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Research Article www.enlivenarchive.org Enliven: Journal of Dietetics Research and Nutrition

ISSN: 2378-5438

A Cross-Sectional Pilot Study Assessing Dietary Intake in People with Multiple Sclerosis and the Relationships with National Diet Guidelines

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Received Date: 16th November 2017
Accepted Date: 10th February 2018
Published Date: 12th February 2018

Citation: Coe Shelly, Philip O, Cossington J, Collett J, Izadi H, and Dawes H (2018) A Cross-Sectional Pilot Study Assessing Dietary Intake in People with Multiple Sclerosis and the Relationships with National Diet Guidelines and with Symptoms of Fatigue Enliven: J Diet Res Nutr 5(1): 001.

Abstract

People with the Multiple Sclerosis (PwMS) modify their diet, however their knowledge of diet is unknown and dietary modifications may have long term health implications. We set out to assess the feasibility of a study to determine diet patterns compared to national nutritional guidelines in PwMS, and in those with and without fatigue.

Methods: In this cross sectional study four MS support groups were attended throughout the Thames Valley area, with approximately 20 to 25 people attending each group at any one point in time. Measures of feasibility were sought. Descriptive statistics were used to determine inconsistencies in nutrient intake in PwMS with and without fatigue compared to the Scientific Advisory Committee on Nutrition guidelines.

Results: 31 PwMS provided dietary data using a Food Frequency Questionnaire, alongside the Fatigue Severity Scale, Barthel Index activities of daily living and demographic data. One third of participants were on a modified diet. Compared to the UK nutrition guidelines, several nutrients were ±1 standard deviation in PwMS, and PwMS tended to miss targets for diet guidelines. Those who were fatigued showed further differences in nutrient intake compared to those who were non-fatigued, and women tended to have healthier diets than men. Missing data was low and response rate was high

Conclusion: For the first time data is provided that shows PwMS may have altered dietary intake compared to national guidelines. Furthermore, those who were fatigued show further differences compared to non-fatigued PwMS. Considering the high incidence of modified diets in this group, more substantial investigation of diet is required.

Keywords: Fatigue; Diet; Multiple Sclerosis; Activities in daily living

Abbreviations: ADL: Barthel Index Activities of Daily Living; EPIC: The European Prospective Investigation into Cancer; FSS: Fatigue Severity Scale; FFQ: Food Frequency Questionnaire; PwMS: People with Multiple Sclerosis; SACN:The Scientific and Advisory Committee on Nutrition

Introduction

A balanced diet is essential to lead a healthy lifestyle, and the importance of diet is amplified in chronic inflammatory conditions such as Multiple Sclerosis (MS) [1,2]. Some studies have indicated a potential relationship between a healthy diet and "lessening" of symptoms and disability in people with MS (PwMS), yet good quality research is lacking. Hadgkiss et al. [3] have shown that a 'healthy' diet pattern in PwMS has positive implications for symptoms, however their diet questionnaire wasn't comprehensive nor did they measure the most debilitating symptoms such as fatigue. The results of Bitarafan et al. [4] are important as they found a relationship between intake of specific nutrients and fatigue, however, they did not report whole food groups. Reporting on the food group that contains the micronutrient would provide more useable information to understand the dietary pattern in this group in line with public health advice.

Interestingly approximately a third of PwMS have previously reported using complementary alternative medicine in conjunction with conventional therapies to try to alleviate such symptoms and reduce disease progression [5]. Evidence shows that, of those surveyed, 91.5% of those with MS were interested in adopting a diet regime to benefit their symptoms and 85% would continue with a diet intervention for longer than 3 months [6]. Indeed in a previous trial the protocol had to be adapted due to the large proportion of PwMS who modified their diets to exclude dairy milk in an attempt to manage symptoms [7]. This observation is worrying as there is limited evidence that supports the positive benefits [5,8] from any of these diets which can result in severe nutrient deficiencies which may impact on the long term health of these individuals. Considering that MS is increasingly diagnosed earlier in life, an understanding of the nutritional implications of what PwMS consume is an important area to understand and consider in clinical advice and when considering dietary interventions for trials.

There is limited high quality evidence to date on the role of diet for optimal health in PwMS, which may in part be due to issues with appropriate measurement instruments. The primary aim of this study is to assess aspects of feasibility, including recruitment rate and completion of questionnaires, and the feasibility of using standard measures of diet and health status in PwMS. The number of PwMS who report being on an altered diet will be estimated along side the number who meet food and nutrition guidelines compared to the UK dietary guidelines from The Scientific Advisory Committee on Nutrition (SACN), who provide information on diet targets and nutritional patterns for the UK general population. Also, it will be estimated if differences exist in diet between those who are fatigued and those who are not fatigued.

Methods

This was a cross sectional pilot study including 31 PwMS (men 7; women 19; n/a 5) over 18 years of age (mean years 55.32 ± 10.23 SD; Table 1). Participants were recruited from support groups for MS throughout the Thames Valley. Potential participants were provided with information about the study and a total of four MS support groups were attended throughout the Thames Valley area, with approximately 20 to 25 people attending each group at any one point in time. If they agreed to take part, consent was implied through the completion and return of anonymised questionnaires. Eligibility criteria included a self-reported diagnosis of MS by a neurologist and ethical approval for this study was granted by the Oxford Brookes University Ethics Committee (150895).

The data collected consisted of three validated questionnaires. The European Prospective Investigation into Cancer (EPIC)-Norfolk Food Frequency Questionnaire (FFQ) [9] was used to measure habitual food intake over the previous 12 months and took approximately 30 minutes to complete. It included questions about specific food items, such as seasonal consumption of fruit and vegetables and habitual consumption of meat, fish, dairy products, potatoes, breads, rice, fats and sugars. Answers range from 'never or less than a month' to '6 + times a day'. In addition, participants were also asked whether they took nutritional supplements and asked questions regarding their cooking methods, including the use of oils and added salt. The FFQ was analysed using software from EPIC-Norfolk Cohort study [9] from which the accuracy of the analysis was originally validated. Through this software, whole foods are converted to total macro and micro nutrients consumed over the previous year in amounts.

Table 1: Participant demographics

Variable	Mean	Fatigued	Non-fatigued
Multiple Sclerosis (MS)	31	24	7
Male	7	5	2
Female	19	14	5
No answer	5	5	-
Age	55.32 ± 10.23	55.88 ± 9.91	53.43 ± 11.91
BMI (m/kg^2)	24.90 ± 4.95	25.30 ± 5.65	21.18 ± 5.83
On a special diet	10/ 31	9/24	1/7
Barthel Index score	17	17	16
Fatigue	5	6	3

The Fatigue Severity Scale (FSS) was used to measure fatigue, which Herlofson et al. [10] previously considered to be highly reliable, valid and consistent. Those who were fatigued as indicated by a score of 4 or more on the FSS were then compared to those who were non fatigued (FSS <4). Additionally, the Barthel Index Activities of Daily Living (ADL) questionnaire was used to rate independence in ADL. The scores were calculated as a total and considered to be a standard measure of activities of daily living by Wade & Collin [11]. The questionnaire packs took an average of 30 minutes to complete. Demographic information was collected including weight, height, gender, date of birth and was also self-reported.

Feasibility aspects of the study were determined through the efficiency of data collection methods through completion of the questionnaires, identification of missing data and recruitment rate. The number of people who have a self-reported modified diet was recorded.

Statistical Analysis

Demographic data were described using descriptive analysis and recruitment rate was determined. Completeness of questionnaires was reported and 80% was considered appropriate for each measure including demographic information.

Nutrient data was compared to the SACN guidelines to identify any obvious and major differences in nutrient intake in PwMS compared to the UK population (± 1 SD). This was also subdivided into people with and without fatigue. These nutrients were then further analysed. The number of people meeting nutrition guidelines for 1, 2, 3, etc of the nutrients/ food groups was determined.

Results

Missing data is reported in Table 1, there was no missing information on the returned diet questionnaires, and the only missing information was on gender and BMI. A total of four MS support groups were attended throughout the Thames Valley area, with approximately 20 to 25 people attending each group at any one point in time. With 31 completed questionnaires returned, this equates to a response rate of approximately 30%. One third of those surveyed were on a special diet of some form (either vegetarian, exclusion of diary or wheat, Swank diet, etc) and about two thirds were fatigued. Table 2 shows the supplement use of the 31 PwMS on the study.

Table 2: Supplement use amongst 31 PwMS per day

Supplement	amount	Number of (and percentage of total) PwMS
Vitamin D3	5000 IU	17 (55%)
	10-25 µg	4 (13%)
Fish oil	1000 mg	14 (45%)
Flaxseed oil	20-40 ml	4 (13%)
Vitamin B12	1000 µg	4 (13%)
Magnesium	250 mg	1 (3%)
	400 mg	1 (3%)
Turmeric	600 mg	2 (6%)
Vitamin B complex	n/a	4 (13%)
Probiotics	n/a	2 (6%)
Coenzyme Q10	100 mg	2 (6%)
Vitamin E	1000 IU	1 (3%)
Multivitamin	n/a	2 (6%)
Cranberry tablets	5000 mg	3 (10%)
Calcium	500 mg	2 (6%)
Zinc	50 mg	1 (3%)
Garlic	2mg	1 (3%)
Primrose oil	n/a	1 (3%)
Biotin	300 µg	1 (3%)

Comparison to UK Nutrition Guidelines

In the current study, the nutrient intake in PwMS was compared to the SACN guidelines and those that showed inconsistencies by a ± 1 SD compared to the guidelines were further analysed. Table 3 represents the nutrients that showed differences that required further analysis. As is shown, those who were fatigued tended to have lower intakes of all nutrients yet had high intakes of alcohol There were gender specific trends with males eating less fibre, potatoes and were less hydrated, yet consumed more alcohol than females. The number of people achieving nutrient/ food targets was then considered (Table 4). Those meeting a greater number of nutrient/ food group targets (8 or more) were more likely to meet guidelines for fruit, non-alcoholic beverages, mono and poly unsaturated fat, carbohydrates, zinc, and fibre, compared to those meeting less than 6 food groups. They were also more likely to be female, however there was no clear pattern with fatigue versus non fatigued PwMS.

Table 3: Nutrient/ food intake in people with Multiple Sclerosis (PwMS) compared to Science Advisory Committee on Nutrition (SACN) guidelines

Nutrient	Energy (Kcal)	Carb (g)	Total Fat (g)	Saturated Fat (g)	Mono Unsaturated Fat (g)	Poly Unsaturated Fta (g)	Fiber (g)	Ergocalciferol (mcg)	Zinc (mg)	B6 (mg)	B12 (mcg)	Milk (g)	Meat (g)	Fruit (g)	Alcoholic Beverages (g)	Potatoes (g)	Non Alcoholic Beverages(g)
PwMS	1648	206	60	20	23	12	20	3	8	2	7	323	70	360	70	65	604
Female	1619	211	58	18	22	13	22	3	8	2	6	289	56	418	40	74	568
Male	1643	189	61	22	23	11	4	4	9	2	7	287	72	424	93	55	458
Fatigued	1583	198	59	19	23	12	18	3	8	2	6	273	68	342	71	60	594
Non Fatigued	1862	239	65	20	24	14	26	4	10	3	7	462	72	483	37	81	625
SACN																	
Female	2000	267	78	24	29	14	18	10	7	1.2	1.5	-	-	400	-	-	1200
Male	2500	333	97	31	36	18	18	10	9.5	1.4	1.5	-	-	400	-	-	1200

Intake in PwMS refers to mean data from the 31 Food Frequency Questionnaires. Nutrients were chosen from 60 nutrients and were those above or below one stand deviation from the SACN recommendations. Whole food groups were also considered. Those nutrients that showed inconsistencies by a ± 1 SD compared to the guidelines were included in this table. Those classified as having fatigue scored 4 or more on the Fatigue Severity Scale

Table 4: Number of PwMS meeting UK nutrition guidelines for total food groups/ nutrients

Total Nutrients/ Food Groups	>3	3	4	5	6	7	8	9	10	11+
Total Number of People	0	1	3	4	6	6	6	3	1	1

Discussion

This study shows that assessing dietary intake in a cohort of PwMS is feasible due to the high response rate (30%) and the high completion rate of the questionnaire packs. We found that overall the diet of PwMS in the current study did not meet UK guidelines (SACN) with a third of PwMS reporting being on altered diets. These findings are important in the context that PwMS often report adopting modified diets, regularly for prolonged periods, in order to impact on their symptoms and disease [5]. Notable differences were found in those with more severe fatigue and in men who generally had a poorer diet. Currently, there is no clear guidance to the benefits of specific restrictive or supplementary diets for symptom and disease management.

This is the first study to compare the dietary patterns in PwMS compared to the UK guidelines (SACN). When subdivided into those with and without fatigue, PwMS with higher fatigue tended to have lower intakes of energy, carbohydrates, fat (mono, poly and saturated), fibre, vitamin D, zinc, B_6 and B_{12} compared to those who were non-fatigued and to the SACN recommendations. In addition, those who were fatigued had lower fruit, milk, meats, potatoes and fluid intakes and higher intakes of alcoholic beverages compared to non-fatigued people. Therefore, this study is the first to show that PwMS have insufficient intakes of many 'healthy' nutrients compared to the UK guidelines, and PwMS who are fatigued have even lower intakes of certain nutrients compared to those who are non-fatigued. In terms of number of nutrients/ foods groups consumed by each person, those who met a higher number of guidelines tended to have more healthy eating patterns and to be female. As this was a pilot study, aspects of feasibility were also considered. Overall those who filled out the questionnaires completed the entire questionnaire with almost no missing information. However, from those who did fill out the questionnaires, there was a high interest in diet and symptom alleviation, and many questions about diet did arise during the administration and completion. Therefore, this work shows importance for a fully powered study to be performed.

This study was the first to compare current dietary intakes in PwMS to UK guidelines using an in depth FFQ. Due to its cross-sectional design, a causality relationship cannot be determined. Therefore, even though this was a pilot study, the implications for a larger study could prove clinically significant. However, this study was performed on a small sample size, with some missing data on gender and BMI. Therefore when assessing number of nutrient/ food groups met, the female target value was used (Table 4) and therefore the five questionnaires with missing gender may have overestimated the number of targets met. In order to provide more accurate and representative results a larger sample size is needed. Data was self-reported, including diagnosis of MS (no clinical confirmation obtained). No statistical analysis was performed on the data in this study but rather trends were assessed to inform future research. Also, those who complete the diet questionnaires may be more interested in nutrition and more conscious of their dietary habits. Therefore we may not have captured those on so called 'unhealthy diets'. The sample population was from the Thames Valley which is an affluent area of the UK, and therefore this may have resulted in diets

being of better quality than the average. Due to the recruitment methods, it is uncertain how many people who were asked and/or received information about the trial, actually participated. However, overall the trial seemed to be well received. With approximately 1% of the total UK population having MS, and a total of 2.1 million people in the Thames Valley, approximately 210 PwMS live in the Thames Valley. If half of those people attend MS support groups, then there is a predicted response rate of approximately 30%.

The EPIC FFQ is a good indicator of nutritional intake as significant correlations have been found between nutrients derived from the FFQ in comparison to biological analysis markers [12]. It does have several limitations including the exclusion of all foods consumed and/or all cooking methods. Also, intake is not necessarily an indicator of nutritional status due to factors such as bioavailability, nutrient absorption and combination of food consumed [13]. Bingham et al. [9] found participants under reported energy intake to portray their diet as 'healthy' resulting in inaccuracies. The risk of this was minimised by the questionnaires being anonymous [14].

Fatigue is frequent in PwMS yet evidence is highlighting that dietary modification may aid in the alleviation of this symptom [4,7]. Indeed previous research from Hadgkiss et al. [3] found a significant association of a healthy diet, to physical and mental health and lower levels of disability in PwMS. However, an in-depth assessment of dietary intake was not performed, nor was the association of diet and fatigue explored. PwMS often suffer with various types of malnutrition, which often go unrecognized causing fatigue and worsening of symptoms [15]. Certainly, a 'Western' type diet which is high in inflammatory promoting nutrients and foods has been thought to promote and worsen pathogenesis of autoimmune diseases such as MS [16]. Compared to the current study, the only other similar study to date was that by Bitarafan et al. [4] who performed a cross sectional study in 101 Relapsing and Remitting MS participants. Diet was assessed using a 3 day food diary and it was found that intake of vitamin D, folate, calcium and magnesium were lower in PwMS compared to the recommended Dietary Reference Intakes, and lower dietary intake of magnesium and folate correlated with higher fatigue scores. Therefore, they suggested that correcting intake of these dietary components may improve fatigue levels in PwMS, however they did not determine differences in diet compared to those who were fatigued (>4 on the FSS) versus non fatigued [4]. What is shown by both this study and our results is that there are trends in altered diet intake patterns in PwMS which are associated with symptoms and therefore should be further explored.

Conclusion

PwMS are often diagnosed earlier in life and there is a lack of rigorously applied research into the diet quality of these people and the effects of diet on long term health and wellbeing. Research into the diet patterns in this group was shown to be highly feasible and well accepted by PwMS. This study is the first to show that PwMS have lower intakes of many 'healthy' nutrients compared to the UK guidelines with most meeting only half of the nutrients/food group targets, and PwMS who are fatigued have even lower intakes of these nutrients compared to those who are non-fatigued. Indeed, although dietary modification does not necessarily imply poorer nutrition, several nutrients were suboptimal in PwMS compared to dietary guidelines. Clear dietary guidance may be required to maintain the health of PwMS and help them understand the implications of dietary manipulation. In order to achieve this goal we propose the need for more regular measurement of diet in order to inform the development of clear guidance of specific at risk nutrients and food groups in order to develop both MS specific recommendations and inform individualized dietary advice for this vulnerable group. Therefore, there is an urgent need to better understand the extent of dietary patterns and for the development of clear guidance for a healthy diet and the implications of dietary manipulation. Future studies need to further assess the role of dietary intake for symptom management including fatigue in PwMS.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. Dawes is funded by Elizabeth Casson Trust and Higher Education Thames Valley and the Biomedical Research Centres.

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