



Preferences for dietary oils and fats in cooking and food preparation methods: a cross-sectional analysis of Australian adults

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Abstract

Dietary oils and fats contain different fatty acid compositions that are associated with cardiometabolic disease risk. Despite their influence on disease outcomes, the types of dietary oils and fats predominately used in Australian households remain unknown. The aim of this study was to investigate the use of dietary oils and fats in cooking and food preparation in Australia. Adults living in Australia completed a cross-sectional online survey outlining their current household oil and fat use from July to December 2021. The survey was disseminated via social media platforms and included questions about the types of dietary oils and fats used for different cooking methods and the perceived motivators for choosing the main household oil. A total of 1248 participants responded to the survey. Participants were mostly female (91.6%) aged between 25 and 44 years (56.7%). The majority of participants (84.5%) reported using some form of olive oil as their main source of oil for cooking and food preparation. Almost two-thirds of the sample (65.4%) reported using extra virgin olive oil (EVOO), mainly in raw food preparation (71.5%) or savoury baking and roasting (58%). Fewer households reported using rice bran oil (4.6%), canola oil (4.3%) and vegetable oil (1.8%). Almost half of all participants (49.6%) identified perceived health benefits as the primary motivating factor for their main choice of oil, followed by sensory preference (46.7%), versatility (10.2%) and convenience (8.8%). Australian adults frequently use olive oil, specifically EVOO, as the main oil for cooking and food preparation in the household.

Keywords: Dietary oils: Olive oil: Cooking: Food preparation: Health

Dietary fats have long been investigated in relation to various health and disease outcomes, in particular CVD. Epidemiological evidence from recent systematic reviews and meta-analyses suggests that excessive intakes of saturated and *trans*-fats are associated with higher all-cause mortality and CVD risk^(1,2). Much of this early evidence and knowledge on the effects of dietary lipids on outcomes related to CVD risk was derived from the Seven Countries Study⁽³⁾ which showed that per capita intake of saturated fat, but not total fat, was strongly associated with incidence of CVD and CVD-related mortality. Despite decades of ongoing research and inconsistent findings between saturated fat intake and coronary outcomes^(4–6), limiting saturated fat intake remains almost universally agreed upon across most global food-based dietary guidelines and recommendations for CVD risk reduction^(7,8). In contrast, reductions in cardiovascular events have

been strongly observed in studies where saturated fats are replaced with unsaturated fatty acids, which has been demonstrated in several systematic reviews that have included evidence from both observational studies and randomised controlled trials^(9–12). Given that certain cardiovascular risk factors are modifiable by improving diet quality, the use of dietary oils and fats is of clinical and public health importance.

Since dietary oils and fats possess different fatty acid profiles, there is renewed interest in their cardiometabolic health effects. For example, in persons at high CVD risk, investigators from the PREDIMED (Prevención con Dieta Mediterránea) study⁽¹³⁾ reported a 30% reduction in the risk of a primary cardiovascular event in participants randomised to receive either a Mediterranean diet supplemented with either extra virgin olive oil (EVOO) or nuts over a 5-year period compared to those assigned to a control (low-fat) diet. There is also great interest and controversy in the

Abbreviations: EVOO, extra virgin olive oil; TC, total cholesterol; LDL, low-density lipoprotein; HDL, high-density lipoprotein; CVD, cardiovascular disease; MUFA, monounsaturated fatty acids; PUFA, polyunsaturated fatty acids; n-3, omega-3.

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consumption of dairy fats (a source of saturated fat) and CVD risk^(14–17). An important aspect of such controversies is that individual variations in fatty acids may have different metabolic pathways and cardiometabolic health outcomes. For example, compared with a variety of plant-based oils, there is meta-analytic evidence to support that olive oil modulates blood lipid profiles, in particular, by decreasing total cholesterol (TC), LDL-cholesterol and triglycerides and increasing HDL-cholesterol⁽¹⁸⁾. In other meta-analyses, olive oil consumption has been inversely associated with diabetes risk, improvements in endothelial function and attenuation of inflammatory biomarkers^(19,20). As such, the potential cardiometabolic benefits of olive oil may in part be due to its predominant fatty acid composition of oleic acid and extends beyond the modulation of plasma lipids and lipoproteins alone⁽²¹⁾. Furthermore, the plant-based omega-3 (*n*-3) fatty acid α -linolenic acid, a precursor for the long-chain *n*-3 PUFA, has also been associated with improved cardiometabolic health outcomes in both observational studies and randomised controlled trials^(22–26) as well as the attenuation of inflammatory mediators⁽²⁷⁾. In a meta-analysis of randomised controlled trials, Amiri *et al.*⁽²⁸⁾ showed that compared with other edible plant-based oils, canola oil (characterised by its high MUFA and α -linolenic acid composition) significantly improved cardiometabolic risk markers including TC, LDL-cholesterol, TC/HDL, LDL/HDL and apolipoprotein B. Moreover, the investigators further reported that the lipid-modulating effect of canola oil was greater when ~15 % of total energetic intake from other oils was replaced with canola oil. Despite evidence suggesting that coconut oil (a rich source of saturated fat) raises TC, LDL-cholesterol and HDL-cholesterol compared with unsaturated plant oils⁽²⁹⁾, when compared against butter, coconut oil has been shown to be beneficial for cardiovascular health by raising HDL-cholesterol and lowering HDL-cholesterol⁽³⁰⁾.

Despite their potential impact on cardiometabolic risk indices, use of dietary oils and fats in Western countries remains largely unknown and has likely changed in recent decades due to multicultural societies and population-based health promotion messaging specifically targeting reductions in saturated fat intake. It is also unclear whether the use of dietary oils and fats for different cooking methods has altered in response to supplier messaging; in recent years, some vegetable oils have been promoted as having a high smoke point for the purpose of certain cooking methods including frying⁽³¹⁾. Nevertheless, there is recent evidence from the United States of America (USA) showing that olive oil is now the most commonly used dietary fat source for cooking and food preparation, followed by vegetable oil and canola oil⁽³²⁾. However, preferences for dietary fats, oil use and the cooking methods associated with their use in Australia remain scant. From a population health perspective, knowledge of dietary oil and fat use is an important step towards facilitating more targeted and effective implementation strategies to encourage consumers to adopt healthier choices that are consistent with dietary guidelines and recommendations.

Therefore, the aim of the present study is to explore the use of dietary oils and fats in cooking and food preparation amongst Australian adults.

Methods

Participants

A cross-sectional study using a mixed methodological approach was undertaken amongst Australian males and females aged ≥ 18 years. Australian adults who were permanent residents of Australia and could complete an anonymous online survey in English were invited to participate. Participants were recruited via social media platforms including Facebook, Twitter, Instagram and LinkedIn from July 2021 to December 2021 requesting voluntary participation. Qualtrics^{XM} survey software was used to construct and distribute the survey. A link to the survey was disseminated via social media platforms where the study protocol and potential risks were clearly outlined to all interested participants. The investigators disseminated the survey link on social media platforms (Facebook, Twitter, Instagram and LinkedIn) weekly from the dates previously outlined. This study was conducted in accordance with the guidelines laid down in the Declaration of Helsinki, and all procedures involving study participants were approved by the Human Research Ethics Committees at the University of South Australia (203972) on 16 June 2021 and the University of the Sunshine Coast (A211607) on 6 July 2021. As the research involved the completion of a self-administered online survey, participants were informed that all information collected would remain confidential. Participants acknowledged an informed consent statement to participate in the study.

Data collection

Dietary oil and fat use amongst Australian adults was assessed using a nineteen-item self-administered online questionnaire, designed to be completed in approximately 10 minutes. Given the lack of a previously validated and reliable survey instrument, the authors developed a prototype questionnaire that was initially piloted against a separate representative sample for face validity. For the assessment of face validity, a convenience sample of volunteers across a range of ages (18–75 years) was invited to complete the prototype questionnaire that was administered online. A total of *n* 12 participants completed the prototype questionnaire (75 % female; 25 % male). Nil changes to the readability of the questions were required following administration of the prototype questionnaire. The online questionnaire was divided into two parts (see online Supplementary Material 1). Part A consisted of open- and closed-ended questions related to participant demographic characteristics. Part B of the online questionnaire consisted of open- and closed-ended questions related to type and household quantity of daily oil used, main fat and oil use for different cookery methods (e.g. shallow frying, deep frying, stir frying, stewing, etc.) as well as perceived attitudes and beliefs related to oil use within the household (Table 1). There were no time restrictions applied to complete the questionnaire and participants were not required to answer all questions before proceeding to subsequent questions. The link to the survey was recognisable once only to the server it was sent thus preventing duplication when responding to the survey. The investigators also screened all of the participant responses (IP address and postcode



Table 1. Summary of questions from part B of the online survey evaluating the types of oils used in cooking and food preparation in Australia

No.	Question	Response options
1.	<p>Considering each of the cooking methods listed below, please indicate from the drop box which oil you mainly use for each of these cooking methods.</p> <p>a) Raw (i.e. for dressings, dipping bread into)</p> <p>b) Boiling</p> <p>c) Sautéing</p> <p>d) Shallow frying</p> <p>e) Deep frying</p> <p>f) Stir frying</p> <p>g) Air frying</p> <p>h) Stewing/Simmering</p> <p>i) Roasting and/or savoury baking</p> <p>j) Sweet baking</p> <p>k) Preserves or condiments</p> <p>l) BBQ or grilling</p> <p>m) Slow cooking or pressure cooking</p> <p>n) Other cooking method not listed (state below)</p>	<p>I don't use oil for this cooking procedure</p> <p>I don't use this cooking method</p> <p>Extra Virgin Olive Oil</p> <p>Olive Oil</p> <p>Light Olive Oil</p> <p>Canola Oil</p> <p>Safflower Oil</p> <p>Sunflower Oil</p> <p>Rice Bran Oil</p> <p>Vegetable Oil</p> <p>Peanut Oil</p> <p>Sesame Oil</p> <p>Macadamia Oil</p> <p>Walnut Oil</p> <p>Grape Seed Oil</p> <p>Coconut Oil</p> <p>Avocado Oil</p> <p>Butter</p> <p>Margarine (any type)</p> <p>Clarified Butter/Ghee</p> <p>Animal Fat/Lard</p>
2.	<p>Considering all of your responses from the previous question, what type of oil do you mainly use in your household? (please select one only)</p>	<p>Extra Virgin Olive Oil</p> <p>Olive Oil</p> <p>Light Olive Oil</p> <p>Canola Oil</p> <p>Safflower Oil</p> <p>Sunflower Oil</p> <p>Rice Bran Oil</p> <p>Vegetable Oil</p> <p>Peanut Oil</p> <p>Sesame Oil</p> <p>Macadamia Oil</p> <p>Walnut Oil</p> <p>Grape Seed Oil</p> <p>Coconut Oil</p> <p>Avocado Oil</p> <p>Clarified Butter/Ghee</p> <p>Animal Fat/Lard</p> <p>I don't use oil</p> <p>Other not listed (state below)</p>
3.	<p>Based on your response from the previous question, how much of this oil would you normally consume on an average day? Please consider what you consume and not the whole household.</p>	<p>Less than 1 tablespoon</p> <p>1–2 tablespoons</p> <p>2–3 tablespoons</p> <p>3–4 tablespoons</p> <p>More than 4 tablespoons</p>
4.	<p>Why do you choose this oil in preference to others?</p>	<p>Open-ended</p>
5.	<p>If you do not use olive oil or extra virgin olive oil as the main cooking oil in your household, could you please tell us why?</p>	<p>Open-ended</p>

viewed to ensure participants were from Australia) to ensure all responses were consistent with the eligibility criteria.

Data analysis

Qualitative data were analysed using conventional content analysis⁽³³⁾. Data were read for familiarisation and to determine initial codes. A recursive process was undertaken independently by two authors (NW and EM) during content analysis to maintain the rich detail of the data^(34,35) and descriptions and rationale for codes were documented to confirm the reliability of the data⁽³⁶⁾. This iterative process was continued by the same two authors (NW and EM) until the research team was in agreement, with the addition of a third researcher (AV) to resolve any

discrepancies. Related codes were grouped into representative themes. Representative quotations that illustrate the themes are presented alongside each theme and referenced with the participant number (in brackets). Furthermore, quantitative content analysis of response data was undertaken⁽³⁷⁾. Identified themes were expressed as frequencies and percentages of responses using Microsoft Excel software. Statistical Package for the Social Sciences (SPSS) for Windows 27.0 software⁽³⁸⁾ was also used to perform analysis of descriptive data and expressed as means ± standard deviations for continuous data and frequencies and percentages for categorical data. A one-way ANOVA was used to explore differences in oil use according to age categories. Additionally, χ^2 analysis using Fisher's exact test was conducted to explore potential differences in the

Table 2. Demographic characteristics of participants (*n* 1248)

Variable	<i>n</i>	%
Gender		
Females	1143	91.6
Males	99	7.9
Non-binary	4	0.3
Gender fluid	1	0.1
Not reported	1	0.1
Age category (years)		
18–24	39	3.1
25–34	303	24.3
35–44	404	32.4
45–54	265	21.2
55–64	154	12.3
65–74	76	6.1
Greater than 75	7	0.6
Weight (kg)		
Mean	74.7	
SD	16.9	
BMI (kg/m ²)		
Mean	26.7	
SD	5.6	
Country of birth		
Australia	1046	83.8
UK	77	6.2
New Zealand	19	1.5
Canada	6	0.5
Other countries combined	97	7.8
Not reported	3	0.2
Mother's country of birth		
Australia	849	68.0
UK	138	11.1
Greece	37	3.0
Italy	24	1.9
China	6	0.5
Other countries combined	191	15.3
Not reported	3	0.2
Father's country of birth		
Australia	786	63.0
UK	152	12.2
Greece	39	3.1
Italy	33	2.6
China	6	0.5
Other countries combined	224	18.0
Not reported	8	0.6
Highest level of education		
No schooling completed	1	0.1
Junior or primary school	1	0.1
Secondary school	112	9.0
Trade/Technical/Vocational training	113	9.1
Diploma/Advanced diploma	172	13.7
Bachelor's degree	484	38.8
Postgraduate degree/Doctorate	365	29.2
Annual Household Income (AUD)		
\$0–24 999	26	2.1
\$25 000–\$74 999	196	15.7
\$75 000–124 999	332	26.6
\$125 000–199 999	404	32.4
\$200 000 or greater	184	14.7
Prefer not to disclose	104	8.3
Not reported	2	0.2
Reported medical conditions		
No medical conditions and otherwise healthy	540	43.3
Anxiety	276	22.1
Depression	159	12.7
High blood pressure	115	9.2
Arthritis	108	8.7
High cholesterol	107	8.6
Endocrine disorders	37	3.0
Osteoporosis	21	1.7

Table 2. (Continued)

Variable	<i>n</i>	%
Type 1 diabetes mellitus	12	1.0
Type 2 diabetes mellitus	29	2.3
Heart disease	14	1.1
Neurological disease	10	0.8
Other	216	17.3

frequency of reported oil use type and the presence of self-reported medical conditions (e.g. medical condition *v.* no medical condition).

Results

Participant characteristics

A total of *n* 1248 participants completed the survey and were included in the final analyses. More than 90% of the survey questions were completed by all participants. Participant characteristics are outlined in Table 2. Participants were predominantly female (females *n* 1143, males *n* 99) with more than half of participants (56.7%) aged between 25 and 44 years. The majority of participants were born in Australia (*n* 1046; 83.8%); however, participants reported a diverse range of cultural backgrounds including 72.8% who identified as Australian, 8.0% identified as English, 3.1% identified as Greek, 2.4% identified as Italian and 1.2% identified as Chinese. More than half of participants (59.0%) reported a total annual household income of between \$75 000 and \$199 999 AUD. Less than half of the participants (43.3%) reported no medical conditions, 25.4% reported one medical condition and 14.6% reported two medical conditions. Anxiety, depression, hypertension, arthritis and high cholesterol were the most reported medical conditions amongst participants.

Quantity and type of oil use in cooking and food preparation

Quantity and reported use of all oil types is presented in Table 3. Approximately half of all participants (*n* 629; 50.4%) reported using less than one tablespoon per day in cooking and food preparation. In contrast, more than one-third of participants (*n* 459; 36.8%) reported using 1–2 tablespoons of oil per day. More than three-quarters of participants (*n* 1055; 84.5%) reported using some form of olive oil as their main source of oil for cooking and food preparation, with almost two-thirds of the sample (*n* 816; 65.4%) using EVOO (Table 3). Of those who reported using some form of olive oil, almost half (*n* 514; 48.7%) reported using less than one tablespoon per day. The next commonly used oils were rice bran (*n* 57; 4.6%) and canola (*n* 54; 4.3%) (Table 3). Rice bran oil (*n* 39; 68.4%) and canola oil (*n* 32; 59.3%) were also reported to be consumed in amounts of less than one tablespoon per day. No significant differences in oil use were observed according to age category ($F(16, 1231) = 1.25, P = 0.22$). No significant differences were observed according to the presence of a medical condition in those that

Table 3. Frequency and percentage of main household oil use differentiated by daily serve size (*n* 1248)

Type of oil	<i>n</i> (% of total sample)		Less than 1 tablespoon		1–2 table- spoons		2–3 table- spoons		3–4 table- spoons		More than 4 tablespoons	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
EVOO	816	65.4	396	47.9	312	37.8	68	8.2	24	2.9	10	1.2
Olive	203	16.3	95	46.8	76	37.4	19	9.4	7	3.4	6	3.0
Rice bran	57	4.6	39	68.4	15	26.3	1	1.8	2	3.5	0	0.0
Canola	54	4.3	32	59.3	16	29.6	1	1.9	4	7.4	1	1.9
Light olive	36	2.9	23	63.9	9	25.0	1	2.8	2	5.6	1	2.8
Vegetable	22	1.8	13	59.1	9	40.9	0	0.0	0	0.0	0	0.0
Coconut	16	1.3	6	37.5	9	56.3	1	6.3	0	0.0	0	0.0
Peanut	9	0.7	6	66.7	2	22.2	1	11.1	0	0.0	0	0.0
Grape seed	8	0.6	4	50.0	3	37.5	1	12.5	0	0.0	0	0.0
Butter	8	0.6	3	37.5	4	50.0	0	0.0	1	12.5	0	0.0
Clarified butter/Ghee	6	0.5	2	33.3	3	50.0	1	16.7	0	0.0	0	0.0
Sunflower	4	0.3	2	50.0	1	25.0	1	25.0	0	0.0	0	0.0
Sesame	2	0.2	2	100.0	0	0.0	0	0.0	0	0.0	0	0.0
Macadamia nut	2	0.2	2	100.0	0	0.0	0	0.0	0	0.0	0	0.0
Avocado	1	0.1	1	100.0	0	0.0	0	0.0	0	0.0	0	0.0
Safflower	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Walnut	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Animal fat/Lard	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Oil not used	4	0.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

Abbreviations: EVOO, extra virgin olive oil.

*Quantity of EVOO used was not reported by *n* 6 participants.

used EVOO, olive oil, light olive oil, rice bran or canola oil as the main household oil (medical condition: *n* 626; no medical condition: *n* 540; not reported *n* 82; all *P* values = >0.05). Walnut oil, safflower oil and animal fat/lard were not reported as the main household oils used by participants; however, they were used for specific food preparation and cooking methods.

Participants reported using a range of different oils for various cooking and food preparation methods (Table 4). Oil use was reported across all food preparation and cooking techniques. However, over three-quarters of participants (*n* 1036; 83.0%) reported nil use of oil for boiling. EVOO was the most frequently reported oil used for raw food preparation methods (e.g. salad/vegetable dressings) (*n* 882; 71.5%), followed by savoury baking or roasting (*n* 724; 58.0%) and sauteing (*n* 679; 54.4%). In contrast, butter was most frequently used by participants for sweet baking (*n* 471; 37.7%). Canola oil and rice bran oil were both most frequently used for shallow frying (canola oil: *n* 140, 11.2%; rice bran oil: *n* 117, 9.4%), while sesame oil was most frequently used for stir frying (*n* 123; 9.9%). However, EVOO was still the main oil used by most participants for shallow and/or stir frying (Table 4).

Perceived motivators for main household oil consumption

Survey responses on the perceived motivators for main oil use were analysed for themes and presented in combination with representative quotes, frequency and percentage of responses (Table 5). A total of seventeen themes were identified as perceived motivators. Almost half of all participants (*n* 619; 49.6%) identified perceived health benefits as the primary motivating factor for the main choice of oil in cooking and food preparation methods. Sensory preference including flavour, taste and smell was also frequently reported as an influential factor determining choice of oil (*n* 583; 46.7%). Versatility (*n* 127;

10.2%) and convenience (*n* 110; 8.8%) were also frequently reported.

Given that some form of olive oil (e.g. EVOO, olive and light) was identified as the predominant oil used in Australian households (*n* 1055; 84.5%), the perceived motivators for its use were akin to those outlined in Table 5. As such, the most frequently reported motivator for olive oil use included the perceived health benefits of olive oil (*n* 561; 53.2%), followed by flavour and taste, including the flavour of infused olive oils (*n* 503; 47.7%), and its versatility for use across different cooking methods (*n* 112; 10.6%). Convenience was also frequently reported as a perceived motivator for using olive oil (*n* 98; 9.3%).

Of the *n* 193 participants who reported not using any form of olive oil as their main dietary oil source, sensory preference, in particular taste and flavour, was the most frequently reported reason for not using this type of oil (*n* 58; 30.1%). Limiting cooking problems (e.g. EVOO having a lower smoke point and potential damage to cooking utensils) was also frequently reported (*n* 49; 25.4%). Moreover, expense (*n* 32; 16.6%) was also identified as an important barrier for not using a form of olive oil.

Discussion

Results from this large cross-sectional analysis demonstrated that olive oil, in particular EVOO, was the main choice of oil for use in cooking and food preparation in this sample of Australian households. The perceived motivators for the use of the main cooking oil in the household included its potential for health benefits, sensory preference and its versatility.

Our findings are indeed novel as this, to the best of our knowledge, is the first Australian study to investigate oils used in cooking and food preparation in Australian households. Nevertheless, our data are representative of previous apparent

Table 4. Frequency *n* (%) of oil use for different cooking methods (*n* 1248)

Type of Oil	Cooking method																									
	Raw		Boiling		Sauteing		Shallow Frying		Deep Frying		Stir Frying		Air Frying		Stewing/Simmering		Roasting/Savoury Baking		Sweet Baking		Preserves/Condiments		BBQ/Grilling		Slow Cooking/Pressure Cooking	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
EVOO	882	71.5	62	0.5	679	54.4	412	33.0	44	3.5	421	33.7	105	8.4	424	34.0	724	58.0	127	10.2	157	12.6	520	41.7	371	29.7
Olive	109	8.7	26	2.1	208	16.7	118	9.5	21	1.7	125	10.0	40	3.2	155	12.4	246	19.7	44	3.5	59	4.7	218	17.5	120	9.6
Light olive	26	2.1	6	0.5	40	3.2	34	2.7	5	0.4	33	2.6	12	1.0	22	1.8	31	2.5	19	1.5	10	0.8	33	2.6	11	0.9
Rice bran	9	0.7	5	0.4	58	4.6	117	9.4	74	5.9	86	6.9	12	1.0	17	1.4	29	2.3	21	1.7	3	0.2	61	4.9	14	1.1
Canola	3	0.2	8	0.6	58	4.6	140	11.2	122	9.8	79	6.3	17	1.4	25	2.0	40	3.2	66	5.3	5	0.4	94	7.5	12	1.0
Vegetable	0	0.0	14	1.1	20	1.6	95	7.6	123	9.9	47	3.8	2	0.3	12	1.0	20	1.6	79	6.3	4	0.3	40	3.2	14	1.1
Coconut	1	0.1	0	0.0	10	0.8	12	1.0	1	0.1	43	3.4	0	0.0	2	0.3	8	0.6	57	4.6	2	0.2	3	0.2	5	0.4
Peanut	1	0.1	2	0.2	8	0.6	30	2.4	11	0.9	177	14.2	2	0.2	4	0.3	5	0.4	2	0.2	3	0.2	11	0.9	2	0.2
Grape seed	1	0.1	0	0.0	9	0.7	13	1.0	8	0.6	10	0.8	1	0.1	4	0.3	8	0.6	14	1.1	4	0.3	12	1.0	3	0.2
Butter	0	0.0	3	0.2	81	6.5	21	1.7	1	0.1	3	0.2	0	0.0	22	1.8	28	2.2	471	37.7	33	2.6	6	0.5	8	0.6
Margarine	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.1	3	0.2	43	3.4	11	0.9	2	0.2	0	0.0
Clarified butter/Ghee	0	0.0	1	0.1	8	0.6	5	0.4	1	0.1	5	0.4	1	0.1	5	0.4	3	0.2	3	0.2	0	0.0	3	0.2	3	0.2
Sunflower	0	0.0	3	0.2	7	0.6	43	3.4	32	2.6	18	1.4	2	0.2	2	0.2	7	0.6	25	2.0	6	0.5	6	0.5	3	0.2
Sesame	7	0.6	2	0.2	5	0.4	1	0.1	1	0.1	123	9.9	0	0.0	1	0.1	0	0.0	0	0.0	8	0.6	0	0.0	1	0.1
Macadamia nut	2	0.2	0	0.0	3	0.2	3	0.2	1	0.1	11	0.9	1	0.1	2	0.2	4	0.3	15	1.2	3	0.2	2	0.2	0	0.0
Avocado	2	0.2	0	0.0	6	0.5	5	0.4	0	0.0	5	0.4	2	0.2	0	0.0	1	0.1	2	0.2	2	0.2	5	0.4	1	0.1
Safflower	0	0.0	0	0.0	0	0.0	4	0.3	5	0.4	4	0.3	0	0.0	0	0.0	0	0.0	1	0.1	1	0.1	2	0.2	0	0.0
Walnut	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.1	0	0.0	0	0.0	0	0.0
Animal fat/ Lard	0	0.0	0	0.0	2	0.2	1	0.1	3	0.2	1	0.1	1	0.1	0	0.0	22	1.8	0	0.0	1	0.1	4	0.3	1	0.1
I don't use oil for this cooking method	135	10.8	1036	83.0	23	1.8	22	1.8	104	8.3	16	1.3	335	26.8	472	37.8	41	3.3	161	12.9	382	30.6	117	9.4	432	34.6
I don't use this cooking method	40	3.2	55	4.4	15	1.2	158	12.7	677	54.2	29	2.3	693	55.5	61	4.9	12	1.0	76	6.1	534	42.8	94	7.5	230	18.4
Not reported	7	0.6	25	2.0	8	0.6	14	1.1	14	1.1	12	1.0	20	1.6	15	1.2	14	1.1	11	0.9	20	1.6	15	1.2	17	1.4

EVOO, extra virgin olive oil.

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Table 5. Perceived motivators of the main oil used by participants in their household (*n* 1248)

Theme	<i>n</i>	%	Representative Quote
Health	619	49.6	'With IBS, I have a sensitivity to high FODMAP foods. A lot of the food we cook include flavours of garlic and onion, and garlic-infused olive oil is a readily available substitute for garlic, so it's the most commonly used one in our house' (Participant 189) 'I also remember reading something a long time about health benefits of grape seed oil, so I started using grapeseed more than EVOO - not that I can remember what this advice was anymore' (Participant 502)
Sensory Preference	583	46.7	'I don't like the taste or smell of butter or animal fat so I can't change my cooking style' (Participant 988) 'High quality EV olive oil tastes best' (Participant 200)
Versatility	127	10.2	'Its versatility of being able to be used for many dishes and cooking styles' (Participant 496) 'I don't like having lots of different products. I find this is most versatile' (Participant 718)
Convenience	110	8.8	'The ease of having one oil to use for most purposes. I know olive oil is not the best oil in all scenarios, but I find it easier to just reach for one oil' (Participant 256) 'I buy it in bulk and it is what is on hand' (Participant 682)
Limiting Cooking Problems	99	7.9	'Good smoke temperature for most uses' (Participant 551) 'Has a decent smoke point for the cooking that I use it for' (Participant 1052) 'Doesn't burn in the pan' (Participant 317) 'The polyphenols protect it from damage during heating' (Participant 658)
Cost	77	6.2	'Have always used it, usually cheaper than the others as you can buy it in those big tins. And we use so little of it I don't see the need to purchase something so expensive' (Participant 839) 'Easy to buy in bulk here in Australia, so as cheap as any of the other oils at my local supermarket' (Participant 238)
Family	70	5.6	'My mother cooks using this oil, so I am used to cooking with it and haven't done much research into the benefits and cooking outcomes of any other oils really' (Participant 24) 'My family produce olive oil and it is delicious!' (Participant 1)
Cooking Preference/Style	63	5.0	'Oil is used frequently for frying in my household and have always been told that rice bran is best to do so' (Participant 230) 'More crispy result' (Participant 872)
Manufacturing	49	3.9	'Easy to get Australian quality olive oil' (Participant 1021) 'Less processed than other cooking oils' (Participant 1076)
Habit	34	2.7	'What I have always used for everyday cooking' (Participant 1009) 'I'm not sure actually, it's just what I've always used' (Participant 1019)
Support Local Produce	33	2.6	'Supports Australian olive farmers' (Participant 345) 'Locally produced' (Participant 831)
Personal Preference	30	2.4	'Grew up on a fruit block that grows olives' (Participant 474) 'I make my own ghee' (Participant 897)
Dietary Preference	27	2.2	'Try to follow a Mediterranean diet' (Participant 554) 'Mediterranean diet recommended by GP' (Participant 404)
Cultural	20	1.6	'It's what I (and my ancestors) have used most of my life and I am genetically predisposed to believe it is the best' (Participant 158) 'Grown up using olive oil as my mother's side of the family have a Mediterranean background' (Participant 560)
External Influences	13	1.0	'Current Australian cooks and media recommend it for its benefit for health over other oils. I always choose locally processed olive oil, so I know its freshness and purity' (Participant 343) 'The marketing I see leads me to believe it's better than other types of oils' (Participant 888)
Food Literacy	9	0.7	'Most knowledge of this oil' (Participant 558) 'I generally cook to the recipe instructed. Also based on my nutritional knowledge of the health benefits of extra virgin olive oil' (Participant 589)
Environmental Sustainability	4	0.3	'Able to buy locally produced and in bulk, minimising plastic and waste' (Participant 768) 'Locally produced and trying to reduce food miles' (Participant 640)

consumption from international data on the use of olive oil for cooking and food preparation in Western countries^(39,40). Specifically, current available data on trends related to olive oil consumption indicate that over the past 30 years, there has been a 75% increase in the consumption of olive oil in Australia⁽⁴⁰⁾. In comparison, olive oil consumption in the USA has also seen a 78% increase from 1991 to 2021. In contrast, olive oil consumption in some Mediterranean countries, including Italy and Greece, has seen between a 13 and 45% decline in olive oil consumption over this timeframe⁽⁴⁰⁾.

The rise in EVOO use in Australian households has the potential to contribute to healthier dietary patterns and positively impact population health due to the myriad of health benefits associated with its high nutritional quality and its unique

composition. In particular, oleic acid in addition with bioactive polyphenolic molecules (such as oleuropein, hydroxytyrosol and tyrosol) are important constituents of EVOO which may help to explain its cardioprotective role including reductions in TC and LDL-cholesterol, blood pressure, pro-inflammatory markers, improved insulin sensitivity and endothelial function and reductions in oxidative stress⁽⁴¹⁻⁴⁵⁾. Regular consumption of EVOO has also been associated with reductions in diabetes mellitus, inflammatory bowel disease, obesity and some cancers⁽⁴⁶⁾. As such, it is not surprising that perceived health benefits were identified as the primary motivator for olive oil use in Australian households. Our findings are in agreement with a smaller study involving *n* 35 men and women in the USA who also identified the perceived health benefits of olive oil as an important factor influencing

consumer choice⁽⁴⁷⁾. Importantly, however, results from the present study as well as the aforementioned study conducted by Santosa *et al.*⁽⁴⁷⁾ did not further articulate the specific details related to perceived health benefits such as cardiovascular benefits and/or reductions in disease risk. Nevertheless, despite the perceived health benefits reported by participants in the present study, the majority reported using less than one tablespoon of olive oil per day, which is markedly less than reported in previously published clinical trials investigating cardiovascular benefits from the use of EVOO^(13,41,48). Whether lower quantities of EVOO incorporated into an otherwise healthy dietary pattern will exert the same cardiovascular benefits remains largely unknown and is subject to ongoing research. Nevertheless, given the potential cardioprotective health benefits associated with EVOO consumption, it would be prudent for health care clinicians to advocate the use of EVOO, particularly in high-risk patients, at quantities that are acceptable to individual, social and health-related needs.

Sensory preference was also a determining factor in the main choice of oil used. In particular, participants favoured a 'neutral' oil including EVOO or olive oil. Nevertheless, some participants reported olive oil as having 'too strong' a flavour and favoured alternative oils depending on cuisine type. Previous evidence suggests that the fatty acid composition of oils may be responsible for taste perception and can play a role in determining taste intensity and perceived retention of taste⁽⁴⁹⁾. Furthermore, some studies have indicated that the phenolic compounds present in EVOO, namely oleuropein, may influence the bitterness and thus perceived taste of the oil⁽⁵⁰⁾. In a sample of *n* 60 Italian adults, Barbieri *et al.*⁽⁵¹⁾ reported that participants did indeed appreciate the fruity flavour when sampling EVOO; however, this was superseded by the perceived bitterness of the oil. Furthermore, sensory perception has been reported to be influenced by more than taste and smell alone, with brand, price, country of origin, and label information and presentation playing a key role in sensory perception⁽⁵²⁾. In the present study, data on the sensory perception of olive oil beyond comments related to the perceived neutrality of the oil were not collected, and as such, we have limited information regarding respondents' motivations on choosing olive oils based on perceptions of specific flavours, pungency or other sensory characteristics.

Limiting cooking problems (e.g. burning food, damage to cookware) was frequently reported as a perceived motivator for choosing the main household cooking oil. Specifically, respondents reported selecting an oil with a high smoke point for the style of cooking (e.g. frying) that would not damage cookware or utensils. As such, this was more frequently reported amongst participants who did not use a form of olive oil as the main oil in the household. Indeed there is a perceived perception that olive oils do not have a high smoke point and are not suitable for certain cooking methods, such as frying; however, evidence continues to mount suggesting that EVOO in particular can be heated to temperatures of 180 degrees Celsius for deep frying and up to 240 degrees Celsius for shallow frying while maintaining stability and producing less polar by-products than its polyunsaturated counterparts and in turn protecting cookware^(53–56). Furthermore, there is also a common perception that heating olive oil to high temperatures may damage the

properties of the oil. However, previous evidence suggests that the phenolic compounds within EVOO play a protective role in minimising oxidation during frying^(57,58), and EVOO with a high oleic acid composition demonstrates a lower formation of toxic compounds during frying⁽⁵⁹⁾. Nevertheless, in the present study, EVOO continued to be the most frequently used oil for sautéing, shallow frying and stir frying which is a finding consistent with a previous cross-sectional survey of *n* 2234 participants in the USA which reported that 86% of participants sautéed with olive oil despite suggestions of the proposed low smoke point associated with the oil⁽⁶⁰⁾. Despite the high use of EVOO across these cooking techniques, we did observe differences between sautéing, stir frying and shallow frying. For example, we observed that a greater proportion of participants (74.3%) used a form of olive oil for sautéing rather than for stir frying (46.3%), which is considered a similar cooking technique albeit at a lower temperature. However, this may also reflect the interpretive differences in oil use for different cooking methods across different ethnicities. Additionally, the theme of minimising damage to cookware was more frequently reported as a perceived motivator for oil choice than cost. This is indeed a novel finding given that some form of olive oil was the most commonly reported oil used in Australian households, despite its high costs relative to other common cooking oils^(61,62). Our findings are in contrast to those previously reported by Errach *et al.*⁽⁶³⁾ and Santosa *et al.*⁽⁴⁷⁾ who identified that cost was one of the main determining factors in participants' decisions to purchase olive oil in *n* 439 adult consumers of olive oil (52.5% female; 47.5% male) in Spain and *n* 35 adults (82.9% female; 17.1% male) in the USA, respectively. However, more recent findings suggest that when choosing a household oil, factors, including sustainability, are more considered than the cost of olive oil⁽⁶⁴⁾. In contrast to these findings, supporting local production of oils and environmental sustainability were not as frequently reported in the present study.

Cultural background and family preferences were also identified by some participants as motivators for choice of oil. The link between cultural background and the main household oil was perhaps somewhat expected given the well-established associations between culture and food choice⁽⁶⁵⁾. This theme was also similar to previous research conducted in Europe which reported that culture and family tradition were important determining factors for consumption of olive oil among Austrian, German, British, Russian, Italian and Croatian citizens⁽⁶⁶⁾. Nevertheless, in the present study, cultural background and family preferences were not reported as frequently in comparison with the aforementioned study.

This study is not without limitations. Firstly, we recruited a convenience sample of Australian adults who were generally younger, well-educated and from a high-income bracket, which was not generalisable to the wider population of Australian adults. Given that we used social media platforms for recruitment, this approach resulted in selection bias and limited our ability to capture oil use and preferences amongst more disadvantaged populations. Therefore, future research into a more socio-economically diverse sample of Australian adults would further identify oil use in cooking and food preparation in Australia and provide a more definitive understanding of the oils



used and the perceived motivators for their use. This would also allow further analysis of the links between oil use and health-related outcomes. In addition, females responded to the online questionnaire at much higher rates compared with males. This may not be unexpected given that females may be more likely to participate in cooking-related activities such as watching cooking programmes and participating in online cooking surveys⁽⁶⁷⁾ as well as cooking and preparing meals in the household^(68,69). However, these findings are unlikely to be generalisable to the wider population of Australian adults. Lastly, reporter bias was also likely given that the quantity of oil use, and the method of food preparation in the household was self-reported.

Conclusions

Findings from this cross-sectional analysis suggest that the majority of households in this sample of Australian adults use some form of olive oil as the main oil in cooking and food preparation, primarily due to its perceived health benefits, sensory preference and versatility. However, although olive oil use was frequently reported in this population, the amount of olive oil used was markedly lower than those amounts needed to elicit cardiovascular benefits. As this is the first study to investigate oil use and consumption in Australian households, further investigation into the quantities consumed and current consumer understanding of the potential health benefits, sensory properties and versatility of olive oil use for different cooking methods will assist in developing more targeted strategies for health care professionals to disseminate advice related to the use of olive and other cooking oils for optimal health and disease prevention.

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Supplementary material

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