



Australian consumers' insights into potatoes - Nutritional knowledge, perceptions and beliefs



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ABSTRACT

Background: There has been a decline in the consumption of potatoes in developed countries worldwide due to many factors including the introduction of new foods and meal trends. In turn, this shift in eating patterns has dramatically affected the Australian potato industry which represents the largest horticulture contributor to gross food revenue. Many factors may influence consumers' food preferences, including the individual's nutrition knowledge, lifestyle factors, personal preferences, attitudes and beliefs. The present study aimed to capture an understanding of the consumer's level of nutritional knowledge and what currently drives consumer decision making.

Methods: Participants aged between 25 and 54 years responded to an online survey which included 52 questions specifically looking at potatoes, nutritional knowledge, views, eating habits and lifestyle factors, preferences and beliefs. Questions in the survey included multiple choice, rank and scale responses and free answers.

Results: A total of 1208 males and females (males $n = 598$, females $n = 610$) were included in the final analysis. The results show that the majority (88.5%) of the participants consume potatoes (not including hot chips/french fries) 4 times per week or less (41.6% ≤ 1 week; 46.9% 2–4 times/week). Overall, 33% of the participants stated that their potato consumption over the last five years had decreased. The main reasons stated for this decrease were that potatoes were high in carbohydrates (30%) and that starchy vegetables were not a healthy option (23%).

Conclusions: Results showed that consumers believe that potatoes are good for all ages, are versatile, convenient, good value for money and delicious. However, the results indicate the majority of people have limited knowledge regarding the nutrient composition of potatoes and associate them negatively with carbohydrates.

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1. Introduction

Potatoes are considered to be the number one vegetable crop in the world grown in both developed and developing countries. They have the ability to adapt to different climates, they are high yielding, and importantly, fast growing to feed growing populations. In Australia, potatoes represent a valuable source of revenue to agriculture with a production of up to 1.25 million tonnes per year. Potatoes are considered a starchy vegetable that supply a good source of carbohydrates, vitamins and minerals in the diet. In

particular, they provide key micronutrients including potassium, magnesium, folate and vitamin C (Food Standards Australian New Zealand (FSANZ), 2015). For these reasons, potatoes are one of the most valuable and nutritious crops grown globally.

However, during the last 20 years there has been a shift in eating patterns which has dramatically affected the Australian potato industry. This has resulted in a national decrease in both the production and consumption of the potato. Comparing data from national surveys from 1995 to 2012 there has been an average decrease in per capita potato consumption across all age groups of ~20% (Australian Bureau of Statistics, 2014). This decrease has coincided with an increase in diversity in the western diet including alternative options to the potato, these being predominantly from grains such as rice, quinoa, durum wheat (made into couscous and pasta), as well as the tuberous sweet potato.

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However, there also appears to be an overall decrease in the per capita consumption of foods in the bread and cereal food group (eg. rice, pasta, bread) over this time (Australian Bureau of Statistics, 1997; 2014) which might indicate other underlying reasons why Australian consumers are choosing not to include them in their diet as frequently.

There are many factors that may influence the choices made by a consumer; including the individual's nutrition knowledge, lifestyle factors, personal taste preferences, attitudes and beliefs (Barker et al., 1995; Buttriss, 1997). With the current decline in potato consumption, this study aimed to capture an understanding of the consumer's level of nutrition knowledge regarding the potato and what factors currently drive consumer decisions. Results from this study could be used to assist in the formation of targeted marketing strategies with a goal to increase the consumption of potatoes.

2. Materials and methods

2.1. Study design and sample

This nationwide study was conducted using an online computer based survey. The survey was designed by Dr John Carragher and Dr Katie Wood (Dietitian) from the University of Adelaide in consultation with Robbie Davis (CEO Potatoes South Australia). Questions were designed in consultation with Potatoes South Australia to obtain relevant information to assist in future public marketing campaigns through establishing consumption levels, taste and nutrition knowledge and the comparison of potatoes with other foods. The survey was piloted on 12 people before release to estimate time of completion and make any adjustments based on respondent feedback. An estimated completion time of 15 min was derived from pilot surveys. Survey questions were designed to separate the consumption of hot chips/French fries from other various forms of potato (boiled, mashed, roasted, baked) due to the focus of this study on the consumption of fresh potatoes and that hot chips are regarded as a discretionary food in the Australian dietary guidelines. Respondents were asked to disregard any additions that may be added to potatoes such as butter, cheese, salt etc. when asked questions regarding taste and nutritional attributes. The survey was approved by the University of Adelaide Human Ethics Committee (Approval No. H-2015-267).

2.2. Data collection

The survey included 52 questions specifically looking at potatoes, nutritional knowledge, eating habits, lifestyle factors, food preferences and beliefs. Questions in the survey included multiple choice, rank and scale responses and free answers. The Australian marketing research company Pureprofile distributed the survey to paid participants aged 25–54 years of age registered on their database. Distribution was completed to ensure respondents were balanced in relation to gender and the number of respondents from each State was proportional to the population of Australia according to the Australian Bureau of Statistics. Respondents were not included in the final survey data if they did not meet criteria including the minimum time taken to complete the survey and consecutive identical answers. Information about the study was provided to the participants in the introduction of the survey and consent was obtained. The survey was conducted in January 2016.

2.3. Statistical analysis

After all responses had been collected the results were collated by Pureprofile (Melbourne, Australia) and sent to the University of Adelaide in an Excel spreadsheet format. Descriptive statistics were

calculated for all variables. A one-way repeated measured analysis of variance (ANOVA; SPSS version 22, IBM Corp. Armonk, NY) was conducted to evaluate differences between foods in questions regarding nutrition and taste (Table 2). Significance was $P < 0.05$.

3. Results

3.1. Participants

In total, 1208 males and females (males $n = 598$, females $n = 610$) responded to this survey and were included in the final analysis. There was a relatively even distribution of respondents across all age groups with 25–29 years (14.5%), 30–34 years (17%), 35–39 years (17.6%), 40–44 years (17%), 45–49 years (17%) and 50–54 years (16.9%). The nationwide sample included responses from New South Wales (32.6%), Victoria (25.8%), South Australia (7.5%), Queensland (18.8%), Western Australia (10.6%), Tasmania (2.4%), Australian Capital Territory (1.7%) and Northern Territory (0.6%). Households with two or three residents (27.5% and 24.5%) made up the majority of the sample with approximately half (49.7%) of the households including at least 1 person under the age of 16 years.

3.2. Diet

There were low proportions of people who identified as being vegetarian (4.1%), pescaterian (2.3%), vegan (0.8%), paleo (0.8%) and other (1.5%), with most people saying they included meat and plants in their diet (90.6%). The majority of the participants in this survey indicated they followed a normal diet (71.2%) with the remainder identifying an Asian influenced diet (7.3%), low fat diet (6.3%), low-carbohydrate diet (5.6%), gluten free diet (2.2%), FOD-MAP diet (1.4%), intermittent fasting (1.4%) and other (4.6%).

3.3. Nutrition knowledge and sources of information

Most respondents (61.2%) considered they had an average overall nutrition knowledge. The use of the internet to access nutrition information was reported by 56.4% of the sample with this trend decreasing as age increased. There was a smaller percentage of older people compared to younger people seeking nutrition advice and overall the survey showed that the majority of people are interested in nutrition but less than 15% are consulting with a qualified nutritionist/dietitian or their doctor (Fig. 1).

3.4. Food preferences and nutrition knowledge

3.4.1. Potato consumption

The results from the survey show that the majority (88.5%) of the participants consumed potatoes (not including hot chips) 4 times per week or less (41.6% ≤ 1 week; 46.9% 2–4 times/week); with only 1.6% reported they never ate potatoes and 0.9% saying they ate them every day. In comparison with alternative foods including rice, noodles and pasta, potatoes ranked the highest food consumed during the week (Table 1). Overall, 53% of the participants stated that their potato consumption over the last five years has stayed the same with 33% indicating that their intake had decreased. The main reasons chosen for a decrease in consumption were that potatoes were “High in carbohydrates” and “Starchy vegetables were not healthy” (Fig. 2). Options including a long cooking time, cost, and the perception of being boring or old fashioned were not an issue for the vast majority of people eating fewer potatoes. Respondents were asked if they knew more about the nutrition benefits of a potato would that influence their consumption of them, 35% indicated that it would. The participants

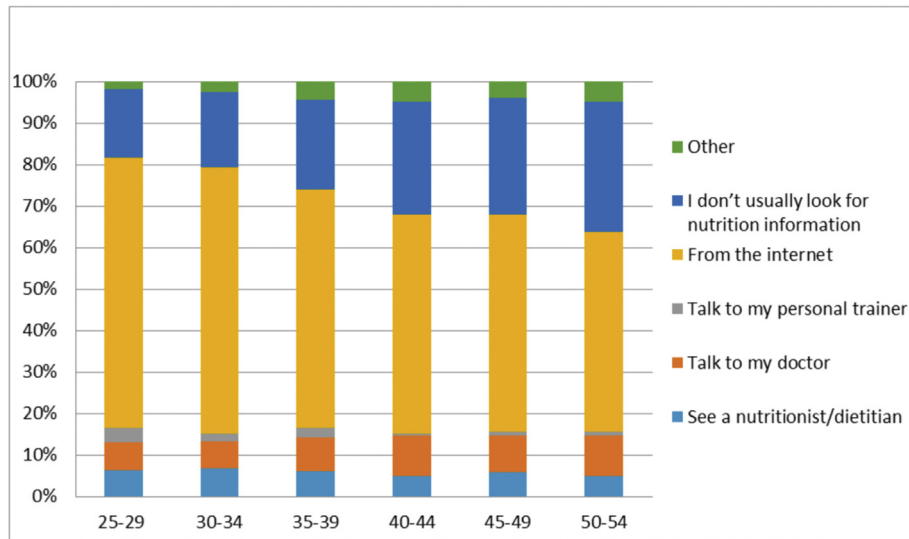


Fig. 1. Nutrition information sources according to age group.

Table 1

Foods consumed during the week.

	1st	2nd	3rd	Total (%)
Potatoes	396	265	260	921 (76%)
Rice	384	255	266	905 (75%)
Pasta	232	357	286	875 (73%)
Sweet Potatoes	108	125	128	361 (30%)
Noodles	66	148	66	280 (23%)
Quinoa	16	32	41	89 (7%)
Couscous	6	26	39	71 (6%)

Data presented as number of participants (n; %).

Foods ranked 1st to 3rd; 1st being the most consumed.

Table 2

Nutrition and Taste scores (n = 1208 Australians, aged 25–54).

	Nutrition rating	Taste rating
Boiled Pasta	4.1 ± 1.3 ^a	5.5 ± 1.3 ^e
Boiled White Rice	4.2 ± 1.4 ^{ab}	5.0 ± 1.4 ^d
Roast Potato	4.3 ± 1.3 ^b	6.1 ± 1.1 ^a
Mashed Potato	4.4 ± 1.3 ^b	5.8 ± 1.4 ^b
Baked Potato	4.6 ± 1.3 ^c	5.7 ± 1.2 ^b
Boiled Potato	4.7 ± 1.3 ^d	4.6 ± 1.5 ^c
Roast Sweet Potato	4.9 ± 1.2 ^e	5.6 ± 1.6 ^e
Mashed Sweet Potato	5.0 ± 1.2 ^f	5.2 ± 1.7 ^d
Boiled Brown Rice	5.3 ± 1.2 ^g	4.6 ± 1.7 ^c

Data presented as mean ± SD; scores ranked from 1 to 7.

Nutrition rating scale (1 is low; 4 is moderate; 7 is high).

Taste rating scale (1 is dislike; 4 moderately like; 7 delicious).

Values with the same superscript within each column are not significantly different.

that indicated they had increased their consumption (14%) indicated that the main reasons were from an increased understanding that vegetables (including potatoes) were a healthy option, they have discovered new ways to use them and were seen as an economical choice.

3.4.2. Nutrition, taste and appetite satisfaction

Overall, 73% of the participants indicated they had an average level of knowledge regarding the nutrition content of a potato. When asked “How nutritious do you rate a serve of this food?” out of a scale of 1–7 (1 low; 7 high) participants ranked brown rice highest with a score of 5.3, followed by sweet potato and potatoes;

there was no significant difference in the rating of the four cooking styles of potato (Table 2). Boiled pasta had the lowest nutritional rating at 4.1 which was not significantly different from boiled white rice but both were significantly lower than potatoes.

In comparison with these other well-known staple foods most styles of potato ranked highest for taste (Table 2) with roasted potato ranked the highest with a score of 6.1 out of 7 ($P < 0.05$) (1 dislike; 7 delicious). Pasta and sweet potato were rated next highest, with white rice rated significantly lower. Boiled potato and boiled brown rice received the lowest scores for taste with scores of 4.6 and 4.4 respectively. Results for nutrition and taste showed a trend to be inversely related, suggesting that the healthier a food is perceived, the less tasty it is regarded ($R^2 = 0.28$). For example brown rice received the highest nutrition score of 5.3 but received the lowest score for taste of 4.4 (Table 2). Potatoes and pasta were ranked equal highest with 5.3/7 for the question “How appetite satisfying do you find the following foods” (data not shown).

3.5. Beliefs and attitudes

The results showed that consumers believe that potatoes are versatile, good value for money, good for them, their families and for older people, and more nutritious with the skins on (Table 3). On the other hand, there is a widely-held view that the carbohydrate content of the potato is not good for their health. Results for the question “I can't lose weight eating potatoes” showed lack of understanding by consumers with 32% not having an opinion and an even number in agreement (32.3%) and disagreement (35.8%) with the statement. There was no significant difference between males and females scores in regards to this statement, however fewer males indicated they strongly agreed (3.0% vs 7.7%) or disagreed (7.5% vs 11.0%) with the statement compared to females. A similar trend was seen in questions “I don't see potatoes as a vegetable but a carbohydrate like bread” with the highest proportion (23.7%) slightly agreeing with the statement. The statement “Potatoes are higher in carbohydrates than pasta” showed that 38.8% of consumers didn't know if they were or not and only 7.1% either moderately or strongly disagreeing. The results also indicate that a relatively small proportion of the respondents (21%) moderately or strongly disagreed with the statement “Potatoes contain gluten” with the majority (69%) having no moderate or strong opinion either way, suggesting a broad lack of understanding of the specific

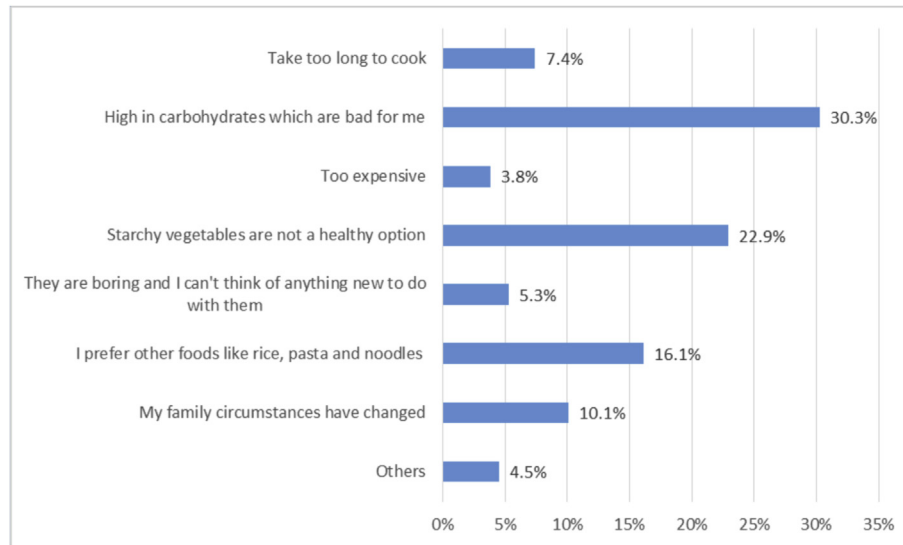


Fig. 2. Reasons for decreased potato consumption in 33% of respondents who stated they had decreased consumption in the last 5 years.

Table 3
Beliefs and Attitudes.

	Strongly Disagree	Moderately Disagree	Slightly Disagree	No Opinion	Slightly Agree	Moderately Agree	Strongly Agree
Potatoes are good value for money	1.2	1.0	4.8	8.5	26.0	31.6	26.8
Potatoes are 'Old Fashioned'	12.6	8.9	14.6	17.4	23.0	16.5	7.0
I don't see potatoes as a vegetable but as a carbohydrate like bread	10.5	9.1	18.5	15.5	23.7	15.8	6.9
Potatoes are higher in carbohydrates than pasta	2.4	4.7	19.6	38.8	20.3	11.4	2.7
Potatoes take a long time to prepare and cook	10.2	12.7	25.2	15.0	24.3	10.3	2.2
Potatoes have a high GI (glycaemic index)	2.1	3.0	8.7	41.1	25.6	15.0	4.6
Potatoes contain gluten	14.2	6.5	9.7	41.4	17.1	8.8	2.4
Potatoes are a good family food	0.3	1.3	3.2	10.0	33.8	33.5	17.8
Potatoes are good for me	0.9	2.0	6.6	18.4	39.6	23.4	9.1
Eating potatoes with skin on is more nutritious	0.6	0.9	3.6	18.4	23.3	29.0	24.2
I can't lose weight eating potatoes	9.4	7.3	19.1	31.9	17.5	9.4	5.4
Potatoes are a versatile vegetable to cook with	0.3	0.7	2.3	12.1	27.7	30.5	26.4

Data presented as % of total number of respondents ($n = 1208$).

nutritional attributes of potato.

4. Discussion

The present study provides results from the largest online study undertaken in Australia specifically looking at the consumption, beliefs and attitudes regarding the potato. The inclusion of five serves of vegetables a day (including potatoes) is recommended in the Australian dietary guidelines with strong evidence supporting the consumption of vegetables as part of a healthy diet for overall health (National Health and Medical Research Council, 2013b, 2013a). The World Health Organisation also recommends fruit and vegetable consumption to decrease the risk of some non-communicable diseases such as cardiovascular disease and some cancers (World Health Organization, 2015). In addition, the inclusion of fruit and vegetables has been shown to assist in reducing weight gain (National Health and Medical Research Council, 2013b; World Health Organization, 2015) which is an important factor given that 63.4% of adult Australians are either classified as overweight or obese (Australian Bureau of Statistics, 2015). Therefore, the evidence suggests that the consumption of vegetables is an important health message for all ages.

Results from this study showed that potatoes are eaten by every

age group and more than 85% of the respondents consumed them 4 times or less per week. They ranked as the highest food consumed during the week with other staples including pasta and rice close behind and were rated equal (to pasta) highest for appetite satisfaction. In regards to versatility, value for money, preparation time and taste, potatoes are seen positively. The majority of Australians eat a home cooked meal 4 out of 5 evenings a week giving rise to many opportunities to include potatoes in the diet (Australian Institute of Health and Welfare, 2012). Taste is a well-known determinant of dietary behaviour and plays a strong influence in food choices (Kourouniotis et al., 2016). A study looking at the importance of taste in dietary choice in 1306 Australian young adults (mean age 20 ± 5 years) reported those that rated taste highly had an overall poorer diet quality and consumed less fruits and vegetables (Kourouniotis et al., 2016). The results from the current study show that the 33% of respondents who reported a decrease in consumption over the last five years has been driven by several factors, but mainly those which are related in a negative sense to the nutritional value of potatoes. Consistent with other countries, a declining trend in the inclusion of potatoes in the diet has been seen, including Norway, Sweden, Canada, the United States of America, Ireland and the United Kingdom, in which the potato was recognised as an important contributor to the general

diet (Fernqvist, Spendrup, & Ekelund, 2015; MacPherson, Dukeshire, Wang-Pruski, & Varma, 2012; O'Brien et al., 2003; Riley, 2010; Storey & Anderson, 2013; Wandel, Fagerli, & Kjaernes, 2001). In contrast to the present study, the findings from those studies suggested inconvenience, increased consumption of alternative carbohydrate sources and changes in socio economic status have contributed to the major decline in consumption (Fernqvist et al., 2015; Wandel et al., 2001).

The nutrition composition of a potato individually and in comparison with other foods is where the Australian consumer's level of understanding and knowledge appears limited and at times confused. This is probably not surprising when you consider what nutrition information most people are exposed to: sensationalised findings of large scale observational studies that report correlations between poor health outcomes/weight gain and self-reported historical intakes of different foods, including potatoes (however, what the media mostly fails to point out, is that such studies identify associations, but do not show a direct cause and effect); and online media featuring more 'celebrity diet advice' which has little or no evidence base for demonising certain foods. Rather, most dietitians and nutritionists prefer to look at overall dietary patterns and not focus on individual foods. For this reason, dietary guidelines usually classify foods into several different groups that together represent an overall healthy diet based on scientific evidence to achieve optimum health outcomes. The Australian Dietary Guidelines recommend an intake of 45–65% of energy to be sourced from carbohydrates and to consume five serves of vegetables a day (National Health and Medical Research Council, 2013a) but the latest data released analysing the Australian Health Survey 2011–2013 (Australian Bureau of Statistics, 2016a) the largest and most comprehensive health survey ever conducted in Australia ($n = 12,000$) indicates that only 4% of adults meet this recommendation. Breads and cereals is the main food group supplying carbohydrates in the Australian diet but even then, the results show only 30% of the population meet the recommended guidelines (Australian Bureau of Statistics, 2016a). It is clear from these results that overall consumption of carbohydrates from all sources is lower than the recommended 45–65% of energy.

Dietary guidelines in the United States are in line with Australia with respect to the inclusion of the potato as a vegetable. Given the low intake of vegetables, including potatoes, in the United States of America this has also coincided with low intakes of potassium in which potatoes are well known as being an excellent source (Storey & Anderson, 2013). In contrast, in the United Kingdom the potato is classified as a 'starchy' food and is not included in vegetable intake targets (Gibson & Francis, 2015). Given the variation that exists between dietary guidelines and how potatoes are 'categorised', it is not surprising that consumers' perceptions of the nutritional value of potato is confused and could be a reason for declining consumption. This is confirmed by the results from our study indicating that people are unsure of which food group the potato belongs to with the majority (46.4%) in agreement and others having no opinion (15.5%) in the potato being classified as a bread/cereal rather than a vegetable.

Results from our study show the predominant reasons that consumers are decreasing their intake of potatoes are nutrition related, in particular, the perception that potatoes have a high carbohydrate content and that starchy vegetables are not a healthy option. Furthermore, the association between eating carbohydrates and being able to lose weight appears to be an area of misunderstanding. In comparison to other starchy foods eg. pasta and rice, the potato contains less energy (kJ), carbohydrates and fat per 100 g or per serving size (Food Standards Australian New Zealand (FSANZ), 2015). A recent systematic review of 11 randomised controlled trial studies ($n = 1169$) comparing low carbohydrate

diets with low fat diets reported an overall greater decrease in weight reduction following a low carbohydrate diet (Mansoor, Vinknes, Veierød, & Retterstøl, 2016). However, authors highlighted that the macronutrient content of the diets did not seem to be the determining factor in weight loss but the overall reduction in energy (kJ) consumed in the diet when carbohydrates are reduced. Further to this, people following the low carbohydrate diets had increases in LDL-cholesterol (Mansoor et al., 2016), a risk factor for cardiovascular disease.

The majority of the respondents in our survey believed they had an average overall nutrition knowledge level, and specifically, knowledge of the nutrient composition of the potato. However, most of these people answered 'no opinion' or only 'slightly agree/disagree' to most questions about the nutritional attributes of potatoes. This suggests the 'average' Australian person does not have much understanding about nutrition. Our results showed that a high proportion of consumers are accessing the internet for information regarding nutrition. The concern regarding this is the availability of various levels of information containing conflicting messages both correct and incorrect. Therefore, it is not surprising that people appear confused about questions such as the amount of energy (kilojoules) in different foods, what is actually good for their health and what they can include in a healthy diet and still have the ability to lose weight if they wish. Consequently, changes in eating behaviour reflect levels of understanding and access to accurate information.

5. Strengths and limitations

This study, to our knowledge, is the first of its kind to undertake a survey investigating into the consumer's knowledge and perceptions regarding the potato in Australia. Results from this study give an estimation of the current intake of potatoes in Australian households and is a positive step in regards to understanding the reasons attributing to the decline in potato consumption.

An online survey has the ability to access a large number of people at the same time, enabling an efficient and fast collection of data from respondents. Online surveys are conducted for this reason quite frequently to obtain statistics in many areas of research. A high percentage (85%) of Australians aged 15 years and over access the internet for personal use on a weekly basis. Household income does play a role in the percentage of people accessing the internet with the lowest income quintile accessing it less (67%) than those in the high income quintile (97%). This survey did not obtain data on the income levels of the participants, education levels and social class which should be explored in future research to understand the generalisability of the results to the general population (Australian Bureau of Statistics, 2016b; O'Brien et al., 2003). Allowing people to complete the survey anonymously in their own time decreases participant burden but also has the potential to decrease the importance placed on the survey. Results in this study showed a wide use of the scales (1–7) indicating that participants were taking time to read and correctly answer the questions. However, the people who participate in these surveys potentially are more inclined to be interested in areas of nutrition which leads to an increased sample bias.

Dietary recall in any study will inevitably have some form of limitations. Asking participants to estimate how many times they eat potatoes per week gives an estimate of potato consumption, but is not as accurate as quantitative data eg. weighed amounts. The use of food frequency questions are both quick and simple thus commonly used in online surveys and, for the purpose of this study, a suitable method.

The Beliefs and Attitudes section of the survey included a "No opinion" statement as a response to the questions in this area. The

analysis of this section showed a majority of respondents frequently answered with “No opinion”. We believe that the use of this response could be further improved in future surveys to be relabelled “Do not know”. In changing this statement interpretation of the results would be clearer for this statement.

6. Conclusion

Findings from this study indicate that Australian consumers of all ages are purchasing and consuming potatoes. It is apparent that a positive association exists regarding their versatility, ease of preparation, taste, appetite satisfaction and cost. The overall trending decline in consumption that has occurred appears to be strongly related to their nutrition content, specifically negative perceptions surrounding carbohydrates.

The nutrient composition of a potato is poorly understood and the vitamin, mineral and macronutrient content (specifically carbohydrates) of a potato is information not well established in the consumer. Understanding the nutritional benefits of eating potatoes appears to be limited and messages to correct this would be beneficial to increase consumption in the future. Findings from this research suggest that future marketing campaigns should emphasise these nutritional messages to encourage the inclusion of the potato as part of a healthy diet. Support is necessary through consistency in dietary guideline recommendations by government health agencies worldwide to ensure a clearer understanding of the important macro- and micronutrient attributes of the potato in a healthy diet.

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