campbell Ellison

Results

The tests were performed on the samples as received.

Customer Sample Name: Freeze-Dried Hass Avocado Flesh Powder **Lab ID:** 20-356741-1

Sample Description: Freeze-Dried Hass Avocado Flesh Powder

Batch/Lot No.: 7/12/20 1 **Sample Condition:** Acceptable

Test	Result	Unit	Method Reference
Ash *	5.6	% m/m	AsureQuality Method
Dietary Fibre	14.9	% m/m	AOAC 991.43
Moisture *	1.2	% m/m	AsureQuality Method
Protein	4.44	% m/m	via Kjeldahl
Histidine (Total) *	107	mg/100 g	AsureQuality Method (UHPLC)
Hydroxyproline (Total) *	79.7	mg/100 g	AsureQuality Method (UHPLC)
Taurine (Total) *	<2.00	mg/100 g	AsureQuality Method (UHPLC)
Arginine (Total) *	207	mg/100 g	AsureQuality Method (UHPLC)
Serine (Total) *	249	mg/100 g	AsureQuality Method (UHPLC)
Glycine (Total) *	210	mg/100 g	AsureQuality Method (UHPLC)
Aspartic acid (Total Asparagine + Aspartic acid) *	384	mg/100 g	AsureQuality Method (UHPLC)
Glutamic acid (Total Glutamine + Glutamic acid) *	524	mg/100 g	AsureQuality Method (UHPLC)
Threonine (Total) *	190	mg/100 g	AsureQuality Method (UHPLC)
Alanine (Total) *	212	mg/100 g	AsureQuality Method (UHPLC)
Proline (Total) *	196	mg/100 g	AsureQuality Method (UHPLC)
Lysine (Total) *	262	mg/100 g	AsureQuality Method (UHPLC)
Tyrosine (Total) *	152	mg/100 g	AsureQuality Method (UHPLC)
Methionine (Total) *	52.1	mg/100 g	AsureQuality Method (UHPLC)
Cystine (Total Cysteine + Cystine) *	52.6	mg/100 g	AsureQuality Method (UHPLC)
Valine (Total) *	252	mg/100 g	AsureQuality Method (UHPLC)
Isoleucine (Total) *	199	mg/100 g	AsureQuality Method (UHPLC)
Leucine (Total) *	329	mg/100 g	AsureQuality Method (UHPLC)
Phenylalanine (Total) *	192	mg/100 g	AsureQuality Method (UHPLC)
Tryptophan (Total) *	53.9	mg/100 g	AOAC 2017.03

AsureQuality Reference: 20-356741 **Report Issued:** 12-Jan-2021

Test	Result	Unit	Method Reference
Thiamine Hydrochloride	0.11	mg/100 g	EN14122: 2003 (Committee for European Normalisation)
Total Vitamin B6	1.59	mg/100 g	Food Chemistry, Volume 48 (1993), Journal of Chromatography. Volume 463 (1989), Journal of Food Science - Volume 58 (1993).
Total Vitamin B2	0.32	mg/100 g	Food Chemistry, Volume 23, JAOAC Volume 62 (1979)
Total Vitamin B3	5.19	mg/100 g	Journal of Chromatography, Volume 301 (1984)
Vitamin C *	25.7	mg/100 g	AOAC 2012.22
Vitamin A	<3	µg/100 g	Methods for the Determination of Vitamins in Food - Recommended by COST 91 (1986)
Vitamin E	6519	µg/100 g	Methods for the Determination of Vitamins in Food - Recommended by COST 91 (1986)
Palmitic C16:0	10230	mg/100 g	AsureQuality Method (Based on JAOCS, 62 (1985))
Palmitoleic C16:1	4450	mg/100 g	AsureQuality Method (Based on JAOCS, 62 (1985))
Stearic C18:0	270	mg/100 g	AsureQuality Method (Based on JAOCS, 62 (1985))
Oleic C18:1n-9	32960	mg/100 g	AsureQuality Method (Based on JAOCS, 62 (1985))
Linoleic C18:2n-6	8430	mg/100 g	AsureQuality Method (Based on JAOCS, 62 (1985))
Alpha Linolenic C18:3n-3	400	mg/100 g	AsureQuality Method (Based on JAOCS, 62 (1985))
Total Sugar	0.9	% m/m	AsureQuality Method (GLC)
Vitamin B5 (Pantothenic Acid) *	1440	µg/100 g	AOAC 2012.16
Folic Acid *	<1.00	µg/100 g	AOAC 2013.13
Fat SBR *	65.1	% m/m	AsureQuality Method
Arsenic *	<0.02	mg/kg	AsureQuality Method (ICP-MS)
Cadmium *	0.045	mg/kg	AsureQuality Method (ICP-MS)
Mercury *	<0.01	mg/kg	AsureQuality Method (ICP-MS)
Lead *	<0.01	mg/kg	AsureQuality Method (ICP-MS)
Calcium	30	mg/100 g	AsureQuality Method (ICP-OES)
Copper	2.0	mg/100 g	AsureQuality Method (ICP-OES)
Iron	2.1	mg/100 g	AsureQuality Method (ICP-OES)
Magnesium	75	mg/100 g	AsureQuality Method (ICP-OES)
Manganese	0.49	mg/100 g	AsureQuality Method (ICP-OES)
Sodium	47	mg/100 g	AsureQuality Method (ICP-OES)
Zinc	1.9	mg/100 g	AsureQuality Method (ICP-OES)

Customer Sample Name: Hass Stone Starch **Lab ID:** 20-356741-2

Sample Description: Starch from Hass Avocado Stone

Batch/Lot No.: 9/12/20 2 **Sample Condition:** Acceptable

Test	Result	Unit	Method Reference
Ash *	0.2	% m/m	AsureQuality Method
Dietary Fibre *	6.7	% m/m	AOAC 991.43
Moisture *	9.7	% m/m	AsureQuality Method
Protein	2.18	% m/m	via Kjeldahl
Starch *	70.84	% m/m	Boehringer Mannheim Methods of Biochemical Analysis and Food Analysis (1987)
Total Sugar *	<0.1	% m/m	AsureQuality Method (GLC)
Fat SBR *	1.0	% m/m	AsureQuality Method

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AsureQuality Reference: 20-356741 **Report Issued:** 12-Jan-2021

Test	Result	Unit	Method Reference
Arsenic *	<0.02	mg/kg	AsureQuality Method (ICP-MS)
Cadmium *	0.0093	mg/kg	AsureQuality Method (ICP-MS)
Mercury *	<0.01	mg/kg	AsureQuality Method (ICP-MS)
Lead *	0.26	mg/kg	AsureQuality Method (ICP-MS)
Calcium	38	mg/100 g	AsureQuality Method (ICP-OES)
Copper	0.23	mg/100 g	AsureQuality Method (ICP-OES)
Iron	1.4	mg/100 g	AsureQuality Method (ICP-OES)
Magnesium	9.4	mg/100 g	AsureQuality Method (ICP-OES)
Manganese	0.11	mg/100 g	AsureQuality Method (ICP-OES)
Sodium	5.6	mg/100 g	AsureQuality Method (ICP-OES)
Zinc	1.3	mg/100 g	AsureQuality Method (ICP-OES)

Customer Sample Name: Destarched Hass Stone **Lab ID:** 20-356741-3

Sample Description: Destarched Hass Avocado Stone

Batch/Lot No.: 9/12/20 3 **Sample Condition:** Acceptable

Test	Result	Unit	Method Reference
Ash *	0.9	% m/m	AsureQuality Method
Dietary Fibre	51.1	% m/m	AOAC 991.43
Moisture *	4.1	% m/m	AsureQuality Method
Protein	4.95	% m/m	via Kjeldahl
Starch *	37.99	% m/m	Boehringer Mannheim Methods of Biochemical Analysis and Food Analysis (1987)
Histidine (Total) *	115	mg/100 g	AsureQuality Method (UHPLC)
Hydroxyproline (Total) *	142	mg/100 g	AsureQuality Method (UHPLC)
Taurine (Total) *	<2.00	mg/100 g	AsureQuality Method (UHPLC)
Arginine (Total) *	355	mg/100 g	AsureQuality Method (UHPLC)
Serine (Total) *	287	mg/100 g	AsureQuality Method (UHPLC)
Glycine (Total) *	239	mg/100 g	AsureQuality Method (UHPLC)
Aspartic acid (Total Asparagine + Aspartic acid) *	444	mg/100 g	AsureQuality Method (UHPLC)
Glutamic acid (Total Glutamine + Glutamic acid) *	592	mg/100 g	AsureQuality Method (UHPLC)
Threonine (Total) *	178	mg/100 g	AsureQuality Method (UHPLC)
Alanine (Total) *	229	mg/100 g	AsureQuality Method (UHPLC)
Proline (Total) *	245	mg/100 g	AsureQuality Method (UHPLC)
Lysine (Total) *	282	mg/100 g	AsureQuality Method (UHPLC)
Tyrosine (Total) *	202	mg/100 g	AsureQuality Method (UHPLC)
Methionine (Total) *	41.9	mg/100 g	AsureQuality Method (UHPLC)
Cystine (Total Cysteine + Cystine) *	78.3	mg/100 g	AsureQuality Method (UHPLC)
Valine (Total) *	298	mg/100 g	AsureQuality Method (UHPLC)
Isoleucine (Total) *	227	mg/100 g	AsureQuality Method (UHPLC)
Leucine (Total) *	348	mg/100 g	AsureQuality Method (UHPLC)
Phenylalanine (Total) *	249	mg/100 g	AsureQuality Method (UHPLC)
Tryptophan (Total) *	3.72	mg/100 g	AOAC 2017.03
Palmitic C16:0	260	mg/100 g	AsureQuality Method (Based on JAOCS, 62 (1985))
Palmitoleic C16:1	67	mg/100 g	AsureQuality Method (Based on JAOCS, 62 (1985))
Stearic C18:0	13	mg/100 g	AsureQuality Method (Based on JAOCS, 62 (1985))
Oleic C18:1n-9	490	mg/100 g	AsureQuality Method (Based on JAOCS, 62 (1985))

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AsureQuality Reference: 20-356741 **Report Issued:** 12-Jan-2021

Test	Result	Unit	Method Reference
Linoleic C18:2n-6	460	mg/100 g	AsureQuality Method (Based on JAOCS, 62 (1985))
Alpha Linolenic C18:3n-3	87	mg/100 g	AsureQuality Method (Based on JAOCS, 62 (1985))
Total Sugar	<0.1	% m/m	AsureQuality Method (GLC)
Fat SBR *	1.7	% m/m	AsureQuality Method
Arsenic *	<0.02	mg/kg	AsureQuality Method (ICP-MS)
Cadmium *	0.024	mg/kg	AsureQuality Method (ICP-MS)
Mercury *	<0.01	mg/kg	AsureQuality Method (ICP-MS)
Lead *	0.12	mg/kg	AsureQuality Method (ICP-MS)
Calcium	100	mg/100 g	AsureQuality Method (ICP-OES)
Copper	0.64	mg/100 g	AsureQuality Method (ICP-OES)
Iron	1.9	mg/100 g	AsureQuality Method (ICP-OES)
Magnesium	60	mg/100 g	AsureQuality Method (ICP-OES)
Manganese	0.44	mg/100 g	AsureQuality Method (ICP-OES)
Sodium	15	mg/100 g	AsureQuality Method (ICP-OES)
Zinc	1.4	mg/100 g	AsureQuality Method (ICP-OES)

Analysis Summary

Auckland Laboratory

Analysis	Method	Accreditation	Authorised by
Ash			
GC-ASH-01, 01-IN_HOUSE_METHOD	AsureQuality Method	Not Accredited	Shivanjani Chand
Dietary Fibre (by Ankom Autoanalyser)			
GC-FIBR01, 03-ANKOM	AOAC 991.43	IANZ	Rishi Kumar
Moisture			
GC-MOIS07, 04-IN_HOUSE_METHOD	AsureQuality Method	Not Accredited	Mohammed Bhamji
Protein			
GC-PROT03, 13-VIA_NITROGEN	via Kjeldahl	IANZ	Mohammed Bhamji
Starch (Boehringer)			
GC-STAR02, 01-DEFAULT	Boehringer Mannheim Methods of Biochemical Analysis and Food Analysis (1987)	Not Accredited	Gita Nand
Amino Acid Profile			
MN-AAP-08, 02-FOOD	AsureQuality Method (UHPLC)	Not Accredited	Pratika Bansal
Total Tryptophan			
MN-TRP-04, 02-OTHER	AOAC 2017.03	Not Accredited	Pratika Bansal
Vitamin B1			
MN-VITB13, 01-DEFAULT	EN14122: 2003 (Committee for European Normalisation)	IANZ	Anthony Faleatua
Vitamin B6			
MN-VITB14, 01-DEFAULT	Food Chemistry, Volume 48 (1993), Journal of Chromatography. Volume 463 (1989), Journal of Food Science - Volume 58 (1993).	IANZ	Rosely Bourke
Vitamin B2			
MN-VITB15, 01-DEFAULT	Food Chemistry, Volume 23, JAOAC Volume 62 (1979)	IANZ	Naleen Raj
Vitamin B3			
MN-VITB16, 01-DEFAULT	Journal of Chromatography, Volume 301 (1984)	IANZ	Rosely Bourke
Ascorbic Acid			
MN-VITC06, 01-FOOD_POWDERS	AOAC 2012.22	Not Accredited	Shipra Gaur
Vitamin A and E			
MN-VTAE01, 01-VITAMIN_A_E	Methods for the Determination of Vitamins in Food - Recommended by COST 91 (1986)	IANZ	Zheng Yu Wang
Fatty Acid Profile			
MN-FAP-02, 01-DEFAULT	AsureQuality Method (Based on JAOCS, 62 (1985))	IANZ	Radhika Pillay

AsureQuality Reference: 20-356741 **Report Issued:** 12-Jan-2021

Analysis	Method	Accreditation	Authorised by
Sugar Profile			
MN-SUGR01, 02-SUGAR_PROFILE	AsureQuality Method (GLC)	IANZ	Josieka Lal
Pantothenic Acid			
MN-VITB36, 01-PANT_ACID	AOAC 2012.16	Not Accredited	Dhruv Pathak
Folate			
MN-VITB37, 03-OTHER	AOAC 2013.13	Not Accredited	Dhruv Pathak
Fat (SBR)			
GC-FSBR01, 07-IN_HOUSE_METHOD	AsureQuality Method	Not Accredited	Mohammed Bhamji
ICP-MS Routine			
TR-ICPM01, 01-DEFAULT	AsureQuality Method (ICP-MS)	Not Accredited	Veebha Waghela
Instrumental Analysis of Prepared Samples By ICP-OES For Macro Elements			
TR-ICPO02, 01-DEFAULT	AsureQuality Method (ICP-OES)	IANZ	Shaireen Prasad

Any tests marked with * are not accredited for specific matrices or analytes.

Results that are prefixed with '<' indicate the lowest level at which the analyte can be reported, and that in this case the analyte was not observed above this limit.

Pratika Bansal
Laboratory Supervisor

Mohammed Bhamji
Analyst

Shivanjani Chand
Analyst

Dhruv Pathak
Technical Customer Champion

Anthony Faleatua
Laboratory Technician

Shipra Gaur
Laboratory Supervisor

Rishi Kumar
Scientific Analyst

Josieka Lal
Analyst

Gita Nand
Laboratory Analyst

Radhika Pillay
Analyst

Shaireen Prasad
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Veebha Waghela
Laboratory Analyst

Zheng Yu Wang
Analyst

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Accreditation

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