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# Adherence to the Mediterranean diet among employees in South West England: Formative research to inform a web-based, work-place nutrition intervention

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ABSTRACT

*Objective.* The aim of this study is to assess internet usage patterns and adherence to the Mediterranean diet among employees in South West England, UK and their differences by personal characteristics.

*Method.* A cross-sectional survey was conducted in 2014 among 590 adults (428 women, 162 men, mean age 43.8 years), employees of four work-place settings. Mediterranean diet adherence was assessed using a validated food frequency questionnaire. Adherence differences were assessed by gender, marital status, education, number of children and food shopping and preparation responsibility.

*Results.* On average, participants reported moderate adherence to the Mediterranean diet. Higher adherence was reported for alcohol, vegetables, cereals and fruit. Few participants achieved high adherence to the Mediterranean diet recommendations for legumes (5.3%), fish (3.2%), dairy products (4.8%), red meat (11.9%), poultry (11.1%) and olive oil (18.2%). A higher Mediterranean diet score was reported among participants who were married/cohabiting, those with higher education attainment and shared responsibility for food preparation.

*Conclusion.* Improvement in the consumption of several Mediterranean diet components is needed to increase adherence in this sample of adults. The findings have the potential to inform the development of a web-based intervention that will focus on these foods to promote the Mediterranean diet in work-place settings in South West England.



## Introduction

The importance of studying and promoting dietary patterns, instead of isolated foods or nutrients, in order to increase the likelihood of acceptability and compliance with nutrition interventions, has been established (Hu, 2002). The Mediterranean diet, rich in olive oil, fruits and vegetables, including whole grains, legumes and nuts, low-fat dairy, fish, moderate alcohol consumption and low quantities of red meat, has been associated with a reduced risk of chronic disease incidence and mortality in the general population (Sofi et al., 2014). This dietary pattern has been recognised as a model for healthy eating and the need to promote it to non-Mediterranean populations has recently been recognised (Council of the European Union, 2014; National Institute for Health and Care Excellence, 2014). It has been suggested that its high palatability makes the Mediterranean diet an attractive diet to promote to Western populations (McManus et al., 2001; Willett, 2006). Components of this diet could be easily transferable to non-Mediterranean populations (Renaud et al., 1995; McManus et al., 2001) and therefore represent an opportunity to change dietary behaviours.

The need to design nutrition behaviour change interventions based on formative research has been emphasised (Kok et al., 2004; National Institute for Health and Clinical Excellence, 2007; Craig et al., 2008; World Health Organisation, 2009). The conceptualisation and development of such interventions should include the identification of the evidence and theory base, supplemented by a needs assessment phase, where health problems in the target population are identified and behavioural risk factors for these problems are assessed (Kok et al., 2004; Craig et al., 2008). Identifying the evidence, as well as the specific needs of the target population is suggested to aid the development and delivery of feasible and effective approaches to promote dietary behaviour change (National Institute for Health and Clinical Excellence, 2007; Craig et al., 2008).

The internet is widely accessible to the general public and is one of the most preferred sources of nutrition information (Horgan and Sweeney, 2012). In the first quarter of 2014, 87% of adults in the UK had used the internet, supporting its potential as a cost-effective intervention tool with large reach (Office for National Statistics, 2014a). Work-place settings provide mechanisms to promote dietary behaviour

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change since they offer accessibility to large populations of adults who can be surveyed repeatedly (Maes et al., 2011). Several web-based nutrition intervention studies have been conducted in work-place settings (Block et al., 2004; Irvine et al., 2004; Oenema et al., 2005; Mills et al., 2007; Robroek et al., 2007). The majority of work-place nutrition interventions have focussed on promoting changes in a limited number of outcomes such as fruit, vegetable and fat consumption (Steyn et al., 2009; Mhurchu et al., 2010). To our knowledge, only one small-scale, web-based intervention has promoted the Mediterranean diet and demonstrated favourable changes in several components of this dietary pattern among healthy employees in Scotland (Papadaki and Scott, 2005a, 2005b, 2008). However, this study was conducted only among female employees, thus not allowing the generalizability of the findings to male participants or the exploration of potential gender differences in Mediterranean diet adherence. In addition, this earlier work did not conduct formative research prior to intervention development, which is an essential step for the development of feasible behaviour change interventions (Kok et al., 2004; Craig et al., 2008).

Although several primary nutrition interventions have attempted to promote the Mediterranean diet in Western populations (Goulet et al., 2003; Papadaki and Scott, 2005a; Djuric et al., 2009; Leighton et al., 2009), no such study has been conducted in England. Thus, to build a formative research base, according to current frameworks (Kok et al., 2004; Craig et al., 2008), on which to develop a future web-based, work-place intervention, this study aimed to assess demographic characteristics, internet usage patterns and adherence to the Mediterranean diet among healthy male and female adult employees in South West England. Secondary objectives were to assess potential differences in these characteristics between genders, as well as differences in adherence to the Mediterranean diet according to demographic characteristics.

## Methods

### *Participants*

During autumn 2013, 44 large-scale work-place settings (>200 employees) in South West England (Bristol, South Gloucestershire and Wiltshire areas) were identified and invited by e-mail to participate in the study. Four work-places (one company engaged in business and professional services and three local government branches) agreed to participate. Data were collected via an online questionnaire. A gatekeeper at each work-place circulated a web link to the online questionnaire to their employees via their intranet and/or electronic newsletters. Eligibility criteria were: (a) being currently employed at the work-place, (b) aged 18–65 years, (c) not suffering from a diet-related disease, (d) having internet access at work and/or at home and (e) using the internet at least 2–3 times/month. Participants were entered into a prize draw to receive one of four £20 gift vouchers per work-place. To provide recompense for disruption from data collection, each worksite received a £50 gift voucher. The study was approved by the School for Policy Studies Research Ethics Committee at the University of Bristol. Participants provided informed consent after reading participant information and before completing the survey.

### *Online survey*

An online survey was used to obtain data about demographic and personal characteristics, internet usage patterns and adherence to the Mediterranean diet. Participants were asked to report their gender, age, marital status ('single'/'married'/'cohabiting'/'separated'/'divorced'/'widowed') (Grundy and Jamieson, 2002), ethnicity ('Caucasian'/'Asian or Asian British'/'Chinese'/'Other Asian background'/'Black or Black British'/'Other Black background'/'Mixed-White and Black Caribbean'/'Mixed-White and Black African'/'Mixed-White and Asian'/'Other mixed background'/'Other ethnic background'/'Disclosure of ethnic origin declined') (Office for National Statistics, 2012), level of education ('postgraduate degree'/'degree or equivalent'/'higher education below degree level'/'A levels'/'high school'/'no qualifications') (Schneider, 2011), occupation ('Managerial'/'Professional'/'Associate professional/technical'/'Administrative/secretarial'/'Skilled trades'/'Personal services'/'Sales/customer services'/'Process'/'Elementary') (Office for National Statistics, 2014b) and number of children (<18 y) living in their household (open response). This part also included questions on participants' working pattern ('full-/part-time status'), food shopping and food preparation responsibility in their household ('I am'/'Family members'/'Shared responsibility'/'Others') (Papadaki and Scott, 2005a). Participants were also asked to report the frequency with which they access the internet at work and at home ('Several times per day'/'Once per day'/'Several times per week'/'Once per week'/'Once per month or less'/'No internet access'), the reasons for accessing the internet (choose all that apply from 'Sending or receiving email'/'Work-business-studies'/'Chatting-social media'/'Online shopping'/'Online gaming'/'Online banking'/'Online education-newspapers'/'Health-related information'/'Entertainment-leisure'/'Other') (Ofcom, 2012) and the level of confidence in their ability to use the internet ('Extremely confident'/'Quite confident'/'Neutral'/'Not very confident'/'Not at all confident').

For ease of interpretation and analysis, categorical variables were collapsed where appropriate. 'Marital status' was collapsed into 'Married/cohabiting', 'Single' and 'Separated/divorced/widowed'. 'Ethnicity' and 'Number of children living in household' were dichotomised into 'Caucasian' and 'Other ethnicity' and 'None' and '≥1', respectively.

### *Adherence to the Mediterranean diet*

Adherence to the Mediterranean diet was assessed via an 11-item food frequency questionnaire that requested participants to report the frequency of consumption of 11 main components of the Mediterranean diet (Panagiotakos et al., 2006a). A composite Mediterranean diet score was calculated as follows: for the consumption of components commonly consumed in the Mediterranean diet (non-refined cereals, potatoes, fruits and fruit juice, vegetables and salad, legumes and fish), a score of 0 (lowest adherence) to 5 (highest adherence) was assigned when a participant reported consumption of 0, 1–4, 5–8, 9–12, 13–18 and >18 servings/month, respectively. For the consumption of components which are consumed less frequently in the Mediterranean diet (red meat and meat products, poultry and whole-fat dairy products), a score of 0 to 5 was assigned for reported consumption of the above options, using a reverse scale. A score of 0 to 5 was assigned for using olive oil (in cooking and meal preparation) 'never', 'rarely', '<1 time/week', '1–3 times/week', '3–5 times/week' and 'daily', respectively. For alcohol (all alcoholic beverages), a score of 5 was assigned for consumption of '<300 ml/day', a score of 0 for 'no consumption or consumption of >700 ml/day', and scores of 4 to 1 for consumption of '300–400 ml', '400–500 ml', '500–600 ml' and '600–700 ml/day', respectively (Panagiotakos et al., 2006a). The resulting total score ranged from 0 to 55, with calculated tertiles indicating low (score = 0–20), moderate (score = 21–35) and high (score = 36–55) adherence to the Mediterranean diet (Panagiotakos et al., 2004, 2006b). The questionnaire has been validated based on the relationship between the calculated total score and individual food component scores and has been suggested to offer a valid method for assessing Mediterranean diet adherence and providing dietary modification advice for primary prevention purposes (Panagiotakos et al., 2006a, 2006c), in addition to having previously been utilised in Mediterranean diet promotion interventions in non-Mediterranean populations (Sexton et al., 2013).

### *Statistical analyses*

Descriptive statistics (M, SD, N and %) were used to explore demographic and personal characteristics, internet usage patterns and eating habits of participants. Independent samples *t*-tests and Chi-square tests were used (with a *P*-value adjusted, as necessary, for multiple-paired

tests), as appropriate, to investigate any differences between males and females, and to examine Mediterranean diet scores and adherence according to marital status, level of education, number of children and household food shopping and preparation responsibility. All analyses were performed using Stata version 13 (StataCorp, version 13. College Station, TX: StataCorp LP, 2013).

## Results

The total number of employees across the four participating workplace settings was 16,214. Five hundred and ninety participants completed the survey between January and March 2014. The mean age of participants was 43.8 years (SD 11.1). The majority of participants were married/cohabiting (75.6%), Caucasian (94.2%) and were educated to degree level or higher (58.5%). Men were more likely to have higher educational levels (68.6 vs. 54.7%, $P = 0.032$), work more hours per week (37.7 vs. 33.6, $P < 0.001$) and work on a full-time basis (93.2 vs. 70.0%, $P < 0.001$), compared to women. Men were also more likely to work in managerial positions (25.3 vs. 14.7%), whereas a higher proportion of women worked in administrative roles (33.6 vs. 16.0%) ($P < 0.001$). A higher percentage of women reported that they were responsible for food shopping (60.4 vs. 19.2%) and preparation (52.2 vs. 19.8%) in their household ($P < 0.001$) (Table 1).

**Table 1**
Demographic and personal characteristics of participants (*n* and %), South West England, UK (2014).

| | Total ($n = 590$) | Females ($n = 428$) | Males ($n = 162$) | *P* |
|---|---|---|---|---|
| Marital status | | | | 0.10 |
| Married/cohabiting | 446 (75.6) | 311 (72.7) | 135 (83.3) | |
| Single | 94 (15.9) | 74 (17.3) | 20 (12.4) | |
| Separated/divorced/widowed | 50 (8.5) | 43 (10.0) | 7 (4.3) | |
| Ethnic origin | | | | 0.94 |
| Caucasian | 556 (94.2) | 404 (94.4) | 152 (93.8) | |
| Other | 34 (5.8) | 28 (5.6%) | 10 (6.2) | |
| Level of education | | | | 0.032 |
| Postgraduate degree | 121 (20.5) | 83 (19.4) | 38 (23.5) | |
| Degree or equivalent | 224 (38.0) | 151 (35.3) | 73 (45.1) | |
| Higher education below degree level | 139 (23.6) | 105 (24.5) | 34 (20.9) | |
| A levels or equivalent | 62 (10.5) | 53 (12.4) | 9 (5.6) | |
| High school | 41 (6.9) | 33 (7.7) | 8 (4.9) | |
| No qualifications | 3 (0.5) | 3 (0.7) | 0 (0.0) | |
| Occupation | | | | <0.001 |
| Managerial | 104 (17.6) | 63 (14.7) | 41 (25.3) | |
| Professional occupation | 173 (29.3) | 126 (29.4) | 47 (29.0) | |
| Associate professional/technical | 103 (17.5) | 64 (15.0) | 39 (24.1) | |
| Administrative/secretarial | 170 (28.9) | 144 (33.6) | 26 (16.0) | |
| Skilled trades | 6 (1.0) | 3 (0.7) | 3 (1.9) | |
| Personal services | 15 (2.5) | 12 (2.8) | 3 (1.9) | |
| Sales/customer services | 17 (2.9) | 16 (3.7) | 1 (0.6) | |
| Process occupation | 0 (0.0) | 0 (0.0) | 0 (0.0) | |
| Elementary occupation | 2 (0.3) | 0 (0.0) | 2 (1.2) | |
| Work status | | | | <0.001 |
| Full-time | 448 (76.0) | 300 (70.0) | 151 (93.2) | |
| Part-time | 139 (23.6) | 128 (30.0) | 11 (6.8) | |
| Number of children living in household | | | | 0.11 |
| None | 356 (60.3) | 267 (62.4) | 89 (54.9) | |
| ≥1 | 234 (39.7) | 161 (37.6) | 73 (45.1) | |
| Food shopping responsibility | | | | <0.001 |
| I am | 289 (49.1) | 258 (60.4) | 31 (19.2) | |
| Family members | 49 (8.3) | 24 (5.6) | 25 (15.4) | |
| Shared | 251 (42.6) | 145 (34.0) | 106 (65.4) | |
| Others | 0 (0.0) | 0 (0.0) | 0 (0.0) | |
| Food preparation responsibility | | | | <0.001 |
| I am | 255 (43.3) | 223 (52.2) | 32 (19.8) | |
| Family members | 60 (10.2) | 29 (6.8) | 31 (19.1) | |
| Shared | 274 (46.5) | 175 (41.0) | 99 (61.1) | |
| Others | 0 (0.0) | 0 (0.0) | 0 (0.0) | |

Differences between genders were examined using the Chi-square test.

A higher percentage of men accessed the internet from work 'several times per day', compared to women (88.4 vs. 74.1%), and a higher percentage of women reported accessing the internet from work 'once a day' (12.8 vs. 4.9%), compared to men ($P = 0.004$). A higher proportion of men reported using the internet for general education (68.5 vs. 48.6%) and entertainment (74.1 vs. 58.2%) purposes ($P < 0.0001$) and a higher proportion of women reported searching for health-related information online (49.8 vs. 33.9%, $P = 0.001$). The vast majority of participants (98.8%) reported feeling extremely or quite confident in using the internet (Table 2).

The mean Mediterranean diet score for the total study sample was 33.8 (SD 5.4), indicating moderate adherence to the Mediterranean diet (Table 3). Higher mean scores (indicating closer adherence to the Mediterranean diet) were reported for alcohol, vegetables, cereals and fruit, whereas lower mean scores (indicating lower adherence to the Mediterranean diet) were achieved for dairy products, fish, legumes, red meat and poultry. Overall, few participants achieved a high adherence to the Mediterranean diet recommendations for legumes (5.3%), fish (3.2%), dairy products (4.8%), red meat (11.9%), poultry (11.1%) and olive oil (18.2%) (Table 4).

The mean Mediterranean diet score differed according to marital status. Participants who were married/cohabiting had a slightly higher score, compared to those who were single (34.2 vs. 32.2, $P = 0.003$). Participants with level of education at degree level or higher had a higher score (34.7 vs. 32.6, $P < 0.001$) and a higher proportion of them had high adherence to the Mediterranean diet (44.6 vs. 30.7%, $P = 0.001$), compared to those with lower educational attainment. There were no differences in mean Mediterranean diet score or percentage of participants adhering to the Mediterranean diet according to number of children living in the household or food shopping responsibility, but

**Table 2**
Internet usage patterns of participants (*n* and %), South West England, UK (2014).

| | Total ($n = 590$) | Females ($n = 428$) | Males ($n = 162$) | *P* |
|---|---|---|---|---|
| Frequency of internet access at work | | | | 0.004 |
| Several times per day | 460 (78.0) | 317 (74.1) | 143 (88.4) | |
| Once per day | 63 (10.7) | 55 (12.8) | 8 (4.9) | |
| Several times per week | 37 (6.3) | 29 (6.8) | 8 (4.9) | |
| Once per week | 15 (2.5) | 14 (3.3) | 1 (0.6) | |
| Once per month or less | 9 (1.5) | 9 (2.1) | 0 (0.0) | |
| No internet access at work | 6 (1.0) | 4 (0.9) | 2 (1.2) | |
| Frequency of internet access at home | | | | 0.19 |
| Several times per day | 345 (58.5) | 245 (57.2) | 100 (61.7) | |
| Once per day | 125 (21.2) | 89 (20.8) | 36 (22.2) | |
| Several times per week | 102 (17.3) | 79 (18.5) | 23 (14.2) | |
| Once per week | 13 (2.2) | 12 (2.8) | 1 (0.6) | |
| Once per month or less | 2 (0.3) | 2 (0.5) | 0 (0.0) | |
| No internet access at home | 3 (0.5) | 1 (0.2) | 2 (1.3) | |
| Reasons for using the internet[a] | | | | |
| Electronic mail | 573 (97.1) | 415 (96.9) | 158 (97.5) | 0.71 |
| Work/business/studies | 469 (79.5) | 332 (77.6) | 137 (84.6) | 0.06 |
| Social media | 381 (64.6) | 286 (66.8) | 95 (58.6) | 0.06 |
| Online shopping | 489 (82.9) | 358 (83.6) | 131 (80.9) | 0.42 |
| Online gaming | 0 (0.0) | 0 (0.0) | 0 (0.0) | 1.000 |
| Online banking | 0 (0.0) | 0 (0.0) | 0 (0.0) | 1.000 |
| Online education/news | 319 (54.1) | 208 (48.6) | 111 (68.5) | <0.0001 |
| Search for health-related information | 268 (45.4) | 213 (49.8) | 55 (33.9) | 0.001 |
| Entertainment/leisure | 369 (62.5) | 249 (58.2) | 120 (74.1) | <0.0001 |
| Confidence in using the internet | | | | 0.31 |
| Extremely confident | 396 (67.1) | 280 (65.4) | 116 (71.6) | |
| Quite confident | 187 (31.7) | 142 (33.2) | 45 (27.8) | |
| Neutral | 0 (0.0) | 0 (0.0) | 0 (0.0) | |
| Not very confident | 7 (1.2) | 6 (1.4) | 1 (0.6) | |
| Not at all confident | 0 (0.0) | 0 (0.0) | 0 (0.0) | |

Differences between genders were examined using the Chi-square test.
[a] This was corrected for potential non-independence using Bonferroni adjustment (resulting $P < 0.00238$).

**Table 3**
Mean total Mediterranean diet score and mean scores of the eleven components of the Mediterranean diet (mean values and standard deviations), South West England, UK (2014).

| | Total ($n = 587$) Mean (SD) | Females ($n = 426$) Mean (SD) | Males ($n = 161$) Mean (SD) | $P$[b] |
|---|---|---|---|---|
| Total Mediterranean diet score[a] | 33.81 (5.42) | 33.95 (5.45) | 33.45 (5.33) | 0.32 |
| Non-refined cereals score | 4.28 (1.22) | 4.23 (1.27) | 4.42 (1.06) | 0.09 |
| Potatoes score | 3.28 (1.29) | 3.27 (1.33) | 3.30 (1.19) | 0.74 |
| Fruits score | 4.08 (1.41) | 4.10 (1.41) | 4.01 (1.39) | 0.49 |
| Vegetables score | 4.47 (0.93) | 4.53 (0.89) | 4.31 (1.01) | 0.014 |
| Legumes score | 2.02 (1.34) | 1.94 (1.33) | 2.22 (1.34) | 0.027 |
| Fish score | 1.81 (1.19) | 1.83 (1.22) | 1.77 (1.10) | 0.59 |
| Red meat score | 2.42 (1.47) | 2.5 (1.51) | 2.19 (1.33) | 0.026 |
| Poultry score | 2.21 (1.48) | 2.23 (1.54) | 2.17 (1.30) | 0.64 |
| Whole-fat dairy score | 1.46 (1.54) | 1.47 (1.58) | 1.41 (1.44) | 0.65 |
| Olive oil score | 3.23 (1.38) | 3.16 (1.40) | 3.41 (1.32) | 0.050 |
| Alcohol score | 4.56 (1.09) | 4.67 (0.91) | 4.22 (1.43) | <0.00001 |

Differences between genders were examined using the independent samples *t*-test.
[a] Range of total Mediterranean diet score = 0–55; range of score for individual components = 0–5 (with a score of 0 indicating lowest adherence and a score of 5 indicating highest adherence).
[b] This was corrected for potential non-independence using Bonferroni adjustment (resulting $P < 0.000758$).

**Table 4**
Percentage of participants achieving a Mediterranean diet score of 0[a] and 5[b] for each component of the Mediterranean diet (*n* and %), South West England, UK (2014).

| | Total ($n = 587$) | Females ($n = 426$) | Males ($n = 161$) | $P$[c] |
|---|---|---|---|---|
| Mediterranean diet adherence | | | | 0.57 |
| Low (score = 0–20) | 3 (0.5) | 2 (0.5) | 1 (0.6) | |
| Moderate (score = 21–35) | 356 (60.6) | 253 (59.4) | 103 (64.0) | |
| High (score = 36–55) | 228 (38.8) | 171 (40.1) | 57 (35.4) | |
| Non-refined cereals adherence | | | | 0.17 |
| Lowest (score = 0) | 5 (0.9) | 4 (0.9) | 1 (0.6) | |
| Highest (score = 5) | 399 (68.0) | 285 (66.9) | 114 (70.8) | |
| Potatoes adherence | | | | 0.020 |
| Lowest (score = 0) | 6 (1.0) | 5 (1.2) | 1 (0.6) | |
| Highest (score = 5) | 131 (22.3) | 99 (23.2) | 32 (19.9) | |
| Fruits adherence | | | | 0.34 |
| Lowest (score = 0) | 7 (1.2) | 7 (1.6) | 0 (0.0) | |
| Highest (score = 5) | 372 (63.4) | 277 (65.0) | 95 (59.0) | |
| Vegetables adherence | | | | 0.09 |
| Lowest (score = 0) | 1 (0.2) | 1 (0.2) | 0 (0.0) | |
| Highest (score = 5) | 405 (69.0) | 308 (72.3) | 97 (60.2) | |
| Legumes adherence | | | | 0.14 |
| Lowest (score = 0) | 68 (11.6) | 52 (12.2) | 16 (9.9) | |
| Highest (score = 5) | 31 (5.3) | 21 (4.9) | 10 (6.2) | |
| Fish adherence | | | | 0.22 |
| Lowest (score = 0) | 63 (10.7) | 49 (11.5) | 14 (8.7) | |
| Highest (score = 5) | 19 (3.2) | 17 (4.0) | 2 (1.2) | |
| Red meat adherence | | | | 0.050 |
| Lowest (score = 0) | 55 (9.4) | 41 (9.6) | 14 (8.7) | |
| Highest (score = 5) | 70 (11.9) | 61 (14.3) | 9 (5.6) | |
| Poultry adherence | | | | 0.06 |
| Lowest (score = 0) | 69 (11.8) | 55 (12.9) | 14 (8.7) | |
| Highest (score = 5) | 65 (11.1) | 56 (13.1) | 9 (5.6) | |
| Whole-fat dairy adherence | | | | 0.41 |
| Lowest (score = 0) | 235 (40.0) | 176 (41.3) | 59 (36.6) | |
| Highest (score = 5) | 28 (4.8) | 22 (5.2) | 6 (3.7) | |
| Olive oil adherence | | | | 0.54 |
| Lowest (score = 0) | 28 (4.8) | 23 (5.4) | 5 (3.1) | |
| Highest (score = 5) | 107 (18.2) | 72 (16.9) | 35 (21.7) | |
| Alcohol adherence | | | | <0.001 |
| Lowest (score = 0) | 19 (3.2) | 10 (2.3) | 9 (5.6) | |
| Highest (score = 5) | 469 (79.9) | 357 (83.8) | 112 (69.6) | |

Differences between genders were examined using the Chi-square test.
[a] Mediterranean diet score of 0 indicates lowest adherence to the Mediterranean diet.
[b] Mediterranean diet score of 5 indicates highest adherence to the Mediterranean diet.
[c] This was corrected for potential non-independence using Bonferroni adjustment (resulting $P < 0.000758$).

mean total score was higher among participants who reported shared responsibility of food preparation, compared to those who reported sole responsibility (34.5 vs. 33.1, $P = 0.010$) (Table 5).

## Discussion

This study showed that the majority of participating working adults had moderate adherence to the Mediterranean diet and 39% of participants had high adherence to the diet. These findings agree with a previous Scottish study, where 36% of participants had a high Mediterranean diet score at baseline (Papadaki and Scott, 2005a). The examination of individual food components revealed that higher mean scores were achieved for vegetables, fruit and non-refined cereals. In addition, the majority of participants achieved high adherence scores for these components, which might reflect the exposure of UK consumers to national campaigns and promotion initiatives for higher consumption of these foods in recent years (Levy, 2013).

Although the results suggest overall moderate compliance with the Mediterranean diet by the sample population, there were a number of elements of the diet that had poor compliance. A very low proportion of participants achieved high adherence scores for legumes, fish and dairy products, as well as red meat, poultry and olive oil. There is a lack of intervention studies promoting the recommended consumption of these foods in free-living individuals in the UK. Legumes, for example, are included in the 'non-dairy sources of protein' category of the current UK dietary guidelines, along with meat, fish and eggs (Harland et al., 2012). The recommendation to eat some foods from this group on a daily basis, with no mentioning of the specific amount of legumes to be consumed (Public Health England, 2013), might result in increased intake of meat, as suggested by the current findings. The reported low intake of fish corresponds to the average UK intake (Bates et al., 2012), whereas the low adherence to the olive oil recommendation might stem from the limited reference to olive oil consumption in the UK guidelines (Public Health England, 2013), which is in contrast to the Mediterranean diet recommendations (Willett, 2006).

Higher adherence to the Mediterranean diet was observed among higher educated participants, compared to those with lower levels of education. This is in agreement with earlier literature which has linked higher levels of education to healthier diets and adherence to dietary recommendations (Darmon and Drewnowski, 2008). It is noteworthy that married participants and those who shared food preparation with family members had higher Mediterranean diet scores, compared to those who were single or had sole responsibility for food preparation, respectively, indicating potential family influences on dietary behaviours. Involving the family has been established as a component of effective work-place interventions (World Health Organisation, 2009), since potential food-related family interactions could provide support for participants while benefiting other family members as well (Ebbeling et al., 2002). This suggests that future work-place interventions should engage participants' families. This could be achieved by developing and distributing newsletters and involving family members in study-related work-place events (e.g. cooking demonstrations) (World Health Organisation, 2009). Such interventions should also explore and tackle potential barriers faced by single participants or those with sole responsibility for food preparation, in order to improve their adherence to the Mediterranean diet.

A major strength of this study is that it complies with current frameworks of behaviour change intervention development by assessing the evidence base and needs of the target population prior to intervention design (Kok et al., 2004; National Institute for Health and Clinical Excellence, 2007; Craig et al., 2008; World Health Organisation, 2009). A limitation is its cross-sectional design and that the use of a self-reported food frequency questionnaire to calculate the Mediterranean diet score might be subject to recall bias. In addition, our sample consisted of a self-selected group of healthy employees with internet access. Although this inclusion criterion might exclude employees

**Table 5**
Differences in total Mediterranean score[a] and percentage of participants achieving a high adherence to the Mediterranean[b] diet according to demographic characteristics, South West England, UK (2014).

| | Total Mediterranean diet score Mean (SD) | *P* | Participants achieving high adherence to the Mediterranean diet *n* and % | *P* |
|---|---|---|---|---|
| Marital status | | 0.003 | | 0.211 |
| Married/cohabiting | 34.22 (5.34) | | 183 (41.1) | |
| Single | 32.18 (5.66) | | 27 (29.4) | |
| Separated/divorced/widowed | 33.18 (5.00) | | 18 (36.0) | |
| Level of education | | <0.001 | | 0.001 |
| Degree or higher | 34.70 (0.27) | | 153 (44.6) | |
| Lower than degree | 32.57 (0.37) | | 75 (30.7) | |
| Number of children living in household | | 0.782 | | 0.578 |
| None | 33.70 (5.30) | | 155 (40.4) | |
| ≥1 | 33.90 (5.50) | | 73 (35.9) | |
| Food shopping responsibility | | 0.415 | | 0.812 |
| I am | 33.50 (5.50) | | 107 (37.3) | |
| Family members | 33.80 (5.40) | | 19 (38.8) | |
| Shared | 34.20 (5.30) | | 102 (40.8) | |
| Food preparation responsibility | | 0.011 | | 0.155 |
| I am | 33.10 (5.70) | | 89 (34.9) | |
| Family members | 33.90 (5.30) | | 19 (32.2) | |
| Shared | 34.50 (5.10) | | 120 (44.1) | |

Differences were examined using the Chi-square test.
[a] Range of total Mediterranean diet score = 0–55.
[b] High adherence to the Mediterranean diet was defined as having a total Mediterranean diet score of 36–55.

with no internet access from participating, we believe that this would not limit the inclusivity of our study, since all of the participating work-places used electronic newsletters for information delivery to their employees, thus indicating wide internet access among all employees. Although the majority (58%) of participants were highly educated, our sample covered a relatively wide range of educational levels and occupations, therefore indicating the range of employees who might be willing to participate in work-place health promotion programmes. It was beyond the scope of the current study to assess physical activity. However, objective measures of physical activity should be collected in a future work-place nutrition intervention, as this variable might potentially confound the impact of the intervention. Although the response rate to the online survey was low (3.6%), we cannot ensure that all employees in each work-place accessed or read the study recruitment advertisements, which might have increased participation rates. Nevertheless, this hinders the ability to generalize our findings to the whole target population of adult employees in South West England.

Results suggest that future interventions promoting the Mediterranean diet in the UK might be best focussed on the promotion of legumes, fish and olive oil, replacing whole-fat dairy products with lower-fat versions and decreasing intake of red meat and poultry. This may be best targeted in a step-wise approach to change these components, in order to encourage gradual dietary behaviour changes, which are more likely to lead to long-term maintenance (Fletcher and Rogers, 1985). In addition, it has been suggested that there is often a considerable gap between awareness of dietary recommendations and actual behaviour when it comes to meeting these (Spronk et al., 2014). As this might result from people not being aware of their unhealthy dietary behaviours (Oenema et al., 2001), future web-based interventions should provide comprehensive information on the recommended intakes of the Mediterranean diet components, as well as the benefits of adhering to those, and incorporate dietary assessment tools to monitor achievement of goals towards increasing individual component adherence and adherence to the Mediterranean diet as a whole. Provision of tailored feedback following dietary assessment, including a comparison of personal dietary intake with targets, has been shown to improve awareness of personal dietary intake, thus facilitating behaviour change (Oenema et al., 2005). Future web-based interventions should also supplement tailored feedback with theory-based advice to account for psychosocial and environmental determinants of dietary behaviour, such as addressing barriers and improving self-efficacy to increase Mediterranean diet adherence, which has been suggested to motivate people to change their eating behaviour (Brug, 1999).

## Conclusion

Improvement in the consumption of several components of the Mediterranean diet is needed to increase adherence to this dietary pattern in this sample of adult employees. Findings from the current formative research can be used to inform the development of web-based interventions to promote the Mediterranean diet in work-place settings in South West England.

## Conflict of interest statement

The authors declare that there are no conflicts of interest.

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A.P. designed and conducted the study; L.W. performed the statistical analyses; A.P., S.S. and R.J. wrote the paper. A.P. had primary responsibility for final content. All authors read and approved the final manuscript.

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