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Barriers and Facilitators to Mediterranean Diet Adoption by Patients with Non-alcoholic Fatty Liver Disease in Northern Europe

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1 **Barriers and Facilitators to Mediterranean Diet Adoption by Patients with Non-alcoholic**
ACCEPTED MANUSCRIPT
2 **Fatty Liver Disease in Northern Europe**

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32
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34
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36 participated in data collection, analysis and interpretation, as well as drafting the article. DH and
37 EH were involved in the acquisition of data. SB, LA, KH and TH aided data analysis and
38 interpretation. All authors revised the manuscript for important intellectual content with QMA giving
39 final approval of the version to be published.

56 **Background & Aims:** Dietary interventions for weight loss are effective therapies for non-
57 alcoholic fatty liver disease (NAFLD). The Mediterranean diet might benefit these patients but it is
58 not followed consistently in Northern European countries. We examined factors that determine
59 Mediterranean diet adoption and maintenance in a northern European population.

60 **Methods:** We used a mixed-methods approach to investigate the effects of a 12-week
61 Mediterranean diet intervention and perceived barriers and facilitators. Nineteen adults with
62 NAFLD were recruited from a tertiary hepatology center in England. Participants were taught
63 behavioral strategies through the provision of shopping lists, meal planners, and recipes; no
64 advice was given on calorie allowances or physical activities. We used the 14-point Mediterranean
65 diet assessment tool to assess dietary intake, based on a small number of foods in servings/day or
66 servings/week, at baseline and after 12 weeks; participants were assigned scores of low (less than
67 5 points), moderate (6–9 points), or high (10–14 points). Semi-structured interviews were audio
68 recorded, transcribed, and analyzed using the framework method.

69 **Results:** Twelve weeks after the dietary advice, Mediterranean diet adoption significantly
70 increased from moderate to high (mean increase of 2.2 points; from 7.6 ± 2.5 at baseline to 9.8 ± 2.8
71 at 12 weeks) ($P = .006$). This increase was associated with a mean reduction in bodyweight of 2.4
72 kg (from $99.2 \text{ kg} \pm 17.0$ at baseline to $96.8 \text{ kg} \pm 17.5$ at 12 weeks) ($P = .001$) and increased serum
73 concentrations of high-density lipoprotein cholesterol in 72% of participants (from 1.10 ± 0.8 at
74 baseline to 1.20 ± 1.30 vs. 1.00 ± 0.5 at 12 weeks) ($P = .009$). Increased nutrition knowledge and
75 skills, family support, Mediterranean diet promotion in media and clinical settings, and the
76 nutritional care facilitated diet changes. Barriers to Mediterranean diet uptake included an
77 obesogenic environment, life stressors, and demand for convenience. Poor understanding of the
78 causes and significance of NAFLD adversely affected readiness to change dietary habits.

79 **Conclusion:** In an analysis of patients with NAFLD the northern United Kingdom, we found a 12-
80 week Mediterranean diet intervention was acceptable and associated with significant reductions in
81 bodyweight and increased serum levels of high-density lipoprotein. We identified barriers and

82 facilitators that could support appropriate treatment adaptations and guide personalized

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83 intervention approaches.

84

85 **KEY WORDS:** MDPS; HDL; metabolic liver disease; scalable diet treatments

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87 Introduction

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88 Non-alcoholic fatty liver disease (NAFLD) affects up to 1-in 3-people, driving the global epidemic in
89 chronic liver disease and consequent healthcare resource utilization (1, 2). NAFLD is a spectrum
90 that encompasses isolated hepatic fat accumulation (steatosis, NAFL); through fat plus
91 inflammation and hepatocyte injury (non-alcoholic steatohepatitis, NASH); ultimately to
92 fibrosis/cirrhosis and potentially hepatocellular carcinoma (3-5). NAFLD is strongly associated with
93 obesity and Type 2 diabetes and is an independent risk factor for the development of
94 cardiovascular disease (CVD) (3).

95
96 Lifestyle interventions are the cornerstone of treatment in the absence of effective
97 pharmacotherapy. The exclusion of processed food and fructose is effective and calorie
98 restrictions to achieve 7-10% weight loss improve clinical biochemistry, histological steatohepatitis
99 and fibrosis (6-8). The Mediterranean diet has been shown to ameliorate steatosis and improve
100 insulin sensitivity/glucose tolerance, independent of weight loss (8-10).

101
102 The factors that determine Mediterranean diet adoption in a northern European patient population
103 are largely unknown. There is scarce evidence on the barriers and facilitators that influence an
104 individual's decision to adopt, and ability to maintain, such a diet long-term. There is limited
105 information on whether an individual's understanding of their underlying liver disease contributes
106 to the adoption of a diet intervention or their perceptions of nutritional care. These data will be
107 highly relevant to the development of scalable diet treatments.

108
109 The aim of the current study was, firstly, to determine key barriers and facilitators to adoption and
110 maintenance of a 12-week Mediterranean diet intervention; and, secondly, to identify which
111 adaptations would optimize treatment delivery and so maximize dietary behavior change.

114 **Materials and methods**

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115 This mixed-methods study was informed by a multi-disciplinary team comprising dietitians,
116 psychologists and medical staff. The aim was to explore participant's experiences of following a
117 12-week Mediterranean diet intervention. Semi-structured interviews were conducted to identify
118 barriers and facilitators to diet uptake and maintenance. Socio-demographic data and routinely
119 measured clinical and lifestyle variables were collected with preliminary changes reported. The
120 information was then integrated into the discussion of the overall results.

122 **Recruitment**

123 Patients were recruited from a specialist NAFLD clinic at a tertiary hepatology center, The
124 Newcastle upon Tyne Hospitals NHS Foundation Trust, which covers a broad geographical area in
125 Northern United Kingdom. Eligibility criteria included capacity to provide informed written consent,
126 and ability to write and converse in English without an interpreter. Inclusion criteria: 18-75 years
127 old with NAFLD, weekly alcohol consumption <14/21 units in the last 24 months, non-smoker.
128 Exclusion criteria: liver cirrhosis or neoplasm, prescribed other diet therapies, food intolerances
129 and/or allergies. The study protocol was approved by East Midlands–Nottingham 1 Research
130 Ethics Committee (REC reference 15/EM/0049). Informed written consent was obtained.

132 Patients were identified by clinicians during routine appointments and invited to participate.
133 Overall, a purposive sample of 20 patients with diverse socio-demographics were recruited. The
134 target sample size was informed by the researchers prior experience and other qualitative studies
135 where data saturation is typically achieved between 12 and 20 participants (11, 12).

137 **Mediterranean diet intervention**

138 Mediterranean diet intervention combined nutrition counselling and education delivered in a single-
139 session by a dietitian. The intervention was based on the Mediterranean diet pyramid, a flexible
140 model of dietary restraint (13). Behavioral strategies of goal setting, action-planning and self-

141 monitoring were targeted through the provision of shopping lists, meal planners and recipes. No
142 advice was given on calorie allowances or physical activities. There was no further nutritional care
143 provided over the 12 weeks, which reflects the standard follow-up interval in routine practice.
144

145 **Quantitative data collection and analysis**

146 Socio-demographic characteristics included age, gender, ethnicity, weekly gross equalized
147 household income and marital status. Although the study was not powered to detect change in
148 outcomes, key clinical and lifestyle variables ((blood lipids, bodyweight, and body mass index
149 (BMI)) were monitored and presented. The 14-point Mediterranean diet assessment tool (MDPS)
150 measured diet intake based on a small number of foods in servings/day or servings/week. The
151 range of possible scores are 0-14; low, moderate or high consumption respectively (≤ 5 , 6-9 and
152 ≥ 10 points) (14).
153

154 Descriptive and inferential analyses were performed in SPSS (version 22) alpha $p < 0.05$.

155 Continuous and categorical data summarized as ((mean, standard deviation (SD) and counts
156 (percentage)). Paired t-tests were used to assess changes in clinical and lifestyle data between
157 baseline and study end for continuous variables. Mann-Whitney U test was used to assess if
158 clinical and lifestyle data differed by the semi-categorical diet adoption score (MDPS).
159

160 **Qualitative data collection and analysis**

161 Face-to-face semi-structured interviews were completed after 12 weeks by a nutrition worker
162 trained in qualitative research methods, audio-recorded and transcribed verbatim (interview
163 schedule, Supplementary Material Table 1). Design and reporting was informed by consolidated
164 criteria for reporting qualitative research (15). Reflexivity was fostered by involving multiple
165 researchers and using a diary to record impressions of the data and analysis process.
166

167 The framework method was used for thematic analysis of the transcripts (16). Two researcher's
168 independently coded the same 40% of transcripts to develop a working analytical framework.

169 These initial findings were discussed during meetings to resolve any discrepancies. This process
170 was replicated with an additional 20% of transcripts, producing further iterations of the framework.
171 Coding involved reading and re-reading transcripts, and coding the content into themes and
172 subthemes until no further codes emerged.

173
174 A third researcher was consulted to refine the framework and ensure consensus was reached on
175 themes and subthemes. This triangulation of expertise captured different perspectives and
176 enhanced trustworthiness of the findings. The framework was then applied by indexing the
177 remaining transcripts using the existing categories and codes, until data saturation occurred at 19
178 transcripts. The summarized abstracted data was charted into a matrix for each final theme. Direct
179 participants quotes are reported to support themes and thus maximize confirmability.

181 Results

182 One participant left the study following a major change in social circumstances, unrelated to
183 participation so the final sample comprised 19 participants. Baseline characteristics are presented
184 in Table 1. Median weekly gross equalized household income was £320.5 (£76.9 to £1249.9),
185 approx. €364.7 (€87.5 to €1422.4). All participants had clinically significant NAFLD: 16 had biopsy
186 proven NASH with Kleiner fibrosis stages ranging between F1-3. The other 3 patients had clinical
187 and radiological evidence of NAFLD with intermediate-range NAFLD fibrosis scores (>-1.445).

188
189 After 12-weeks diet intervention, Mediterranean diet adoption significantly increased from
190 moderate to high levels (mean increase of 2.2 points; 7.6 ± 2.5 at baseline to 9.8 ± 2.8 at 12 weeks)
191 ($p=.006$) (Fig.1). In parallel, 79% of participants reduced bodyweight by mean 2.4kg (from
192 $99.2\text{kg} \pm 17.0$ at baseline to $96.8\text{kg} \pm 17.5$ at 12 weeks) ($p=.001$) (Fig.2). Participants with improved
193 diet uptake (72%) had increased high-density lipoprotein (HDL) cholesterol (1.10 ± 0.8 to 1.20 ± 1.30

194 vs. 1.00 ± 0.5) ($p = .009$). No association between diet adoption and socio-demographics were
195 observed.

196
197 Interview data are described with participants identified by gender and age only. Figure 1 provides
198 the analytical framework for themes, subthemes, barriers and facilitators. The links between
199 quotes and the framework are presented (Supplementary Material Table 2).

201 **NAFLD conceptualization**

202 Poor understanding about NAFLD appeared to influence the priority placed on following dietary
203 advice. NAFLD was not well-defined and knowledge of the potential to induce disease
204 regression/reduce progression was limited. Illness-related demands were perceived as lethargy,
205 discomfort, pain, bloating, anxiety, disordered temperature regulation and altered immunity.
206 Conversely, several reported no symptoms, or attributed symptoms to diabetes or ageing.

207
208 NAFLD causality and the strength of these associations produced responses that incorporated
209 physiological drivers, lifestyle behaviors and genetic predisposition. The absence of alcohol in
210 disease development was stressed. Poor diet and excess weight were often viewed as causal,
211 and the regional cultural identity as influential. Conversely, the diet-disease relationship and
212 impact of excess weight was questioned by a few participants.

213
214 *"I understand that if I lose weight, it might improve it. I'm struggling to be convinced by that."* (F, 55
215 years 05)

216
217 NAFLD specific self-care priorities and acceptance for dietary self-control was imperceptible.

218 Although, it was generally recognized that high-quality dietary patterns improve life expectancy
219 and health outcomes. In some cases personal healthy dietary behaviors were shared to

220 emphasize that further dietary changes weren't needed. Participants were less likely to engage in
221 the change process if they interpreted their habitual diet as either low or high Mediterranean.

222
223 *"Well, I haven't had to make many changes, so it's not been a challenge. I've just been more*
224 *aware."* (F, 55 Years 05).

226 **The process of dietary behavior change**

227 *Readiness and psychological factors*

228 Placing high value on potential health benefits and the expectation of dietary enjoyment increased
229 participants' readiness to change their habitual diet. Improved Mediterranean diet adoption was
230 linked to responses portraying self-determination and high intrinsic motivation. Conversely,
231 difficulties were related to perceived helplessness and increased demand for food skills.

232
233 *"Yes, I want to change; I'm finding it hard to change, but I want to change. I'm a creature of habit."*
234 *(F, 38 years)*

235
236 Higher internal locus of control—belief in one's own ability to control events—assertiveness and a
237 balanced relationship with food supported diet modifications. Stressful experiences, ambivalence
238 and optimistic bias hindered the process. High responsiveness to cues outside of hunger, resulting
239 in treats, cheats or rewards were obstacles to following dietary advice. Attitudes diverged on
240 whether it was feasible to consume Mediterranean diet across seasons.

241
242 *"When I left work this afternoon I walked into the administration office I saw the big bag of*
243 *Maltesers® there made up of little bags. I know I shouldn't, but I did."* (M, 59 years)

244
245 *"Then Christmas came in the middle of it, and Christmas just isn't geared up for the Mediterranean*
246 *diet, really, is it?"* (F, 38 years)

248 Mediterranean diet intervention was highly acceptable to many participants with impressions of
249 food abundance, variety and enjoyment. The cost of Mediterranean diet ingredients did not
250 emerge as an obstacle to participants following this dietary pattern. Portion sizes were typically
251 considered adequate and a range of individual Mediterranean foods were consumed. Enhanced
252 nutrition knowledge/skills and self-regulation supported diet uptake.

254 *"I'm just amazed at how much fruit and vegetables you can buy for quite a low amount of money."*

255 *(M, 59 years)*

256
257 Participants encountered difficulties with an obesogenic environment and a societal pressure to
258 consume. The unhealthy selections available in institutions, workplaces and supermarkets
259 negatively impacted diet maintenance. Work patterns and dietary habits were problematic for
260 appetite regulation and food routines. In contrast, easy access to budget supermarkets, good
261 transport links and having family diet supporters were regarded positively.

262
263 *"I always bring my food with me, which makes me look a bit like an outsider. So, I have to fight my
264 corner." (F, 55 years 05)*

266 **Dietary management**

267 Personalized approaches combining nutrition education and counselling skills induced diet
268 modifications. The dietitian was considered an advocate of flexible dietary restraint and the
269 Mediterranean style of eating. The importance of role modelling and credibility was identified.
270 Participants reported food selections based on therapeutic benefits with nutritional quality,
271 freshness and palatability. However, taste preferences were a clear barrier in some cases and
272 sustained dietary changes also appeared dependent upon improvements in clinical parameters.

274 79% of participants achieved weight reduction. These individuals largely perceived the adoption
275 of the diet as more feasible, conveying a greater magnitude of dietary changes.

276
277 (F, 55 years 04) reduced her weight by 5.6kg and said *"I would want them to know it's really easy.
278 It's very enjoyable, and a variety of foods." "There is enough food you can eat."*

279
280 Conversely, in those cases where weight loss was not attained, difficulties applying dietary
281 changes were more often reported.

282
283 (F, 38 years) gained 2.3kg and stated *"What I found hard was, because I rely quite a lot on
284 convenience, preparing everything from scratch, you weren't able to just grab something and go
285 you had to think about it."*

287 **Treatment adaptations**

288 Measures to shape future diet interventions were suggested, such as joint creation of resources
289 and personalized dietary input on a quarterly basis. Face-to-face contacts were preferred with
290 support from an online program, thus enabling housebound patients and those from a wider
291 geographical area to engage. Telephone contacts appeared to be least helpful and groups cost-
292 effective and motivating. Mediterranean diet promotion in clinical settings and increased coverage
293 in books and television facilitated diet uptake.

295 **Discussion**

296 The Mediterranean diet is widely studied and has beneficial properties in a broad range of
297 diseases (17, 18). The PREDIMED study reported that high Mediterranean diet adoption (MDPS
298 ≥ 9), was associated with significantly lower odds ratios for obesity prevalence and CVD risk.
299 Furthermore, a 2-point increase in MDPS was associated with reduced risk of ill-health (19, 20).
300 Our results are consistent with emergent evidence within the NAFLD population (21).

301 Mediterranean diet adoption significantly increased and was associated with modest but significant
302 bodyweight reduction and increased HDL-cholesterol in participants. These findings suggest this
303 dietary pattern alongside other lifestyle changes contribute to an improved CVD risk profile in
304 NAFLD patients.

305
306 Perhaps unsurprisingly, Mediterranean diet consumption was lower in the study population (MDPS
307 7.6 ± 2.5) than in a Mediterranean population (MDPS 8.7 ± 2.0) (20). Accordingly, Mediterranean
308 diet interventions outside the Mediterranean region may face additional challenges and warrant
309 specific approaches. Interestingly, we identified no association between socio-demographic
310 characteristics at baseline or end-of study MDPS, though the ability to detect associations may
311 have been impeded by small numbers.

313 **Barriers and facilitators of Mediterranean diet adoption and maintenance**

314 **NAFLD conceptualization**

315 Acceptance of NAFLD as a disease and nutritional care engagement is impacted by patients
316 understanding of their condition. Poor health service utilization may be in part attributed to lack of
317 symptoms, and viewing long-term diseases and their outcomes as inevitable (22, 23). Therefore,
318 clinicians should stress that NAFLD is treatable and even reversible if diet improvements are
319 sustained (6). Perceived stigma in obesity and liver disease poses psychological burden. In this
320 study, the absence of alcohol in NAFLD causality, social desirability and optimistic bias was
321 emphasized.

323 **Readiness and psychological factors**

324 Participants readiness to change, underpinned diet adoption and maintenance with low intrinsic
325 motivation and ambivalence obstacles to following dietary advice. This is consistent with recent
326 findings that willpower and willingness to change affect healthy eating adoption (24-26). Self-
327 efficacy is one of the best psychological predictors of good outcomes in lifestyle interventions that

328 target obese adults, but is low in NAFLD patients compared to other liver disease patients (27,
329 28).

330
331 Self-regulation and higher autonomous motivation have been found to be positive predictors of
332 diet adherence in obesity interventions, which is in line with our findings (29). The negative impact
333 of treats or rewards, and life stressors were evident and appear common in interventions targeting
334 obese adults (28). Thus, having a balanced relationship with food is pivotal to success as well as
335 the ability to manage moods, emotions and stressors.

337 **Dietary management**

338 Tangible markers of weight loss, improved glycemic control and well-being expedited diet
339 maintenance. Our data supports the view that individuals with weight loss found the adoption of
340 the diet more straightforward, as evidenced by the diet modifications reported. Published data
341 indicates early weight loss is a prominent predictor of treatment adherence among obese patients
342 and subsequent weight loss (28, 30). Trust in the dietitian–patient relationship encompassing;
343 professional credibility; role modelling; and diet advocacy induced changes. Participants want
344 effective personalized interactions and not standardized approaches.

345
346 Nutrition knowledge was significantly associated with Mediterranean diet adherence and lower
347 obesity prevalence among the Molise population, Italy (MOLI-SANI study) (31). Nutrition
348 counselling interventions have also been shown to induce moderate diet improvements previously
349 (32). Hence, nutrition education and counselling are crucial ingredients in diet interventions.

350 Although, more intensive approaches may have greater effectiveness than brief interventions (24).

352 **Practical and social factors**

353 One of the most significant findings in our study is that the Mediterranean diet is an acceptable
354 healthy eating model in a non-Mediterranean country (24, 33). There were impressions of cost

355 neutrality, despite the study population having a mean weekly household income that is £227.4,
356 approx. €258.8 lower than the UK average (34). Furthermore, previous research found diet
357 changes did not equate to significantly increased purchase costs (1-point increase MDPS
358 equivalent to £0.55) (24), which is supported by published cost analysis (35, 36).

359
360 Commitment to a diet intervention amongst other obligations appears demanding. Diet saboteurs
361 and spousal conflict impacted the home environment to undermine food routines. Consistent with
362 our data, research that examined barriers to healthy eating adoption also identified time pressures,
363 busy lifestyle, irregular working hours and desire for convenience (37).

364 365 **Treatment adaptations**

366 The various treatment adaptations suggested underscores the futility of a one-size-fits-all
367 approach. The joint development of intervention tools between patients and clinicians may
368 optimize treatment adoption and maintenance. Personalized dietary input on a quarterly basis
369 combined with an online program was also favored. Earlier intervention studies have used these
370 components effectively (38).

371
372 The MOLI-SANI study reported that exposure to mass media information was significantly
373 associated with greater adoption of a Mediterranean-style diet (41). Furthermore, that participants
374 found increased coverage in media, books, magazines and television induced dietary behavior
375 change, which is consistent with our findings.

376
377 The main limitation of the current study is potential for selection bias, with participants perhaps
378 more health-motivated and interested in the diet intervention, which might not be applicable to the
379 wider NAFLD population. However, steps were taken to address transferability by recruiting a
380 purposive sample of individuals with diverse socio-demographics and making connections to the
381 regional cultural and social context. Further larger studies are needed to assess Mediterranean

382 diet uptake and its impact in a larger population. Another limitation was that a detailed assessment
383 of Mediterranean diet impact on markers of liver function was not conducted. However, this study
384 primarily focused on identifying barriers and facilitators to a Mediterranean diet in patients with
385 NAFLD, rather than assessing its impact on the liver, which has already been subject to a
386 controlled trial (9). The sample size may be considered small in an epidemiological context, but
387 was sufficiently robust to achieve the aims of this mixed-methods study.

388
389 Despite these limitations, this study adds to the body of literature indicating that a Mediterranean
390 diet was highly acceptable, and its adoption was associated with positive clinical outcomes. The
391 findings provide simple ways in which clinicians can optimize patient consultations in clinical
392 practice. This study is the first to explore the factors that influence Mediterranean diet adoption in
393 a northern European NAFLD patient population and demonstrates its potential to be translated in
394 regions that consume a typical western diet. Importantly, no specific advice on calorie allowances
395 or physical activities was given during the intervention and this still led to positive effects on
396 bodyweight and HDL levels.

397
398 A 12-week Mediterranean diet intervention was acceptable in NAFLD patients and was associated
399 with positive changes in bodyweight and serum HDL levels. The Mediterranean diet intervention
400 effectively modified diet adoption and maintenance in a northern European patient population.
401 Furthermore, during dietary intervention we identified a range of perceived barriers and facilitators,
402 which may enable a more targeted and personalized intervention approach. Treatment
403 adaptations to enhance personalized nutritional care were highlighted alongside the benefits of
404 sustained exposure to Mediterranean diet information in media and clinical sources.

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Table 1. Baseline characteristics of Mediterranean diet population. Values are means (SD).

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Variable	Mean (SD), n=19
Gender (% Female)	63.2
White British (%)	89.4
Age (years)	58.5 (10.6)
Married or cohabiting (%)	78.9
Type II diabetes (%)	68.4
Weight (kg)	99.2 (17.0)
BMI (kg/m ²)	36.2 (6.3)
≤30	5.3%
30-34.9	47.4%
35-39.9	26.3%
≥40	21%
MDPS (<5, 6-9, >10)	7.6 (2.5)

Fig.1. Themes, subordinate-themes, barriers and facilitators

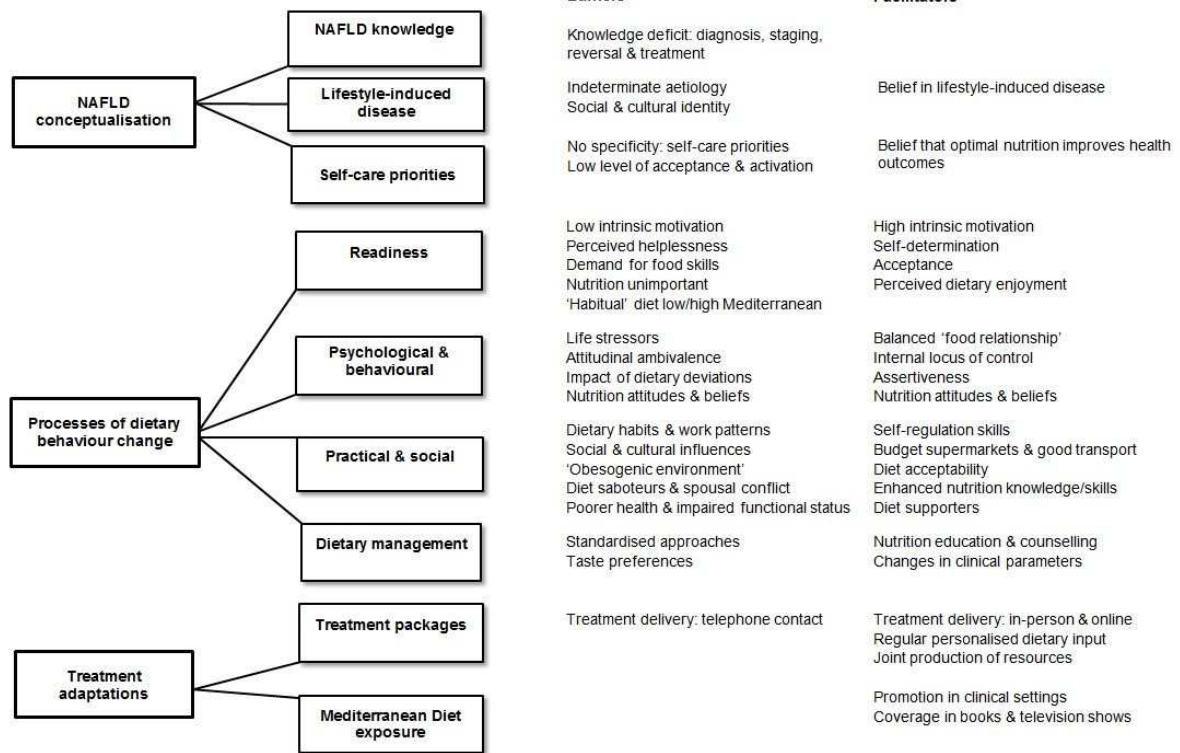
Fig. 2. Mediterranean diet adoption at baseline and after 12-weeks diet intervention.

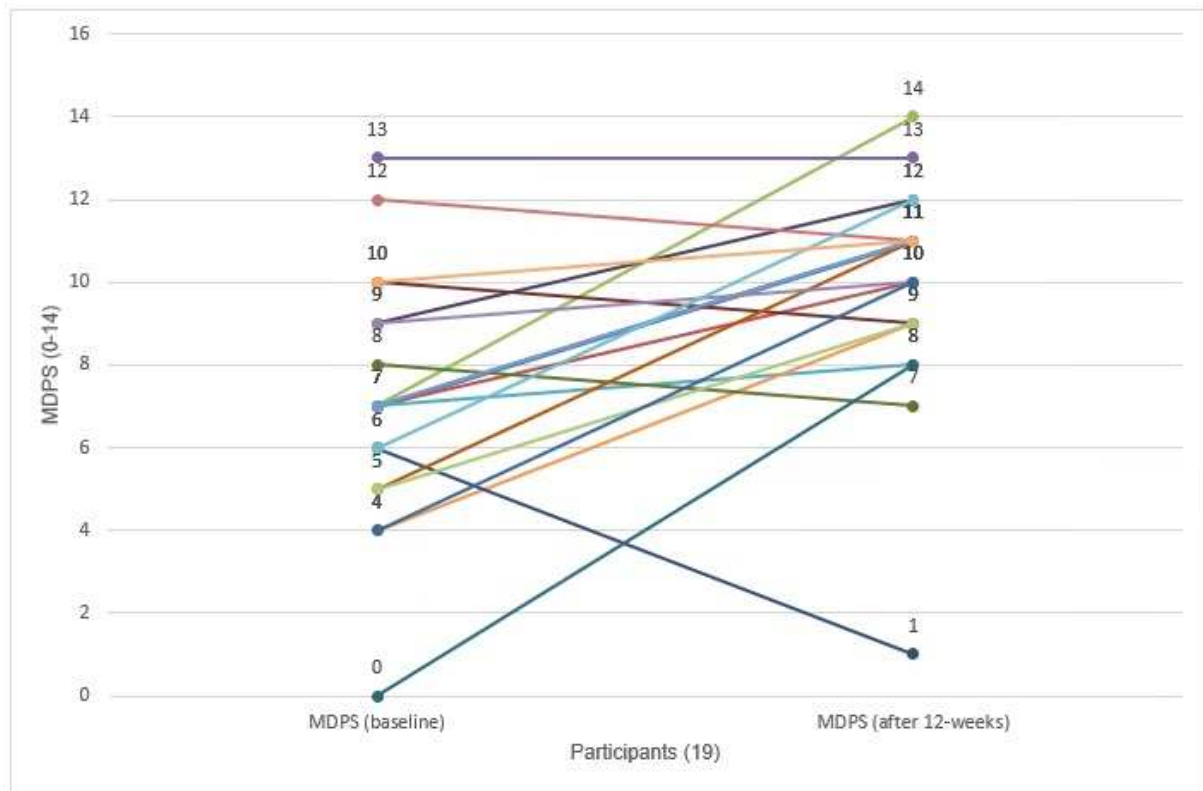
Significance: $p=.006$ (paired t-test)

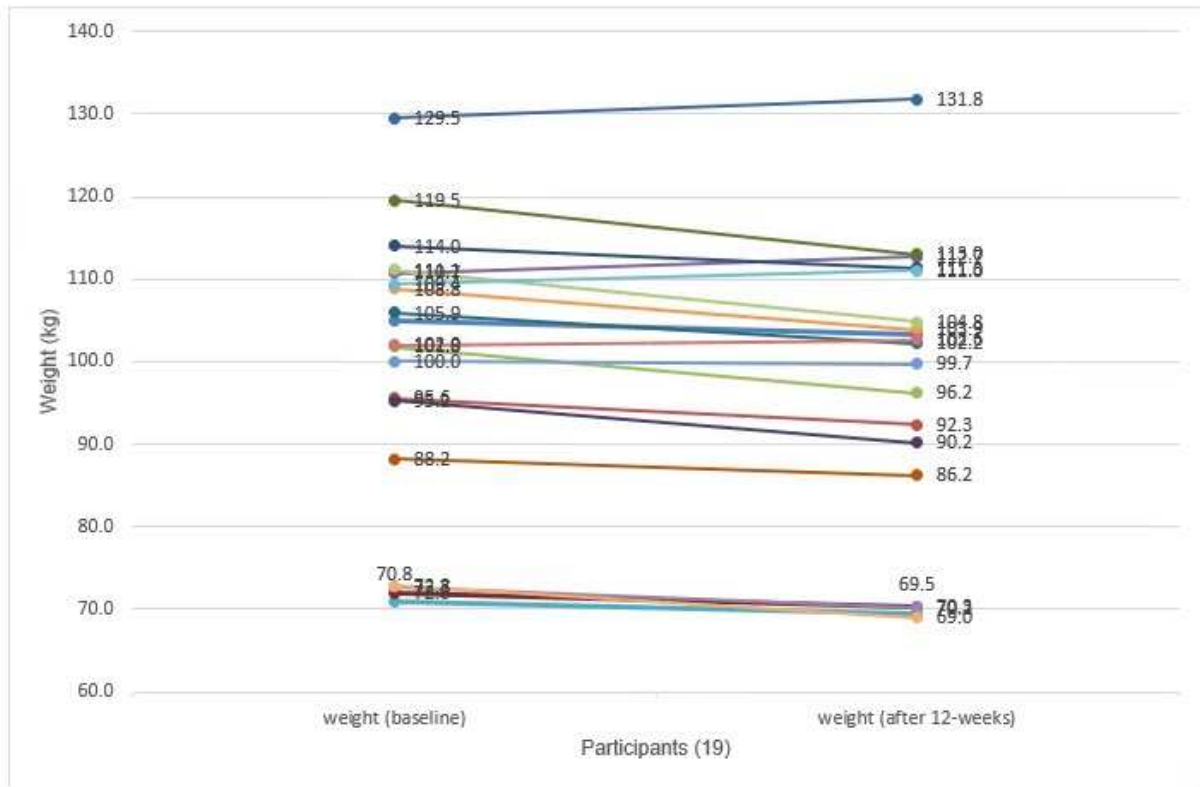
Fig. 3. Bodyweight at baseline and after 12-weeks diet intervention. Significance: $p=.001$

(paired t-test)

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What You Need to Know

Background

- The Mediterranean diet may be beneficial in non-alcoholic fatty liver disease (NAFLD).
- Information on the factors that determine Mediterranean diet adoption and maintenance in a northern European population is scarce.

Findings

- A 12-week Mediterranean diet intervention is an acceptable approach and its adoption associated with positive clinical outcomes.
- A range of key barriers and facilitators to Mediterranean diet adoption were identified. Knowledge of these could support a more targeted and personalized intervention approach.

Implications for patient care

- Characterizing barriers and facilitators of Mediterranean diet consumption may be a useful strategy to tailor diet interventions, in regions that consume a typical western diet.

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**Barriers and Facilitators to Mediterranean Diet Adoption by Patients with Non-alcoholic Fatty
Liver Disease in Northern Europe**

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Table of contents:

Table 1. Interview schedule Pages 2-3

Table 2. Thematic framework and illustrative quotations Pages 4-8

Table 2. Interview schedule

Perceptions of NAFLD and its management	Prompts
Please tell me, what do you understand about non-alcoholic fatty liver disease (NAFLD)?	
Please describe, in what ways does NAFLD affect you?	Is there anything that you have changed in your daily life because of the condition? Why?
Perceptions of Mediterranean Diet	
On a scale of 0-10, how important is what you eat and drink to you? (where 0 = not very and 10 = very)	How do you feel about changing your diet to manage the condition?
If you were advising a friend about how to follow a Mediterranean diet, what would be the key points you would want them to know?	What are the potential health benefits? What do you see as advantages/disadvantages? What are the priorities when choosing foods/drinks?
How did following a Mediterranean diet compare with your expectations? Easier or harder?	Why?
Please tell me has changing your diet affected those close to you?	And if so in what ways?
Can you describe what has helped you to follow a Mediterranean diet?	How does that work? What has worked out best so far and why?
Is there anything that might stop other people from following a Mediterranean diet?	And if so what are these? Was that a problem for you? Was there anything you found difficult? Did anything get in the way?
On a scale of 0-10 how confident are you about being able to follow a Mediterranean diet in the long-term? (where 0 = not very and 10 = very)	

Perceptions of dietary management

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Can you think about the most useful Mediterranean diet information you learned? What made it particularly helpful?	
Can you recall the dietary information given to you in clinic? What was the most helpful?	Was goal setting useful or difficult? Was diary keeping helpful/easy to do or difficult?
Do you have any suggestions about how we can make it easier for people to follow a Mediterranean diet?	At clinic and at home?
Would you like to receive further advice about a Mediterranean diet?	From whom? Which topic(s)?
How would you like to receive this further advice?	Individually or in a group? How often? Face-to-face? Telephone? Web-based support?
And, finally, is there anything else you want to tell me about your experience of following a Mediterranean diet?	

Table 2. Thematic framework and illustrative quotations

1.0 Theme: NAFLD conceptualization	
1.0a NAFLD-related knowledge	<ul style="list-style-type: none"> • “I don’t know how bad it is, I don’t know what happens next.” (F, 54 years) • “I don’t really know what the effects of non-alcoholic fatty liver disease are, because I associate any symptoms that I have to diabetes, which is tiredness, lethargy – things like that.” (F, 62 years) • “We are both getting older, so we do have other health problems. So, we can’t really say that it’s connected with non-alcoholic fatty liver disease.” (M, 77 years)
1.0b Lifestyle-induced disease	<ul style="list-style-type: none"> • “The first thing I can tell you is that it’s complicated, that I understand I developed it because I’m diabetic, mostly.” (F, 55 years 05) • “Obviously, you can only go down to a regular weight for your liver. If that still doesn’t do it, then I presume it’s genetic.” (F, 56 years) • “I’m very overweight and I have been for, probably about 20 years, and that, obviously, didn’t help my liver.” (F, 55 years 04) • “Er. Well, I know it’s nothing to do with alcohol and that sort of thing.” (M, 66 years)
1.0c Self-care priorities	<ul style="list-style-type: none"> • “The other thing I found, when I was doing this, when I did lose the weight, was my blood sugar dropped, so there are obviously advantages there as well.” (M, 60 years) • “I mean, the one thing that does help me is the fact that I have got a disease. I know that I need to try and do something about it.” (M, 59 years) • “It’s an acceptance that this is where we are and we have to face it. I think just the fact that I know now that there is nothing that can be done for my condition except changing the way I eat.” (F, 69 years)
1.1 Theme: The processes of dietary behavior change	
1.1a Readiness	<ul style="list-style-type: none"> • “I know I should, and I do try. Sometimes I might fall by the wayside, but we’re all human. Long term? It depends on my motivation. If I can see that it’s having a good impact, then I’m probably quite high up that scale.” (F, 62 years) • “Er. I don’t know. My wife goes out and gets all the stuff, you know, so. She does the shopping and cooking and that, and all I do is just eat it.” (M, 66 years) • “Relatively easy. If they’re committed to it in some kind of way.” (M, 59 years)

<p>1.1b Psychological and behavioral</p>	<ul style="list-style-type: none"> • “I have a very busy life. I forget, then a week later I think ‘oh no, portion sizes.’ I forgot about goal setting because I was doing other things. I’m sorry, I was too busy.” (F, 55 years 05) • “I went on holiday, and when you go on holiday. I just went all erratic when I came back. That was it. It broke everything.” (F, 61 years)
<p>1.1c Practical and social Self-regulation, nutrition knowledge/skills Work patterns/diet habits ‘Obesogenic environment’</p>	<ul style="list-style-type: none"> • “You see how much sugar’s in them and go for a lower content.” (F, 65 years) • “Actually my planning food, rather than just eating what you fancy and making everything from scratch rather than convenience.” (M, 44 years) • “We’ve tried to use a smaller dinner plate rather than a huge one.” (M, 77 years) • “I was doing homemade soup and everything. You know, I was doing things like that, which I wasn’t doing before.” (F, 61 years) • “Whereas now I’ll take a pot of fruit in with me and I’ll pick on that, rather than chocolate, and stuff out of the machine.” (F, 38 years) • “I will return to food diaries because I think they are really good – they really help you. They’re very motivating.” (F, 55 years 05) • “Trying to fit things in on my shift. You only get ten minutes and you’re trying to eat a salad and it’s impossible.” (F, 61 years) • “So I knew at the start of it, it was going to be hard to break my normal eating habits.” (M, 37 years) • “I don’t cook, I haven’t for years, because I’m never really in long enough to cook, because I work, then I do stuff outside of work.” (F, 38 years) • “It’s social situations. When you’re in an environment where other people don’t follow the same diet as you do, it’s always a bit awkward, because food is about socializing as well as being nutritious.” (F, 55 years 05) • “In college, the food that is provided is very poor quality.” (F, 55 years 05) • “It’s getting through your bait and then not wanting to go to the burger vans and catering vans that come to site.” When you’re doing your food shopping, not putting – ‘ah, the Pringles are on offer, I’ll take a packet.” (M, 37 years) • “Why don’t pub meals involve more Mediterranean diet? You know? Over Christmas we went in and I had to ask, can you cut out that bit and am I allowed

<p>Family support</p>	<p>more servings of vegetable? And, the shock-horror, you know?" (F, 56 years)</p> <ul style="list-style-type: none"> • "One son has got me going, on a Sunday morning, and doing a park run, which I would never have envisaged me doing before. And my other son, who is a chef – well, not a chef but he's a cook – he's now helping with that side of things: he's making up recipes that are really good for me to have." (F, 55 years 04) • "My wife and my daughters will test out recipes I have a supportive environment around me. They were scrutinized by my food government at home. Both of my daughters will look at the contents of food, food labelling stuff." (M, 59 years) • "It's made him realize that I suddenly have an opinion and I've got to do something for me. Overall it's been quite fun because, as I say, I like learning new things. But, at the same time it has caused a certain amount of stress at home." (F, 69 years)
<p>1.1d Dietary management</p> <p>Food and drink selections</p>	<ul style="list-style-type: none"> • "I think she believed in it and it made us, it came across that it's pointless doing something or getting somebody to do it if you don't believe it yourself." (F, 52 years) • "I would tell them just the thing Laura showed us, with the plate size, and how it was divided up, which was very important because when you go off that guideline, you know what you're eating and it's balanced." (F, 52 years) • "When I started on it, I had the one-on-one with Laura, and that was really good for portion sizes, because that is where I was falling down. She made it properly tactile; you could have a handful of whatever, and that was your portion size and, rather than just getting told you need a portion of this, and a portion of that, it's good to see it, because you can really visualize it. Then, when you go round the supermarket, you think, 'that's two portions in there', and you know what you're buying." (F, 38 years) • "I think it was the dietitian going through it at the beginning. You know, pointing out the reasons, and then obviously giving you some support recipes. That was quite useful. It was interesting to find out about lentils and nuts and things, because I had always thought, keep well off those because they are full of calories." (F, 56 years) • "The fact that people in the Mediterranean don't suffer so much with liver disease, given the fact that they are living using fresh vegetables, and I know they don't use processed foods at all." (F, 62 years)

Taste preferences	<ul style="list-style-type: none"> • “To change to olive oil, definitely and to eat more pulses. That has been the two big things for me. Now, I’m really eating much more vegetables, so I go for vegetable dishes more than meat (F, 54 years) • “Don’t use butter; use olive oil, eat loads of fruit and veg; that’s the main thing.” (F, 61 years) • “It would revolve around fresh fruit, fresh vegetables, actually cooking rather than takeout. Trying as far as possible to avoid processed food. (M, 59 years) • “Priorities are to try and keep within the guidelines of the Mediterranean Diet, and try not to consume as much red meat as I did; more on the chicken, turkey side of things.” (M, 60 years) • “Preparing everything fresh, and not going for the convenience.” (F, 38 years) • “There was a lot of stuff that I wouldn’t eat, and I wouldn’t, you know, wouldn’t look at really food-wise. (M, 66 years) • “But I found it rather hard because I’m not a pasta eater.” (F, 65 years) • “The disadvantages, I would say, are there’s lots of things that, me, personally, I don’t like; the beans, pulses, I’m not a great lover of them. I’m not a great salad eater.” (M, 60 years)
1.2 Theme: Treatment adaptations	
1.2a Treatment packages	<ul style="list-style-type: none"> • “I think a bit more advice about takeout meals or going into a restaurant, you know pub meals?” (F, 69 years) • “I think it would be good if there was some sort of online resource that you could tap into. I got a set of recipes to begin with, but, if there was a library that, if you’re struggling for ideas, you could just go to. That would be really useful, I think; probably would keep the motivation going a bit.” (F, 38 years) • “Web-based is good because you do it in your own time. If it’s online it could be whenever you want to know, really – on a ‘need to know’ basis. (F, 55 years 05) • “Just more recipes; practical recipes and extra resources once a month.” (F, 56 years) • “I wonder if it would help giving people prices of things, preparing prices or saying to folk, “Look, this is what you spend when you get your takeout’s” “So maybe some

<p>Groups</p> <p>Joint creation of resources</p>	<p>easy accessible resources.” (M, 59 years)</p> <ul style="list-style-type: none"> • “It’s good to have, like, a group session because you can give each other support, and it also motivates you to follow it more closely, because if your weight and, you know, waist measurements and what-have-you are shared with a group of people, you’re more motivated.” (F, 62 years) • “Groups could be fun – I think fun is important. Groups are probably more cost-effective. Maybe some classes on how to experiment with food, having a bit of confidence, really improve people’s perceptions. I think that would make a big difference. I wouldn’t want to commit myself, I just haven’t got enough time. I would love to have the time to do something like that.” (F, 55 years 05) • “The only thing I could think of is maybe if there was a recipe that we thought about, it could be included. Like my husband’s vegetable soup – he tells everybody about it” (F, 55 years 04)
<p>1.2b Mediterranean diet promotion</p>	<ul style="list-style-type: none"> • “I think it’s a good idea, a very good idea, but I think it needs promoting a lot more, than what it’s actually promoted at the moment. You read about all these other diets, and I think this one has benefits, but it’s not out there, in your face, like all these other things. It’s advertised but I don’t think it’s as well-known as it should be. I think your waiting room is a prime example; there’s not one thing in your waiting room referring to the Mediterranean Diet. That and hand-outs, even bits on the tables.” (M, 60 years) • “It was all the Mediterranean Diet, all in the Daily Express (F, 62 years) • “I’ve been buying books and magazines with Mediterranean diet and watching the programs on the television with Michael Mosley and the team.” (F, 69 years)