

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

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ABSTRACT

Background:

Strong evidence links consumption of the Mediterranean diet (MD) to a reduced risk of Cardiovascular Disease (CVD), however there is uncertainty whether non-Mediterranean regions will adopt this dietary pattern. This research aimed to investigate attitudes towards a MD in individuals at high CVD risk in a Northern European population. Involvement of the target population in early intervention development helps to understand factors influencing dietary change. Results will inform the development of an intervention to encourage dietary change towards a MD.

Methods:

A qualitative methodology using focus group discussion was undertaken. Focus groups (n=12) were held with the target group and explored awareness of a MD, attitudes towards MD components and barriers to dietary change towards a MD. Discussions were audio-recorded, transcribed verbatim and analysed thematically. Nvivo software was used to manage the coded data.

Results:

Sixty-seven adults at high risk of CVD (60% female, mean age 64 y) took part. Participants were aware of the MD but knowledge of the specific composition of this dietary pattern was limited. Barriers associated with healthy eating in general were evident, however, barriers specific to following a MD were also identified, including food specific barriers, consumption of a moderate fat diet, culture and climate.

Conclusions:

Although there was good awareness of the term MD in this Northern European sample at high CVD risk, there was limited knowledge of the specific composition of a traditional MD and a number of barriers to adopting a MD were identified. Knowledge gaps and barriers revealed will inform the development of a MD intervention in a Northern European population.

KEYWORDS

Mediterranean diet, dietary change, barriers, focus groups

BACKGROUND

Cardiovascular disease (CVD) is a major public health problem. In the UK approximately 7 million people are affected by CVD [1], with this figure being expected to increase dramatically over the next 10-15 years [2]. Strong evidence supports consumption of the Mediterranean diet (MD) for a reduction in overall mortality and occurrence of CVD [3]. The PREDIMED study, a recent primary prevention trial of MD with CVD showed a 30% reduction in risk of CVD with consumption of a MD supplemented with extra virgin olive oil (Multivariate-adjusted HR 0.70, 95% CI: 0.54, 0.92) and a MD supplemented with nuts (Multivariate-adjusted HR 0.72, 95% CI: 0.54, 0.96) in comparison with a low fat diet, after a period of 5 years [4]. This reduction would have a significant impact on the at risk population. The traditional MD is largely based on fruit and vegetables, wholegrain cereal products and nuts, moderate amounts of fish and dairy products and small amounts of poultry and meat. Olive oil is the main fat source in the diet and wine is consumed in moderation [5].

Although the health benefits of following a MD are well established, there is uncertainty about whether non-Mediterranean regions will adopt this dietary pattern. While general barriers to dietary change are well documented in the literature [6-9], there is very limited information on the specific barriers that may exist in relation to adoption of a MD by Northern European populations. Understanding the practical and cultural factors that may affect dietary behaviour change towards a MD in non-Mediterranean populations is essential when trying to guide dietary change.

Perceived barriers to adopting and following this dietary pattern need to be determined among this population, particularly in groups at high risk of CVD who may gain the greatest health benefits from this dietary change. Such information will help to guide the development of appropriate MD behaviour change interventions.

This paper describes qualitative research that aimed to explore awareness of and attitudes towards consuming a MD in individuals at high risk of CVD from a Northern European population in order to inform the development of a MD intervention in this group. As recommended in the MRC framework for the design and evaluation of complex interventions to improve health [10], involvement of the target population in the early stage of intervention development is important to better understand the factors influencing behaviour and what needs to shift for the desired behaviour to occur. This approach will help to tailor a MD intervention accordingly and maximise the chance of positive dietary behaviour change in the target population.

METHODS

Recruitment and participants

A qualitative methodology using focus group discussion was undertaken. Eligible participants were those aged ≥ 50 years with two or more CVD risk factors (overweight/ obese, hypertension, hypercholesterolemia and smoking) but having no medical history of CVD or type II diabetes. Participants were recruited via a number of routes including through making contact with community health centres and

community group networks. A number of general practices also screened patient data and sent a letter of invitation to take part in the focus groups to individuals that met the inclusion criteria. Telephone calls were also made to invite individuals who were participants in previous dietary interventions at the Centre for Public Health, Queen's University Belfast (CPH, QUB) to take part. Interested individuals who were suitable to take part were provided with an information sheet detailing the purpose of the research, what participation would involve and potential limitations of taking part and were asked to provide written informed consent. Ethical approval was received by the Office for Research Ethics Committees Northern Ireland (ORECNI). The study was conducted between December 2012 and July 2013. Participant travel expenses were reimbursed.

Data collection

Focus group procedure

It was attempted to conduct focus groups that included representation of both genders and individuals from different geographical locations (urban/ rural) to enable inclusion of views of individuals from different demographic backgrounds. Different geographical areas were targeted for recruitment and groups were assembled to be homogeneous with regards to gender and geographical location. Having homogeneous groups is beneficial as individuals may have more readily disclosed their views with individuals that they perceived to be similar to themselves [11].

Initially, participants were asked to complete a demographic, lifestyle and medical information questionnaire which also assessed awareness of the MD, awareness of the link between CVD risk and diet and willingness to change diet. Additionally, this questionnaire contained a brief 8-item Food Frequency Questionnaire (FFQ) to provide information on consumption of key MD components. Participants were asked to select how frequently in the past year they consumed each item using a scale ranging from never or less than once per month to ≥ 6 servings/ day.

Following questionnaire completion, the focus group discussion commenced. Two trained members of the research team conducted the focus groups (SEM, CTM), with one acting as facilitator and one as an assistant to ensure all topic areas were adequately covered in the discussion. Various informal settings were used to hold the focus groups, including general practices, community centres, and at the CPH, QUB. Discussions lasted approximately 90 minutes.

Focus group schedule

A semi-structured focus group schedule was designed by the research team, which was designed based on a review of current literature and strategies used in previous qualitative studies. The schedule explored the following: perception of the main differences between this dietary pattern and current diet; if participants felt people in NI could adopt a MD; and the main barriers to this type of dietary change. A sample of questions from the schedule are shown in **table 1**. While not reported in this paper, focus groups were also used to explore views on commonly used peer support

methods and peer supporter requirements in order to inform the development of a PS model to be used as part of a pilot study to examine ways to encourage MD adoption.

Following the first focus group, the transcript was reviewed by the research team to ensure the desired data was being captured. After a number of focus groups had been delivered (n=8), progress was again reviewed by the research team to assess if coverage included a variety of participant demographics and to review if any areas required further exploration. This resulted in the addition of a question to the focus group protocol to consider participants thoughts on the term 'Mediterranean diet' to describe this dietary pattern and this was incorporated into all subsequent focus groups. Additionally, a number of focus groups were arranged in rural locations at this stage (n=3) to ensure a range of geographical locations were covered. Focus groups were conducted until saturated of themes was reached.

Data analysis

Qualitative data

Focus group discussions were audio recorded, transcribed verbatim and a thematic approach based on the framework outlined by Braun and Clarke [12] was used to analyse the data. Following repeated reading of transcripts, a thematic analysis framework to code data and identify themes based on the research aims was agreed by the research team. The framework was applied to transcripts by one researcher (SEM) and themes were identified through an iterative process. Themes were then reviewed by an additional member of the research team (MMK), with any discrepancies resolved through discussion. NVivo qualitative indexing software (QSR NVivo version 10, QSR International) was used to manage the coded data. Quotations were used to represent participant views.

Quantitative data

In order to analyse the FFQ administered as part of the focus group procedure, a Mediterranean Diet Score (MDS) was developed based the frequency of consumption of eight key MD foods. A score of 0 or 1 was assigned for each FFQ item, one point was given for high consumption of foods eaten readily as part of a MD and low consumption of foods eaten rarely as part of a MD. This gave a total score ranging from 0-8 with a score of 0 indicating the lowest adherence to a MD and a score of 8 indicating the highest adherence (**Table 2**).

Statistical analysis of focus group participant demographic data was implemented using SPSS for Windows version 21.0 (SPSS Inc, Chicago, IL). Difference between variables were examined using chi-square tests. Owing to expected values <5, Fisher's Exact Test was used. Significance was defined as $P < 0.05$.

RESULTS

Study sample

Twelve focus groups were conducted, as saturation of ideas and themes was reached at this stage. The sample included 67 adults (40 females, 27 males) of mean age 64 years. Participants were overweight, with a mean Body Mass Index (BMI) of 29 kg/m² and at high CVD risk with 67.2% reporting high blood pressure and 68.7% reporting high cholesterol. Some of the recruited sample (40.3%) stated that they were aware of the MD. Most participants stated that being at an increased risk of heart disease caused them to think about their diet (83.6%) and reported that they would consider making dietary changes due to being at increased risk of heart disease (84%). The mean MDS was 2.25, indicating that, overall, the sample had low adherence to a MD (**Table 3**).

Focus groups included male (n=5) and female only groups (n=7) and were held at both urban (n=9) and rural (n=3) geographical locations. Nine out of twelve focus groups indicated that all members (100%) would be willing to consider making dietary changes, and more than 80% of the other three groups expressed the same sentiment. Focus groups had a mean MDS ranging from 0-2 (67%), 3-5 (33%) and

no groups had a MDS ranging from 6-8. Focus groups with the two highest MDS's were both female groups of which $\geq 67\%$ of individuals were aware of the MD. In comparison, the groups with the two lowest MDS's were both male groups of which 0% of individuals were aware of the MD. There were no obvious differences in geographical location, age and consideration of making dietary changes between higher and lower MDS groups (**Table 4**).

Chi square tests (Fisher's Exact test) were used to determine if MD awareness or MDS category differed by focus group demographics, including age category, gender, geographical location, relationship status, BMI classification, high blood pressure, high cholesterol and smoking. A greater proportion of individuals living in an urban area were aware of the term MD (92.6%) compared to those from a rural setting (7.4%) ($P=0.002$). Additionally, a greater proportion of individuals with high blood pressure were aware of the term MD (51.1%) compared to those that did not have high blood pressure (18.2%) ($P=0.007$). There were no significant differences between focus group demographics and MDS category (**Table 5**).

Awareness and knowledge of the MD

The focus group discussion began with asking participants if they were aware of the term MD. The term MD was associated with sunshine and a hot climate, with words such as 'sun', 'warmth', 'sea' and 'relaxation' being used and foods mentioned included fruit and vegetables, salads, pasta, fish, wine, olive oil and bread. It was associated with healthy eating, fresh food and preparation of meals. Knowledge of

the specific composition of a MD however was limited. Participants did not mention health in relation to the term MD.

Attitudes towards MD adoption

The MD was then explained to participants in more detail using a MD food pyramid [13]. Following this, views on adopting a MD were discussed. Overall, attitudes towards adoption of a MD in NI varied. Some participants thought that the MD was very different to what is commonly consumed in NI and others thought that the MD was similar to a typical diet consumed in NI, with the main difference being proportions of food groups consumed:

“It’s handier eating your basic run of the mill Northern Ireland food, isn’t it?”

(Male, FG10)

“...changing to this diet is doing a 360 degree turn and it wouldn't be as comforting food” (Male, FG1)

“It’s what I eat anyway. What might be different is the proportion of each that I eat”

(Male, FG10)

Some participants felt that the MD was a palatable and varied dietary pattern and that change was within the realms of possibility:

“What I like about this diet is the variety. There is just so much” (Female, FG4)

“The one thing I think about that diet, when it’s on a plate it looks very attractive”

(Male, FG12)

“I think it would be simple enough if they set their mind to it” (Female, FG11)

Others however indicated that they would find it difficult to make dietary changes towards a MD. It is noteworthy that these individuals were often part of focus groups that had a lower mean MDS.

“Myself, I would find that hard” (Female, FG2)

“Speaking for myself, I would find it very hard to do” (Male, FG10)

There were no obvious differences in willingness to make dietary changes towards a MD between individuals of different genders or from different geographical locations.

Some individuals felt that the term ‘Mediterranean’ would be a positive way of encouraging people to adopt a MD. Reasons for this included the positive image created through associations of the term with sunshine and the attractiveness of a non-restrictive dietary pattern:

“I think the word Mediterranean has sort of a dramatic feel about it. You associate Mediterranean with nice sunshine, sea, things that we probably aspire to” (Male, FG10)

“But that there, the word Mediterranean, it doesn’t make it sound like a diet that you live on two lettuce leaves a day or something” (Male, FG10)

Some individuals, however, stated that they felt the term ‘Mediterranean’ was appropriate to use but that the term ‘diet’ may have negative connotations which could discourage engagement from the target population:

“I think once you mention “diet” people are turned off” (Male, FG12)

I think most people think of diet as something you have to go off, it’s not pleasant
(Male, FG 12)

Barriers to MD adoption

During focus group discussions on MD adoption, barriers to following a MD were also discussed. Many of the commonly reported barriers to dietary change were mentioned including cost, availability, eating habits, resistance to change, lack of knowledge, lack of cooking skills, lack of time and the amount of media coverage on diets. Exemplar quotes are given in **Table 6**.

Cost

It was clear from discussions that cost was a significant barrier. Overall it was perceived that it would be expensive to follow a MD, in particular due to the cost of some of the key components such as olive oil, nuts and fruit and vegetables. It was felt that it would be difficult for those on lower incomes to adopt this dietary pattern.

Availability

Some participants felt that the availability of certain components of the diet, specifically fresh fish and fruit and vegetables are limited, which would discourage them from purchasing these foods. The wide availability of fast-food restaurants and delivery services was also frequently mentioned as a hindrance to following a MD.

Eating habits

Several participants felt that it would be difficult to change the eating habits that they have developed since childhood, with frequent consumption of red meat and potatoes often described as an established eating habit.

Resistance to change

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

Lack of knowledge

Some participants expressed a lack of awareness of the MD and most expressed a lack of knowledge of its composition which they felt would be a significant barrier to following this dietary pattern.

Lack of cooking skills

Most participants felt that a number of people wouldn't have the cooking skills required to follow a MD or have the ability to translate information provided on the dietary pattern into everyday meals.

Lack of time

Time was also mentioned as a barrier as participants felt that it would be time consuming and require additional effort to adopt a MD and therefore may not be convenient for individuals with busier lifestyles.

Amount of media coverage on diets

Many participants also highlighted that the amount of media coverage on diets and conflicting information on healthy eating would discourage them from following this advice and making dietary changes towards a MD.

MD specific barriers

In addition to these barriers, further barriers were mentioned that were specific to following a MD including acceptability of components of the MD, consumption of a moderate fat diet, culture and climate (Exemplar quotes given in **Table 7**).

Acceptability (taste/ digestion/ frequency of consumption as part of a MD)

Acceptability of the MD was discussed and some participants mentioned specific components of a MD that would be difficult to adopt, including olive oil, nuts and

fish, and components that would be difficult to reduce their intake of in order to follow a MD including red meat, processed foods and sweet foods.

Olive oil

Some participants felt that it would be difficult to incorporate olive oil into their diet due to disliking the taste and as using it in meals, other than as a cooking fat, did not appeal to them.

Nuts

Some participants expressed that they would not consume nuts, other than salted varieties or that they avoid nuts due to difficulties chewing and digesting them.

Fish

Some participants perceived that fish is not frequently consumed in NI, other than battered fish. Acceptability of fish differed between individuals with some liking and others disliking the taste.

Red meat

Most participants felt that it would be difficult in NI for people to reduce their red meat consumption, holding the view that it is consumed in greater amounts and traditionally makes the basis of meals in NI.

Processed foods

It was also felt that it would be difficult for people in NI to reduce their intake of processed foods, due to the perception that many people in NI relied on such foods due to a lack of cooking skills, busy lifestyles or having a low income.

Sweet foods

Participants felt it would be difficult to reduce their intake of sweet foods, with individuals expressing an enjoyment of sweet foods and having the perception that most people in NI have a sweet tooth.

Consumption of a moderate fat diet

Several participants perceived components of the MD including olive oil and nuts to be fattening and associated them with weight gain. These participants held negative attitudes towards increasing their intake of these MD components for this reason.

Culture

Culture was mentioned as a barrier, as participants felt that the MD differs widely from the typical diet in NI, particularly in terms of the inclusion of olive oil and nuts and the lower red meat content and therefore that it would be difficult to follow a dietary pattern different to that dictated by cultural influences.

Climate

The climate in Northern Ireland was also consistently mentioned as a barrier to following a MD. Participant perception of a MD was of salads and fruit and vegetables which they felt would not be satisfying in a colder climate, where

preference would be towards warm meals, which were perceived as providing a higher satiety.

Variation on frequency and nature of barriers mentioned between focus groups

Generally, the types and numbers of barriers mentioned were similar across focus groups. The most frequently mentioned barrier was cost, followed by changing eating habits. These barriers were mentioned in >50% of groups. Acceptability of increasing intake of olive oil and reducing intake of red meat were the most commonly mentioned MD specific barriers, mentioned in 50% of groups (**Table 8**).

One of the MD specific barriers, acceptability of reducing intake of processed foods, was only mentioned by female focus groups. Urban based groups reported, on average, more barriers than rural based groups. In rural groups, availability of fast foods/ processed foods and lack of cooking skills were not mentioned. Additionally, rural groups did not feel that it would be difficult to increase intake of fish and nuts to reduce intakes of red meat and sweet foods, in comparison with urban based groups that did feel that these dietary changes would be challenging (**Table 8**).

Notably, focus groups with the highest mean MDS's (FG 4, 5, 1, 7) (**Table 4**) mentioned a greater number of general and MD specific barriers than groups with the lowest mean MDS's (FG 3, 9, 10, 2) (**Table 8**).

DISCUSSION

Awareness and knowledge of the MD

This sample of adults at high CVD risk from a Northern European population had a low MDS, but some were willing to make dietary changes, with 84% of the sample indicating that being at a high risk of CVD had made them think about changing their diet. Although many individuals indicated that they had heard the term 'Mediterranean diet' before, most individuals had limited knowledge of what a MD consisted of. There is a need for further education on this dietary pattern that offers significant health benefits for this at risk group.

Attitudes towards following a MD varied, with some individuals feeling that they could make changes towards it and others stating that they would find it very challenging. It is useful that attitudes of those less willing to make dietary changes towards a MD were captured in order to inform the development of interventions to encourage MD adoption that are more likely to reach resistant groups which are often missing from this type of research. Most individuals found the term 'Mediterranean diet' an acceptable way to brand the dietary pattern. It should be considered, however, that some individuals felt that use of the word diet could dissuade people from engaging in dietary change. Interventions to encourage adoption of a MD should therefore consider whether use of the term 'Mediterranean diet' is the most appropriate branding to use.

Barriers to dietary change identified in this study included cost, availability, eating habits, resistance to change, lack of knowledge, cooking skills, time and the amount of media coverage on diets. These barriers are consistent with barriers to general healthy eating that have been identified in the dietary change literature [6-7,-13, 14]. Cost, availability of key MD foods, lack of knowledge and lack of cooking skills have also previously been reported as barriers to adoption of the MD specifically in another non-Mediterranean population [15].

Further barriers specific to following a MD were also identified, including acceptability of components of the MD, consumption of a moderate fat diet, culture and climate. Culture has previously been reported as a significant barrier to following a MD in a Northern European population [16]. Interventions to encourage MD adoption in non-Mediterranean populations should address these perceived barriers. As participants perceived the MD to be made up of cold foods such as salad and fruit and vegetables, practical information is needed to educate individuals on the specific components of the MD, highlighting that it also includes warm, hearty meals. Provision of culturally tailored MD meal ideas and recipes could reduce perceptions that culture is a significant barrier to MD adoption. Education about the benefits of monounsaturated and polyunsaturated fats as contained in olive oil and nuts could help to overcome perceptions of these foods as unhealthy and fattening. Increasing intake of olive oil and reducing intake of red meat were the most commonly mentioned MD food-specific specific barriers. Perceptions of olive oil could be changed through education on the health benefits of olive oil and recommendations of methods for consuming it in different ways. Some participants felt that it would be difficult to reduce red meat intake, due to it traditionally forming the basis of meals.

This indicates the need to provide alternative meal ideas. Overall, these barriers highlight that education on the specific components and health benefits of the MD and provision of culturally tailored, low cost recipes and meal ideas are needed to help individuals to integrate a MD into their normal eating patterns.

The only difference observed in barriers reported by individuals of different genders was that reduction in intake of processed foods was mentioned by females only. Previous studies considering demographic differences in reported barriers to dietary change have reported gender differences in views as well as differences in views with individuals of different age, education level, employment status and income [15, 17, 18]. In this study, rural groups mentioned less barriers to adopting a MD than urban groups. This may be due to differences in the food environment [19-20] or eating patterns [21-22] between rural and urban settings. This highlights the importance of exploring how demographic influences on dietary change in order to ensure interventions cover a range of barriers relevant to all sections of the population.

Strengths and limitations

A major strength of this work was the sample size obtained which was relatively large for qualitative research. This increases the generalisability of findings for a population at high CVD risk. Findings however may not be generalisable to all Northern European populations, therefore similar studies in other regions would be beneficial. Additionally, the sample included both genders and individuals from both

urban and rural geographical locations. This enabled a broad range of views to be obtained, as different individuals may differ in their receptiveness to dietary change.

It must be considered that, due to the nature of qualitative research, bias may arise due to the views of one individual affecting another or over-representation of the views of more dominant individuals. Trained facilitators conducted the research using techniques to help ensure that views of all individuals were represented. The presence of the facilitator may also affect participant responses, however, facilitators were careful to create a comfortable and non-judgemental atmosphere to minimise the likelihood of this.

Focus groups were assembled to be homogeneous with regards to gender and geographical location (urban/ rural). It has been suggested that diverse groups may provide different perspectives and increase the breadth of discussion, therefore enhancing data obtained [23]. It can be argued, however, that homogenous groups are beneficial as individuals more readily disclose their views with individuals they perceive to be similar to themselves [14]. As a small number of groups were conducted in rural locations (n=3), differences in views between geographical locations should be interpreted with caution. The small size of some included focus groups (n ≤5) could be a limiting factor as common group sizes in previous research have included six to twelve individuals per group [24]. Conversely, small groups encourage cohesion of the group, help to maintain focus on the topic and help to ensure participation from all individuals [24].

CONCLUSION

This research indicates that, although there was already some awareness of the term MD in this Northern European sample at high CVD risk, knowledge of the specific composition of a MD was limited. Barriers associated with healthy eating in general were evident, however, barriers specific to following a MD were also identified, including food specific barriers, consumption of a moderate fat diet, culture and climate. The knowledge gaps and barriers captured here will be used to inform the development of a MD intervention which will then be piloted in a Northern European population. This study provides information that will be valuable to other researchers targeting this dietary change.

Table 1: Sample of questions from focus group schedule

Focus group schedule questions
<ul style="list-style-type: none">• How is this type of diet different to the way you currently eat?• Do you think people in Northern Ireland could adopt a diet such as this?• What components of a Mediterranean diet would people from Northern Ireland find easier/more difficult to adopt in their everyday lives?• What do you feel are the main things that would prevent people from making this type of dietary change?

Table 2: MDS used for 8-item FFQ

FFQ items	Criteria for 1 point
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 3: Focus group participant demographic information (n=67_{Max})

Variable	
Age in years mean(SD)	63.98 (10.03)
Age category n(%)	
40 - 49	4 (6.0)
50 - 59	20 (29.9)
60 - 69	20 (29.9)
70 - 79	16 (23.9)
80 - 89	6 (9.0)
Not reported	1(1.5)
Gender n(%)	
Males	27 (40.3)
Females	40 (59.7)
Geographical location n(%)	
Urban	49 (73.1)
Rural	18 (26.9)
Relationship status n(%)	
Single	5 (7.5)
Co-habiting	0 (0)
Married	40 (59.7)
Divorced	8 (11.9)
Widowed	11 (16.4)
Not reported	3 (4.5)
Current smokers n(%)	8 (11.9)
Weight (kg)	80.74 (16.39)
BMI (kg/m²)	28.77 (4.53)
BMI classification* n(%)	
Normal weight	12 (17.9)
Overweight	23 (34.4)
Obese	24 (35.8)
Not reported	8 (11.9)
Reported high BP n(%)	45 (67.2)
Reported high cholesterol n(%)	46 (68.7)
Taking BP or cholesterol medication n(%)	44 (65.7)
Responsible for household shopping n(%)	
Self	39 (58.2)
Partner/ spouse	12 (17.9)
Other	2 (3.0)
Shared	13 (19.4)
Not reported	1 (1.5)
Responsible for household cooking n(%)	
Self	39 (58.2)
Partner/ spouse	9 (13.4)
Other	2 (3.0)
Shared	16 (23.9)
Not reported	1 (1.5)
Aware of Mediterranean diet n(%)	27 (40.3)
High CVD risk evoked thought about diet n(%)	56 (83.6)
Extent diet is related to CVD risk n(%)	
Not related at all	0 (0)
Somewhat related	10 (14.9)
Don't know	16 (23.9)
Related a little	16 (23.9)
Related a lot	23 (34.3)
Not reported	2 (3.0)
Would consider dietary changes due to high CVD risk n(%)	63 (94)
MDS mean (SD)	2.25 (1.6)
MDS category n(%)	
0-2 points	39 (58.2)
3-5 points	24 (35.8)
6-8 points	2 (3.0)
Not reported	2 (3.0)

*BMI (Body Mass Index) according to WHO classifications. BP: Blood pressure

Table 4: Focus group participant demographic information by group (n=12)

Focus Group	Gender	Geographical location	Number in group (n=67)	Mean Age (years)	Aware of MD n(%)	Would consider dietary changes n(%)	Mean MDS
1	Male	Urban	5	53.8	1 (20.0)	5 (100.0)	2.8
2	Female	Urban	7	54.7	2 (28.6)	6 (85.7)	1.6
3	Male	Urban	5	64.6	0 (0.0)	5 (100.0)	0.6
4	Female	Urban	6	72.0	4 (66.7)	6 (100.0)	4.0
5	Female	Urban	2	56.0	2 (100.0)	2 (100.0)	3.5
6	Female	Urban	5	56.2	2 (40.0)	5 (100.0)	2.4
7	Male	Urban	6	65.8	5 (83.3)	6 (100.0)	2.7
8	Female	Urban	6	62.5	4 (66.7)	5 (83.3)	2.3
9	Female	Rural	3	70.3	1 (33.3)	3 (100.0)	1.3
10	Male	Rural	4	59.3	0 (0.0)	4 (100.0)	1.0
11	Female	Rural	11	75.3	1 (9.1)	9 (81.8)	2.3
12	Male	Urban	7	64.6	5 (71.4)	7 (100.0)	2.3

Table 5: P values showing associations between participant demographics and MD awareness/ Mediterranean diet Score (MDS)

	Awareness	P value	MDS Category			P value
	of MD (%)		0-2	3-5	6-8	
Gender						
Male	40.7	1.00	63.0	29.6	3.7	0.87
Female	40.0		55.0	40.0	2.5	
Age category (years)						
40-49	25.0		25.0	75.0	0.0	
50-59	45.0		55.0	40.0	5.0	
60-69	40.0	0.71	70.0	30.0	0.0	0.12
70-79	43.8		56.3	37.5	6.3	
80-89	33.3		66.7	16.7	0.0	
Geographical location						
Urban	92.6	0.002	64.1	87.5	4.1	0.14
Rural	7.4		35.9	12.5	0.0	
Relationship status						
Single	20.0		80.0	20.0	0.0	
Married	50.0	0.33	40.0	50.0	5.0	0.06
Divorced	25.0		75.0	25.0	0.0	
Widowed	18.2		100.0	0.0	0.0	
BMI classification						
Normal weight	33.3		33.3	50.0	8.3	
Overweight	52.2	0.16	52.2	43.5	4.3	0.21
Obese	29.2		66.7	29.2	0.0	
High blood pressure						
Yes	51.1	0.007	60.0	33.3	4.4	0.67
No	18.2		54.5	40.9	0.0	
High Cholesterol						
Yes	47.8	0.24	54.3	37.0	4.3	0.98
No	22.2		66.7	33.3	0.0	
Smoking status						
Yes	37.5	1.00	75.0	25.0	0.0	0.82
No	40.7		55.9	37.3	3.4	

Variable comparisons were made using Fisher's Exact tests (P<0.05) with 2df.

Table 6: Barriers to MD adoption reported in focus group discussions

Barrier	Representative quotes
Cost	<ul style="list-style-type: none"> • “A lot of people couldn't afford that diet” • “I think that there are components that would maybe be prohibited for some people, depending on their income, because the likes of the nuts and things like that, seeds and so on, are very expensive” • “Who’s going to buy olive oil if you can buy lard, for example, significantly cheaper” • “When you look at the price now of fruit, vegetables, I find it shocking how much they’ve gone up” • “Fish has become more expensive than meat”
Availability	<ul style="list-style-type: none"> • “Some supermarkets say they have fresh fish but it doesn’t look fresh and when you open it, it stinks” • “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”
Low availability of fresh foods	
High availability of fast foods	<ul style="list-style-type: none"> • “No matter where you go there’s four eating houses in a row and a shop closes down, a Chinese will move in or kebab or pizza” • “Now you can phone all these different departments and they bring the food to your door”
Eating habits	<ul style="list-style-type: none"> • “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” • “It’s partly tradition, it’s partly the habit that you grew up with, how you were brought up and I think those habits are extremely difficult to change” • “My generation you just sort of had a very stable diet. Your diet was red meat and potatoes and all that and I have to say that that’s what I was brought up on and that’s what I would eat now” • “It’s the diet you’ve been brought up on, a lot of meat and a lot of potatoes, filling food”
Resistance to change	<ul style="list-style-type: none"> • “If you like the food, enjoy it. My motto is now, I’m coming 70, I’ll eat whatever I want and enjoy it” • “There comes a stage where I don’t think you’re prepared to try different things. It’s nearly ‘no I don’t eat that’ ‘I don’t like that’ • “What is the point? life’s short, enjoy it” • “I think we’re just too late in life now to change” • “I don’t think that a lot of people would want to change their ways”
Lack of knowledge	<ul style="list-style-type: none"> • “I haven’t heard of it but I presume the Mediterranean diet is simply the diet that people who live around the Mediterranean eat” • “I think I’ve heard of it but I really don’t know. I would have an idea in my head it would be something like olive oil and tomatoes and vegetable type, pasta”. • “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” • “If you went out and stopped a lot of people in the street they wouldn’t know what polenta, bulgur wheat was, any of those things” • “It looks lovely but what would you do with what? What is a Mediterranean diet or meal out of that?”
Lack of cooking skills	<ul style="list-style-type: none"> • “A lot of people today don't really get into the kitchen and get to know about the basics of cooking” • “There is a generation that wouldn't have the same leaning to cook as previous generations” • “We all need to eat fruit and vegetables but converting it into something-is the problem and going home and preparing it”
Lack of time	<ul style="list-style-type: none"> • “People seem to have less time now” • “It’s all about really convenience. I think people’s lifestyles have sort of changed so much. It’s all rush, rush, rush. 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” • “With shift working it just depends, maybe coming in late it’s easier to go and get a takeaway then than start to cook”

Table 6 (cont.): Barriers to MD adoption reported in focus group discussions

Barrier	Representative quotes
Amount of media coverage on diets	<ul style="list-style-type: none">• <i>“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”</i>• <i>“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”</i>• <i>“Had you been taking cuttings out of the papers this last 15 years what you should eat or what you shouldn’t eat, you’d be eating nothing!”</i>• <i>“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”</i>

Table 7: MD specific barriers from focus group discussions

MD specific barrier	Representative quotes
Acceptability	
Olive oil	<ul style="list-style-type: none"> • <i>“If you do it in olive oil it’s not the same”</i> • <i>“I don’t mind cooking in the olive oil and rapeseed oil but don’t ask me to pour it over pasta. I just wouldn’t eat it”</i> • <i>“That particular type of fat, oil drizzled. It doesn’t do it for me”</i>
Nuts	<ul style="list-style-type: none"> • <i>“Beans, nuts, not really, I’m not into that”</i> • <i>“It’s probably the unhealthy nuts we would be inclined to eat here, salted peanuts”</i> • <i>“I find them hard to digest and swallow”</i>
Fish	<ul style="list-style-type: none"> • <i>“A lot of people here don’t eat fish... It’s mainly fish and chips”</i> • <i>“It depends on the individual... some like fish, some don’t”</i> • <i>“I only eat battered fish or something but otherwise, no”</i>
Red meat	<ul style="list-style-type: none"> • <i>“Northern Ireland, I think, has a tradition of eating a lot of red meat”</i> • <i>“I don’t think the meat intake would change”</i> • <i>“You make the dinner and if it’s not a big chop or sausages, even mince and onions, it’s not a proper dinner”</i>
Processed foods	<ul style="list-style-type: none"> • <i>“One of the other things that would work against this is the sort of thing of not cooking, people buying ready-made”</i> • <i>“I, just out of curiosity, watch people when I’m shopping, and the amount of people that fill their trolleys out of the frozen section with ready meals and pizzas and all that sort of stuff”</i> • <i>“If you go to the supermarket, the processed, the crap food is buy one get six free or something like that”</i>
Sweet foods	<ul style="list-style-type: none"> • <i>“I think we all have a sweet tooth, don’t we?”</i> • <i>“I do eat a lot of sweet stuff. I like biscuits and cakes and things like that”</i> • <i>“I like a sweet bite after my dinner or tea”</i> • <i>“My diet could be coke and sweets, coke and chocolate”</i> • <i>“I would have a wee bender at night and I would take maybe a piece of Swiss Roll or something like that. You get pleasure out of it”</i>
Consumption of a moderate fat diet	<ul style="list-style-type: none"> • <i>“They put a whole lot of olive oil on their food and it’s all calories”</i> • <i>“They put this olive oil all over their pasta, and they said that that was a lot of why they had a lot of weight on, because obviously it’s that has the calories in it”</i> • <i>“My wife keeps saying don’t use too much olive oil and I thought maybe it wasn’t good”</i> • <i>“I don’t buy them (nuts) because I know they’re fattening”</i> • <i>“I do love nuts but they’re quite high in calories”</i> • <i>“When you’re doing certain diets they’ll say nuts are very high in calories, very high in fat”</i>
Culture	<ul style="list-style-type: none"> • <i>“I suppose what I’m arguing is that the diet that is associated with a particular geographical area is a product of all kinds of historical, social and economic factors over a period of time. The Irish diet is not the Mediterranean diet. I’m not saying that is a recommendation but it doesn’t therefore follow that it would be easy for Irish people to switch to the Mediterranean diet”</i> • <i>“But it’s not natural to our way here in Northern Ireland to eat that way”</i> • <i>“It’s handier eating your run of the mill Northern Ireland food, isn’t it?”</i>
Climate	<ul style="list-style-type: none"> • <i>“To me, it’s not a diet that’s sort of seems suited to our, when I say our way of life I mean our climate here really”</i> • <i>“I think because we’re such a cold country too you want warmer foods”</i> • <i>“A lot of this food is good in a nice warm environment where you’re sitting and the sun’s beaming in”</i> • <i>“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”</i>

Table 8: Summary of barriers reported by FG

Barriers	Focus group											
	1	2	3	4	5	6	7	8	9	10	11	12
	MU	FU	MU	FU	FU	FU	MU	FU	FR	MR	FR	MU
General barriers to dietary change												
Cost	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	X
Availability (fresh foods)	✓	X	X	X	✓	X	X	X	✓	X	X	X
Availability (fast/processed foods)	X	X	✓	X	✓	X	✓	X	X	X	X	✓
Eating habits	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	X	X
Resistance to change	X	X	✓	✓	X	✓	X	✓	✓	X	X	✓
Lack of knowledge	✓	X	X	X	✓	✓	✓	✓	X	✓	X	X
Lack of cooking skills	X	X	X	X	✓	✓	✓	✓	X	X	X	✓
Lack of time	✓	X	X	X	✓	X	X	X	✓	X	X	X
Media coverage on diets	X	X	X	✓	X	X	X	✓	X	✓	X	X
General barriers total	5	2	4	4	6	5	5	6	4	4	1	3
Mediterranean diet specific barriers												
Acceptability of olive oil	✓	✓	✓	✓	X	X	✓	X	X	✓	X	X
Acceptability of nuts	✓	✓	✓	✓	✓	X	X	X	X	X	X	X
Acceptability of fish	X	✓	✓	X	X	X	X	X	X	X	X	X
Acceptability of reducing red meat	✓	X	✓	✓	✓	✓	X	✓	X	X	X	X
Acceptability of reducing processed food	X	X	X	✓	✓	X	X	✓	✓	X	X	X
Acceptability of reducing sweet foods	X	X	X	X	✓	✓	✓	✓	X	X	X	X
Consumption of moderate fat diet	X	X	X	✓	✓	✓	✓	X	X	✓	X	X
Culture	✓	X	X	✓	✓	X	✓	X	X	✓	X	X
Climate	✓	X	X	✓	X	✓	X	X	✓	✓	X	X
MD specific barriers total	5	3	4	7	6	4	4	3	2	4	0	0
All barriers TOTAL	10	5	8	11	12	9	9	9	6	8	1	3

M=Male, F=Female, U=Urban, R=Rural

LIST OF ABBREVIATIONS

BMI	Body Mass Index
CPH, QUB	Centre for Public Health, Queen's University Belfast
CVD	Cardiovascular Disease
FFQ	Food Frequency Questionnaire
FG	Focus group
MD	Mediterranean diet
MDS	Mediterranean Diet Score
MRC	Medical Research Council
Nvivo	Qualitative indexing software
SPSS	Data analysis and statistical software

COMPETING INTERESTS

The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

JW was Principal Investigator on the grant and was responsible for management of this work. CME and SM conducted data collection, analysis and interpretation and SM drafted the manuscript. JL and LP advised on the details of focus group sampling, conduct and analysis. FK, IY, MMK, CP, KA, SH, DMC, MC provided substantial advice on conception and design aspects of this research. All authors read and approved the final manuscript.

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