

1 **The healthy Nordic diet and Mediterranean diet and incidence of disability 10 years later in**
2 **home-dwelling old adults**

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28 **Key words:** disability, Nordic diet, Mediterranean diet, mobility limitation, ageing

29 **Running title:** Healthy diet and disability

30 **Word, reference, tables: the abstract 257, main text 2992, references 41, tables 3, appendix**
31 **table 1.**

32

33 **Acknowledgements**

34 This work was supported by grants from Academy of Finland, Finska Läkaresällskapet, Samfundet
35 Folkhälsan, Juho Vainio Foundation, Signe and Ane Gyllenberg Foundation, Yrjö Jahnesson
36 Foundation, Diabetes Research Foundation, Finnish Foundation for Cardiovascular Research. EU
37 H2020-PHC-2014-DynaHealth grant no. 633595. The Academy of Finland supported MBvB (grant
38 no. 257239); EK (grants no. 127437, 129306, 130326, 134791 and 263924), and JGE (grants no.
39 129369, 129907, 135072, 129255 and 126775).

40

41 **Conflict of interest**

42 None.

43

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45 **home-dwelling old adults**

46

47 **Abstract**

48 **Background/Objective:** Diet has a major impact on a person's health. However, limited
49 information exists on the long-term role of the whole diet on disability. We investigated the
50 association of the healthy Nordic diet and the Mediterranean diet with incident disability 10 years
51 later.

52 **Design:** Longitudinal, with a follow-up of 10 years.

53 **Settings/Participants:** A total of 962 home-dwelling men and women from the Helsinki Birth
54 Cohort Study, mean age 61.6 y, who were free of disability at baseline.

55 **Measurements:** At baseline, 2001-2004, the Nordic diet score (NDS) and modified Mediterranean
56 diet score (mMDS) were calculated using a validated 128-item food-frequency questionnaire.
57 Higher scores indicated better adherence to the diet. Participants' incident disability was assessed
58 during 2011-2013 by a self-reported questionnaire and was based on mobility limitations and
59 difficulties to perform self-care activities. Analyses were performed using logistic regression and
60 adjusted for potential confounding factors.

61 **Results:** In total, 94 participants (9.8%) developed mobility limitations and 45 participants (4.7%)
62 developed difficulties in self-care activities during 10 year follow-up. The likelihood of having
63 mobility limitations (odds ratio (OR) 0.42, 95% confidence interval (CI) 0.22–0.80) and difficulties
64 in self-care activities (OR 0.38, 95% CI 0.15–0.94) were lower among those in the highest NDS
65 tertile than among those in the lowest NDS tertile. Greater mMDS was associated with a lower
66 disability incidence; however, the association was not statistically significant.

67 **Conclusions/Implications:** Adherence to the healthy Nordic diet predicts 10-year incidence of
68 mobility limitations and difficulties to perform self-care activities in old age and may thus be
69 protective against disability in Nordic population.

70 **Introduction**

71 World Health Organization identifies disability in old individuals as people's difficulty to
72 participate in daily activities or activities that are necessary for independent living and integration in
73 their environment. ⁽¹⁾ There are several domains of disability, such as mobility limitations and
74 difficulties in activities of daily living (ADL) or instrumental activities of daily living (IADL) that
75 are essential for independent life. Studies have shown that mobility limitation is a strong predictor
76 of ADL and IADL disability. ⁽²⁾ It has been estimated that 8–35% of individuals 65 years old or
77 older have mobility limitations or difficulties in performing ADL tasks. ⁽²⁻⁴⁾ Mobility limitations
78 and difficulties to perform self-care activities increase the risk for hospitalization, nursing home
79 admission and are strong predictors of mortality. ^(5, 6) Therefore, it is important to understand the
80 processes that cause the progression of disability in order to develop strategies to prevent or delay
81 disability.

82

83 Poor health and physical performance, smoking as well as cognitive impairment are well known
84 risk factors for disability. ^(2, 7) Diet is also a potential modifiable factor affecting disability.
85 Observational studies have shown associations between low circulating levels of carotenoids and
86 vitamin D and B12 ^(8, 9) as well as low intakes of single antioxidant nutrients, fruits and vegetables
87 ^(10, 11) and mobility limitations and ADL. However, despite the previously described studies
88 concerning single dietary factors and disability, the role of the whole diet in disablement process is
89 still mostly unknown. A few studies have shown that adherence to Healthy Eating Index ^(12, 13) and
90 Japanese diet ⁽¹⁴⁾ are related to a lower likelihood of mobility limitations. In addition, Mediterranean
91 diet has been shown to decrease the risk of disability and slow the decline of mobility and walking
92 speed. ⁽¹⁵⁻¹⁸⁾ We have recently observed a positive relationship between the healthy Nordic diet and
93 overall physical performance and muscle strength. ^(19, 20) However, no studies exist in which the
94 association of the healthy Nordic diet with incidence of disability has been examined. In addition,
95 previous studies have not been investigated and compared different diet scores in the same cohort
96 with respect to incidence of disability. Investigating different diet scores may help in identifying
97 which diet is appropriate for population concerned. Therefore, we investigated whether two diet
98 scores, the Nordic diet and the modified Mediterranean diet scores, predicts mobility limitations and
99 difficulties to perform self-care activities 10 years later in initially healthy home-dwelling men and
100 women aged 61 years on average at baseline.

101

102 **Methods**

103 *Design and Study Population*

104 The subjects in this study belong to the Helsinki Birth Cohort Study which originally included 4630
105 men and 4130 women who were born as singletons at Helsinki University Central Hospital between
106 1934 and 1944. ⁽²¹⁾ A random sample of 2 902 individuals were invited to participate in a clinical
107 examination conducted between 2001 and 2004. Of these, 2003 men (n = 928) and women (n =
108 1075) participated in the examination. From 2011–2013, 1404 subjects were still traceable. Of
109 these, 1094 participants (478 men and 616 women) attended a clinical examination between 2011
110 and 2013. ⁽¹⁹⁾ Those who participated in the follow-up clinical examination had lower rates of
111 mobility limitations (6.2% v. 16.6%) and difficulties in self-care activities (4.6% v. 12.1%) at
112 baseline compared to those who did not participate. Participants who had adequate data on diet and
113 disability, and were free of disability at baseline were included in this study (n = 962).

114
115 This study was conducted according to the guidelines laid down in the Declaration of Helsinki and
116 all procedures involving human subjects were approved by the Ethics Committee of the Helsinki
117 and Uusimaa Hospital District. Written informed consent was obtained from all subjects.

118 119 *Dietary Assessment*

120 At the baseline clinical examination, diet was assessed by a validated, self-administered, 128-item
121 food-frequency questionnaire (FFQ). ^(22, 23) Participants were asked how often, on average, they
122 consumed each food item in the past year. The frequency responses ranged from “never or seldom”
123 to “at least six times a day”. The portion size was fixed for each food item or mixed dish (e.g. slice
124 and glass) based on the national Findiet Study and present the most commonly used portion sizes in
125 Finland. At the clinic, a research nurse checked the FFQ. The final decision regarding the
126 completeness of the FFQ was made by a nutritionist. Exclusions were made due to incompletely
127 filled FFQ and daily energy intake cut-off points corresponding to 0.5% at both ends of the daily
128 energy intake distributions for men and women. ⁽²⁴⁾ The average daily intakes of nutrients and foods
129 were calculated with the national food composition database Fineli®.

130
131 Details of the Nordic diet score (NDS), which is also known as the Baltic Sea diet score, and the
132 modified Mediterranean diet score (mMDS) are described in detail elsewhere. ^(25, 26) Briefly, the
133 NDS is based on 9 components. Favourable food components (Nordic vegetables (excluding
134 potatoes), Nordic fruits, Nordic cereals, fish, a ratio of polyunsaturated fatty acids to saturated and
135 trans-fatty acids, and low-fat milk) were assigned values of 0–3 according to ascending sex-specific
136 quartile ranks, and unfavourable food components (red and processed meat, and intake of total fat)
137 were assigned values of 0–3 according to descending sex-specific quartile ranks. In addition, men

138 consuming ≤ 20 g/day and women consuming ≤ 10 g/day of alcohol received 1 point; otherwise, a 0
139 point was given. The mMDS is based on 9 components. For vegetables (excluding potatoes), fruit
140 and nuts, cereals, legumes, fish and fish products, and the ratio of monounsaturated and
141 polyunsaturated to saturated fat, 1 point was given if intake was above the sex-specific median, 0
142 otherwise. For meat and dairy products, 1 point was given if intake was below the sex-specific
143 median, 0 otherwise. For alcohol, 1 point was given if intake was between 10–50 g/day in men and
144 5–25 g/day in women; otherwise, a 0 point was given. The NDS ranged from 0–25 and the mMDS
145 from 0–9.

146

147 *Disability*

148 Disability was assessed with the Finnish validated version of the RAND 36-Item Health Survey 1.0
149 (Short Form 36 [SF-36])⁽²⁷⁾ at baseline and follow-up clinical examination. The question on
150 difficulties in walking 500 m was used to assess mobility limitations and difficulties to perform
151 self-care activities was assessed with questions on difficulties in dressing or bathing. Response
152 categories were: no difficulties; little difficulties; many difficulties. Participants were considered to
153 have mobility limitations if they reported any difficulties in walking 500 m and difficulties to
154 perform self-care activities if they reported any difficulties in dressing and/or bathing.

155

156 For comparing whether self-reported mobility limitations is valid and identify those with worse
157 physical performance, participants' physical performance was tested at follow-up clinical
158 examination with the validated Senior Fitness Test⁽²⁸⁾ and total score was calculated as described
159 earlier.⁽¹⁹⁾

160

161 *Covariates*

162 During the baseline clinical examination, height was measured to the nearest 0.1 cm and weight to
163 0.1 kg. BMI was calculated as weight (in kg) divided by height (in m²). At the baseline clinical
164 examinations, the level of educational attainment (elementary school; vocational school; senior high
165 school and college; university degree), smoking status (never; former; current), presence of main
166 chronic diseases (cancer; cerebrovascular disease; hypertension; diabetes) were asked using
167 questionnaire. Energy intake was measured with an FFQ as an average intake (in MJ per day).
168 Participants' physical activity over the previous 12 months was assessed using a validated exercise
169 questionnaire.⁽²⁹⁾ Depressive symptoms were assessed using the Beck depression inventory (BDI)
170⁽³⁰⁾, and participants with score ≥ 10 were classified as having at least mild depression. Cognitive

171 status was assessed by Mini-Mental State Examination (MMSE) ⁽³¹⁾ score (0-30) during 2009-2011,
172 and participants with a score <24 were classified as having impaired cognition.

173

174 *Statistical Methods*

175 There were no significant interactions for the healthy diet and sex on disability, therefore, men and
176 women were analysed together. Descriptive characteristics were reported as mean (standard
177 deviation), proportions, or median (interquartile ranges) values, and the differences of baseline
178 characteristics across tertiles were tested with one-way ANOVA or Chi-square test. The association
179 between tertiles of NDS and mMDS and likelihood of having mobility limitations or difficulties to
180 perform self-care activities were examined by logistic regression models. The relationships between
181 each of the NDS and mMDS components and self-reported disability were also examined using
182 logistic regression models. Model 1 was adjusted for age and sex. To investigate whether diet was
183 independently related to disability, the Model 2 was further adjusted for potential confounding
184 factors related to disability or diet: BMI, physical activity, smoking status, educational attainment,
185 energy intake, and presence of chronic diseases and depression. ^(2, 32, 33) Model 3 was further
186 adjusted for cognitive status and included only those participants whose MMSE test result was
187 available (n=832). All statistical analyses were done using the SPSS Statistics version 23 for
188 Windows® (SPSS Inc., Chicago, IL, USA). Significance was defined as P<.05.

189

190 **Results**

191 The basic characteristics of the study population for men (n=439) and women (n=523) are seen in
192 **Table 1** and daily intakes of NDS and mMDS components in **Appendix Table 1**. The correlation
193 between NDS and mMDS was 0.56 (P<.001). Incident mobility limitation was more common than
194 self-care dependence. During a 10-year follow-up, 94 participants (9.8%) developed mobility
195 limitations and 45 participants (4.7%) developed difficulties to perform self-care activities. Senior
196 Fitness Test total score was significantly smaller among those with mobility limitations (32.9
197 points, SD 15.1) than those with no limitations (47.9 points, SD 16.6).

198

199 After adjusting for age, BMI, educational attainment, physical activity, smoking status, energy
200 intake, and the presence of chronic disease and depression the likelihood of having difficulties to
201 walk 500 m were lower among those in the highest NDS tertile than among those in the lowest
202 NDS tertile (odds ratio (OR) 0.42, 95% confidence interval (CI) 0.22– 0.80) (**Table 2**). In addition,
203 individuals with the highest adherence to a healthy Nordic diet at baseline had lower likelihood of
204 developing difficulties to perform self-care activities compared with those with the lowest

205 adherence (OR 0.38, 95% CI 0.15–0.94). In total, 832 participants had completed MMSE test
206 results. Including cognitive status to the model, the likelihood of having disability were lower
207 among those with high NDS, however, only the association between the NDS and mobility
208 limitations remained significant.

209

210 After adjusting for age and sex the likelihood of having mobility limitation (OR 0.65, 95% CI 0.35–
211 1.22) and difficulties to perform self-care activities (OR 0.59, 95% CI 0.26–1.35) was lower among
212 those who had the highest mMDS compared to those who had the lowest mMDS, however, the
213 associations did not reach statistical significance (**Table 2**). Adjusting for further potential
214 confounders did not have a major effect on the results.

215

216 When investigating the associations between NDS and mMDS components and disability, we found
217 statistical significant associations of greater intake of fat and smaller intake of cereals with
218 increased likelihood of having difficulties to perform self-care activities (**Table 3**). Greater intake of
219 alcohol was significantly related to lower likelihood of having mobility limitations.

220

221 **Discussion**

222 In our study of 962 home-dwelling ageing men and women, we observed that the healthy Nordic
223 diet is a strong predictor of two states of disability; mobility limitations and difficulties to perform
224 self-care activities, even after adjusting for potential confounding factors including physical
225 activity, chronic diseases and depression. Adherence to the Mediterranean diet was also related to
226 lower likelihood of being disabled, however, the association was not statistically significant. To our
227 knowledge, there are no previous studies that have compared different healthy diets within the same
228 cohort for disability outcomes. Our findings extend the relevance of a healthy diet to target mobility
229 limitations and difficulties to perform self-care activities and support the importance of diet in the
230 pathogenesis of disability in old age.

231

232 Our results support the previous findings in which the protective effect of healthy diet, including the
233 Healthy Eating Index, Japanese diet and Mediterranean diet, on disability has been observed.⁽¹²⁻¹⁶⁾
234 Even though these diets vary in food and nutrient components, they all capture essential elements of
235 a high-quality diet including high consumption of fruits, vegetables, and fish and low consumption
236 of red and processed meat. When we investigated single food components of NDS and mMDS, we
237 observed that only intake of fat, alcohol and cereals were related to disability. Based on our results,
238 we suggest that the whole diet is a stronger predictor of disability in old age than single foods or

239 nutrients. Therefore, the findings in our study extend the previous results and suggest that healthy
240 diet, which include high amounts of fruit, vegetables, and fish, moderate intake of alcohol, and
241 small amounts of red meat and fat, help to prevent disability in old age.

242

243 Even though the healthy Nordic and Mediterranean diet were related to lower likelihood of
244 disability, only the association of healthy Nordic diet with disability was significant. The healthy
245 Nordic diet contains locally grown healthy Nordic foods whereas the widely investigated
246 Mediterranean diet contains foods familiar in the Mediterranean area such as seeds, nuts and olive
247 oil. Therefore, adherence to the healthy Nordic diet may be easier in Nordic population. The major
248 difference between these diets is that dairy products are beneficial in the NDS, whereas they are
249 detrimental in the mMDS. In addition, as these diet scores are based on study specific cut-offs for
250 each food components, the absolute intake of each component may differ between studies even
251 though diet scores are identical. Indeed, we observed that the median consumption of food
252 components included in the mMDS, such as fruits and vegetables, were in part lower than observed
253 in previous studies ^(15, 18), suggesting that the diet of our study population is not as healthy than in
254 the Mediterranean area. Furthermore, it should be noted that there are several different versions of
255 Mediterranean diet score, which make it difficult to compare the results. Moreover, the range of the
256 MDS is much smaller (0-9) compared to the NDS (0-25) which may limit the statistical power.
257 Therefore, we propose that these could partly explain why we did not observe as strong associations
258 between Mediterranean diet and disability as with healthy Nordic diet.

259

260 Strong evidence exist that mobility limitations are the results of physical impairments, such as
261 decreased muscle strength ^(34, 35). Several diseases and changes in body homeostasis also affect
262 muscle strength and thus mobility. Previously, it has been demonstrated that adherence to the
263 healthy Nordic and Mediterranean diet predicts greater muscle strength and thus better overall
264 physical performance. ^(16, 18-20) In addition, both of these diets have been found to be associated with
265 a lower risk of several diseases, such as diabetes and cardiovascular disease, and changes in body
266 homeostasis including insulin resistance and inflammation. ⁽³⁶⁻³⁹⁾ Therefore, we suggest that
267 plausible explanations for the observed associations between the healthy diet and disability are
268 multifactorial, including beneficial effects of diet on muscle strength and on risk factors of chronic
269 diseases. In addition, adherence to the healthy diet may also be linked with overall healthy lifestyles
270 practices including increased physical activity, which associates with disability.

271

272 A significant strength of our study is its longitudinal study design that provides opportunity to
273 investigate long-term influences of diet on disability. In addition, our study included a large study
274 population consisting of both men and women. A further strength of our study is that we measured
275 two states of disability; difficulties to perform self-care activities, which is more serious and
276 mobility limitations, which are more common. Our study also has some limitations as discussed
277 earlier.⁽²⁰⁾ Firstly, we adjusted for a multitude of covariates, including physical activity,
278 socioeconomic status and chronic diseases; however, potential unmeasured and residual
279 confounding cannot be excluded. Secondly, diet was measured by a validated FFQ^(22, 23) only at
280 baseline; therefore changes in the diet were not captured. Thirdly, the disability status of
281 participants was self-reported, which may cause misclassification of disability status.⁽³⁾ However, it
282 has been shown that self-reported difficulties in walking reflect people's physical performance
283 status and is able to identify those with worse physical performance.^(40, 41) Therefore, it is valid and
284 has clinical significance. We also observed that those who reported mobility limitations had
285 significantly poorer physical performance than those with no limitations. In addition, we measured
286 only one of the ADL components, difficulty to bath and dress, which may underestimate the
287 difficulties in self-care activities. However, difficulty to bath is the most common ADL disability
288 and it represents the first ADL in which most persons become disabled. Therefore, we suggest that
289 it is a good indicator of ADL. Further, as reported earlier, those individuals who participated in the
290 follow-up clinical examination had lower rates of disability, were younger, thinner, more educated,
291 and had healthier diet at baseline compared with those who did not participate.⁽¹⁹⁾ Those with
292 unhealthy lifestyle habits may have died at earlier ages or developed disability and were, therefore,
293 excluded from the study. Selective survival may thus have influenced the association between the
294 healthy diet and disability. In addition, the incidence of disability was low during a 10-year follow-
295 up which may limit the statistical power. Thus, participants may not be fully representative of all
296 older people living in Finland.

297

298 **Conclusions**

299 Our study indicates that adherence to the healthy Nordic diet decreased the likelihood of mobility
300 limitations and difficulties to perform self-care activities in old age. In addition, Mediterranean diet
301 may also have a beneficial impact on disability. Our results may have important clinical
302 implications. As disability is common among older age and restricts a person's independence as
303 well as affects overall health, it is important try to prevent dis ability. Our results indicates that
304 adherence to healthy diet provide one opportunity to prevent or delay disability. In addition, it is
305 well known that adherence to healthy diet has several other health benefits as well. Therefore,

306 adhering to a healthy diet may have major beneficial effect on people's health. However, future
307 intervention studies as well as longitudinal studies, that compare different diet scores with incidence
308 of disability, are critically needed.
309

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416 **Table 1.** Characteristics of the subjects by adherence to the diet score tertile

	Nordic diet score							modified Mediterranean diet score						
	Low (0-11)		Middle (12-15)		High (16-25)		P	Low (0-3)		Middle (4-5)		High (6-9)		P
n (men %)	366	(48.4)	308	(42.2)	288	(45.8)	.28	284	(45.8)	423	(44.7)	255	(47.1)	.83
Age (years) *	61.0	2.7	61.3	2.8	61.4	2.7	.25	61.3	2.9	61.2	2.8	61.2	2.5	.81
Body mass index (kg/m ²) *	26.9	3.9	26.9	3.8	26.9	4.0	.97	27.0	3.8	26.9	3.9	26.7	3.9	.60
Current smokers (%) *,†	26.6		16.3		10.2		<.001	25.0		17.7		11.9		.003
University degree (%) *	22.2		27.0		29.5		.28	21.8		25.1		31.8		.015
Physical activity (MET h/week) *	34.9	23.4	38.7	29.0	42.1	24.3	<.001	36.5	26.4	36.8	23.8	42.9	27.6	.004
Energy intake (MJ) *	8.5	2.9	9.4	3.3	10.0	3.1	<.001	8.1	2.7	9.2	3.1	10.5	3.4	<.001
Chronic diseases (%) *,‡	37.5		41.0		41.3		.50	38.4		40.1		40.8		.34
Depressed (%) *,§	14.9		11.4		14.4		.36	12.0		15.9		11.8		.20
Impaired cognition (%) *	2.3		3.2		1.6		.47	2.5		2.4		2.3		.99
Mobility limitations (%)	12.3		10.7		5.6		.013	9.9		11.6		6.7		.11
Self-care dependence (%) ,¶	5.7		5.5		2.4		.097	6.0		4.5		3.5		.39

417 MET, metabolic equivalent.

418 Data are expressed as mean values (with standard deviations) for continuous values or percentages for categorical values. The differences
 419 between the diet score groups were tested with one-way ANOVA for continuous variables and Chi-square test for categorical variables.

420 * At baseline clinical examination.

421 † Smoking one or more cigarettes per day.

- 422 ‡ Presence of at least 1 chronic disease.
- 423 § Having at least mild depression.
- 424 || At follow-up clinical examination.
- 425 ¶ Difficulties to perform self-care activities.
- 426

427 **Table 2.** Odds ratios of mobility limitations and difficulties to perform self-care activities
 428 over 10-year follow-up for baseline adherence to Nordic and Mediterranean diet among
 429 Helsinki Birth Cohort Study participants (n=962)

	Model 1 *			Model 2 †			Model 3 ‡		
	OR	95% CI	P §	OR	95% CI	P §	OR	95% CI	P §
Mobility limitations									
NDS tertiles									
Low	Ref.			Ref.			Ref.		
Middle	0.86	0.54–1.39		0.88	0.53–1.48		0.81	0.46–1.40	
High	0.42	0.23–0.76	.005	0.42	0.22–0.80	.010	0.42	0.21–0.84	.014
mMDS tertiles									
Low	Ref.			Ref.			Ref.		
Middle	1.21	0.74–1.97		1.15	0.68–1.98		1.15	0.65–2.01	
High	0.65	0.35–1.22	.12	0.69	0.34–1.37	.26	0.61	0.28–1.30	.16
Difficulties to perform self-care activities									
NDS tertiles									
Low	Ref.			Ref.			Ref.		
Middle	0.92	0.47–1.78		0.89	0.45–1.79		0.87	0.41–1.86	
High	0.39	0.16–0.93	.039	0.38	0.15–0.94	.039	0.45	0.17–1.16	.087
mMDS tertiles									
Low	Ref.			Ref.			Ref.		
Middle	0.75	0.38–1.47		0.60	0.30–1.23		0.60	0.28–1.27	
High	0.59	0.26–1.35	.21	0.51	0.21–1.25	.17	0.45	0.17–1.21	.12

430 OR, odds ratio; CI, confidence interval; NDS, Nordic diet score; mMDS, modified

431 Mediterranean diet score; Ref., referent value.

432 * Model 1, adjusted for sex and age.

433 † Model 2, adjusted for Model 1 plus body mass index, educational attainment, smoking
 434 status, physical activity, energy intake, presence of chronic diseases and depression.

435 ‡ Model 3, adjusted for Model 2 plus impaired cognitive function (n=832).

436 § P for a linear trend.

437

438 **Table 3.** Association between sex specific tertiles of Nordic and Mediterranean diet score components and risk of mobility limitations and
 439 difficulties to perform self-care activities during a 10 year follow-up of old adults (n=962) *

Component (g/d)	Mobility limitations					Difficulties in self-care activities				
	1	2	3	1	2	3	1	2	3	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
NDS component										
Nordic vegetables	Ref.	0.95	0.53–1.70	0.76	0.39–1.47	Ref.	0.64	0.28–1.47	0.99	0.42–2.35
Nordic fruits	Ref.	0.94	0.52–1.71	0.94	0.49–1.78	Ref.	1.26	0.56–2.82	1.30	0.53–3.21
Nordic cereals	Ref.	0.62	0.34–1.12	0.77	0.42–1.44	Ref.	0.91	0.42–1.97	0.64	0.27–1.50
Fat intake (E%)	Ref.	2.12	1.11–4.05	1.93	0.94–3.97	Ref.	3.52	1.21–10.24	4.13	1.33–12.84 †
Fat ratio ‡	Ref.	1.03	0.57–1.88	1.14	0.60–2.18	Ref.	0.98	0.45–2.13	0.65	0.26–1.62
Low-fat milk	Ref.	1.80	1.02–3.20	1.03	0.54–1.94	Ref.	2.36	1.02–5.45	1.59	0.63–4.00
Fish	Ref.	1.00	0.57–1.76	0.74	0.38–1.47	Ref.	0.50	0.22–1.16	0.68	0.28–1.65
Red meat	Ref.	1.16	0.62–2.16	1.09	0.54–2.19	Ref.	2.58	1.01–6.60	1.28	0.44–3.72
Alcohol §	Ref.	0.77	0.45–1.35	0.48	0.25–0.91 †	Ref.	1.21	0.54–2.70	1.02	0.42–2.45
mMDS component										
All vegetables	Ref.	0.53	0.29–0.98	0.80	0.42–1.51	Ref.	0.46	0.18–1.17	1.82	0.79–4.19
All fruits and nuts	Ref.	0.71	0.39–1.30	0.55	0.29–1.05	Ref.	1.38	0.61–3.15	0.88	0.36–2.15
All cereals	Ref.	0.66	0.35–1.25	0.74	0.36–1.49	Ref.	0.54	0.24–1.22	0.26	0.09–0.73 †

Legumes	Ref.	0.58	0.32–1.07	0.94	0.52–1.70	Ref.	1.21	0.56–2.60	0.59	0.24–1.43
All dairy products	Ref.	0.78	0.43–1.42	0.81	0.44–1.50	Ref.	1.11	0.48–2.53	1.07	0.46–2.49
Fat ratio ‖	Ref.	0.74	0.40–1.36	0.99	0.53–1.87	Ref.	0.63	0.28–1.41	0.49	0.20–1.21
Fish ¶¶	Ref.	1.76	0.99–3.10	0.94	0.48–1.86	Ref.	1.10	0.50–2.41	0.91	0.36–2.25
Meat **	Ref.	1.31	0.71–2.43	1.13	0.56–2.27	Ref.	3.11	1.24–7.78	2.29	0.80–6.61
Alcohol §	Ref.	0.74	0.43–1.28	0.45	0.24–0.85 †	Ref.	1.14	0.52–2.50	0.78	0.33–1.85

440 OR, odds ratio; CI, confidence interval; NDS, Nordic diet score; mMDS, modified Mediterranean diet score; Ref., referent value.

441 * Adjusted for sex, age, body mass index, educational attainment, smoking status, physical activity, energy intake, presence of chronic diseases
442 and depression, and mutually adjusted for the diet score components.

443 † P for a linear trend <.05.

444 ‡ A ratio of polyunsaturated fatty acids to saturated and trans-fatty acids.

445 § Both diet scores included alcohol, calculated as 100% ethanol.

446 ‖ A ratio of unsaturated fatty acids to saturated fatty acids.

447 ¶¶ All fish and fish products.

448 ** All meat and meat products.

449

450 **Appendix Table 1.** Daily intakes of healthy Nordic diet score and modified Mediterranean
 451 diet score components by sex in 962 Helsinki Birth Cohort Study participants

Component (g/day)	Men	Women	452 453
NDS component			454
Nordic vegetables	179 (121, 268)	231 (160, 331)	455
Nordic fruits	84 (30, 161)	116 (58, 207)	456
Nordic cereals	58 (31, 81)	54 (30, 75)	457
Fat intake (E%)	33 (29, 36)	32 (29, 36)	458
Fat ratio *	0.4 (0.4, 0.5)	0.4 (0.3, 0.5)	459
Low-fat milk	153 (13, 412)	86 (11, 221)	460
Fish	45 (29, 64)	33 (21, 45)	461
Red and processed meat	128 (87, 178)	80 (54, 119)	462
Alcohol †	11 (4, 19)	3 (2, 7)	463 464
mMDS component			465
All vegetables	217 (149, 324)	275 (191, 392)	466
All fruits and nuts	206 (93, 331)	263 (147, 428)	467
All cereals	151 (108, 198)	131 (97, 164)	468
Legumes	9 (4, 14)	8 (4, 12)	469
All dairy products	394 (250, 695)	442 (270, 652)	470
Fat ratio ‡	1.4 (1.2, 1.6)	1.4 (1.1, 1.6)	471
Fish and fish products	53 (36, 77)	39 (25, 53)	472
All meat and meat products	168 (114, 222)	117 (82, 162)	473
Alcohol †	11 (4, 19)	3 (2, 7)	474 475

476 NDS, Nordic diet score; E%, percent of energy intake, mMDS, modified Mediterranean diet
 477 score. Values are medians (interquartile ranges).

478 * A ratio of polyunsaturated fatty acids to saturated and trans-fatty acids.

479 † Both diet scores included alcohol, calculated as 100 % ethanol.

480 ‡ A ratio of unsaturated fatty acids to saturated fatty acids.

481

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