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## **Barriers to adopting a Mediterranean diet in Northern European adults at high risk of developing cardiovascular disease**

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1 **Barriers to adopting a Mediterranean diet in Northern European adults at high risk of**  
2 **developing Cardiovascular disease**

3  
4 **Abstract**

5  
6 **Background**

7  
8 Strong evidence links consumption of the Mediterranean diet (MD) to a reduced cardiovascular  
9 disease (CVD) risk, however there is uncertainty whether non-Mediterranean regions will adopt this  
10 diet. This qualitative research aimed to investigate attitudes towards a MD in individuals at high  
11 CVD risk in a Northern European population. This information is needed to inform development of  
12 MD interventions in non-Mediterranean high-risk populations.

13  
14 **Methods**

15  
16 Focus groups (n=12) were held with individuals at high CVD risk from Northern Europe ( $\geq 2$  CVD  
17 risk factors, aged  $\geq 50$  years, no established CVD/ type 2 diabetes). Attitudes to dietary change  
18 towards a MD were explored. Data were analysed using inductive thematic analysis.

19  
20 **Results**

21  
22 Sixty-seven adults participated (60% female, mean age 64 years). There was some awareness of the  
23 term MD but limited knowledge of its composition. Barriers to general dietary change were evident  
24 including *perception of expense, concern over availability, expectation of time commitment, limited*  
25 *knowledge, lack of cooking skills, amount and conflicting nature of media information on diets,*  
26 *changing established eating habits and resistance to dietary change.* Barriers specific to MD  
27 adoption were also identified, including *perceived difficulty living in a colder climate, perceived*  
28 *impact on body weight, acceptability of a MD and cultural differences.*

29  
30 **Conclusions**

31  
32 Knowledge of a MD was limited in this Northern European sample at high CVD risk. In addition to  
33 general barriers to dietary change, barriers specific to a MD were identified. These findings have  
34 implications for the development of interventions to promote MD adoption in non-Mediterranean  
35 populations.

## 1 **Introduction**

2  
3 Cardiovascular disease (CVD) is a leading cause of morbidity and mortality globally and is  
4 therefore a major public health concern<sup>(1)</sup>. Strong evidence supports consumption of the  
5 Mediterranean diet (MD) for a reduction in CVD risk<sup>(2)</sup>. A meta-analysis of cohort studies  
6 investigating the effects of adherence to the MD on health status found that a two-point increase in  
7 Mediterranean diet score was associated with a 10% reduction in risk of CVD incidence or  
8 mortality<sup>(3)</sup>. The PREDIMED study, a recent primary prevention trial of MD with CVD outcomes,  
9 showed a 30% reduction in CVD risk with consumption of a MD supplemented with olive oil or  
10 nuts, in comparison with a low fat diet after five years<sup>(4)</sup>. Further PREDIMED analyses highlighted  
11 that MD adherence led to significant improvements in CVD risk factors<sup>(5,6)</sup>. Additional RCTs also  
12 demonstrate a cardio protective effect of the MD<sup>(7,8)</sup>. The MD is largely based on fruit and  
13 vegetables and wholegrain cereal products; moderate amounts of dairy products, fish and poultry;  
14 and small amounts of red meat and sweet foods. Olive oil is the main fat source in the diet and wine  
15 is consumed in moderation<sup>(9)</sup>.

16  
17 Although the health benefits of following a MD are well established, there is uncertainty about  
18 whether non-Mediterranean regions will adopt this diet. The typical diet consumed by UK adults is  
19 considerably different to the MD, being low in fruit and vegetables, legumes, oily fish and  
20 wholegrains and high in saturated fat and sugar<sup>(10,11)</sup>. Additionally, research suggests that it can be  
21 difficult to follow a MD outside a Mediterranean region<sup>(12)</sup>. Intervention studies to encourage MD  
22 adoption conducted in Northern European populations, although limited in number, have reported  
23 increases in MD adherence<sup>(13, 14)</sup>. Understanding the practical, cultural and other factors that may  
24 affect dietary behaviour change towards a MD in non-Mediterranean populations is essential when  
25 trying to guide this type of dietary change. While barriers to general dietary change are well  
26 documented in the literature<sup>(15-19)</sup>, there is very limited information on specific barriers that may  
27 exist in relation to adoption of a MD by Northern European populations. To our knowledge, only  
28 two small qualitative studies have investigated barriers to consuming a MD in the UK in one  
29 region<sup>(20, 21)</sup>. These studies represent the views of healthy adults, however, it is critical to gain  
30 insight into the views of adults at high CVD risk, who may gain the greatest health benefits from  
31 changing to a MD and who a MD intervention would ideally target. As eating habits in Northern  
32 Ireland (NI) are less optimal than the UK as a whole<sup>(22)</sup>, there is a particular need to target this UK  
33 region with MD advice. Research is needed to explore attitudes towards this dietary pattern in a  
34 Northern Irish population at high CVD risk to guide development of appropriate MD behaviour  
35 change interventions for this population and other non-Mediterranean populations. It is important to

1 develop interventions that are effective in facilitating dietary behaviour change towards a MD that  
2 could be rolled out at the population level.

3

4 Following the MRC framework for the design and evaluation of complex interventions to improve  
5 health<sup>(23)</sup>, this research aimed to explore attitudes towards consuming a MD in individuals at high  
6 CVD risk from a Northern European population to inform the development of a MD intervention in  
7 this group. Involvement of the target population in the early stage of intervention development is  
8 needed to better understand the factors influencing behaviour and what needs to shift for the desired  
9 behaviour to occur. This approach will help to tailor a MD intervention accordingly and maximise  
10 the chance of positive dietary behaviour change in the target population.

11

## 12 **Materials and Methods**

13

### 14 **Study design and participants**

15

16 Focus groups were used to provide an insight into group norms rather than individual  
17 preferences<sup>(24)</sup>. A purposive sample was recruited of individuals with  $\geq 2$  CVD risk factors  
18 (overweight/ obese, hypertension, hypercholesterolemia and smoking) but having no medical  
19 history of CVD or type 2 diabetes and aged  $\geq 50$  years, as this age group is at higher risk of  
20 developing CVD. Participants were recruited through making contact with community health  
21 centres and community group networks; screening by general practices for individuals that met the  
22 inclusion criteria followed by an invitation by letter; and telephone invitations being extended to  
23 individuals who had participated in previous dietary interventions at the research centre. Ethical  
24 approval was given by the Office for Research Ethics Committees Northern Ireland  
25 (Reference:13/NI/0152) and participants provided written informed consent. The study was  
26 conducted between December 2012 and July 2013. Participant travel expenses were reimbursed.

27

28 Recruitment was undertaken to obtain a diverse sample in terms of gender, age and geographical  
29 location (urban/rural). Focus groups were assembled to be homogeneous with regards to gender and  
30 geographical location (urban/ rural), as it has been suggested that individuals more readily disclose  
31 their views with individuals they perceive to be similar to themselves<sup>(25)</sup>.

32

33 Participants completed a demographic, lifestyle and medical information questionnaire which also  
34 assessed awareness of the MD, awareness of the link between CVD risk and diet and willingness to  
35 change diet (Supplementary material p1-3). Additionally, this questionnaire contained an 8-item

1 Food Frequency Questionnaire (FFQ) to provide information on consumption of key MD  
2 components. This FFQ was based on a validated 14-item Mediterranean diet score (MDS) used in a  
3 previous MD intervention<sup>(26)</sup> but shortened for accessibility within the focus group setting and adapted  
4 for a Northern European population. Adaptations comprised of rapeseed oil being included, as it is a  
5 locally available alternative with a favourable fatty acid profile<sup>(27)</sup>. Consumption of legumes was  
6 assessed in combination with vegetables, as in Northern European populations, legume consumption  
7 is low<sup>(10)</sup>. Oily fish was specified due to being high in omega-3 fatty acids which have significant  
8 health benefits for this population<sup>(28)</sup>. Additionally, consumption of wholegrains was included to  
9 reflect current guidelines for consuming a MD<sup>(9)</sup>. This was used to calculate an 8-point MDS for each  
10 participant. Scoring criteria was based on the validated MDS<sup>(26)</sup> the FFQ was developed from and  
11 MD guidelines<sup>(9)</sup>. Serving amounts of MD components were based on UK dietary guidelines. A score  
12 of 0 represented the lowest adherence to a MD and 8 represented greatest adherence (Supplementary  
13 material, Table S1).

14

### 15 **Focus group procedure**

16

17 Two researchers conducted the focus groups (SM, CME), with one acting as facilitator and one as  
18 an assistant to ensure all topic areas were adequately covered in the discussion. At the start of the  
19 discussion the facilitator introduced themselves and explained that they were a University researcher.  
20 Effort was taken to minimise social differences between the researcher and group that may affect  
21 responses through establishing a sense of commonality and creating a non-judgemental  
22 atmosphere<sup>(29)</sup>. To reduce bias arising due to the views of one individual affecting another or over-  
23 representation of the views of more dominant individuals, the researchers were trained in focus  
24 group facilitation and used techniques to help ensure that all views were represented.

25

26 A semi-structured focus group schedule<sup>(24)</sup> was designed by the research team, which was based on  
27 a literature review and strategies used in previous qualitative studies and informed by the study  
28 aims. The schedule explored attitudes to dietary change towards a MD (Supplementary material,  
29 Table S2). Discussions began with asking participants if they were aware of the term MD.  
30 Participants were then shown an image of a MD food pyramid based on the Oldways MD  
31 pyramid<sup>(30)</sup> and the facilitator gave a short description of the proportions of food groups in this  
32 dietary pattern. Following this, attitudes towards adopting a MD were discussed. The schedule was  
33 followed as a guide with probes used to stimulate discussion. Where divergence from the schedule  
34 occurred due to natural conversation, individuals were encouraged to share their views that were of  
35 relevance to the topic. At the end of the session, participants were given the opportunity to discuss

1 other issues that they felt were relevant. Focus groups were held at informal settings including  
2 community centres and the research centre and lasted approximately 90 minutes.

3  
4 Subsequent to the first focus group, the transcript was reviewed by the research team to ensure the  
5 desired data were being captured. After eight focus groups, progress was again reviewed to assess if  
6 any areas required further exploration and if coverage included a sufficiently socio-demographically  
7 diverse sample. As a consequence, future participants were asked to comment on their  
8 understanding of a 'Mediterranean diet' and to describe the associated dietary pattern. A number of  
9 focus groups were also arranged in rural locations at this stage (n=3), to ensure a full range of  
10 geographical locations were covered. Data collection continued until no new findings or themes  
11 were identified in the data collected<sup>(31)</sup>. Twelve focus groups were conducted with group size  
12 ranging from 2-11 participants and an average of 6 participants. Each participant took part in one  
13 group.

#### 15 **Data analysis**

16  
17 Focus group discussions were audio recorded, transcribed verbatim and analysed using an inductive  
18 thematic approach as outlined by Braun and Clarke<sup>(32)</sup>. This approach involved two researchers  
19 (SM, CME) reading and cross comparing transcripts to enable familiarisation with the data and to  
20 generate initial codes (words/ short phrases). Following this, a coding framework was agreed by the  
21 research team and applied to transcripts by SM. Related codes were grouped into themes. Themes  
22 were then reviewed to ensure they were clear and distinct and were named and defined. Data was  
23 analysed at the semantic level to provide a descriptive account of participant views <sup>(32, 33)</sup>. An  
24 additional member of the research team who was not involved in data collection (MMK) checked  
25 and compared the codes to confirm the reliability of the analysis<sup>(34)</sup> and discrepancies were  
26 discussed until full agreement was reached. NVivo software (version 10, QSR International) was  
27 used to manage the coded data. Quotations were used to represent views and are presented in italics  
28 and referenced as (Participant number, gender, focus group number). Quotations were selected that  
29 exemplified views from a range of groups and illustrated the concepts found within the data.  
30 Interactions between participants were largely complementary<sup>(35)</sup> and there were no obvious  
31 negative cases among groups<sup>(36)</sup>, therefore views towards a MD are representative of the group as a  
32 whole. While a formal comparison of views between individuals of different genders or from  
33 different geographical locations was not an aim of this study, data revealed few obvious differences.

## 1 **Results**

2  
3 The recruited sample (**Table 1**), included 67 adults (40 females, 27 males) with mean age 64.0  
4 years. Most participants were overweight or obese, with a mean Body Mass Index (BMI) of 28.8  
5 kg/m<sup>2</sup> and the majority had other CVD risk factors, with 67.2% reporting high blood pressure and  
6 68.7% reporting high cholesterol. A minority (40.3%) stated that they were aware of the MD.  
7 Participant MDSs ranged from 0-6 points. The mean MDS was 2.3, indicating that, overall, the  
8 sample had low adherence to a MD. Most participants stated that being at increased CVD risk  
9 caused them to think about their diet (83.6%) and reported that they would consider making dietary  
10 changes due to this increased risk (94.0%).

11  
12 Some participants were aware of the term MD and generally it was associated with sunshine and a  
13 hot climate and foods including fruit and vegetables, salads, pasta, fish, wine, olive oil and bread.  
14 Participants largely associated the MD with healthy eating, consumption of fresh food and preparation  
15 of meals. Knowledge of the specific composition of this dietary pattern, however, was limited.  
16 Attitudes towards adopting a MD varied, with some individuals feeling that they could make changes  
17 towards it and others stating that it was very different to their usual diet and that they would find it  
18 challenging. The main themes identified from the analysis were (i) barriers to general dietary change  
19 (**Table 2**) and (ii) barriers specific to MD adoption (**Table 3**). Barriers are presented alongside  
20 recommendations for future interventions to encourage adoption of a MD.

### 21 22 ***Barriers to general dietary change***

23  
24 Overall there was a **perception of expense** towards following a MD, in particular due to the cost of  
25 key components such as olive oil, fish and fresh fruit and vegetables. It was felt that it would be  
26 particularly difficult for those on lower incomes to adopt this dietary pattern.

27  
28 *“It is more expensive I’d say because you have more fruit and all these things”* (050; Female;  
29 FG11)

30  
31 Some participants expressed **concern over availability** of certain components of the diet,  
32 specifically feeling that fresh fish and fruit and vegetables are limited in supermarkets, which would  
33 discourage them from purchasing these foods. The wide availability of fast-food restaurants was  
34 also frequently mentioned by urban groups. It was felt that being surrounded by an unsupportive  
35 eating environment would be a hindrance to following a MD.

1     *“If they’re going to improve us all, they’re going to have to try and give us fresher food”* (043;  
2     Female, FG9)

3  
4     *“There’s four or five different pizza companies and that many Chinese, they deliver all these*  
5     *leaflets, it’s temptation”* (064; Male; FG12)

6  
7     There was a clear **expectation of time commitment** for following a MD, as participants felt that it  
8     would be time consuming and require additional effort to adopt a MD and therefore may not be  
9     convenient for individuals with busier lifestyles.

10  
11    *“I suppose depending on your circumstances at home, but preparation of food, the really only*  
12    *chance you get to put a bit of time in in my house is at the weekend”* (001; Male; FG1)

13  
14    Some participants expressed a lack of awareness of the MD and most expressed a **limited**  
15    **knowledge** of its composition, which they felt would be a significant barrier to following this  
16    dietary pattern.

17  
18    *“It’s just knowing what it is that you really should be eating, and I must admit that’s surprised me,*  
19    *the red meat at the very very top, and the poultry and fish”* (040; Female; FG8)

20  
21    Most participants highlighted that a **lack of cooking skills** would prohibit people from following a  
22    MD and felt that many people would not have the skills required to follow a MD or have the ability  
23    to translate information provided on the dietary pattern into everyday meals.

24  
25    *“But that’s one of the things that goes against, the pattern of not cooking”* (019; Female; FG4)

26  
27    Many participants also highlighted that the **amount and conflicting nature of media coverage on**  
28    **diets** would discourage them from following this advice and making dietary changes towards a MD.

29  
30    *“That’s one of the big problems is that every result you see, within a year or so the whole thing’s*  
31    *reversed back over. So people have been demotivated from getting involved in anything to do with*  
32    *diet”* (031; Male; FG7)

33  
34    Several participants felt that it would be difficult **changing established eating habits** to follow a  
35    MD. Participants frequently expressed that their eating habits had been developed since childhood



1 and that it would be challenging to adopt a diet that is different to what they had been brought up  
2 with and become used to.

3  
4 *“You've grown up with one particular type of food and the way things are prepared and then to  
5 start introducing... I think it would be very very hard”* (005; Male; FG1)

6  
7 Some participants were **resistant to dietary change**, with the view of not wanting to be restricted  
8 and to be able to enjoy eating the foods they want to eat. Participants mentioned that, being in the  
9 later stages of life, often individuals are less willing to make dietary changes.

10  
11 *“If you like the food, enjoy it. My motto is now, I'm coming 70, I'll eat whatever I want and enjoy  
12 it”* (064; Male; FG12)

13  
14 ***Barriers specific to MD adoption***

15  
16 Consistently among participants there was a **perceived difficulty of living in a colder climate** for  
17 following a MD. Participants' perception of a MD was of a diet pattern predominantly containing  
18 salads and fruit and vegetables which they felt would not be satisfying in a colder climate, where  
19 the preference would be towards warm meals, which were perceived as providing a higher  
20 satisfaction.

21  
22 *“...Come the cold November nights, I don't see that people would be that keen to follow a  
23 Mediterranean diet, to be quite honest”* (049; Male; FG10)

24  
25 It was also apparent that there was a **perceived impact on body weight**. Several participants  
26 perceived components of the MD, including olive oil and nuts, to be fattening and associated them  
27 with weight gain. These participants held negative attitudes towards increasing their intake of these  
28 MD components for this reason.

29  
30 *“I do love nuts but they're quite high in calories”* (029; Female; FG6)

31  
32 Additionally, **acceptability of a MD** was discussed and some participants mentioned components  
33 of a MD that would be difficult to adopt or reduce their intake of to follow a MD. Some participants  
34 felt that it would be difficult to incorporate olive oil into their diet due to disliking the taste and as  
35 using it as a dressing did not appeal to them. Some participants expressed that they would not

1 consume nuts, other than salted varieties or that they avoided nuts due to difficulties chewing and  
2 digesting them. A number of individuals expressed a dislike for fish and it was perceived by some  
3 participants that fish is not frequently consumed in NI, other than battered fish. Most participants  
4 felt that it would be difficult in NI for people to reduce their red meat consumption, holding the  
5 view that it is consumed in greater amounts and traditionally makes the basis of meals in NI. While  
6 these views were held by some participants, others had a higher acceptability towards different MD  
7 components, with some individuals stating that they would use olive oil as their main cooking fat,  
8 some sharing that they enjoy consuming nuts and/or fish and a few participants expressing that they  
9 infrequently consume red meat. It was also felt by a number of participants that it would be difficult  
10 for people in NI to reduce their intake of processed foods, due to the perception that many people  
11 rely on such foods due to a lack of cooking skills, busy lifestyles or having a low income.  
12 Additionally, several participants felt it would be difficult to reduce their intake of sweet foods,  
13 with individuals expressing an enjoyment of the taste and getting pleasure out of eating them.

14  
15 *“It’s probably the unhealthy nuts we would be inclined to eat here, salted peanuts”* (024; Female;  
16 FG5)

17  
18 *“A lot of people here don’t eat fish...It’s mainly fish and chips”* (015; Male; FG3)

19  
20 *“You make the dinner and if it’s not a big chop or sausages, even mince and onions, it’s not a  
21 proper dinner”* (009; Female; FG4)

22  
23 Furthermore, **Cultural differences** in diet were mentioned as a barrier, as participants felt that the  
24 MD differs widely from the typical diet in NI. Participants expressed that it would not be natural to  
25 people in NI to reduce their intake of red meat and consume more fish, olive oil and fruit and  
26 vegetables as it would not be the cultural norm and would be difficult to follow a dietary pattern  
27 different to that dictated by cultural influences. It was apparent from discussions that foods eaten as  
28 part of a traditional meal in NI, including red meat with potatoes and vegetables, have been  
29 engrained as part of the eating culture in NI over time. Individuals stated that they had been  
30 surrounded by this way of eating and expressed a strong attachment towards it, which would make  
31 dietary change very challenging.

32  
33 *“It’s not a normal diet for us in this country at all”* (002; Male; FG1)

34  
35

## 1 **Discussion**

2  
3 Findings revealed the main challenges associated with following a MD. Knowledge of the specific  
4 composition of a MD was limited, therefore there is need for further education on this dietary  
5 pattern that offers significant health benefits for this at risk group. Barriers to general dietary change  
6 were identified. Most of these barriers are consistent with barriers to general healthy eating that are  
7 established in the dietary change literature<sup>(15-19)</sup> and have been identified as barriers to following a  
8 MD in other non-Mediterranean populations<sup>(20, 21, 37)</sup>. Some previously identified barriers to healthy  
9 eating including social activities and family food preferences, however<sup>(17, 21, 37)</sup>, were not a major  
10 concern to participants in this study. These studies were carried out with younger adults who may  
11 place greater significance on social barriers. Participants had a mean age of 64 years. Family food  
12 preferences may not be a major barrier as, at this age, participants may not have children living with  
13 them and influencing food decisions. More important may have been the increased health risks  
14 associated with ageing, and therefore both spouses may be willing to make dietary changes.  
15 Additionally, these other studies included healthy adults who may have less family support for  
16 dietary change than those at high CVD risk. The present research demonstrates further barriers  
17 specific to following a MD in a Northern European population that need to be considered.

18  
19 This data suggests that cultural identity has a significant impact on food choice and that people may  
20 distance themselves from a dietary pattern that is not the cultural norm. Literature widely supports  
21 that cultural values and beliefs in relation to food greatly influences dietary behaviour<sup>(38)</sup>. This has  
22 important implications for how the MD is presented to non-Mediterranean populations. MD advice  
23 should be tailored to adapt to different cultural eating patterns and traditional views surrounding  
24 food. Participants felt that it would be difficult to follow a MD in a colder climate. As the MD was  
25 perceived to be made up of salads and fruit and vegetables, practical information is needed to  
26 educate individuals on the specific components of the MD, highlighting that it also includes warm,  
27 hearty meals and therefore may be more acceptable in a colder climate. The concern of some  
28 participants that consumption of olive oil and nuts would cause weight gain is a common perception  
29 that has lead to research being carried out that demonstrated that consumption of these MD  
30 components does not promote adiposity<sup>(5)</sup>. Such views could be overcome through education about  
31 the health benefits of replacing saturated fat with monounsaturated and polyunsaturated fats<sup>(39)</sup>.  
32 Acceptability was an identified barrier to following a MD in this population. It is well established  
33 that acceptability of a food, particularly taste is strongly linked to dietary behaviour<sup>(40)</sup>. Research  
34 suggests that increased exposure to foods can lead to increased consumption<sup>(41)</sup>. Acceptability of the  
35 MD therefore needs to be addressed through providing tasting sessions, demonstrations of different

1 methods of consuming foods or alternative meal ideas. Overall, the barriers identified highlight that  
2 education on the specific components and health benefits of the MD and provision of culturally  
3 tailored, low cost, quick and easy to prepare recipes and meal ideas are needed to help individuals at  
4 high CVD risk from a Northern European population to integrate a MD into their normal eating  
5 patterns.

6  
7 Two small qualitative studies in healthy adults also reported that a colder climate, a perceived  
8 impact on body weight, acceptability and cultural differences are important barriers to MD adoption  
9 in a Northern European population<sup>(20, 21)</sup>. Findings from this study contribute to this limited  
10 evidence base of factors effecting MD adoption in non-Mediterranean populations and extend this  
11 knowledge to views of individuals at high CVD risk. Interventions to encourage dietary behaviour  
12 change towards a MD in non-Mediterranean regions are limited in number<sup>(13,14)</sup> and are needed to  
13 explore the transferability of this dietary pattern. In the development of such interventions, it is  
14 important to identify and address any dietary related barriers which could limit the intervention  
15 impact, as it has been shown that perceived barriers to following a healthy diet are associated with  
16 dietary behaviour<sup>(40, 42)</sup>. This formative research is therefore essential to help enhance the  
17 effectiveness of interventions for encouraging MD adoption in non-Mediterranean populations<sup>(23)</sup>.

18  
19 A major strength of this work was the sample size obtained, which was relatively large for  
20 qualitative research, and the recruitment across different genders and geographical areas. This  
21 helped to gather a broad range of views, as individuals may differ in their receptiveness to dietary  
22 change. Factors which may limit the generalisability of findings should be considered. The recruited  
23 sample included more females than males, therefore findings may be more representative of female  
24 views. This is an important consideration as males are at higher risk of developing CVD than  
25 females<sup>(43)</sup> so it is important to capture their views and as views may differ between genders.  
26 Females are generally considered to be more amenable to making dietary changes than males<sup>(44)</sup>.  
27 The majority (94%) of this sample, however, were willing to make dietary changes and data  
28 revealed few obvious differences between male and female views. It is therefore unlikely that this  
29 bias significantly impacted findings. Some findings may be specific to a Northern Irish population,  
30 therefore similar studies in other regions would be beneficial. It must also be considered that  
31 individuals who volunteer to participate in diet-focused research may be more motivated to make  
32 dietary changes than the general at risk of CVD population. As with most qualitative research,  
33 findings are not empirically generalisable<sup>(36)</sup>, however they provide an insight into participant views  
34 and can be used to develop concepts, understand phenomena and make theoretical propositions that  
35 are relevant to other populations and settings<sup>(36)</sup> and findings are consistent with previous research.

1 Focus groups typically consist of 6-12 people<sup>(45)</sup>. The small size of some included focus groups (n  
2  $\leq 5$ ) could therefore also be a limiting factor. Focus groups were each planned to include  
3 approximately eight individuals, but expected numbers were sometimes not met due to the nature of  
4 working in the community. It has been suggested, however, that small groups encourage group  
5 cohesion, help to maintain focus on the topic and help to ensure participation from all  
6 individuals<sup>(45)</sup>. Additionally, a reflexive account of the research process would have increased the  
7 reliability of findings<sup>(36)</sup>, however researchers established a sense of commonality with participants  
8 to minimise their potential impact on discussions<sup>(29)</sup> and three researchers were involved in data  
9 analysis. Limitations associated with measurement of MD adherence should also be considered. The  
10 FFQ and MDS were not previously used or validated, they were however based on a validated  
11 measure<sup>(26)</sup>. A specific limitation of shortening the questionnaire includes assessing consumption of  
12 legumes in combination with vegetables, which will have limited the scope for considering  
13 consumption of this key MD component. Perceptions on consumption of legumes could also have  
14 been explored further during focus group discussions.

15

16 In conclusion, this research indicates that although there was already some awareness of the term  
17 MD in this Northern European sample at high CVD risk, knowledge of the specific composition of  
18 a MD may be limited. Barriers associated with healthy eating in general were evident, including  
19 *perception of expense, concern over availability, expectation of time commitment, limited*  
20 *knowledge, lack of cooking skills, amount and conflicting nature of media coverage on diets,*  
21 *changing established eating habits and resistance to dietary change.* Further barriers specific to  
22 following a MD, however, were also identified, including *perceived difficulty of living in a colder*  
23 *climate, perceived impact on body weight, acceptability of a MD and cultural differences.* The  
24 knowledge gaps and barriers captured here will be used to inform the development of a MD  
25 intervention which will then be piloted in the study population. Key elements of this tailored  
26 intervention will include:

- 27 • Education on the specific MD components, emphasising that it includes warm meals
- 28 • Education on the health benefits of the MD and types of fat
- 29 • Provision of low cost, quick and easy to prepare, culturally tailored MD recipes
- 30 • Food tasting sessions to promote acceptability of MD components

31 Consideration of these elements may be useful to researchers planning MD interventions in other  
32 Northern European populations to enhance the potential impact of the intervention and therefore  
33 could inform development of a public health program which successfully facilitates dietary  
34 behaviour change towards a MD. Findings also emphasise the importance of tailoring public health

1 nutrition education for the target population though addressing knowledge gaps, attitudes and  
2 barriers.

#### 4 **Transparency declaration**

5  
6 The lead author affirms that this manuscript is an honest, accurate, and transparent account of the  
7 study being reported.

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**Table 1:** Focus group participant demographic information (n=67Max)

<b>Variable</b>	
<b>Age in years mean(SD)</b>	64.0 (10.0)
<b>Gender n(%)</b>	
Males	27.0 (40.3)
Females	40.0 (59.7)
<b>Geographical location n(%)</b>	
Urban	49.0 (73.1)
Rural	18.0 (26.9)
<b>Relationship status n(%)</b>	
Single	5.0 (7.5)
Married	40.0 (59.7)
Divorced	8.0 (11.9)
Widowed	11.0 (16.4)
Not reported	3.0 (4.5)
<b>Current smokers n(%)</b>	8.0 (11.9)
<b>Weight (kg) mean (SD)</b>	80.7 (16.4)
<b>BMI (kg/m<sup>2</sup>) mean (SD)</b>	28.8 (4.5)
<b>BMI classification (WHO) n(%)</b>	
Normal weight	12.0 (17.9)
Overweight	23.0 (34.3)
Obese	24.0 (35.8)
Not reported	8.0 (11.9)
<b>Reported high blood pressure n(%)</b>	45.0 (67.2)
<b>Reported high cholesterol n(%)</b>	46.0 (68.7)
<b>Taking blood pressure or cholesterol medication n(%)</b>	44.0 (65.7)
<b>Responsible for household shopping n(%)</b>	
Self	39.0 (58.2)
Partner/ spouse	12.0 (17.9)
Other	2.0 (3.0)
Shared	13.0 (19.4)
Not reported	1.0 (1.5)
<b>Responsible for household cooking n(%)</b>	
Self	39.0 (58.2)
Partner/ spouse	9.0 (13.4)
Other	2.0 (3.0)
Shared	16.0 (23.9)
Not reported	1.0 (1.5)
<b>Aware of Mediterranean diet n(%)</b>	27.0 (40.3)
<b>High CVD risk evoked thought about diet n(%)</b>	56.0 (83.6)
<b>Extent diet is related to CVD risk n(%)</b>	
Not related at all	0.0 (0.0)
Somewhat related	10.0 (14.9)
Don't know	16.0 (23.9)
Related a little	16.0 (23.9)
Related a lot	23.0 (34.3)
Not reported	2.0 (3.0)
<b>Would consider dietary changes due to high CVD risk n(%)</b>	63.0 (94.0)
<b>Mediterranean Diet Score mean (SD)</b>	2.3 (1.6)
<b>MDS category n(%)</b>	
0-2 points	39 (58.2)
3-5 points	24 (35.8)
6-8 points	2 (3.0)
Not reported	2 (3.0)

**Table 2:** Barriers to general dietary change reported by adults at high risk of CVD from a Northern European population and recommendations for future interventions to encourage MD adoption

Barrier	Representative quotes	Recommendations for future MD interventions
<b>Perception of expense</b>	<ul style="list-style-type: none"> <li>• “It is more expensive I’d say because you have more fruit and all these things” (050; Female; FG11)</li> <li>• “It (Olive oil) is dear and anybody that’s on a low income, you can’t use it constantly” (010; Female; FG2)</li> </ul>	Budgeting tips/ MD cost comparison with typical westernised diet/ Low cost recipe ideas
<b>Concern over availability</b> (Low availability MD foods/ high availability fast food)	<ul style="list-style-type: none"> <li>• “Fish has got very, very expensive, I find” (002; Male; FG1)</li> <li>• “Some supermarkets say they have fresh fish but it doesn’t look fresh and when you open it, it stinks” (025; Female; FG5)</li> <li>• “I don’t think our fruit and vegetables are that good, I think we’re getting them all far too late...if they’re going to improve us all, they’re going to have to try and give us fresher food” (043; Female, FG9)</li> <li>• “There’s four or five different pizza companies and that many Chinese, they deliver all these leaflets, it’s temptation” (064; Male; FG12)</li> </ul>	Discuss local sources of foods/ Tips for eating out – healthier restaurants or menu options
<b>Expectation of time commitment</b>	<ul style="list-style-type: none"> <li>• “People seem to have less time now” (044; Female; FG9)</li> <li>• “It’s all about really convenience” “I suppose depending on your circumstances at home, but preparation of food, the really only chance you get to put a bit of time in in my house is at the weekend” (001; Male; FG1)</li> <li>• “It’s not taking time. I see it with my daughter... and her hours are so long in the day, she comes home at night, the last thing she wants to do is cook” (024; Female; FG5)</li> </ul>	Explanation that components of the MD can be purchased pre-prepared/ Provide recipes for meals that take < 30 mins
<b>Limited knowledge</b>	<ul style="list-style-type: none"> <li>• “I haven’t heard of it but I presume the Mediterranean diet is simply the diet that people who live around the Mediterranean eat” (049; Male; FG10)</li> <li>• “It’s just knowing what it is that you really should be eating, and I must admit that’s surprised me, the red meat at the very very top, and the poultry and fish” (040; Female; FG8)</li> <li>• “It looks lovely but what would you do with what? What is a Mediterranean diet or meal out of that?” (003; Male; FG1)</li> </ul>	Education
<b>Lack of cooking skills</b>	<ul style="list-style-type: none"> <li>• “But that’s one of the things that goes against, the pattern of not cooking” (019; Female; FG4)</li> <li>• “A lot of people today don’t really get into the kitchen and get to know about the basics of cooking” (063; Male; FG12)</li> <li>• “We all need to eat fruit and vegetables but converting it into something-is the problem and going home and preparing it” (005; Male; FG1)</li> </ul>	Cooking demonstrations
<b>Amount and conflicting nature of media coverage on diets</b>	<ul style="list-style-type: none"> <li>• “That’s one of the big problems is that every result you see, within a year or so the whole thing’s reversed back over. So people have been demotivated from getting involved in anything to do with diet” (031; Male; FG7)</li> <li>• “Don’t you think that every magazine you lift, every paper, there’s diets in it, there’s eat this and do you know, it all becomes too much, I think” (041; Female; FG8)</li> <li>• “Nearly everything you touch, one day it’s okay and the next it’s not, and I just decided ‘right, I’m just not going to worry too much’” (019; Female; FG4)</li> </ul>	Provide evidence based information
<b>Changing established eating habits</b>	<ul style="list-style-type: none"> <li>• “But habit is so powerful” (036; Male; FG7)</li> <li>• “You’ve grown up with one particular type of food and the way things are prepared and then to start introducing... I think it would be very very hard” (005; Male; FG1)</li> <li>• “And it’s what you’re brought up to have, if you know what I mean”(030; Female; FG6)</li> </ul>	Advice on adapting meals to be more Mediterranean
<b>Resistant to dietary change</b>	<ul style="list-style-type: none"> <li>• “If you like the food, enjoy it. My motto is now, I’m coming 70, I’ll eat whatever I want and enjoy it” (064; Male; FG12)</li> <li>• “I don’t think that a lot of people would want to change their ways” (040; Female; FG8)</li> <li>• “I think we’re just too late in life now to change” (016; Male; FG3)</li> </ul>	Suggest small dietary changes to make

**Table 3:** Barriers specific to MD adoption reported by adults at high risk of CVD from a Northern European population and recommendations for future interventions to encourage MD adoption

Barrier	Representative quotes	Recommendations for future MD interventions
Perceived difficulty of living in a colder climate	<ul style="list-style-type: none"> <li>• “A lot of this food is good in a nice warm environment where you’re sitting and the sun’s beaming in” (005; Male; FG1)</li> <li>• “Our food is potatoes, hot meals, warm meals, meat, potatoes, things that keep you warm, stews that warm you up inside, whereas the Mediterranean consciousness is different. They’re eating things like vegetables, salads, tomatoes, all of those things, which are okay in the summer, but come the cold November nights, I don’t see that people would be that keen to follow a Mediterranean diet, to be quite honest” (049; Male; FG10)</li> <li>• “I think because we’re such a cold country too you want warmer foods” (030; Female, FG6)</li> </ul>	Education about components of MD/ Provide MD recipe ideas adapted for a colder climate
Perceived impact on body weight	<ul style="list-style-type: none"> <li>• “They put this olive oil all over their pasta, and they said that that was why they had a lot of weight on, because obviously it’s that has the calories in it” (021; Female; FG4)</li> <li>• “I stay away from them (nuts) because I’m calorie counting” (036; Male; FG7)</li> <li>• “I do love nuts but they’re quite high in calories” (029; Female; FG6)</li> </ul>	Education about the benefits of monounsaturated and polyunsaturated fats
Acceptability of a Mediterranean diet	<ul style="list-style-type: none"> <li>• “That particular type of fat, oil drizzled. It doesn’t do it for me” (001; Male; FG1)</li> <li>• “It’s probably the unhealthy nuts we would be inclined to eat here, salted peanuts” (024; Female; FG5)</li> <li>• “A lot of people here don’t eat fish...It’s mainly fish and chips” (015; Male; FG3)</li> <li>• “You make the dinner and if it’s not a big chop or sausages, even mince and onions, it’s not a proper dinner” (009; Female; FG4)</li> <li>• “One of the other things that would work against this is the sort of thing of not cooking, people buying ready-made” (019; Female; FG4)</li> <li>• “I think we all have a sweet tooth, don’t we? At some part of the day you’re going to eat maybe something, a biscuit or something like that” (032; Male; FG7)</li> </ul>	Tasting sessions/ Demonstrate methods of consuming food in different ways/ Alternative meal and snack ideas
Cultural differences	<ul style="list-style-type: none"> <li>• “It’s not a normal diet for us in this country at all” (002; Male; FG1)</li> <li>• “But Northern Ireland, I think, has a tradition of eating a lot of red meat” (023; Female; FG4)</li> <li>• “Historically, the Irish have never been particularly good at getting much beyond potatoes and cabbage. It’s fascinating that. One of the really interesting things to me is that if you go to parts of Ireland where fishing is a significant activity, you will not find that the local people eat fish” (035; Male, FG7)</li> </ul>	Provision of culturally tailored MD meal ideas and recipes/ Different labelling of the dietary pattern

**Supplementary material**

**Demographic Questionnaire**

**Focus group number:** \_\_\_\_\_ **Date:** \_\_\_\_\_

Many thanks for agreeing to participate in this research study. Before we begin the focus group discussion, please take a few minutes to complete the following questions about you and your diet. All information you provide is anonymous and strictly confidential.

What is your date of birth? \_\_\_\_\_

Age (yrs): \_\_\_\_\_

Gender: Male  Female

What is your postcode? \_\_\_\_\_

Relationship status: Single  Co-habiting  Married  Divorced

What is your occupation? \_\_\_\_\_

What is your current weight? \_\_\_\_\_

What is your height? \_\_\_\_\_

Do you smoke? Yes  No

If yes, how many do you smoke each day? \_\_\_\_\_

If no, did you ever smoke? Yes  No

Has your doctor/nurse ever told you that you have high blood pressure?

Yes  No

Has your doctor/nurse ever told you that your blood cholesterol was high?

Yes  No

Do you take any medications to reduce your cholesterol level or blood pressure?

Yes  No

If yes, can you remember the names of the medications? (Please list below)

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*The next few questions ask about your diet.*

Who does most of the shopping in your household?

You                   Spouse/partner                   Other person                   Shared

If other person, please specify their relationship to you

---

Who does most of the cooking in your household?

You                   Spouse/partner                   Other person                   Shared

If other person, please specify their relationship to you

---

Have you heard of the Mediterranean diet before today?

Yes                   No

Has realising you are at an increased risk of heart disease made you think about your diet?

Yes                   No

To what extent do you think your diet is related to your risk of heart disease? Please circle your response.

1	2	3	4	5
Not related at all	Somewhat related	Don't know	Related a little	Related a lot

Would you consider making dietary changes because you are at increased risk of heart disease?

Yes                   No

Please put a tick ( ✓ ) in the box to indicate how often, on average, you have eaten the specified amount of each food during the past year.

FOODS AND AMOUNTS	AVERAGE USE LAST YEAR								
	Never or less than once/month	1-3 per month	Once a week	2-4 per week	5-6 per week	Once a day	2-3 per day	4-5 per day	6+ per day
<b>Olive oil/Rapeseed oil</b> (1 tablespoon)									
<b>Fruit and natural fruit juice</b> (1 portion = 1 apple/banana (80g), small glass juice (150ml))									
<b>Vegetables not including potatoes but including raw/cooked vegetable, salad, peas, beans or lentils</b> (3 tablespoons/80g)									
<b>Oily fish such as mackerel, salmon, trout, herring, kippers or sardines</b> (1 fillet/small fish or 140g)									
<b>Wine</b> (1 small glass/125ml)									
<b>Red meat including beef, pork, lamb, sausages, ham, bacon, meat pies and other meat products</b> (1 medium serving)									
<b>Wholegrain bread, rice or cereals including brown rice, porridge, weetabix, shreddies, bran flakes, fruit n' fibre</b> (1 medium serving)									
<b>Nuts</b> (1 small handful)									

**Table S1:** 8-point Mediterranean diet score used to determine participant adherence to a Mediterranean diet

<b>FFQ items</b>	<b>Criteria for 1 point</b>
1. Olive oil/ Rapeseed oil (1 tbsp.)	≥4-5/ day
2. Fruit and natural fruit juice (1 portion = 1 apple/banana (80g), small glass juice (150ml)	≥2-3/ day
3. Vegetables not including potatoes but including raw/cooked vegetable, salad, peas, beans or lentils (3 tablespoons/80g)	≥2-3/ day
4. Oily fish such as mackerel, salmon, trout, herring, kippers or sardines (1 fillet/small fish or 140g)	≥2-4/ week
5. Wine (1 small glass/125ml)	≥2-4/ week ≤ 2-3/ day
6. Red meat including beef, pork, lamb, sausages, ham, bacon, meat pies and other meat products (1 medium serving)	≤ 2-4/ week
7. Wholegrain bread, rice or cereals including brown rice, porridge, weetabix, shreddies, bran flakes, fruit n' fibre (1 medium serving)	≥2-3/ day
8. Nuts (1 small handful)	≥2-4/ week

**Table S2:** Sample of questions from semi-structured focus group schedule exploring attitudes to dietary change towards a Mediterranean diet

<b>Semi-structured focus group schedule</b>
<ul style="list-style-type: none"> <li>• How is this type of diet different to the way you currently eat? (Probe: What are the main differences?)</li> <li>• Do you think people in Northern Ireland could adopt a diet such as this?</li> <li>• What components of a Mediterranean diet would people from Northern Ireland find easier/more difficult to adopt in their everyday lives? (Probe: What other components do you think would be easier or more difficult/ Ask about specific components that haven't been discussed e.g. What about Olive oil?)</li> <li>• What do you feel are the main things that would prevent people from making this type of dietary change? (Probe: Is there anything else that might prevent people from adopting a Mediterranean diet?)</li> </ul>