

The use and acceptability of diet-related apps and websites in Australia: Cross-sectional study

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Abstract

Objective: Diet-related apps and websites are developed to help improve dietary intake. The aim of this study is to explore the use and acceptability of diet-related apps and websites in Australia.

Methods: In a cross-sectional study, 241 participants (mean age = 40.6 years) completed an online survey about demographic characteristics, lifestyle behaviours and health concerns, experience and confidence in technology use, and preferences, attitudes and perception of diet app and website use. Descriptive analysis and unadjusted multiple logistic regression were used to explore data.

Results: Overall, 63.5% of participants were current or previous app users. App users were more confident in using technology, more concerned about diet and weight, and more trusting of information provided in diet-related apps compared to non-app users ($p \leq .05$). Features such as food tracking, nutrient check and barcode scanning were preferred by both users and non-users. The likelihood of using diet-related apps was higher for those who trust the app information (OR 5.51, 95% CI: 2.40–12.66), often count calories (OR 2.28, 95% CI: 1.01–5.24) and are often on diet (OR 4.16, 95% CI: 1.21–14.21) compared to their counterparts.

Conclusions: More than half of the Australians that participated in this study used diet-related apps and websites. App features that allow the user to accurately record and monitor food intake and scan barcodes may motivate app use. Future public health strategies may take advantage of diet-related apps and websites to improve dietary behaviour at the population level and reduce the burden of obesity and non-communicable diseases.

Keywords

Diet app, mHealth, eHealth, behavioural change, food intake monitoring, lifestyle behaviours

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Introduction

The rising prevalence of obesity and its related non-communicable diseases (NCDs) continue to place a heavy strain on global healthcare systems.¹ For most individuals, improving dietary behaviours (e.g., increasing fruit and vegetable intake, and reducing energy, sugar, and salt intake) is a critical component in addressing the burden of NCDs.² In Australia, and many other countries, dietary guidelines and associated resources have been developed to support the general public in adopting a healthy diet.³ However, adherence to national dietary guidelines is generally poor, both in Australia⁴ and other countries.⁵ For

example, only 7% of Australian adults consume the recommended daily amount of fruit and vegetables, with a large proportion of the population overconsuming ‘energy-dense’ ‘discretionary foods’.⁴ A recent systematic review

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of seventeen high-, low- and middle-income countries also indicates that almost 40% of the population (irrespective of income category) do not adhere to national dietary guidelines; with low consumption of fruit, vegetables and whole-grain foods, and high consumption of 'junk' foods.⁵ Thus, despite decades of global attempts to align eating habits with national recommendations, poor diet remains one of the biggest contributors to NCDs.

The provision of evidence-based nutrition interventions for public health is an ongoing topic, with advances in technology creating novel opportunities for population-based strategies.⁶ Mobile internet-capable technologies, particularly smartphones, have become increasingly accessible and accepted by the general public. They also permit users to install applications (apps) with features that can track, monitor and review dietary intake, including the provision of 'personalised' feedback. Thus, these technologies have the potential to facilitate dietary behaviour change.⁷ Diet-related apps and websites can be useful tools for healthcare settings (e.g., dietetic practice)³⁵. Literature suggests that healthcare professionals are willing to use technology assisted means such as diet-related apps as supplemental tools to expand daily practice, monitor and engage patients, improve care, and reduce healthcare costs.^{36, 37} Despite the positive general perception about using technology such as diet apps³⁷, concerns regarding content reliability and accuracy are barriers to greater uptake by healthcare professionals.³⁶

Despite an abundance of diet-related apps and websites being available to consumers, there is limited information currently available on their use and acceptability. Understanding individuals' expectations, preferences and use of diet-related apps and websites is an important step in guiding public health and eHealth/mHealth interventions (e.g., medical and public health services supported via the internet or mobile technology) that meet consumer's needs. Therefore, the aim of this study was to: 1) explore the personal characteristics (e.g., age, gender, etc.) of diet-related apps and websites in users and non-users in Australia; 2) explore the attitudes/preferences of Australian adults towards the use of diet-related apps and websites; and 3) identify factors that influence diet app and website use.

Methods

Design

A cross-sectional study design was employed, with an online questionnaire hosted on the Qualtrics platform (Qualtrics, 2021) used to collect data. The questionnaire was distributed using CQUniversity institutional newsletters, email invitations and social media channels. Participation in this study was voluntary and participants were free to withdraw at any time before survey responses

were submitted without prejudice or consequences. Participants were also recruited through convenience and snowball sampling techniques. Eligible participants included Australian residents aged 13 years and older. Data was collected between April and August 2020. Ethics approval was obtained from CQUniversity Human Research Ethics Committee (Approval Number 0000022892). All participants were provided with an information sheet and consent form at the beginning of the questionnaire.

Data collection

The questionnaire consisted of $n=11$ core and $n=27$ subset questions, including participant demographic characteristics, health behaviours, diet attitudes, diet app (and/or website) use and preferences, reasons for stopping use or never using diet-related apps and websites. The questionnaire was piloted ($n=5$) to estimate the survey length and took ~15–20 min to complete. Participant demographic information included age, gender, ethnicity, education, health-related training (e.g., nursing, public health, medicine), income, and existing health conditions (including eating disorders). Health behaviour questions ($n=15$) examined typical diet, physical activity, smoking and alcohol intake behaviours. Diet questions ($n=8$) asked about daily intake of the five main food groups, discretionary (junk) food intake and sweetened beverage consumption based on recommendations made in the Australian Dietary Guidelines.³ Physical activity was investigated using two questions to address the Australian physical activity guidelines.⁸ Physical activity guidelines were met if participants reported five or more days of 30 min of physical activity in total at an intensity high enough to increase rate of breathing (question: In the past week, on how many days have you done a total of 30 min or more of physical activity at an intensity high enough to increase your rate of breathing?).⁸ Answer options were 0 days per week to 7 days per week. Alcohol consumption was explored in two questions to address Australian guidelines to reduce health risks from drinking alcohol.⁹ Participants' alcohol consumption was classified as 'low risk' if they reported no more than 10 standard drinks a week and no more than four standard drinks on any isolated drinking occasion. Participants' alcohol consumption was classified as 'risky' if this limit was exceeded⁹ (questions: How many standard drinks of alcohol do you usually drink? and How often did you have 4 or more standard drinks on one occasion in the past year?).

Information technology questions ($n=7$) explored use, devices used, internet access, and confidence in using these devices. Likert scale questions also asked about concern ($n=5$; 1='Not at All Concerned' to 5='Extremely Concerned') and confidence ($n=7$; 1='Strongly Agree' to 5='Strongly Disagree') towards

overall health and dietary intake. Likert scale questions were collapsed and reported on 3-point scales due to limited cases. Survey questions were based on similar literature^{10, 11} but developed specifically for the purpose of this study. The use of diet-related apps (and websites), preference, and reasons for stopping use or never using were explored using 14 questions. Participants were prompted to answer two different sets of questions, depending on their diet-related app/website use and frequency of use. Participants were initially prompted to report their 'current' or 'previous' use of diet-related app(s) and website(s). If participants answered 'no' to 'current' or 'previous' use, they were classified as 'non-users'. Participants were classified as 'users' if they answered 'I am currently using diet-related app(s) or website(s)', and 'previous users' if they answered 'I previously used diet-related app(s) or website(s), but I have stopped using them'.

Questions on 'current users' asked participants to choose (from a list of 23 options) the diet-related apps and/or websites they use and rank them from most preferred to least preferred (e.g., MyFitnessPal, Easy Diet Diary, Noom, Weight Watchers). The main reasons for using, and use of specific features were also examined. Nine questions were used to explore the frequency of use and user preferences in 'current' and 'previous' app users. Those who indicated 'never' using a diet-related app/website were directed to answer three questions to determine reasons for this.

Sample size was calculated using GPower software version 3.1.9.2.¹² Using the Chi-squared test with contingency tables, and assuming a medium-sized effect (Cohen's $w = 0.3$)⁴² with 95% power, $\alpha = 0.05$ and 2 degrees of freedom, data from at least 172 participants was necessary for statistical power. Considering a 30% nonrespondent/incompletion rate, a total sample size of 224 participants was required.

Statistical analysis

Data was analysed using IBM SPSS Statistical Software version 28.0.0.0.¹³ Participants' characteristics, diet app use and preferences were examined using descriptive analysis and reported as frequency and percentage. Characteristics, confidence and preferences of 'diet app users' were compared to 'non-users' using cross-tabulation and Pearson's Chi-square tests for categorical variables. Multiple logistic regression was used to identify factors associated with diet app and website use. In the first model, variables with reported bivariate differences (with p -value < 0.01) between 'users' and 'non-users' were entered into the regression model. In the second model, the regression was adjusted for the confounding influence of demographic variables with a bivariate difference (with a p -value < 0.01). Associations were presented as odds ratio (OR) with 95% confidence interval (CI). An alpha level < 0.05 was accepted as statistically significant.

Results

Characteristics and health behaviours

A total of 276 participants attempted the survey and 241 completed all questions. Table 1 summarises the demographic characteristics of participants. Overall, 62 participants were current app users (25.7%), 91 were previous app users (37.8%) and 83 were app non-users (26.5%). Participants were mostly Caucasian (84.2%), female (85.5%), aged between 18 and 34 years (41%), had completed University or higher education (61%), and reported a combined weekly household income between \$600 and \$2999 (57.8%). In terms of occupation, 43.2% of participants worked in a professional job and 36.1% had health-related training. Compared to non-users, a larger proportion of app users were classified as people with overweight and obesity (70.1% versus 50.6% $p = 0.009$). The majority (88.3%) of app users were Caucasian, and app non-users were Asian (11.5%) or other nationalities including Caucasians ($p = 0.03$). The majority of both app users and non-users worked in a professional (42.2% versus 44.8%) or white-collar occupation (27.0% versus 25.3%); however, app non-users were 12.7% more likely to work in a blue-collar occupation ($p = 0.005$). No statistically significant differences were observed between app users and non-users for any other demographic characteristics.

Participants health behaviours are reported in Table 2. Based on the Australian Dietary Guidelines (women aged between 19 and 50 years), almost half of participants (44.0%) reported meeting the recommended daily serves for fruit intake, but only 16.2% met the recommended daily intake of vegetables. The majority of participants (70.1%) reported meeting the recommended daily number of serves of meat or alternatives. More than half (54.4%) of the participants met the recommendations for daily dairy or alternative intake but only 1.2% reported meeting the recommended serves of grains and cereals. Almost half of participants reported that they rarely eat fast-food or take-away foods (46.1%) and never consume sweetened beverages (43.2%). Less than half of the participants (40.0%) reported consuming 7 or more cups of water daily. The majority of participants were non-smokers (94.6%) and more than two-thirds were classified as risky alcohol consumers. All reported health behaviours were not statistically different between diet app users and non-users.

Confidence and use of technology

Cross-tabulation and Pearson's Chi-square tests were used to compare confidence in technology use between diet app users and non-users (Table 3). Compared to non-users, the majority of diet app users were very confident in using computers/laptops (95.5% versus 77.0%, $p < .001$) and smartphones/tablets (92.2% versus 74.7%, $p < .001$) including for internet searching and browsing, social media use, emailing and messaging. All app users (100%) whereas

Table 1. Characteristics of diet-app ‘users’ and ‘non-users’.

	All participants N(%)	App users N(%)	App non-users N(%)	χ^2	P-value
Number of participants	241	154	87		
Age (years)				4.124	.389
18–34 years	88 (36.5)	55 (35.7)	33 (37.9)		
35–44 years	63 (26.1)	45 (29.2)	18 (20.6)		
45–54 years	50 (20.7)	31 (20.1)	19 (21.8)		
55 years and over	40 (16.6)	23 (14.9)	17 (19.5)		
Gender				5.880	.053
Male	33 (13.7)	15 (9.7)	18 (20.7)		
Female	206 (85.5)	138 (89.6)	68 (78.2)		
Other	2 (0.8)	1 (0.6)	1 (1.1)		
BMI				9.441	.009
Underweight (<18.5 kg/m ²)	5 (2.1)	2 (1.3)	3 (3.4)		
Healthy (18.5–24.9 kg/m ²)	84 (34.9)	44 (28.6)	40 (46.0)		
Overweight/Obese (\geq 25.0 kg/m ²)	152 (63.1)	108 (70.1)	44 (50.6)		
Living status				4.581	.333
Living alone	36 (14.9)	22 (14.3)	14 (16.1)		
Living with partner	133 (55.2)	84 (54.5)	49 (26.3)		
Living with parent(s)	22 (9.1)	11 (7.1)	11 (12.6)		
Sole parent living with child/children	11 (4.6)	9 (5.8)	2 (2.3)		
Other	39 (16.2)	28 (18.2)	11 (12.6)		
Highest level of education				6.835	.555
Secondary/High school or below	31 (12.9)	15 (9.7)	16 (18.4)		
Technical/Further education	63 (26.1)	42 (27.3)	12 (13.8)		
University/Higher education	119 (77.2)	97 (63)	28 (32.2)		
Health-related training				0.154	.694
Yes	87 (36.1)	57 (37.0)	30 (34.5)		
No	154 (63.9)	97 (63.0)	57 (65.5)		

(continued)

Table 1. Continued.

	All participants N(%)	App users N(%)	App non-users N(%)	χ^2	P-value
Health condition				3.133	.077
Yes	118 (49.0)	82 (53.2)	36 (41.1)		
No	123 (51.0)	72 (46.8)	51 (58.6)		
Occupation				12.716	.005
Blue collar	22 (9.1)	7 (4.5)	15 (17.2)		
White collar	79 (32.8)	57 (37.0)	22 (25.3)		
Professional	104 (43.2)	65 (42.2)	39 (44.8)		
No paid job	36 (14.9)	25 (16.2)	11 (12.6)		
Income (weekly combined household)				0.511	.916
Not willing to disclose	19 (7.8)	12 (7.8)	7 (8.0)		
Low income (<\$650)	24 (10)	14 (9.1)	10 (11.5)		
Middle income (\$650-\$2999)	139 (57.8)	91 (59.1)	48 (55.2)		
High income (\geq \$3000)	59 (24.5)	37 (24.0)	22 (25.3)		
Nationality				13.980	.030
Caucasian	203 (84.2)	136 (88.3)	67 (77.0)		
Asian	16 (6.6)	6 (3.9)	10 (11.5)		
Other	22 (9.2)	12 (7.6)	10 (11.4)		
Residential community				3.389	.184
Metropolitan	133 (55.2)	91 (59.1)	42 (48.3)		
Rural/Remote	107 (44.4)	62 (40.3)	45 (51.7)		

Values are total number of participants (%).

96.6% of non-users reported having internet access at home ($p = .020$). Compared to non-users, the majority of app users trusted the information provided in diet-related apps and websites (82.3% versus 40.0%, $p < .001$). No statistically significant differences were observed between app users and non-users for information technology device use and frequency of use.

Attitudes towards health and diet

Cross-tabulation and Pearson's Chi-square test were used to compare concerns about overall health and confidence in

ability to make healthy food choices between app users and non-users (Table 4). App users were more concerned about their general diet (40.9% versus 27.6%, $p = .026$), putting weight on (60.4% versus 36.8%, $p = .001$), and classed as overweight or obese (49.4% versus 29.9%, $p = .001$) compared to non-users. App users reported being less confident in choosing healthy food, they were often counting calories to decide if something is fine to eat (52.3% versus 21.8% $p < .001$), and were often on a diet (40.9% versus 10.3% $p < .001$) compared to non-users. Compared to current users, previous app users were less likely to read food labels and choose food based on the

Table 2. Health behaviours of diet-app ‘users’ and ‘non-users’.

	All participants N(%)	App users N(%)	App non-users N(%)	χ^2	P-value
Vegetable consumption (daily serves)				2.206	.137
Does not meet recommendation	202 (83.8)	125 (81.2)	77 (88.5)		
Meets recommendation (5 + serves)	39 (16.2)	29 (18.8)	10 (11.5)		
Fruit consumption (daily serves)				0.779	.378
Does not meet recommendation	135 (56.0)	83 (53.9)	52 (59.8)		
Meets recommendation (2 + serves)	106 (44.0)	71 (46.1)	35 (40.2)		
Meat/Alternatives consumption (daily serves)				0.341	.559
Does not meet recommendation	72 (29.9)	48 (31.2)	24 (27.6)		
Meets recommendation (2.5 + serves)	169 (70.1)	106 (68.8)	63 (72.4)		
Dairy/Alternatives consumption (daily serves)				0.121	.728
Does not meet recommendation	110 (45.6)	69 (44.8)	41 (47.1)		
Meets recommendation (2.5 + serves)	131 (54.4)	85 (55.2)	46 (52.9)		
Cereal/Grain consumption (daily serves)				0.010	.920
Does not meet recommendation	238 (98.8)	152 (98.7)	86 (98.9)		
Meets recommendation (6 + serves)	3 (1.2)	2 (1.3)	1 (1.1)		
Fast food consumption (weekly frequency)				7.452	.059
Never	20 (8.3)	14 (9.1)	6 (6.9)		
Rarely (1–3 times/month)	101 (41.9)	55 (35.7)	46 (52.9)		
Weekly (1–3 times/week)	89 (36.9)	65 (42.2)	24 (27.6)		
Daily/almost daily	31 (12.9)	20 (13.0)	11 (12.6)		
Sweetened-beverage consumption (weekly frequency)				7.479	.058
Never	104 (43.2)	74 (48.1)	30 (34.5)		
Rarely (1–3 times/month)	54 (22.4)	27 (17.5)	27 (31.0)		
Weekly (1–3 times/week)	48 (19.9)	29 (18.8)	19 (21.8)		
Daily/almost daily	35 (14.5)	24 (15.6)	11 (12.6)		
Water consumption (daily cups)				1.219	.544

(continued)

Table 2. Continued.

	All participants N(%)	App users N(%)	App non-users N(%)	χ^2	P-value
2 cups or less	20 (8.30)	12 (7.8)	8 (9.2)		
3–6 cups	124 (51.5)	76 (49.4)	48 (55.2)		
7 cups or more	97 (40.2)	66 (42.9)	31 (35.6)		
Smoking status (18 years and older)				4.059	.131
Non-smoker	228 (94.6)	148 (96.1)	80 (92.0)		
Smoker	11 (4.6)	6 (3.9)	5 (5.7)		
Alcohol consumption risk				1.049	.306
Low risk	61 (25.3)	36 (23.4)	25 (28.7)		
Risky	178 (73.9)	118 (76.6)	60 (69.0)		
Physical activity (30 min at an intensity high enough to increase rate of breathing/day)				0.623	.430
Does not meet recommendation (under 5 days/week)	167 (69.3)	104 (67.5)	63 (72.4)		
Meets recommendation (5 days or more)	74 (30.7)	50 (32.5)	24 (27.6)		

Values are total number of participants (%).

label (59.3% versus 87.1%, $p < .001$), count calories to decide if something is fine to eat (36.3% versus 74.2%, $p < .001$), and be on a diet (33.0% versus 53.2%, $p = .008$) (Multimedia Appendix 5).

Preferences and attitudes of diet app users and non-users

Of the 65 current users of diet-related apps, 72.5% used their app on a daily basis and 27.4% used them weekly or monthly. Of the 91 previous users, 34.0% used diet-related apps for more than 3 months, 37.3% for 1–3 months, and 38.5% for less than a week (data not reported in the tables). The majority (81.8%) of current users preferred diet-related apps over websites. The most preferred diet app was MyFitnessPal (53.9%), followed by Easy Diet Diary (19.4%) and Weight Watchers (18.1%). Similarly, the most preferred diet website was MyFitnessPal (29.0%), followed by Total Wellbeing Diet (CSIRO) (14.0%), and Weight Watchers (12%) (Multimedia Appendix 1).

The most used diet app features (in current users) included diet recording and food intake monitoring (38.2%), nutrient checking (22.4%) and the food barcode scanner functionality (20.7%) (Multimedia Appendix 2).

Previous users also prefer apps to have features such as diet recording and food intake monitoring (50.2%), nutrient checking (47.3%), and the ability to scan food barcodes for decision making regarding the selection of food alternatives (46.9%). Non-users also indicated an interest in features such as nutrient checking (53.0%) and the ability to scan food barcodes for selection of food alternatives (50.6%), but also indicated an interest in apps having healthy recipes or cooking tips as features (53.0%). Non-users were also confident that they can ‘improve or maintain body weight’ (68.6%) or ‘dietary behaviours’ (72.2%) without the need to use diet-related apps and websites, but still believed they would need help from a dietitian/nutritionist or other health professional (Table 5).

When participants were asked to rank the main reason/s for using diet-related apps (Multimedia Appendix 3), ‘weight management’ (weight gain, loss, maintenance) was ranked first (93.5%), followed by to ‘maintain healthier eating habits’ (reducing salt, sugar, saturated fats, etc.) (82.6%). The main influences for stopping the use of diet-related apps and websites were because they were perceived as time-consuming (73.6%), difficult to use (32.9%), costly (31.8%), and not useful (31.8%) (Multimedia Appendix 4).

Table 3. Confidence and use of technology.

	All participants N(%)	App users N(%)	App non-users N(%)	χ^2	P-value
Confidence of computer and laptop use				20.796	<.001
Not at all confident	5 (2.1)	0 (0.0)	5 (5.7)		
Somewhat confident	22 (9.1)	7 (4.5)	15 (17.2)		
Very confident	214 (88.8)	147 (95.5)	67 (77.0)		
Confidence of smartphone and tablet use				14.496	<.001
Not at all confident	11 (4.6)	3 (1.9)	8 (9.2)		
Somewhat confident	23 (9.5)	9 (5.8)	14 (16.1)		
Very confident	207 (85.9)	142 (92.2)	65 (74.7)		
Internet access					
Home				5.377	.020
Yes	238 (98.8)	154 (100.0)	84 (96.6)		
No	3 (1.2)	0 (0.0)	3 (3.4)		
Work				1.886	.389
Yes	194 (80.5)	123 (79.9)	71 (81.6)		
No	12 (5.0)	6 (3.9)	6 (6.9)		
I don't work	35 (14.5)	25 (16.2)	10 (11.5)		
Are the information technology devices you use connected to the internet				2.048	.359
Yes, almost all the time	218 (90.5)	141 (91.6)	77 (88.5)		
Yes, only when at work	22 (9.1)	13 (8.4)	9 (10.3)		
No	1 (0.4)	0.0 (0.0)	1 (1.1)		
How often do you use any of the devices you mentioned above?				0.515	.473
Not Frequent (once a month/day)	6 (2.5)	3 (1.9)	3 (3.4)		
Frequent (few times/large part of each day)	235 (97.5)	151 (98.1)	84 (96.6)		
Trusting information provided in diet app/websites				39.38	<.001
I trust them	129 (69.7)	107 (82.3)	22 (40.0)		
I feel Neutral about them	36 (19.5)	19 (14.6)	17 (30.9)		

(continued)

Table 3. Continued.

	All participants N(%)	App users N(%)	App non-users N(%)	χ^2	P-value
I don't trust them	20 (10.8)	4 (3.1)	16 (29.1)		

Values are total number of participants (%).

Predictors of diet-related apps and website use

Multiple logistic regression was used to identify the predictors of diet app and website use (Table 6). The likelihood of using diet-related apps and websites was higher for those who indicated having greater trust in the information provided by the diet-related apps and websites (OR 5.51, 95%CI: 2.40–12.66), those who often count calories to decide on what food to eat (OR 2.28, 95%CI: 1.01–5.24), and those who are often on a diet (OR 3.45, 95% CI: 1.31–9.03). The association remained significant after adjusting for the confounding influence of gender, BMI, existing health conditions, occupation, and nationality for those who indicated trusting the information provided by apps and websites (OR 24.85 95%CI: 4.97–124.27) but did not reach statistical significance for those who are often on a diet or count calories to choose food.

Discussion

Principle results

The present study explored the use and acceptability of diet-related apps and websites in a sample of Australian participants. Overall, more than half (63.5%) of the participants were current or previous diet-related app and website users. While the literature on the use and acceptability of diet-related apps and websites is scarce, similar results have been recorded in the U.S., with approximately 60% of participants aged 18 to 45 years indicating that they currently use or previously used apps to track diet and nutrition information.¹⁴

Findings from the present study suggest that diet-related app use is more prevalent in Caucasians, individuals classified as overweight or obese and those working in a professional or 'white collar' occupation (mostly office jobs). Aligning with the current study, previous literature reports increased use of health apps in participants with a higher BMI.^{15, 16} However, in contrast, Elavsky *et al.*, (2017) report that app users had a slightly lower BMI than non-users. Physical inactivity is notably higher among individuals employed in professional and 'white collar' roles, and is linked to a higher risk of NCDs.¹⁷ Therefore,

individuals in these occupations may have more concern about weight management and a higher likelihood of engaging in dieting behaviours to compensate for their sedentary lifestyle.

In the current study, diet-related apps and website users were more concerned about their general diet, putting weight on, and being classed as overweight or obese. App users were also more likely to be on a diet and count calories to decide if something is fine to eat. Counting calories and being on diet was also associated with a higher likelihood of diet app and website use. These results support previous work conducted in the Czech Republic where healthy eating, keeping a diet and weight loss were identified as predictors of health-related app use.¹⁸ The results also support the hypothesis that individuals who are more concerned about their diet are more likely to actively seek health information and use health and diet-related apps for support.¹⁹ Although concerns about health and diet may motivate app use, it may also reinforce maladaptive disordered eating such as diet obsession or 'orthorexia nervosa'.²⁰ This is important given the alarming increase in diet obsession behaviours, especially in young adults.²⁰ However, we did not find differences in the use of diet-related apps and websites according to age group in the present study. Nonetheless, future research should investigate whether individual behaviours, including excessive calorie counting and dieting, influence use of diet-related apps and websites.

Diet-related app and website users were also more likely to trust the information being provided by their app and this was also associated with a higher likelihood of diet app use. Previous research has indicated that the accuracy and credibility of information, data security, and privacy of health-related apps is a common concern for individuals.^{19–22} Indeed, poor execution of these factors may lead to distrust in users, therefore presenting a barrier for future use or reasons for stopping use.¹⁵ Concerns regarding data accuracy, specifically food intake tracking errors and incorrect caloric information, have been reported frequently in the literature.^{19,20,22} Studies have criticised health-related apps for supplying potentially deceiving and unreliable information.^{22, 23} Accordingly, participants question whether the apps are derived from credible and legitimate sources, and prefer expert-developed apps to

Table 4. Confidence and concerns of health and dietary behaviour.

	All participants	App users	App non-users	χ^2	P-value
	N(%)	N(%)	N(%)		
Concerns about overall health					
I am concerned about my physical health				5.489	.064
Not concerned/slightly concerned	110 (45.6)	63 (40.9)	47 (54.0)		
Somewhat concerned	51 (21.2)	32 (20.8)	19 (21.8)		
Concerned	80 (33.2)	59 (38.3)	21 (24.1)		
I am concerned about my mental health				0.913	.634
Not concerned/slightly concerned	135 (56.0)	88 (57.1)	47 (54.0)		
Somewhat concerned	37 (15.4)	25 (16.2)	12 (13.8)		
Concerned	69 (28.6)	41 (26.6)	28 (32.2)		
I am concerned about my diet				7.284	.026
Not concerned/slightly concerned	103 (42.7)	56 (36.4)	47 (54.0)		
Somewhat concerned	51 (21.2)	35 (22.7)	16 (18.4)		
Concerned	87 (36.1)	63 (40.9)	24 (27.6)		
I am concerned about being overweight / obese				13.385	.001
Not concerned/slightly concerned	104 (43.2)	53 (34.4)	51 (58.6)		
Somewhat concerned	35 (14.5)	25 (16.2)	10 (11.5)		
Concerned	102 (42.3)	76 (49.4)	26 (29.9)		
I am concerned about putting weight on				13.158	.001
Not concerned/slightly concerned	80 (33.2)	40 (26.0)	40 (46.0)		
Somewhat concerned	36 (14.9)	21 (13.6)	15 (17.2)		
Concerned	125 (51.9)	93 (60.4)	32 (36.8)		
Confidence of healthy food choices					
I am confident I eat enough vegetables				2.730	.255
Agree	136 (56.4)	88 (57.1)	48 (55.2)		
Neutral	21 (8.7)	10 (6.5)	11 (12.6)		
Disagree	84 (34.9)	56 (36.4)	28 (32.2)		

(continued)

Table 4. Continued.

	All participants N(%)	App users N(%)	App non-users N(%)	χ^2	P-value
I am confident that I don't eat much fast food, takeaways, and restaurant foods				2.430	.297
Agree	171 (71.0)	104 (67.5)	67 (77.0)		
Neutral	18 (7.5)	13 (8.4)	5 (5.7)		
Disagree	52 (21.6)	37 (24.0)	15 (17.2)		
I am confident about my level of sugar and salt intake				1.448	.485
Agree	146 (60.6)	89 (57.8)	57 (65.5)		
Neutral	30 (12.4)	20 (13.0)	10 (11.5)		
Disagree	65 (27.0)	45 (29.2)	20 (23.0)		
I often read food labels and choose food based on their labels				3.103	.212
Agree	161 (66.8)	109 (70.8)	52 (49.8)		
Neutral	24 (10.0)	13 (8.4)	11 (12.6)		
Disagree	56 (23.2)	32 (20.8)	24 (27.6)		
I often count calories to decide if something is fine to eat				20.289	<.001
Agree	98 (40.7)	79 (51.3)	19 (21.8)		
Neutral	30 (12.4)	17 (11.0)	13 (14.9)		
Disagree	113 (46.9)	58 (37.7)	55 (63.2)		
I often feel bad because I eat more than I should				4.649	.098
Agree	138 (57.3)	95 (61.7)	43 (49.4)		
Neutral	25 (10.4)	12 (7.8)	13 (14.9)		
Disagree	78 (32.4)	47 (30.5)	31 (35.6)		
I am often on a diet				27.107	<.001
Agree	72 (29.9)	63 (40.9)	9 (10.3)		
Neutral	46 (19.1)	29 (18.8)	17 (19.5)		
Disagree	123 (51.0)	62 (40.3)	61 (70.1)		

Values are total number of participants (%).

Table 5. Attitudes of diet app and website ‘non-users’.

Non-users (n = 83)	Agree N(%)	Neutral N(%)	Disagree N(%)
Reasons for not using			
My dietary habits do not need improvement	25 (10.4)	18 (7.5)	40 (16.6)
I am happy with my current body weight and I do not feel the need to change	26 (10.8)	16 (6.6)	41 (17.0)
I do not need any apps/ websites to improve my diet	44 (18.3)	21 (8.7)	18 (7.5)
I haven't tried them yet, but I am willing to give them a go	22 (9.1)	20 (8.3)	41 (17.0)
I believe diet-related apps/websites don't work or are a waste of time	31 (12.9)	28 (11.6)	24 (10.0)
I don't have a smart device to use them on	6 (2.5)	7 (2.9)	70 (29.0)
I believe diet apps/websites cost too much	30 (12.4)	42 (17.4)	11 (4.6)
I don't have access to a stable network or internet coverage	7 (2.9)	8 (3.3)	68 (28.2)
Friends/ family discouraged me to use them	7 (2.9)	22 (9.1)	54 (22.4)
Doctor/dietician discourages me to use them	4 (1.7)	27 (11.2)	52 (21.6)
Confidence about health			
I can improve or maintain my body weight without the help of diet apps or websites	57 (68.6)	18 (21.6)	8 (9.6)
I can improve or maintain my dietary behaviours without the help of diet apps or websites	60 (72.2)	16 (19.2)	7 (8.4)
I can improve or maintain my body weight/dietary behaviour without the help of diet apps or websites, but would need help from a dietitian/nutritionist or other health professional	37 (44.5)	22 (26.5)	24 (28.9)

Values are total number of participants (%).

those from unidentified or less credible sources.²⁴ As a result, indicators of a reliable source and accurate nutritional information are important considerations for developers when designing diet-related apps and websites to meet consumers' needs.

The most frequently reported reasons for stopping use of diet-related apps and websites were that they were time-consuming, difficult to use, cost-prohibitive and had limited usefulness. Furthermore, common reasons for not using diet-related apps and websites were that they were perceived as not being necessary to improve diet and that they don't work or are a waste of time. These findings are consistent with previous literature highlighting the need for enhanced app usability through reduced set-up time, avoidance of long instructions, and being user-friendly.^{19,21,22} Improvement of food tracking features (e.g., automated tracking functions, barcode scanners, photo-based recording, an indication of portion size) would further assist in positive perceptions of diet-related apps and websites.^{15, 20–22} Diet-related apps and websites

have the potential to be a cost-effective technique for modifying diet behaviour at scale.²⁵

Inclusion of features such as diet recording and food intake monitoring, nutrient checking, and food barcode scanning may act as important motivators to encourage use of diet-related apps and websites. Non-users of diet-related apps and websites also indicated an interest in having healthy recipes or cooking tips as features. Previous research has reported consumer interest in diet recording and food intake monitoring features, which may increase effectiveness and engagement.^{23–40} Features such as goal setting, monitoring, and the ability to personalise the platform have also been identified as desirable behaviour change techniques in health-related apps.⁴¹ These features align with health behaviour change theories, which may promote more effective and sustainable dietary behaviour change.

Notwithstanding the potential of diet-related apps and websites, literature included in this study relates to the barriers and predictors of app use and feature preferences.

Table 6. Predictors of diet app and website use.

	Diet app and website use (Model 1)	Diet app and website (Model 2)
	OR* (95% CI)	OR* (95% CI)
Confidence of Computer use (ref: confident)		
Somewhat confident	0.00	0.00
Not confident	0.31 (0.07–1.40)	0.36 (0.07–1.85)
Confidence of smart phone use (ref: confident)		
Somewhat confident	0.54 (0.07–3.87)	0.53 (0.07–4.14)
Not confident	0.49 (0.11–2.14)	0.44 (0.09–2.23)
Trusting information provided in diet app/websites (ref: I don't trust them)		
I trust them	5.51 (2.40–12.66)***	6.91 (2.75–17.38)***
I feel neutral about them	0.95 (0.39– 2.30)	1.05 (0.41–2.68)
Concerned about my physical health (ref: Not concerned)		
Somewhat concerned	0.69 (0.25–1.94)	0.72 (0.24–2.12)
Concerned	1.74 (0.61–4.94)	1.86 (0.58–5.99)
Concerned about my diet (ref: not concerned)		
Somewhat concerned	1.29 (0.44–3.81)	1.60 (0.50–5.12)
Concerned	0.74 (0.23–2.42)	1.17 (0.32–4.22)
Concerned about being overweight / obese (ref: Not concerned)		
Somewhat concerned	2.16 (0.66–7.05)	1.34 (0.37–4.89)
Concerned	2.05 (0.56–7.47)	0.17 (0.27–5.04)
Concerned about putting weight on (ref: Not concerned)		
Somewhat concerned	1.48 (0.49–4.48)	1.43 (0.41–5.01)
Concerned	1.59 (0.52–4.82)	1.58 (0.46–5.43)
Attitude: I often count calories to decide if something is fine to eat (ref: Disagree)		
Agree	2.28 (1.01–5.24)*	2.30 (0.94–5.62)
Neutral	0.90 (0.31–2.61)	0.49 (0.28–2.67)
Attitude: I often feel bad because I eat more than I should (ref: Disagree)		

(continued)

Table 6. Continued.

	Diet app and website use (Model 1)	Diet app and website (Model 2)
	OR* (95% CI)	OR* (95% CI)
Agree	0.51 (0.22–1.22)	0.48 (0.19–1.20)
Neutral	0.57 (0.15–2.12)	0.50 (0.11–2.17)
Attitude: I am often on a diet (ref: Disagree)		
Agree	3.45 (1.31–9.03)*	2.69 (0.98–7.46)
Neutral	1.93 (0.73–5.08)	2.03 (0.73–5.63)
R squared	0.33	0.36

Model 1: Unadjusted multiple logistic regression; Model 2: Adjusted for confounding variables (gender, BMI, health condition, and nationality).
*p-value <.05; *** p-value<.001.

However, further research is needed to explore the implementation of diet-related apps and websites as behavioural interventions targeting dietary habits (e.g., increased vegetable intake or reduced salt intake). Adherence to the national dietary guidelines is generally poor in Australia.⁴ Similar findings were observed in the present study with less than half of the participants reporting that they consume the recommended number of daily serves for fruit and vegetable intake. Previous research suggests that health-related apps may have a positive effect on fruit and vegetable consumption.^{33, 34} Given the potential for technology-based interventions to embrace multiple behaviour change techniques and have wider reach and better accessibility,³¹ they may offer a more effective population-based means of delivering behaviour change interventions than standalone face-to-face interventions. Thus, with improvement and innovation, diet-related apps and websites may be employed as a public health strategy to improve dietary behaviours and reduce the global burden of obesity and NCDs.

Strengths and limitations

To the best of our knowledge, this is the first study to investigate the use, acceptability and preferences of diet-related app users and non-users in Australia. Nonetheless, there are some limitations that should be considered when interpreting the overall findings of this study. For example, responses from the survey relied on self-reporting measures, which may present bias.²⁶ Participants may provide poor estimates and under- or over-report their confidence and concerns influenced by their perception of desirable answers. Although participants were asked about their health condition history, minimal consideration was made for increased use of diet-related apps and websites due to

disordered eating or their potential to contribute to or reinforce maladaptive behaviours. Low numbers in certain sociodemographic sub-groups (e.g., males) limit the generalisability of the results. In addition, the study had a limited number of participants from Australia; recruited mostly via institutional lists and social media platforms. This may limit generalisation of the findings to other populations such as those located outside of Australia, individuals not undertaking higher-education study and infrequent users of social media. While we attempted to invite participants 13 years of age and older to complete the survey, none were under 18 years of age. Given that diet app use is prevalent in younger populations,^{27, 28} understanding their preferences and reasons for use is important. Also, exploring the clinical accuracy and reliability of the dietary information provided within these apps and websites was beyond the scope of this study but may influence participant's perception and use of such technologies. Other factors such as social (e.g., technological literacy and nutritional literacy), environmental (e.g., accessibility and affordability of technology/smartphones) or personal (e.g., cognitive and physical skills)²⁹ may also impact the use of diet-related apps or websites and will require further investigation. Furthermore, due to restrictions in place as a result of the SARS-CoV-2 pandemic at the time of this study, it is possible that individuals' health behaviours and technology use patterns reported in this study do not accurately reflect typical behaviours/patterns.

Conclusions

Diet-related app use is common in Australian adults. Calorie counting, following a diet and weight loss, were identified as predictors of app use. Diet-related apps and websites that incorporate diet recording and food intake

monitoring, nutrient checking and food barcode scanning are likely to be important features that could motivate individuals to engage with diet-related apps. Diet-related apps and websites have the potential to be used in public health interventions aimed at improving lifestyle behaviours such as dietary intake.

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Contributorship: AF, SK, CI & CV designed the study. AF & SK collected data and performed the statistical analysis. All authors contributed to the manuscript development.


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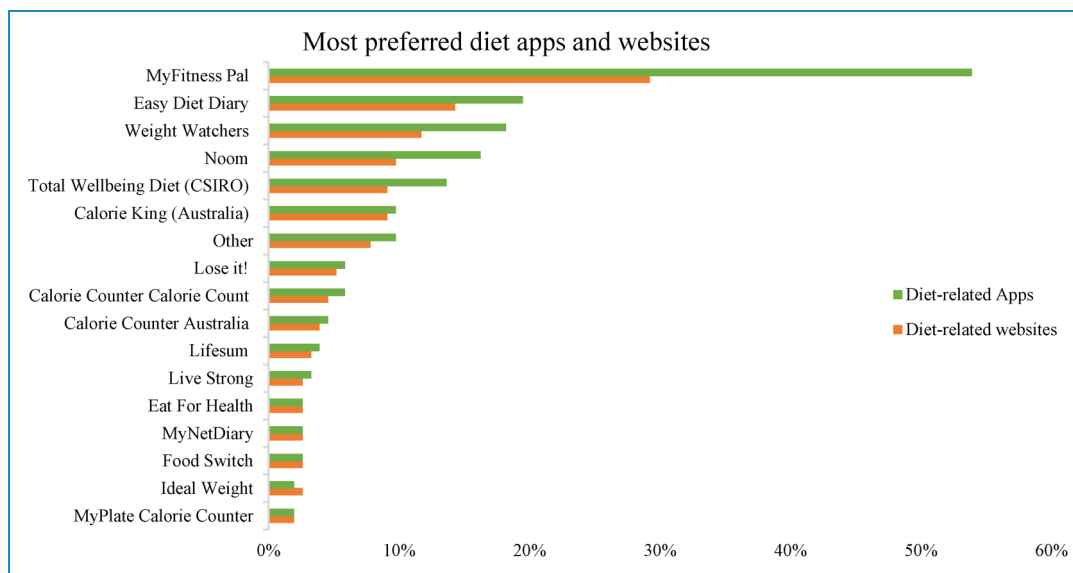
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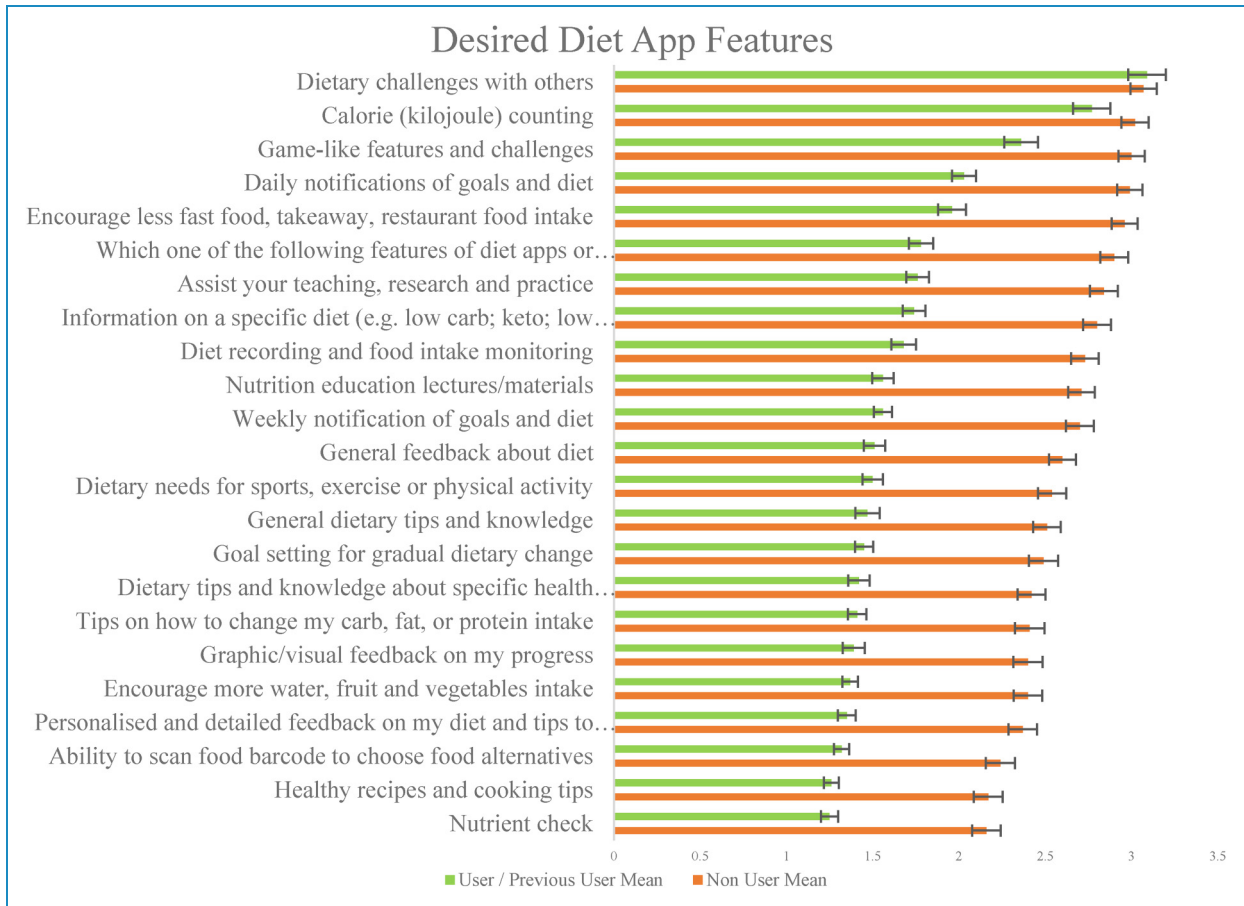
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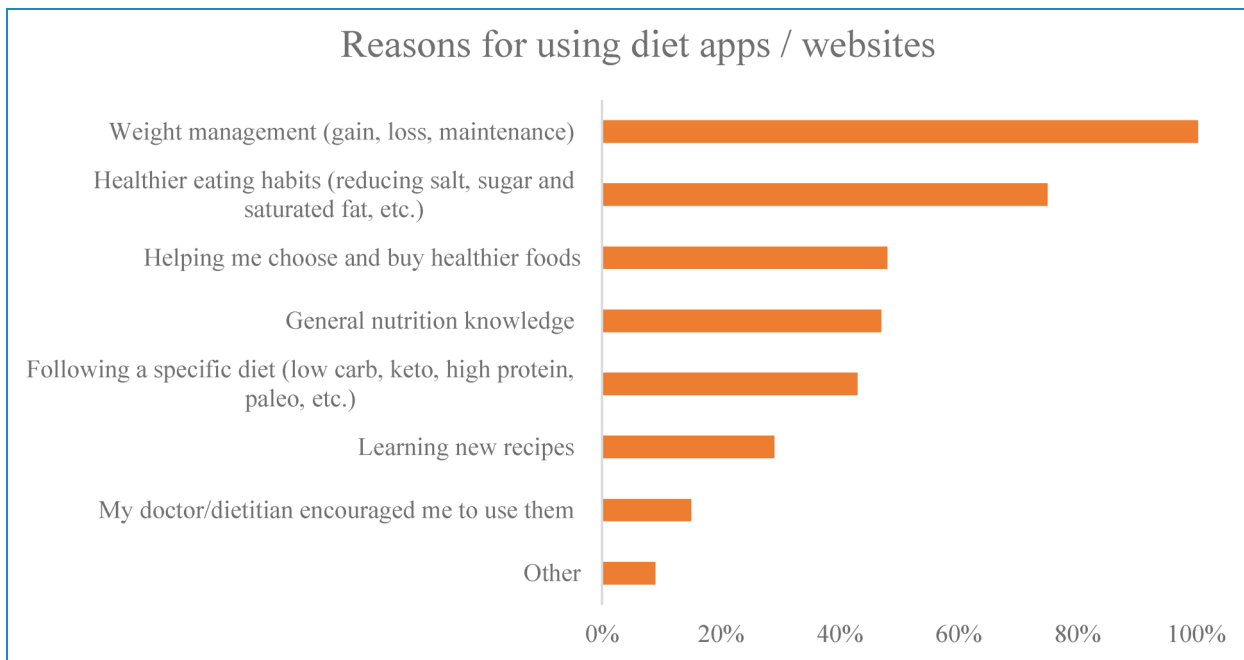
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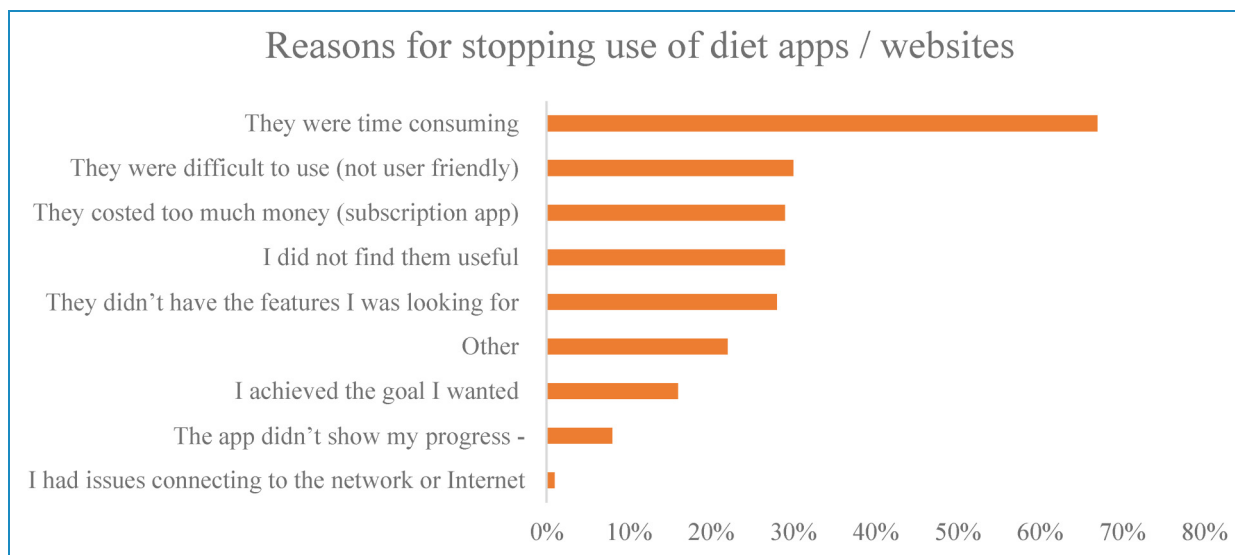
Multimedia Appendix 1. Most preferred diet apps and websites among diet app users. Values are the total number of participants (%).



Multimedia Appendix 2. *Desired diet app features among diet app users and non-users.* Mean score of desirability between 0 and 5 (0 representing least desired) (Error bars presented as mean + /- SE).



Multimedia Appendix 3. *Reasons for using diet apps and websites.* Values are total number of participants (%).



Multimedia Appendix 4. Reasons for stopping the use of diet apps and websites. Values are total number of participants (%).

Multimedia Appendix 5. Confidence and concerns regarding health and dietary behaviours in users and previous users.

	Current users N(%)	Previous users N(%)	χ^2	P-value
Concerns about overall health				
I am concerned about my physical health	26 (41.9)	37 (40.7)	2.085	0.353
Not concerned/slightly concerned	16 (25.8)	16 (17.6)	1.016	0.602
Somewhat concerned	20 (32.3)	38 (41.8)	0.215	0.898
Concerned	28 (61.3)	50 (54.9)	1.951	0.377
I am concerned about my mental health	8 (12.9)	17 (18.7)	0.121	0.941
Not concerned/slightly concerned	16 (25.8)	24 (26.4)		
Somewhat concerned	24 (38.7)	32 (35.2)		
Concerned	14 (22.6)	21 (23.1)		
I am concerned about my diet	24 (38.7)	38 (42.8)		
Not concerned/slightly concerned	23 (37.1)	30 (33)		
Somewhat concerned	7 (11.3)	18 (19.8)		
Concerned	32 (51.6)	43 (47.3)		
I am concerned about being overweight/obese				
Not concerned/slightly concerned				

(continued)

Multimedia Appendix 5. Continued.

	Current users N(%)	Previous users N(%)	χ^2	P-value
Somewhat concerned				
Concerned				
I am concerned about putting weight on				
Not concerned/slightly concerned	15 (24.2)	24 (26.4)		
Somewhat concerned	9 (14.5)	12 (13.2)	4.879	0.087
Concerned	38 (61.3)	55 (60.4)	4.889	0.087
Confidence of healthy food choices	42 (67.7)	46 (50.5)	9.096	0.011
I am confident I eat enough vegetables	4 (6.5)	6 (6.6)	16.929	<0.001
Agree	16 (25.8)	39 (42.9)	21.799	<0.001
Neutral	48 (77.4)	55 (60.4)	3.244	0.197
Disagree	4 (6.5)	9 (9.9)	9.652	0.008
I am confident that I don't eat much fast food, takeaways, and restaurant foods	10 (16.1)	27 (29.7)		
Agree	44 (71)	45 (49.5)		
Neutral	3 (4.8)	17 (18.7)		
Disagree	15 (24.2)	29 (31.9)		
I am confident about my level of sugar and salt intake	54 (87.1)	54 (59.3)		
Agree	5 (8.1)	8 (8.8)		
Neutral	3 (4.8)	29 (31.9)		
Disagree	46 (74.2)	33 (36.3)		
I often read food labels and choose food based on their labels	5 (8.1)	12 (13.2)		
Agree	11 (17.7)	46 (50.5)		
Neutral	43 (69.4)	52 (57.1)		
Disagree	5 (8.1)	6 (6.6)		
I often count calories to decide if something is fine to eat	14 (22.6)	33 (36.3)		
Agree				
Neutral				
Disagree				

(continued)

Multimedia Appendix 5. Continued.

	Current users N(%)	Previous users N(%)	χ^2	P-value
I often feel bad because I eat more than I should				
Agree				
Neutral				
Disagree				
I am often on a diet				
Agree	33 (53.2)	30 (33)		
Neutral	13 (21)	15 (16.5)		
Disagree	16 (25.8)	46 (50.5)		

Values are total number of participants (%).