Dietary supplement user patterns among Norwegian middle-aged women

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Note

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Abstract

Background

Our study describes characteristics of DS use among middle-aged Norwegian, including medication use and socioeconomic factors.

Material and methods

This is a cross-sectional analysis of questionnaire data from 3231 women (born 1943-57) from the Norwegian Women and Cancer study, data collected in 2003-2006, response rate 72%.

Results

The prevalence of DS use (during past week) was 71% (2297 of 3231 women), while 48% used dietary supplement and medication concurrently. Omega-3 and vitamin/minerals were the most frequent categories. Among users, 60% used more than one supplement and 12 % used four or more. Use was associated with higher age, education, income, medication use and markers of a healthy lifestyle (physical activity, lower body mass index, non-smoking). Similar associations were found for extent of DS use (number of products). The association between medication and supplement use was primarily due to high supplement use among women taking medication for less serious disorders and for muscle/joint/pain and cardiovascular disease.

Interpretation

Dietary supplements were extensively used among middle-aged Norwegian women. Use was associated with socioeconomic, lifestyle and health-related factors, including medication use which implies a risk that health personnel should be aware of.

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Background

Use of dietary supplements (DS) in Norway increased extensively from 1986 to 2004 [1]. Total sales have not changed noteworthy thereafter, but there has been some increase in sales of omega-3 and a slight decrease in the category «other supplements» (including herbs) after 2006 [2].

Reports from other countries with a so-called western lifestyle suggest that women use more DS than men, and most show that prevalence of use increases with increasing age, socioeconomic status and healthy lifestyle [3-7]. However, some inconsistencies exists, either due to true geographical variation or caused by varying definitions of DS use.

Research on DS use in Norway is sporadic [8], but there are publications on use of herbs among pregnant women [9], and among patients [10-13]. Data from the Norwegian Women and Cancer study (NOWAC) have shown that use of cod-liver oil among Norwegian women is associated with variables indicating a healthy lifestyle [14]. A large European cohort study showed a wide variation in supplement use across Europe (use the previous 24 hours) [15]. The prevalence varied from 2% (Greek men) to over 60% (Norwegian women).

Health personnel usually regard DS as a positive initiative if the user has some medical need, such as vitamin deficiency. Many are worried, however, for the potential health risk associated with unnecessary use, particularly among persons who combine use of medication and DS [11, 12, 16, 17]. Studies investigating use of complementary and alternative medicine (CAM) in general, or DS in particular, have shown that patients take a substantial amount of DS [11-13, 18-20]; not necessarily for treatment of disease, but rather for strengthening their general health [20]. It has also been shown that most users do not discuss their DS use with health personnel, mostly because they are not asked about it [11].

The aim of this study was to describe the pattern of DS use among middle-aged Norwegian women, with regard to demography, socioeconomic factors, lifestyle and health, including medication use.

Material and methods

The Norwegian Women and Cancer study (NOWAC) is a nationwide, population based cohort study with participants randomly sampled from the Central Population Register, held by Statistics Norway [21]. Since 1991, approximately 170 000 women have answered questionnaires on health, lifestyle and demography.

From 2002 to 2006 approximately 50 000 women participated in the blood sample collection for the NOWAC biobank (response rate 71%). Participants (born 1943-1957) gave detailed information on their use of medication and DS during the week preceding the blood draw.

The women were invited in groups of 500 for practicality. Data from nine randomly chosen groups (4500 invited) were electronically available at the time of analysis and comprise the basis of our study sample of 3231 women (response rate 72%).

Variables

The questions on DS use were "Have you taken X during the past week?", where X denotes the following four DS types: cod-liver oil (liquid), capsules containing fish oil/omega-3, soy and other DS (vitamin/minerals). Use of DS was defined as answering yes to one or more of these four questions. The participants were asked to list the brand names of all products used in each category, except cod-liver oil. The supplements were further categorized according to main content as omega-3 (including cod-liver oil and vitamin/mineral combinations), vitamin/minerals (except combinations with omega-3), other polyunsaturated fatty acids (PUFAs), herbs/herbal extracts/mixtures, soy, and others (including unknown).

The questions on medication use were "Have you taken X during the past week?", where X denotes the following three categories: oral contraceptives (OC), menopausal hormone therapy (MHT) and other medication. Use of medication was defined as answering yes to one or more of these three questions. Participants were asked to list all medications used. Medications were coded according to the Anatomic Therapeutic Chemical (ATC) classification system [22]. The ATC codes were further classified into the following 12 categories: infection (cold/flu medication and antibiotics), allergy, gynecological (excluding OC), cancer/immune system/opioids(strong) (including systemic corticosteroids), muscle/joint/pain, asthma/Chronic Obstructive Pulmonary Disease (COPD), cardiovascular disease (CVD), psychiatry (including epilepsy and Parkinson's),

hypothyroidism, diabetes, OC, and other (gastrointestinal, prescription vitamins/minerals, glaucoma, anemia, and dermatological medication among others).

Self-perceived health was categorized as very good, good or poor (response alternatives poor and very poor were combined due to small numbers). Marital status was dichotomized into living alone (unmarried, divorced, widow) or in a relationship (married, cohabitant). Employment was categorized as full-time work, part-time work or unemployed (student, housewife, pensioner (age- or disability-)). Smokers were defined as women who answered yes to the question "have you been smoking during the past week?" Age, years of education, body mass index (BMI, kg/m^2) and physical activity (discrete scale 1-10) were included in the analyses as continuous variables.

Statistics

Statistical analyses were performed using IBM SPSS Statistics version 21. Potential associations between DS use and sociodemographic and -economic characteristics were analyzed using Pearson's Chi-squared test for categorical variables and Student's t-test for continuous variables. Analyses adjusted for covariates were performed using multiple logistic regression. Analysis of variance (ANOVA) was used to analyze the potential association between the extent of DS use (number of products) and continuous variables (age, education, BMI and physical activity). P-values below 5% were considered statistically significant.

Ethics

This study was conducted according to the guidelines laid down in the Declaration of Helsinki. NOWAC is approved by the Regional Committee for Medical and Health Research Ethics in North Norway. Storage of data is in compliance with the rules of the Norwegian Data Inspectorate. Written informed consent was obtained from all participants.

Results

There were extensive DS use among the study population. Among the 3231 women, 2297 (71%) used DS, while 1549 (48%) were taking DS and medication concurrently. Among the DS users, 1383 (60%) used more than one supplement and 277 (12%) used four or more. Omega-3 was the most used DS (78% of 2297 DS users), followed by vitamin/mineral supplements (49%) and

herbal products (22%) (Figure 1). Omega-3 was used as a single supplement much more frequently than other supplement categories. The relative proportion of herb users increased with increasing number of products (data not shown).

Use of DS was associated with several demographic and health related factors. The unadjusted analyses showed an association between use of DS and the variables age, education, household income, medication use (dichotomous), BMI, physical activity and smoking (Table 1). These associations remained significant after adjustment. The odds for being a DS user was higher with higher age, education and physical activity, and lower with increasing BMI. Medication users had higher odds for being DS users than those who did not take medication, and smokers had 30% lower odds for being DS users than non-smokers.

As soy supplements are mainly used for menopausal symptoms, we assessed a potential association with menopausal status and MHT. We found strong significant relationships between soy supplementation and both menopausal status and MHT use (Table 2). Women having irregular or no menstruation periods were three times more likely to use soy supplements. Women using MHT were 68% less likely to use soy.

When classifying supplement users according to number of products used, we found an association between higher number of products and higher age, higher education, higher physical activity and lower BMI (Figure 2). There were also fewer smokers and more medication users with increasing number of DS products used (p<0.05, data not shown).

Through the categorization of medication users, we could further investigate the variation in DS use according to medication use. The highest prevalence of DS use was found among participants using medication for less serious disorders, for instance infection, allergy and "other" (figure 3). The latter includes gastrointestinal medication (72%). The three largest medication categories: muscle/joint/pain, CVD and gynecological medication (mainly MHT), also contributed to the association between medication and DS use. Diabetes and OC were the only categories with lower proportion of DS use than among non-medication users.

Discussion

This study shows that over 70% of middle-aged Norwegian women use DS, almost 50% combines DS use with medication, and over 10% of users report four or more DS products. This

is a high prevalence compared with other European countries [15], and at least as high as concurrent estimates from the National Health and Nutrition Examination Survey (NHANES, United States) [7], especially as NHANES defines prevalence based on use the previous 30 days.

We find that supplement use is associated with higher age, higher socioeconomic status and markers of a healthy lifestyle (non-smoking, physical activity and lower BMI), in line with previous publications [3-7].

Omega-3 products are popular, with a long Norwegian tradition of cod-liver oil use [14]. Most omega-3 products also contain vitamins, either as a natural component in the fish oil or as added components. It is therefore not surprising that omega-3 products are the most frequent category, particularly among single product users.

Previous publications have shown extensive DS use among patients [11-13, 18-20]. Thus, the identified high prevalence of DS use among medication users was anticipated. Our cross-sectional cannot inform on causal associations, but it seems that women taking medication for less serious disorders are the most frequent DS users, perhaps reflecting that people with serious disorders receive effective treatment through conventional health services. Most people are aware that DS cannot treat serious disease. Regarding diabetes, less use of DS could be a marker of a less healthy lifestyle that may have led to diabetes. A lower proportion of DS use among OC users probably reflects the younger age and thereby lower general morbidity than the population average. However, these small numbers should be interpreted with caution.

Users of medication for less serious disorders, and perhaps disorders for which medical treatment is less successful, may be more inclined to resort to DS. An Australian survey showed that the use of CAM varied greatly between diagnoses [18]. Among women aged 30-59 years, the prevalence of CAM use was >40% for women with arthritis and osteoporosis, and <10% for women with asthma, diabetes and CVD. Although the numbers are not directly comparable to our study, we see that the prevalence is higher among those with chronic but not life-threatening disease. A previous Norwegian study among patients in general practice also found the highest proportion of supplement use among users of medications for gastro-intestinal conditions [11]. Contrary to our study, they found that antihistamine users had the lowest proportion of supplement use. Such differences could be explained by differences in study populations or by their investigation of herbal supplements versus DS in our study. The low

number of participants per category in the general practice study also make their estimates harder to interpret.

Almost half of the study population used medication and DS concurrently. This is a matter of concern for health personnel since it could imply serious risk for some of the users [12, 17]. Herbs are considered the main problem regarding DS–medication interactions. The relatively high proportion taking many DS products is therefore noteworthy, as the percentages of both herb use and medication use increases with increasing number of DS. Herbs are more likely used for specific medical conditions compared to omega-3 and vitamin/minerals, which are primarily used to prevent ill health in general. Considering the diversity of herbal products, these user groups were too small in this material to be investigated individually regarding user characteristics, medication use etc, although this would be interesting in a larger data material. The exception is soy, with high prevalence of use and with a clearly defined content and medical indication (menopausal symptoms). As expected, we find a strong relationship between soy use and menopausal status, as well as an inverse relationship between MHT use and soy use.

Use of DS increased with increasing education and income. For education, this is in line with studies from other countries [3, 4, 6, 7]. Income is less investigated, but sales statistics from the Health Food Trade Association suggest that income may influence consumption trends in Norway [2].

Limitations and strengths

All data were self-reported. NOWAC has previously documented high correlation between reported intake of cod-liver oil/omega-3 supplements and serum fatty acid and vitamin D concentrations [23, 24]. MHT use has been validated against plasma hormone concentrations [25]. Questions on current use (the past week) will usually ensure accordance with real use, particularly regular use [26]. The opportunity to list all products should ensure as complete a reporting as possible. However, some underreporting cannot be ruled out. The question on other DS specifies "(vitamins/minerals)" which may have caused underreporting of purely herbal products, and some products will simply be forgotten.

Length or frequency of use could not be established from our material. Instead, we applied number of DS reported as a measure of extent of DS use.

The indication for use was not recorded for neither medication nor DS use, so the distinction between medication for serious and less serious disorders will be rather crude. Additionally, some participants contributed in more than one medication category. Our interpretation of DS use according to seriousness of disease should be interpreted accordingly.

Our questionnaire measures point prevalence, while many other studies of DS use measure period prevalence, for instance one-year prevalence. For investigating concurrent use of DS and medication, point prevalence is most relevant. If the aim had been to define total use and to provide a better estimate of the distribution of use across different supplement types, a one-year prevalence would have been preferred. Using point prevalence, the results might to a greater extent be influenced by seasonal variation. In our study the questionnaire (9 emissions) was distributed at different seasons (3 autumn, 2 spring and 4 winter) so a potential seasonal influence should be evened out.

NOWAC is a large population based cohort with random sampling of participants from the Central Population Register and acceptable response rate. The participants are considered representative for Norwegian middle-aged women [27]. Data was collected 10-15 years ago, but neither sales figures [2] nor the biannual report from NAFKAM (National Research Center in Complementary and Alternative Medicine) [28] suggest that the consumption of DS has changed dramatically since then.

We need updated knowledge about use of DS and questions regarding this topic should be included in comprehensive, repeated data collections, like the large health surveys and the NAFKAM survey. The Norwegian mother and child study (MoBa) [29], probably has the most extensive DS database in Norway, and work is being done to make this database available [30].

Conclusion

The majority of middle-aged Norwegian women used dietary supplements and about half combined the use of medication and dietary supplements. More than one in ten supplement users took four or more products. There was an association between use of dietary supplements and higher education, higher age, a healthy lifestyle and medication use.

Acknowledgments

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Table and figures

Table 1 Participant characteristics and dietary supplements (DS) use (number(%) or mean(SD))

	Not using DS		DS users		P value[a]	OR[b]	(95% CI)
	n = 919[a]		n = 2297		unadjusted		
Age, years, mean (SD)	54.2	(4.0)	55.1	(4.0)	**<0.01**	**1.07**	**1.04-1.09**
Education, years, mean (SD)	12.6	(3.4)	13.0	(3.4)	**0.01**	**1.03**	**1.00-1.06**
Household gross income, n (%)							
≤ 300 000 NOK	228	(25.7)	467	(21.4)		ref.	
300 000 - 600 000 NOK	431	(48.6)	1114	(51.0)		**1.31**	**1.02-1.68**
> 600 000 NOK	227	(25.6)	604	(27.6)	**0.03**	**1.40**	**1.03-1.91**
Employment, n (%)							
Full-time work	472	(52.2)	1174	(51.8)		ref.	
Part-time work	258	(28.5)	673	(29.7)		1.04	0.85-1.27
Unemployed	175	(19.3)	419	(18.5)	0.75	1.01	0.77-1.31
Marital status, n (%)							
Alone	164	(18.0)	421	(18.5)			
In relationship	745	(82.0)	1858	(81.5)	0.78	0.82	0.63-1.07
Self-perceived health, n (%)							
Very good	282	(31.5)	657	(29.8)		ref.	
Good	541	(60.5)	1379	(62.5)		1.20	0.98-1.47
Bad (including very bad)	71	(7.9)	172	(7.8)	0.58	1.26	0.85-1.86
Medication use, n (%)							
No	360	(39.2)	769	(33.5)			
Yes	559	(60.8)	1528	(66.5)	**<0.01**	**1.22**	**1.02-1.47**
BMI, kg/m^2, mean (SD)	26.1	(4.6)	25.5	(4.3)	**<0.01**	**0.97**	**0.95-0.99**
Physical activity[c], mean (SD)	5.6	(1.9)	5.8	(1.8)	**<0.01**	**1.06**	**1.01-1.11**
Smoking, n (%)							
No	630	(69.1)	1747	(76.2)			
Yes	282	(30.9)	545	(23.8)	**<0.01**	**0.70**	**0.57-0.85**

DS= Dietary supplements, OR= Odds Ratio, CI= Confidence interval, BMI= Body Mass Index (kg/m^2)

[a] Missing information on DS use for 15 participants

[b] Student's t-test (continuous variables) or Chi^2 test (categorical variables)

[c] Logistic regression, mutually adjusted for the listed covariates

[d] Discrete scale from 1 to 10

Significant results are marked in bold. Number of participants with missing information vary from zero (age) to 208 (physical activity).

In the logistic regression ([c]), 564 (17%) of the participants are excluded due to missing information on at least one variable.

Table 2 Use of soy supplements in relation to menopausal status and use of menopausal hormone therapy (number(%))

	Not using soy n=2941[a]		Soy users n=180		*P* value[b] unadjusted	OR[c]	(95 % CI)
Menstruation, n (%)							
Regular (premenopausal)	392	(97.3)	11	(2.7)		ref.	
Irregular (perimenopausal)	239	(91.9)	21	(8.1)		**3.19**	**1.51-6.76**
No menstruation (postmenopausal)	2284	(94.2)	147	(6.0)	**0.01**	**3.57**	**1.84-6.93**
Menopausal hormone therapy (MHT), n (%)							
No	2279	(94.3)	177	(6.6)		ref.	
Yes	642	(97.9)	14	(2.1)	**<0.01**	**0.32**	**0.18-0.56**

OR= Odds Ratio, CI= Confidence interval
[a] Missing information on soy use, menstruation and/or hormone replacement therapy for 110 participants
[b] Chi-squared test
[c] Logistic regression mutually adjusted for hormone therapy and menstruation, as well as age. Exclusion of women with regular menstruation did not change the estimate for hormone therapy.
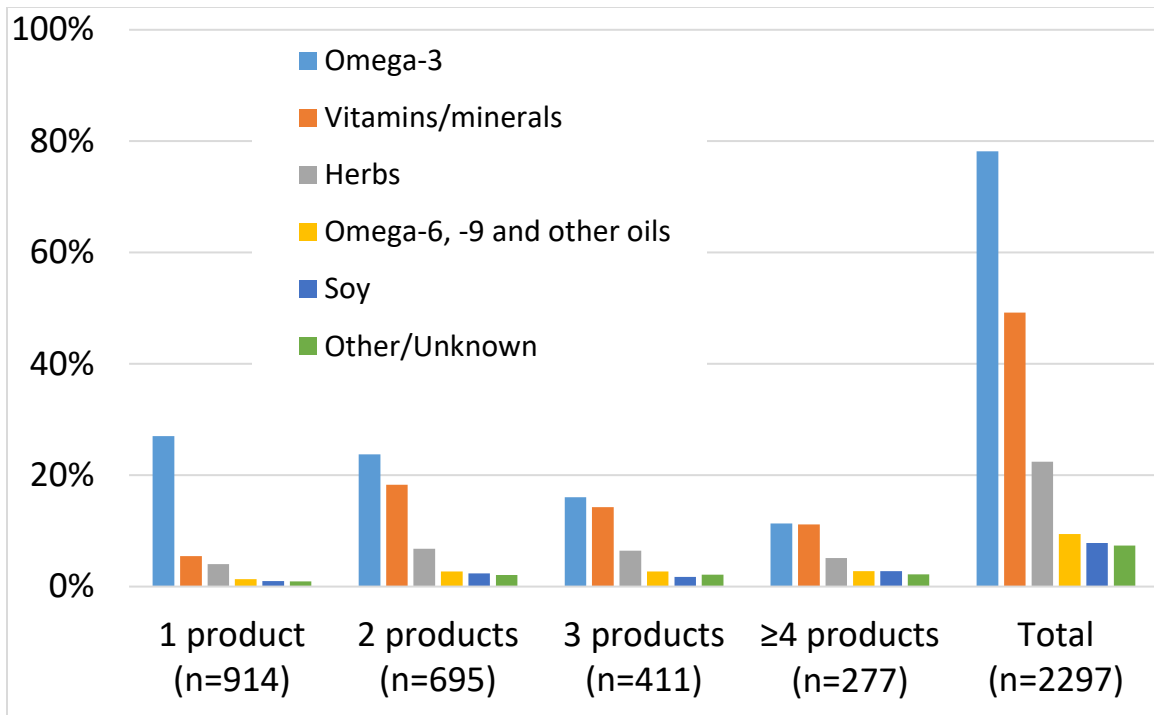Significant results are marked in bold.

Figure 1 Fractions (%) of different types of dietary supplements among all supplement users (n=2297) and according to extent of use (number of products)
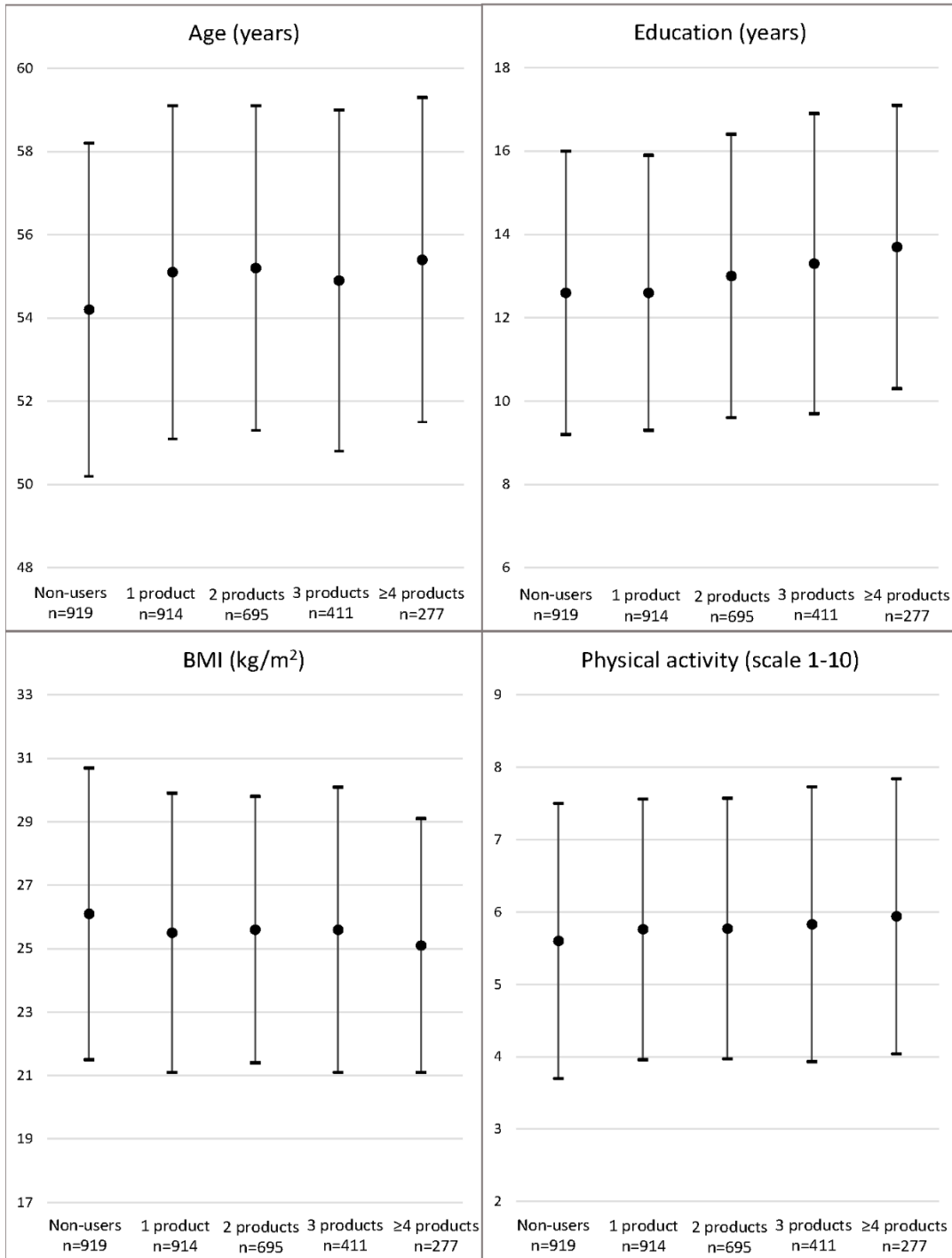
Figure 2 Mean(SD) age (A), education (B), physical activity (C) and BMI (D) according to extent of dietary supplement use (*p*<0.05 for all four comparisons (ANOVA) unadjusted analysis)
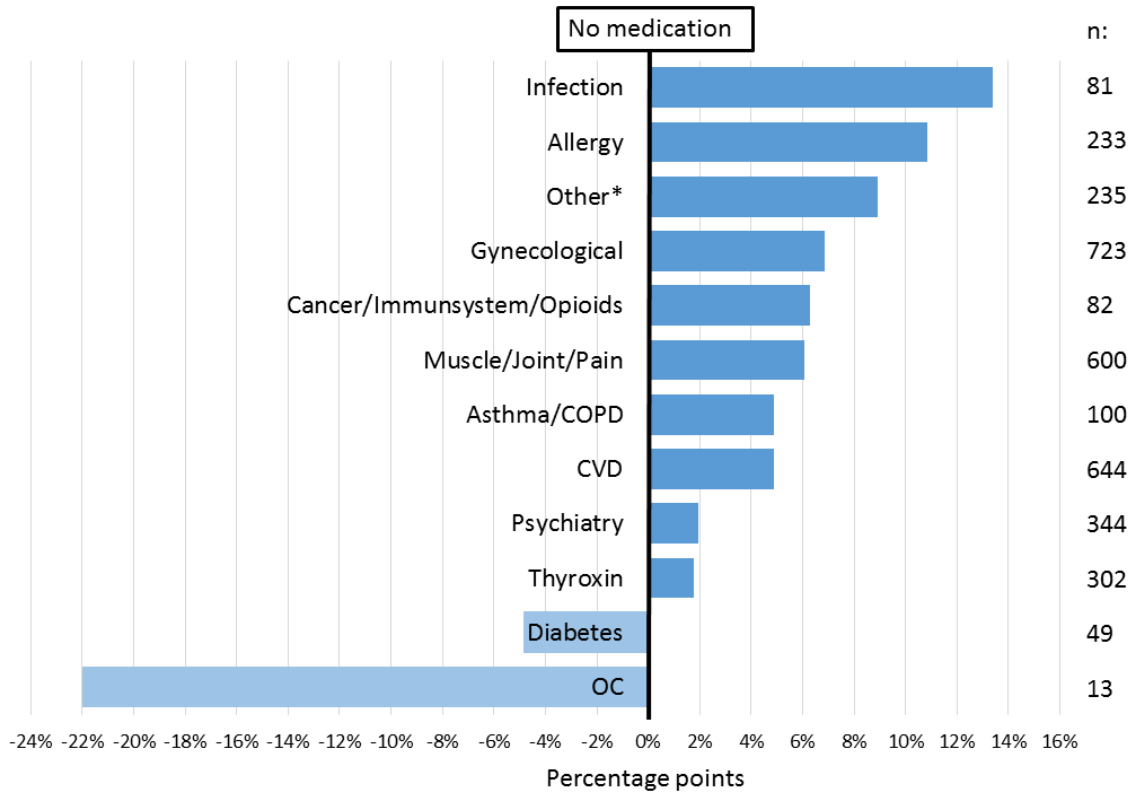
BMI = body mass index

Figure 3 Use of dietary supplements across different categories of medication use, deviation (percentage points) from the prevalence among those who do not take any medication

Explanation: Among those who do not take medication, 68% use dietary supplements, assigned 0 percentage points (black vertical line). Thereby, among women using medication for allergy for instance, 79% are using dietary supplements. The n column denotes the number of medication users in each category. The medication categories are not mutually exclusive as many use more than one medication and may contribute to more than one category.

Abbreviations: COPD=Chronic Obstructive Pulmonary Disease, CVD=Cardiovascular disease, OC=Oral Contraceptives

* "Other" (n=235) includes participants taking medication for gastrointestinal disorders (72%), prescription (high dose) vitamins and/or minerals (16%), anemia (6%), glaucoma (3%) dermatological disorders (2%), as well as several small user groups (pilocarpine, nicotine, chloroquine, mefloquine, dehydroepiandrosterone, and anti-inflammatory eye drops) (7% in all).

** Except analgesics