

Meal-related difficulties and weight loss in older people: Longitudinal data from MAPT study

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- 1 Meal-related difficulties and weight loss in older people: longitudinal data from MAPT study.
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- 3 MAPT DSA Study Group

4 1. Conflicts of interest

All authors have stated that they have no competing interests (financial or non-financial) related tothe study.

7 2. Cover letter

- 8
- 9 Dear editors,
- 10
- 11 We would like to submit to your judgment the present manuscript entitled 'Meal-related difficulties
- 12 and weight loss in older people: longitudinal data from MAPT study'No. YCLNU-D-18-01304R1
- 13 to be considered for publication in International Journal of Clinical Nutrition.
- 14 This manuscript includes only original material and is going to be part of the doctoral thesis of Gaëlle
- 15 Soriano, PhD Student and Registered Dietitian. It has not been previously considered for publication
- 16 or published in another journal.
- 17 All authors have contributed to the paper and have given permission for their names to be included
- as co-authors. Each author has read and approved the contents of the final submitted manuscript.
- 19 We suggest as potential reviewers:
- 20 Heather Keller: hkeller@uwaterloo.ca
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- 22 Midori Ishikawa ishikawa@niph.go.jp
- 23 Joseph Sharkey jrsharkey@srph.tamhsc.edu
- We hope that you will consider this paper suitable for publication and would be very pleased about apositive response.
- 26 Yours sincerely,
- 27
- 28

Gaëlle Soriano on behalf of all authors

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38 **3.** Author agreement

39 The authors' responsibilities were as follows—SA, SG and BV: conceptualized MAPT study; GS:

40 designed and led the present study, analyzed the data, wrote the first draft of the manuscript; and all

41 authors: read and approved the final manuscript.

42 5. Manuscript

43 Abstract

44 Background

Difficulties with meal-related activities (preparing meals and food shopping) may influence food
intake, and contribute to nutritional risk among elderly people. All known studies on this topic had a
cross-sectional design, thereby no causal relationships could be derived. We aim to investigate if
difficulties with meal-related activities can contribute to subsequent weight loss in communitydwelling older people.

50 Methods

We used data of older subjects from the MAPT Study (n=1531, median age = 74 years, 64% women), who provided prospective data on weight every 6 months and cognitive, physical condition, and functional capacities every year during a 3-year period. Difficulties preparing meals and shopping were evaluated each year with the Alzheimer's Disease Cooperative Study-Activities of Daily Living Prevention Instrument (ADCS ADL-PI) Scale. The risk of losing weight (≥ 5% or ≥ 3 kg in the following year) was estimated using a time-dependent Cox regression model.

57 Results

58 During the 3-year follow-up, a total of 851 subjects experienced at least a 5% or 3 kg weight loss. Two 59 hundred thirty-seven subjects declared having difficulties with meal preparation at least once, and 60 133 declared having difficulties shopping. Subjects reporting any meal-related difficulties were older (p<0.001), had more depressive symptoms (p<0.001), and a lower physical function (p<0.001)61 62 compared to those without difficulties. They also had a lower cognitive score (preparing meals: 63 p<0.001; shopping: p=0.005) and a lower body mass index (preparing meals: p=0.005; shopping: 64 p=0.023) at the end of the study. Meal-related activities were not associated with weight loss in 65 unadjusted analysis and after adjustment for sex, age, depression, physical and cognitive status.

66 Conclusion

67	Difficulties preparing meals and shopping had no effect on weight loss in community-dwelling older
68	people, despite their association with advanced age, functional decline, and depressive symptoms.
69	

70 Keywords: elderly, weight loss, activities of daily living, meal preparation, cooking, shopping

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73 Introduction

74 Functional abilities in daily activities often decrease with old age [1]. On average older men spend 6 75 years and women 11 years in different states of dependency[2]. Meal-related activities are among 76 the most common self-reported difficulties with daily activities, increasing rapidly with age [3]. After 77 age 75, 12% of men and 19% of women declare difficulties preparing meals and 21% of men and 78 41% of women declare difficulties food shopping [1]. Meal-related difficulties may influence food 79 intake and contribute to nutritional risk among older people[4]–[6]. Nevertheless, the association 80 between meal-related difficulties and nutritional risk in community-dwelling older people has been 81 poorly investigated. Two cross-sectional studies found a positive association between malnutrition 82 risk defined by the MNA (Mini Nutritional Assessment) and meal-related difficulties [6], [7] whereas 83 another study reported no association between weight loss in the previous year and disability in food 84 preparation and food purchasing [8]. It was also found that older people presenting 3 or more 85 different meal-related difficulties (combining tasks among meal preparation, food consumption, and 86 food shopping) had a lower nutrient intake [5], [9].

The lack of standardized operational definition of meal-related difficulties may also explain the discrepancies with these previous findings. More importantly, all of these studies are cross-sectional; it is thus currently unclear whether meal-related difficulties predict poor nutritional status. Indeed, malnutrition and meal-related difficulties may affect one another. Meal-related difficulties may 91 predispose people to weight loss by decreasing food intake. Losing weight can also lead to a decline
92 in strength, functional capacities, and autonomy in activities of daily living.

The objective of this study was to investigate longitudinally whether difficulties in meal-related activities can contribute to weight loss among older subjects, independently of physical and cognitive function. We sought 1) to identify factors associated with meal-related difficulties, defined as preparing meals and food shopping, and 2) to determine the association between meal-related difficulties and nutritional risk, determined by weight loss over the 3- year interval of study.

98 Methods

99 Study population

100 We used data from the Multidomain Alzheimer Preventive Trial (MAPT)[10], [11], a French multicenter, randomized, placebo-controlled trial (registration no.: NCT00672685). This trial was 101 102 designed to test the effect of polyunsaturated fatty acids (PUFAs) supplementation and a 103 multidomain intervention (physical activity, cognitive training, and nutritional advice) on cognitive 104 decline in older adults over 3 years, with four parallel groups (multidomain intervention with PUFA 105 supplementation; multidomain intervention with placebo; PUFA supplementation alone; and 106 placebo). The MAPT population included community-dwelling older adults aged 70 years and above, 107 recruited from 2008 to 2011, presenting at least 1 of the 3 following clinical criteria: (1) spontaneous 108 memory complaints, (2) limitation in one instrumental activity of daily living (IADL) [12], (3) slow gait 109 speed (≤ 0.8 m/s). People with diagnosed dementia, a Mini-Mental State Examination (MMSE) score 110 <24 [13], or any limitation in basic activities of daily living (ADL) [14] at baseline were not included in 111 the trial. Of 1,680 subjects participating in MAPT study, 149 were removed due missing data on 112 weight evolution, resulting in an analytic sample of 1531 subjects. The protocol was approved by the 113 by the French Ethical Committee in Toulouse (CPP SOOM II), France. Written informed consent was 114 obtained from all subjects.

115 Assessments

116 Cognitive, physical condition, and functional capacities were recorded at 0, 6, 12, 24 and 36 months 117 at the research center. Socio-demographic data measured at baseline included age, sex, and 118 education. Education level was classified into three categories: low (no diploma or primary school 119 certificate), medium (secondary education), and high (higher education). Cognitive status was 120 evaluated with the MMSE [13], a 30-item questionnaire developed to detect cognitive impairment in 121 older adults. Physical function was assessed with the Short Physical Performance Battery (SPPB), a 122 tool combining gait speed, chair stand, and balance tests [15]. Frailty status was defined using 5 123 components proposed by Fried [16]: weight loss (unintentional weight loss of more than 4.5 kg in the 124 previous year), exhaustion, low grip strength, slow gait speed, and low physical activity. Subjects 125 were categorized as non-frail (=0 criteria), pre-frail (=1 or 2 criteria), or frail (\geq 3 criteria). Depressive 126 symptoms were assessed using the 15-item Geriatric Depression Scale (GDS) [18]. To classify 127 nutritional status, BMI (Body Mass Index) was used, calculated as weight in kilograms divided by 128 height in square meters, with standing body height recorded to the nearest 1 cm. According to World 129 Health Organization (WHO) guidelines [19] and the French Guidelines for protein-energy malnutrition 130 in the elderly published by Haute Autorité de Santé (HAS) [17], subjects were classified as follows: 131 underweight (BMI<21 kg/m²), normal weight (BMI [21-25[kg/m²), overweight (BMI [25-30[kg/m²), 132 obesity (BMI \geq 30 kg/m²).

The dependent variable was weight loss occurring during the study follow-up. Body weight was measured every 6 months and recorded to the nearest 0.1 kg. Clinically relevant weight loss was defined as a decrease of \ge 5% or \ge 3 kg in body weight over 6-12 months [20]–[22].

The two independent variables were meal-related difficulties (for cooking and shopping). Questions about meal-related activities were self-reported using the Alzheimer's Disease Cooperative Study-Activities of Daily Living Prevention Instrument (ADCS ADL-PI) Scale [23]. ADCS ADL-PI is an inventory questionnaire targeting the earliest changes in ADL (Activities of Daily Living) in community-dwelling older adults. For each item, scoring was based on the following possible answers: no difficulties, as well as usual, with a little difficulty, with a lot of difficulty, do not do this activity. For statistical reasons (few people in some categories), responses to questions concerning meal-related difficulties were combined into two groups: having difficulty (a little or a lot difficulty) vs. having no difficulty. People declaring no participation in meal-related activities were classified as missing data. Each variable was analyzed separately.

146 Statistical analysis

Categorical variables are presented as frequencies (percentage) and continuous variables as medians 147 148 (interquartile range), due to the absence of a normal distribution. For bivariate analysis, the Chi² test 149 or Fisher's Exact test for categorical variables were used, in addition to the Mann-Whitney U test for 150 continuous variables. Meal-related difficulties were analyzed in separate models (preparing meals 151 and food shopping) to 1) study the different characteristics of people declaring difficulties compared 152 to people with no difficulty at baseline and at 36 months, and 2) determine impact of such difficulties 153 on weight loss. To this end, time-dependent Cox proportional hazards regressions with discrete times 154 (weight loss does not occur on a specific date but between 2 follow-up visits) were performed to 155 assess the association between the independent (i.e., declaring difficulties preparing meals or food 156 shopping) and dependent (i.e., subsequent weight loss) variables. Follow-up was performed on 157 patients until the first occurrence of the event (weight loss), or until the censor date (drop-out, 158 death, final endpoint). For the time-dependent covariates, we used the last available measurement 159 before the event. We presented the first bivariate associations between the dependent and each 160 independent variable (Model 1). Then, data was adjusted based on socio-demographic variables (sex, age, education) (Model 2), and subsequently based on Model 2 variables and time-dependent 161 variables (depressive symptoms, physical and cognitive status) (Model 3). Potential confounding 162 163 variables were selected due to their possible impact on older adults' ability to perform meal-related 164 activities, based on the literature [4]. Results are presented as hazard ratios (HRs) with 95%

165 confidence intervals (CIs) and *p*-values. All tests were two-tailed and statistical significance was set at

166 *p*<0.05. Analyses were performed using SAS (version 9.4) and STATA software (version 11.2).

Three sensitivity analyses were conducted to test the stability of our results: 1) classifying people who declared no participation in meal-related activities as declaring no difficulty (depending on visits, approximately 130-150 subjects for preparing meals and 20-30 subjects for shopping); 2) conducting our analyses separately for men and women, as they may operate differently in meal-related difficulties across sex[24], [25]; 3) excluding subjects declaring weight loss before baseline visit (70 subjects) to reduce the risk of reverse causality.

173 Results

174 The present analysis included 1531 subjects from the French MAPT cohort. Sociodemographic, 175 baseline functional and nutritional characteristics of subjects from MAPT are presented in Table 1. 176 Median age was 74 years (range 70–94 years at baseline visit). Approximately 64 % were women, 177 with nearly 30 % with a high education level. The majority of subjects had no physical or cognitive 178 impairment at baseline. According to Fried's criteria, less than 5 % of our population reported weight 179 loss of 4.5 kg or more prior to the study. Only 8 % were underweight and 16 % were obese. Weight 180 loss occurred in 261 subjects (17.1%) during the first year, 286 subjects (18.7%) the second year and 181 304 subjects (19.9%) the third year. In total, 851 subjects experienced at least 5% or 3 kg weight loss 182 during the study follow-up.

Table 2 displays the subjects' characteristics by each reported meal-related difficulties. During the 3year follow-up, 237 older subjects declared having difficulties meal preparation at least once, and 133 declared having difficulties shopping. People reporting difficulties preparing meals were more often women (p<0.005) and were 2 years elderly (p<0.001). At baseline and at the end of the study (3 years later), they had a lower BMI (baseline: p=0.015; 3 years: p=0.005), were more often frail and pre-frail (baseline: p=0.023; 3 years: p=0.000), had lower physical performance (baseline and 3 years: p<0.001), and displayed more depressive symptoms (baseline and 3 years: p<0.001). A lower 190 cognitive score was associated with difficulties preparing meals at the end of the study (*p*<0.001).

191 Similar characteristics were found for people declaring having difficulties shopping.

Table 3 includes the findings from time-dependent Cox proportional hazards regressions, conducted separately for each meal-related activity. The unadjusted results showed that older people experiencing difficulties preparing meals or shopping did not present a higher risk of weight loss in the following year, compared to subjects without meal-related difficulties. Results were found to be similar when analyses were adjusted based on socio-demographic factors, functional status, and depressive symptoms.

When subjects were separated by sex, we observed no significant effect on the final results, except a significant association between weight loss and difficulties preparing meals for men in the unadjusted analysis (p=0.049). However, the association was no longer statistically significant after adjusting for age and education (p=0.082) and other potential confounding factors (p=0.107).

202 Discussion

The present study showed that, despite an association with advanced age and health-related decline (lower cognitive and physical status, higher frailty risk, and depressive symptoms), neither difficulties preparing meals nor difficulties shopping are found to have an effect on weight loss among a sample of autonomous community-dwelling older people. To our knowledge, this is the first study addressing this nutritional risk factor with longitudinal follow-up of measured body weight.

Our results are consistent with a recent study [8], which found that weight loss is the only frailty component not associated with IADL disability in food purchasing and food preparation in 1643 community-dwelling people aged 65 years and older. Others studies showed contradictory results, examining nutritional risk using the MNA scale and diet quality [4]–[7]. Three hypotheses could be proposed. First, in the MAPT study, subjects were in good general health, so functional limitations are probably not important enough to affect meal-related activities. Indeed, most of the subjects declared having "little difficulty" and fewer "significant difficulty". Moreover, according to 215 longitudinal data, declared difficulties appear to be fluctuant for some subjects, which seems to 216 support the hypothesis that these difficulties could be minor and temporary. Then, despite declaring 217 difficulties, older subjects were able to utilize several coping strategies to maintain food intake. Many 218 strategies are described in qualitative and quantitative studies and include simplifying meals, 219 resorting to help from others, or requiring meal delivery, ready meal [26]-[30], which may permit 220 them to maintain dietary intake. It seems that nutritional status and meal patterns remain adequate 221 as long as older people received the support (help from caregivers, neighbors, or meal delivery) they 222 needed for cooking and shopping [31], [32]. Since formal or informal support was not measured in 223 our study, this may have confounded our findings. It is also possible that meal-related difficulties 224 affect quality but not quantity of food intake, as underlined by a previous study [30].

225 Some limitations should be considered when interpreting these findings. First, our population is 226 rather young, with a mean age of 74 years, and few people seemed concerned by difficulties with 227 meal-related activities. A study showed that median age of onset of disability is 73-77 years for 228 shopping, and 83-85 years for meal preparation, depending on sex [33]. Subjects may have access to 229 transportation (public or private) and therefore may not encounter any problems shopping. Second, 230 each meal-related difficulties was evaluated as a single item, extracted from a non-purposive scale, 231 giving an over-simplified view of difficulties preparing meals and shopping. Since we used self-report 232 measures, evaluation of difficulties is based on older people subjective perceptions, making it 233 possible that their answers do not reflect their real degree of difficulties. In addition, the item for 234 shopping was not specifically focused on food shopping. Nevertheless, daily shopping mainly includes 235 buying food. Meal-related activities are complex to evaluate and we have no standardized definition 236 or gold-standard measure. Moreover, we could not distinguish unintentional weight loss from 237 intentional weight loss. The present study's strengths should also be highlighted. The results were 238 obtained from a multicenter study that recruited a sample of subjects from different areas in France. 239 Furthermore, to our knowledge, this study is the first to focus on this subject with a longitudinal 240 approach, despite the magnitude of the meal-related difficulties reported by older people. We had access to several assessments of weight at 6-month intervals, which permitted us to closely monitor
weight loss over time.

243 This study suggests that, in a sample of autonomous older people, difficulties preparing meals and

shopping, despite being a common result of aging, have no effect on weight loss in older people.

245 Meal-related activities are affected in later life, with functional decline and depressive symptoms and

a need to be better monitored. Further work is needed to develop practical methods to assess meal-

247 related difficulties in the older population.

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- 359

361 **Table 1** Baseline characteristics in MAPT participants included in analysis (n=1531)

	n (%) or median [IQR]
Age (years), median [IQR]	74 [72-78]
Sex, Women	981 (64.08)
Education ##	
≤ Low*	332 (22.0)
Medium **	736 (48.9)
High ***	439 (29.1)
MMSE score, median [IQR], /30	28 [27-29]
GDS score, median [IQR], /30 ##	3 [1-4]
ADCS-ADL PI score, median [IQR], /45 ##	43 [41-45]
Frailty status ##	
Robust	715 (49.3)
Pre-frail	703 (48.4)
Frail	33 (2.3)
SPPB score, median [IQR], /12 ##	11 [10-12]
BMI, kg/m² ##	
BMI < 21	125 (8.2)
BMI 21 – 25	517 (33.9)
BMI 25-30	638 (41.8)
BMI ≥ 30	247(16.2)
Unintentional weight loss \geq 4.5 kg before	70 (4.8)

study (according Fried's criteria)

362 Missing data (24 for education, 7 for GDS, 12 for ADCS-ADL PI, 30 for SPPB, 80 for frailty status, 4 for BMI)

363 ^{##} n, Number; IQR, Inter Quartile Range; MMSE, Mini-Mental State Examination; GDS: Geriatric Depression

364 Scale; ADCS-ADL PI: Alzheimer Disease Cooperative Study-Activities of Daily Living Prevention Instrument;

365 SPPB: Short Physical Performance Battery; BMI: Body Mass Index.

366 * Low: no diploma or primary school certificate, ** Medium: Secondary education, *** High: Higher education

 Table 2: Characteristics of subjects declaring meal-related difficulties at baseline and at 3 years (n=1531).

	Pre	eparing meals		Shopping			
	No difficulty	Difficulty	<i>p</i> -value	No difficulty	Difficulty	<i>p</i> -value	
	n=1,294	n= 237		n=1,398	n=133		
Sex							
Women	810 (62.60)	171 (72.15)	0.005 1	900 (64.38)	81 (60.90)	0.425 ¹	
Men	484 (37.40)	66 (27.85)		498 (35.62)	52 (39.10)		
Age (years), median [IQR]	72[71-78]	74 [72-80]	<0.001 ²	74 [72-78]	76 [72-80]	<0.001 ²	
Education							
≤ Low*	275 (21.64)	57 (24.15)	0.220 ¹	299 (21.73)	33 (25.19)	0.657 ¹	
Medium **	633 (49.80)	103 (43.64)		675 (49.06)	61 (46.56)		
High ***	363 (28.56)	76 (32.20)		402 (29.22)	37 (28.24)		
BMI, kg/m²							
Baseline							
BMI < 21	96 (7.44)	29 (12.24)	0.015 ¹	111 (7.96)	14 (10.61)	0.320 ¹	
BMI 21 – 25	427 (33.10)	90 (37.97)		470 (33.69)	47 (35.61)		
BMI 25-30	555 (43.02)	83 (35.02)		592 (42.44)	46 (34.85)		
BMI ≥ 30	212 (16.43)	35 (14.77)		222(15.91)	25 (18.94)		

At 3 years (M36)

BMI < 21	74 (6.92)	29 (13.88)	0.005 ¹	87 (7.44)	16 (14.81)	0.023 ¹
BMI 21 – 25	346 (32.37)	71 (33.97)		387 (33.08)	30 (27.78)	
BMI 25-30	469 (43.87)	78 (37.32)		507 (43.33)	40 (37.04)	
BMI ≥ 30	180 (16.84)	31 (14.83)		189 (16.15)	22 (20.37)	
MMSE score, mean (±SD), /30						
Baseline	28.1 ± 1.6	27.9 ± 1.7	0.0697 ²	28.1 ± 1.6	27.8 ± 1.7	0.022 ²
At 3 years (M36)	28.1 ± 1.9	27.4 ± 2.2	<0.001 ²	28.0 ± 1.9	27.3 ± 2.3	0.005 ²
GDS score, median [IQR], /30						
Baseline	3 [1,4]	4 [1,6]	<0.001 ²	3 [1,4]	3 [2,6]	<0.001 ²
At 3 years (M36)	2 [1,4]	4 [2,7]	<0.001 ²	2 [1,5]	5 [3,8]	<0.001 ²
Frailty status						
Baseline						
Robust	624 (50.77)	91 (40.99)	0.023 ¹	673 (50.79)	42 (33.33)	0.000 1
Pre-frail	579 (47.11)	124 (55.86)		626 (47.25)	77 (61.11)	
Frail	26 (2.12)	7 (3.15)		26 (1.96)	7 (5.56)	
3 years (M36)						
Robust	349 (37.21)	50 (27.03)	0.000 1	373 (36.43)	26 (26.26)	0.086 ³

Pre-frail	559 (59.59)	1118 (63.78)		610 (59.57)	67 (67.68)	
Frail	30 (3.20)	17 (9.19)		41 (4.00)	6 (6.06)	
SPPB score , median [IQR], /12						
Baseline	11 [10,12]	11 [9,12]	<0.001 ²	11 [10,12]	10 [9,12]	<0.001 ²
3 years (M36)	11 [10,12]	10 [9,12]	<0.001 ²	11 [10,12]	10 [9,12]	<0.001 ²
Randomization group						
Ctrl +/ - Omega 3	648 (50.08)	117 (49.37)	0.841 ¹	704 (50.36)	61 (45.86)	0.322 ¹
MD +/- Omega 3	646 (49.92)	120 (50.63)		694 (49.64)	72 (54.14)	

¹Chi 2 test, ²Man-Whitney Wilcoxon test, ³ Fisher's Exact test

n, Number; IQR, Inter Quartile Range; MMSE, Mini-Mental State Examination; GDS: Geriatric Depression Scale; ADCS-ADL PI: Alzheimer Disease Cooperative Study-Activities of Daily Living Prevention Instrument; SPPB: Short Physical Performance Battery; BMI, Body Mass Index; Ctrl, Control group; group with or without omega-3 supplementation; MD, multidomain intervention group with or without omega-3 supplementation.

* Low: no diploma or primary school certificate, ** Medium: secondary education, *** High: highereducation

Table 3: Time-dependent associations between perceived difficulties cooking and shopping and subsequent weight loss (≥3 kg or 5%) over 3-year follow-up, in 1531 older subjects from the MAPT Study.

		Difficulties cooking		Difficulties shopping			
	HR	95% CI	<i>p</i> -value	HR	95% CI	<i>p</i> -value	
Model 1	1.252	(0.904–1.734)	0.177	0.762	(0.436– 1.332)	0.340	
Model 2	1.246	(0.896 – 1.732)	0.191	0.743	(0.424 – 1.303)	0.301	
Model 3	1.189	(0.847-1.668)	0.316	0.671	(0.380-1.16)	0.170	

HR, Hazard Ratio, CI, Confidence Intervals

Stable weight or gained weight were used as the reference category

Model 1 was unadjusted.

Model 2 was adjusted for socio-demographic characteristics: age, sex, and education.

Model 3 was additionally adjusted for time-dependent variables: depressive symptoms (GDS), physical (SPPB) and cognitive (MMSE) status.