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Vitamin and Supplement Use in the Old Order Amish: Gender-specific prevalence and associations with use

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Abstract

Background—Complementary and alternative medicine (CAM) in the form of vitamin and supplement use is increasingly prevalent in the United States. The interplay between CAM use and use of conventional medications is not well studied. We examined this issue in the Old Order Amish (OOA), a population lacking several factors known to influence supplement use, whose culture and barriers to conventional medications may result in high rates of supplement use.

Objective—We characterized the patterns of supplement use in the OOA, including the extent to which CAM use aggregates in families, and assessed whether higher use of supplements is associated with lower medication use.

Design—We conducted a cross-sectional study of conventional medications and supplements in 2,372 adult Amish from the Lancaster County, PA area. Data were collected through face-to-face interviews. Supplements were subcategorized as herbal versus vitamin/mineral supplements.

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Results—Seventy-seven percent of all Amish adults reported current supplement use, whereas 22% reported medication use. Women used supplements more often and used more supplements than men, and familial aggregation of supplement use was stronger in family pairs involving women. Supplement use was associated with lower medication use after controlling for age, sex, BMI, and self-reported histories of hypertension, diabetes, and hyperlipidemia (adjusted OR 0.96, 95% CI 0.92 to 1.00, $p=0.047$). This association was driven primarily by use of herbal supplements (adjusted OR 0.94, 95% CI 0.89 to 0.99, $p=0.025$) as vitamin/mineral supplements were not associated with different use of medication (adjusted OR 0.99, 95% CI 0.90 to 1.09, $p=0.8$). In analyses limited to cardiovascular medications and cardiovascular supplements in participants with hyperlipidemia, hypertension, or diabetes, supplement use was not associated with conventional medication use.

Conclusions—The Old Order Amish take dietary supplements much more frequently than they use conventional medications, particularly women. Use of herbal supplements is associated with less use of conventional medications whereas vitamin/mineral supplement use is not.

INTRODUCTION

Complementary and alternative medicine (CAM) includes vitamin, herbal, and other supplements not considered part of conventional medicine. When these therapies are taken in addition to, or without influencing conventional medicine, they are considered complementary. In contrast, they are considered alternative if they are taken in place of conventional medicine.¹

Understanding the patterns and determinants of CAM use is important. CAM represents a major health care expenditure in the United States, with an estimated \$33.9 billion dollars spent in 2007.² Of this amount, approximately \$14.8 billion was spent on non-vitamin, non-mineral dietary supplements, which is equivalent to 31% of the out-of-pocket expenses for pharmaceutical drugs spent in the same year. The medical significance of CAM use also warrants consideration. While the purported benefits ascribed to complementary and alternative therapies are often controversial, the potential benefits attributable to placebo effect alone may be significant.^{3;4} However, when these therapies are taken as alternatives to proven conventional therapies, potential for harm exists. CAM use has been associated with lower vaccination rates,⁵ lower rates of conventional treatment for cancer,⁶ and worse adherence to conventional medications.⁷

Attitudes toward CAM may be more positive amongst women. Studies have consistently demonstrated higher rates of CAM use in women compared to men.^{8–12} Female medical students express a more favorable attitude toward CAM,^{13;14} and female medical practitioners are more likely to refer patients for CAM therapies.¹⁵

Prior studies have demonstrated that rates of supplement use are influenced not only by sex, but also by race, education, income, and geographic location.^{10;12} The Old Order Amish (OOA) of Lancaster County, PA are Caucasian with relative homogeneity of education, income level, and geographic location. They lead a distinct lifestyle particularly notable for very limited use of modern technologies such as electricity, telephones, and automobiles. They are self-insured and utilize conventional medical therapies at a fraction of the non-

Amish rate.¹⁶ These low rates are in part attributable to cultural norms.^{17;18} The Amish tend to be stoic and generally do not complain or seek medical attention unless their condition impedes their activities of daily living.¹⁷ In addition, Amish do not attend school after the 8th grade and thus the trained professional health care providers they see are non-Amish. As barriers in access to conventional medicine have been associated with increased utilization of CAM,¹⁹ we hypothesized that CAM utilization in the form of dietary supplement use in this population would be high, and that higher use of dietary supplements would be associated with lower use of conventional medications.

The goal of this report is to characterize patterns of supplement use in the Amish, including within families, and to determine whether higher use of supplements in this population is associated with lower medication use.

METHODS

This report is based on cross-sectional data collected from adult members of the Old Order Amish community of Lancaster County who participated in three population surveys of cardiovascular and metabolic health carried out as part of the Amish Complex Disease Program conducted by researchers at the University of Maryland School of Medicine in Baltimore. Amish included in these studies were consenting participants recruited through word of mouth in the Amish community between 2002 and 2012. Data were collected similarly, and enrollment was limited to adult (age ≥ 18 years) Amish participants in all three studies. The majority of participants (n=1306) had participated in a wellness screening program offered to the community beginning in 2010 and open to all Amish adults aged 18 years and older. An additional 685 participants had previously participated in a study of cardiovascular health between 2002–2006 in which enrollment was limited to persons age ≥ 30 years and excluded pregnant women.²⁰ The remaining 381 participants had participated in a study of longevity conducted between 2001–2006 that enrolled participants ≥ 90 years of age, as well as their offspring and the spouses of their offspring.²¹ Amish who had participated in multiple studies were included only once in these analyses, using data from their initial evaluation. All studies were conducted with approval from the Institutional Review Board of the University of Maryland.

Participants were questioned at their home in person by a researcher about their medical histories and medication usage, both prescription and non-prescription, as well as their use of dietary supplements. Medications and supplements taken regularly were presented to the interviewer for inventory, and the lists generated consisted of medication/supplement names with no loss of information related to attempts to categorize during collection of the raw data (online supplement). From these lists, medication and supplement use, including pill counts, were tabulated and categorized by physician (RMR) review. Medications or supplements containing multiple ingredients were counted as a single tablet. As dosing regimens were not available from the data, pill counts did not incorporate dosing frequency. For analysis and presentation, prescription and non-prescription medications taken regularly (e.g. aspirin) were categorized together as “medications” in part due to the availability of some medications both by prescription and over-the-counter. Supplement use was additionally divided into vitamin/mineral versus herbal supplement. An herbal supplement was defined

as any supplement not primarily identified as a vitamin/mineral by physician review. As many supplements contain both vitamin, mineral, and herbal ingredients, the categorization of such combination products was determined to be herbal if the supplement contained a non-vitamin/mineral ingredient and was marketed for the treatment of a specific condition rather than for nutritional purposes. A subset of supplements specifically identified as being marketed primarily for cardiovascular health was categorized for subanalysis. A complete list of these cardiovascular supplements as well as a representative partial sample of all reported supplements is provided in the Supplementary Data section. Categories of supplements were not mutually exclusive: a supplement could be categorized as a cardiovascular supplement, an herbal, as well as a dietary supplement. More detailed tabulation of supplements was not feasible due to the degree of variation in the nature of the supplements reported and the frequency of combination supplements.

Comorbidities analyzed as part of this report included hypertension, hyperlipidemia, and diabetes mellitus because these were the most common medical diagnoses identified in study participants. Furthermore, the feasibility of identifying supplements marketed for cardiovascular health facilitated meaningful analysis. The case definition for each medical comorbidity was based on participant self-report.

Statistical analysis

Data are presented as means $\pm$ SD, medians with interquartile range (IQR), and odds ratios (OR) with 95% confidence intervals (CI). Between-group comparisons applied Student's T, Wilcoxon rank-sum, Kruskal-Wallis, Chi-square, or Fisher's exact testing as appropriate. We examined medication and supplement use as dichotomous variables and subsequently as ordinal variables. As dichotomous variables, rates of medication use were examined in categories of gender, comorbid diagnoses, and quartiles of age using Chi-square testing between supplement use versus non-use. Significant associations were subsequently evaluated in multivariable logistic regression models. We then performed analyses examining use in ordinal terms according to medication or supplement tablet count. Multivariable ordered logistic regression models evaluating tablet counts initially examined medication counts as the dependent variable with supplement counts as the independent variable of interest. These models controlled for age, sex, body mass index (BMI), comorbidities (diabetes, hyperlipidemia, and hypertension). To evaluate whether supplement use aggregated within families, we calculated between-pair correlations among family members using the FCOR module in the SAGE statistical program (S.A.G.E. Statistical Analysis for Genetic Epidemiology, version 6.3). With the exception of familial aggregation analysis, all statistical analysis was performed using STATA 11 SE software (StataCorp-LP, College Station, TX). For all analyses, $p < 0.05$ in two-sided testing was considered statistically significant.

RESULTS

The study population included 2,372 adult Amish individuals whose characteristics are presented in Tables 1 and 2.

Age and gender differences

Older age was associated with higher odds of taking more supplements in unadjusted association (OR 1.01 per year, 95% CI 1.01 to 1.02, $p<0.001$), and in adjusted models controlling for sex, BMI, diabetes, hyperlipidemia, and hypertension (adjusted OR 1.02 per year, 95% CI 1.01 to 1.02, $p<0.001$). Age was similarly associated with higher odds of taking more medications in unadjusted association (OR 1.06 per year, 95% CI 1.05 to 1.07, $p<0.001$), and in similarly adjusted models (adjusted OR 1.05 per year, 95% CI 1.04 to 1.05, $p<0.001$).

Despite similar rates of diabetes, hypertension, and medication use, Amish women reported supplement use more frequently than did Amish men (82.9% vs 69.9%, $p<0.001$) (Table 1). When examined according to quartiles of age, rates of supplement use and medication use increased with age in men (Figure S1). Medication use also increased with age in women, but supplement use varied. Rates of supplement use were most similar between sexes in the oldest quartiles. High rates of supplement use in the youngest quartile of women were partially attributable to the use of prenatal vitamins. After controlling for age, BMI, and comorbidities, female sex correlated with more supplement use (adjusted OR 2.40, 95% CI 1.96 to 2.94, $p<0.001$). This remained true when examined individually for vitamin use (adjusted OR 2.33, 95% CI 1.96 to 2.76, $p<0.001$), and herbal use (adjusted OR 1.49, 95% CI 1.25 to 1.77, $p<0.001$). When limited to cardiovascular supplements (CV-supplements), there was a non-significant trend favoring use in women (adjusted OR 1.19, 95% CI 0.97 to 1.46, $p=0.09$), which was due primarily to higher rates of use of omega-3 fatty acid supplements in women (adjusted OR 1.61, 95% CI 1.26 to 2.06, $p<0.001$). Additionally, women who used supplements reported taking more supplements than men who used supplements (3.5 ± 2.5 versus 3.0 ± 2.3 , $p<0.0001$).

Comorbidities

Twenty-four percent of the Amish participants reported having high cholesterol, 12% reported hypertension, and 4% reported diabetes mellitus. Of those reporting hyperlipidemia, only 9% reported statin use. Use of non-statin medications for hyperlipidemia was extremely uncommon. Gemfibrozil use, for example, was reported by a single participant. Of medications taken, aspirin was more commonly taken by men (7.1% vs 3.5%, $p<0.001$). By contrast, thyroid supplementation was more frequently taken by women (7.7% vs 2.1%, $p<0.001$), consistent with the known higher prevalence of hypothyroidism in women.²² Further details pertaining to medication use for comorbidities of hypertension and diabetes mellitus are presented online (online supplement).

In analyses adjusted for age and sex, relative to those without a diagnosis of hyperlipidemia, those with a diagnosis of hyperlipidemia had higher odds of medication use (adjusted OR 1.60, 95% CI 1.26 to 2.02, $p<0.001$) and more medications taken (0.6 ± 1.5 versus 0.4 ± 1.1 , $p=0.0005$), but no difference in the frequency of supplement use (adjusted OR 0.99, 0.79 to 1.25, $p=0.9$) with slightly greater number of supplement tablets taken (2.7 ± 2.7 versus 2.5 ± 2.5 , $p=0.03$). Hyperlipidemia was associated with a higher odds of taking a CV-supplement (adjusted OR 1.69, 95% CI 1.36 to 2.10, $p<0.001$).

Familial aggregation

We examined the correlations among first-degree family members in terms of the number of supplements taken, as well as for the subcategories of vitamin/mineral versus herbal supplements (Table 3). The strongest correlations for supplement use were those between husband-wife pairs ($r = 0.50$, $p < 0.0001$), and the weakest correlations were between fathers and offspring ($r: 0.04$ – 0.08 for sons and daughters, neither correlation statistically significant). Correlations among mother-offspring pairs and sibling pairs were moderate ($r: 0.13$ – 0.21 , all $p < 0.01$). Use of vitamin/minerals and herbals generally followed these same patterns with the father-offspring correlations far weaker than between spouse pairs and weaker than those for mother-offspring pairs and among sibling pairs.

Associations Between Medication And Supplement Use

To examine whether supplement users were less likely to be medication users, use of each was evaluated in dichotomous terms (Table S1). Overall, rates of medication use did not correlate with rates of supplement use across categories of age, sex, or comorbidity. When supplement use was examined separately between vitamin/mineral use and herbal use, several notable differences emerged. Men who reported taking a vitamin/mineral supplement were more likely to also report taking a medication than men who did not report taking a vitamin/mineral supplement at all (25.3% vs 18.0%, $p=0.005$). This correlation persisted after controlling for comorbidities, age, and BMI (adjusted OR 1.51, 95% CI 1.05 to 2.17, $p=0.025$). The opposite was true for women. Fewer women who took vitamin/mineral supplements reported concomitant medication use (21.3% vs 26.8%, $p=0.02$). This correlation also persisted after adjusting for comorbidities, age, and BMI (OR 0.71, 95% CI 0.53 to 0.95, $p=0.023$). An interaction factor for sex in a non-stratified analysis was also significant ($p=0.003$). To evaluate whether prenatal vitamin use accounted for this observation in women, the analysis was repeated after excluding the youngest age quartile, and the correlations persisted.

The correlation between herbal use and medication use differed amongst the youngest and oldest individuals studied. In the youngest quartile, those who took herbs reported higher rates of concomitant medication use (9.9% vs 5.6%, $p=0.05$), whereas the opposite was observed in older participants. In the oldest quartile, those who took herbs reported lower rates of medication use (42.2% vs 54%, $p=0.007$). This correlation persisted in a logistic regression model adjusting for sex, BMI, and comorbidities (table S2). Differential effects of medication and supplement use according to sex were not found in sex-stratified models or through evaluation of an interaction factor.

In order to assess for associations related to pill burden, we then examined use in ordinal terms to evaluate for a relationship between the number of medications taken and the number of supplements taken. Participants who reported the highest counts of one therapeutic modality often reported lower counts of the other (Figure S2). We applied ordered logistic regression models controlling for sex, age, BMI, diabetes, hyperlipidemia, and hypertension (Table 4). In these models, supplement use was associated with a lower odds of taking more medications. Subgroup analyses suggested this effect was primarily due to an inverse correlation with herbal supplements.

Analysis of use of any supplement or medication in the entire cohort irrespective of medical condition has the advantage of larger sample size and greater generalizability to the population; however, interpretation regarding motives behind any relationship between supplement use and medication use is tenuous given that many factors could influence this relationship. By contrast, participants with a known medical condition likely saw a physician, and there is the implicit assumption that they have chosen to take a medication, a supplement, or both to treat that medical condition.

For this reason, we then examined the interplay between medication use and use of supplements marketed primarily for the treatment or prevention of cardiovascular disease (online supplement). There were 562 participants who reported having been told they have high cholesterol. Of these, 31% were taking a cardiovascular supplement (CV-supplement) and 9% were taking a statin. The majority (62%) took neither a CV-supplement nor a statin, 28% took a CV-supplement alone, 6% took a statin alone, and 3% took both a statin and a CV-supplement. In univariate and multivariable models, there was no direct or inverse association between CV-supplement use and statin use. We observed a similar lack of association ($p>0.5$) between CV-supplement use and use of antihypertensive medications.

DISCUSSION

In this study we describe the use of dietary supplements and the use of conventional medications in a well-characterized sample of Old Order Amish. Overall supplement use was high with 77% of all Amish adults reporting current use; by contrast, use of medications was low with only 22% of Amish adults reporting use. Overall associations between supplement use and medication use showed lower medication use in those who used more supplements. This effect was driven primarily by the use of herbal rather than vitamin supplements. When we focused on the interplay between cardiovascular supplement use and medication use in participants who reported a cardiovascular diagnosis, we found no evidence for reduced likelihood to use medications associated with reported use of cardiovascular supplements.

Women in this study reported rates and quantities of medication use similar to men, but reported both higher rates and higher quantities of supplement use compared to men. Males demonstrated an age-related increase in medication, supplement, and herbal use. Female use was more complicated with supplement use highest during the quartiles that correspond to childbearing years and menopause. The pattern of familial aggregation observed could also suggest a greater female role in supplement use.

Satia-Abouta, et al. evaluated the association between supplement use and medical conditions, including risk factors for cardiovascular disease, in a cross-sectional study involving 45,748 respondents to a mailed questionnaire.²³ They found generally higher mean supplement counts in respondents with medical conditions, and noted the patterns of use differed between medical conditions in a way that suggested respondents were taking supplements to treat those specific diseases. The patterns of use of cardiovascular supplements in participants with risk factors for cardiovascular disease observed in our sample could be explained similarly.

Rates of supplement use in the United States have been assessed in several large epidemiologic surveys that have yielded similar results despite methodologic differences. One study described a rate of 18.9% of respondents reporting herbal use in the year prior,¹⁰ and other studies evaluating use in the month prior reported rates of 17.7%²⁴ and ~20%.¹² We found far higher rates in Amish adults with 62.4% reporting current use of herbal remedies, supporting our initial hypothesis that supplement use in this population would be high. Our results extend the findings of a prior small study of supplement use in the Ohio Amish.²⁵ In that study, supplement use was compared between 134 Amish adults and 154 non-Amish adults. It showed significantly higher rates of herbal supplement use in the Amish compared to non-Amish men (55% versus 17%, $p<0.01$) and women (71% versus 23%, $p<0.01$). There is clearly high consumption of complementary and alternative medicine in the Amish which is in part attributable to the Amish world view. Per Kraybill, "They [the Amish] see nature as God's handiwork and think that the more one embraces nature, the closer one walks with God. Likewise, because the body is a natural organism, the more one treats its ills with natural remedies, the more one is in tune with the mysteries of God's intents."¹⁷

Gardiner and colleagues examined a large database from the National Center for Health Statistics for multivariate associations with herbal supplement use in a general US population.¹⁰ Similar to our observations, they found independent associations between increased herbal use and female sex. They also found increased use of herbal supplements in people taking prescription medications. The highest rates of herbal use occurred in participants between 45 and 65 years of age with less frequent use in participants >65 . Unadjusted analysis of the NHANES database also failed to observe increased herbal use in the oldest quartile.¹² This contrasts our findings in which the most frequent use of herbal medications occurred in the oldest quartile. While no clear explanation presents itself to reconcile these observed differences, it should be noted that the Amish have lived a similar lifestyle over several generations which limits the variability introduced by temporal changes that otherwise might influence comparisons made between the young and old. The Amish young are raised in the modern era much more similarly to their elders than is true for the general population. We postulate that the comparably greater exposure to healthcare in elderly non-Amish may effectively compete with herbal therapy use, whereas the more limited utilization of conventional healthcare in the elderly Amish¹⁶ reduces this competing effect.

It is also possible that the observed difference is partially explained by the number of medications taken. Previous studies have shown lower adherence rates in patients prescribed a greater number of medications.^{26–28} As more medications are prescribed through conventional medical practitioners, it is likely that patients take fewer supplements because of pill burden. We observed fewer supplements taken in participants reporting more medications and vice versa. We observed a rate of medication use of 22.4%, whereas NHANES data show a rate of 56.4% in the general population.²⁹ As the Amish take fewer medications than the non-Amish, this competing effect attributable to pill burden which ordinarily would be expected to reduce herbal use may be less pronounced in the Amish. This would likely manifest primarily in the elderly who are prescribed the greatest number

of medications, and may reconcile the observed differences between our observations in the Amish and prior publications in the non-Amish.

Strengths and Limitations

It is well known that supplement use varies by culture, and this report describes patterns of supplement use in a distinct sample of the Pennsylvania Amish population. While Amish attitudes toward traditional medications and CAM influence patterns of use,¹⁷ it is also possible that lower rates of medication use relates in part to better health. Despite higher mean body mass index than observed in non-Amish populations, the Amish seem to have better health including lower rates of diabetes³⁰ which has been attributed to more active lifestyle and lower rates of childhood obesity.^{30–32} While these differences present some limitations on generalizability of the findings, the Amish also represent a strength of the study. The Amish participants exhibit little variability in lifestyle, race, income, education, or geographic location. Furthermore, exposures have varied less through time than would be the case for a non-Amish group. To exemplify, the non-Amish over the last several decades have progressively been more likely raised in an urban environment, become more sedentary, eaten more processed foods, and watched more television. These and numerous other lifestyle changes over time have not occurred to the same degree within the Amish community. This minimizes confounding influences of a cohort effect and facilitates meaningful comparisons between the young and old. As such, analysis is much simplified and power to detect a significant signal is improved by having fewer conditional associations to control for. It warrants emphasis that a global competing (alternative) effect of supplement use is suggested by the overall high rates of supplement use coupled with low rates of conventional medication use described in our study as well as in prior publications.^{16;18;25} The additional complementary and alternative associations we describe should therefore be interpreted as occurring within and in addition to this global context of highly limited use of conveniences of modern life including modern medicine.

Our data are also limited by the lack of specific questioning of participants about the rationale for using dietary supplements and whether they specifically choose them as an alternative to traditional medicine. In our experience with the Amish, this certainly seems to occur with significant frequency, but our data do not permit direct quantification. Furthermore, frequency of dosing was not captured and could introduce a nondifferential misclassification bias into the analyses of pill burden. This would be expected to bias toward the null hypothesis, however, and so our positive results in those analyses are less likely observed by chance. A final limitation to our data is that it is not possible to differentiate between medications and supplements taken to prevent disease versus those intended to treat known diseases or symptoms. This is also a limitation of other studies.^{8–12}

CONCLUSIONS

The Old Order Amish take dietary supplements much more frequently than they use conventional medications. Women use more supplements than do men, and supplement use aggregates in families in a female-centric pattern. The pattern of use suggests that herbals may be used more often as alternatives to medication rather than to complement medication

use. Dietitians and other medical practitioners should remain cognizant that dietary supplements may contribute to overall pill burden and thus influence medication adherence. Particular attention should be paid to the use of herbals to assess whether they are being used as substitute for conventional medicine.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Characteristics and gender differences of Old Order Amish study participants from Lancaster County in whom dietary supplement and medication use was assessed in a cross-sectional study.

	Study Group (n=2,372)	Men 44% (n=1,043)	Women 56% (n=1,329)	P
Demographics				
Age at evaluation (yrs) [†]	49 (36 to 62)	50 (38 to 63)	48 (35 to 62)	0.007
BMI (kg/m ²) [†]	27 (23 to 30)	26 (23 to 29)	27 (23 to 31)	<0.001
Diabetes mellitus	3.9%	3.6%	4.2%	0.4
Hypertension	11.9%	10.1%	13.3%	0.02
Hyperlipidemia	24.1%	24.1%	24.2%	0.9
Dietary Supplement Use				
Use of any supplement	77.2%	69.9%	82.9%	<0.001
Average number of supplements reported by supplement users [‡]	3.3 (±2.4)	3.0 (±2.3)	3.5 (±2.5)	<0.0001
Use of vitamin/mineral	49.5%	39.1%	57.6%	<0.001
Use of herbal	62.4%	58.0%	65.8%	<0.001
Any cardiovascular supplement	23.3%	22.1%	24.3%	0.2
Omega-3 fatty acids	13.8%	11.0%	16.0%	<0.001
Medications				
Use of any medication	22.4%	20.8%	23.6%	0.1
Average number of medications reported by medication users [‡]	2.2 (±1.7)	2.3 (±1.7)	2.2 (±1.6)	0.3
Aspirin	5.1%	7.1%	3.5%	<0.001
Statin	4.1%	4.7%	3.6%	0.2
Loop diuretic	1.3%	1.2%	1.4%	0.7
Any diabetic medication	1.9%	1.3%	2.3%	0.1
Any HTN medication	8.7%	8.7%	8.7%	>0.9
ACEI/ARB	4.1%	4.3%	3.9%	0.6
Beta blocker	4.5%	4.9%	4.1%	0.4
Thyroid replacement therapy	5.2%	2.1%	7.7%	<0.001

Data are expressed as

[†] medians (IQR),

[‡] means (±SD) or as percentages.

BMI: body mass index; HTN: hypertension; ACEI: angiotensin converting enzyme inhibitor; ARB: angiotensin receptor blocker. P values represent difference between sexes and were obtained through T-testing, Chi-square, or Fisher's exact test as appropriate. With the exception of herbal vs. vitamin/mineral, supplement categories were not mutually exclusive.

Table 2

Characteristics of Old Order Amish study participants from Lancaster County in whom dietary supplement and medication use was assessed in a cross-sectional study, presented according to categories of supplement and medication use.

	Use of Any Supplement			Use of Any Vitamin/mineral			Use of Any Herbal			Use of Any Medication		
	Nonusers	Users	P	Nonusers	Users	P	Nonusers	Users	P	Nonusers	Users	P
Age (yrs)	47(±17)	50 (±17)	<0.0001	48 (±17)	50 (±17)	0.01	47 (±17)	51 (17)	<0.0001	46 (±16)	61 (±16)	<0.0001
Male	58%	40%	<0.001	53%	35%	<0.001	49%	41%	<0.001	45%	41%	0.1
BMI	27.5 (±5)	27.0 (±5)	0.06	27.3 (±5)	27.0 (±5)	0.2	27.1 (±5)	27.1 (±5)	0.9	26.7 (±5)	28.6 (±5)	<0.0001
Obese	26.8%	25.6%	0.6	26.7%	25.2%	0.4	24.8%	26.7%	0.3	22.8%	37.0%	<0.001
Systolic BP (mmHg)	116 (±17)	116 (±17)	0.8	116 (±17)	115 ± (17)	0.3	114 (±16)	117 (±18)	0.004	113 (±16)	124 (±20)	<0.0001
HDL (mmol/dL)	56 (±14)	61 (±17)	<0.0001	57 (±15)	62 (±17)	<0.0001	58 (±15)	61 (±17)	0.0005	60 (±16)	57 (±16)	<0.0001
LDL (mmol/dL)	133 (±41)	136 (±44)	0.1	134 (±43)	136 (±44)	0.3	132 (±42)	137 (±44)	0.009	135 (±44)	136 (±41)	0.7
Diabetes Mellitus	2.6%	4.3%	0.07	4.2%	3.7%	0.5	2.6%	4.7%	0.009	1.3%	13.2%	<0.001
Hypertension	11.7%	12.0%	0.8	11.9%	11.8%	0.9	10.5%	12.7%	0.1	5.1%	35.4%	<0.001
Hypertlipidemia	23.9%	24.2%	0.9	25.5%	22.7%	0.1	22.9%	24.9%	0.3	21.9%	32.0%	<0.001

Data are expressed as mean (±SD) or percentiles. P values were obtained through T-testing, Chi-square, or Fisher's exact test as appropriate.

Correlation among family relative pair types in the use of supplements, vitamins/minerals, and herbals from a cross sectional group of Old Order Amish from Lancaster County.

Table 3

	N	Supplement Use		Vitamin/mineral Use		Herbal Use	
		r (±SD)	P	r (±SD)	P	r (±SD)	P
Husband-wife	297	0.50 (±0.04)	<0.0001	0.38 (±0.05)	<0.0001	0.49 (±0.04)	<0.0001
		Parent-Offspring					
Father-son	382	0.04 (±0.06)	0.4	0.13 (±0.05)	0.008	0.01 (±0.06)	0.9
Father-daughter	393	0.08 (±0.06)	0.2	0.02 (±0.06)	0.7	0.11 (±0.05)	0.05
Mother-son	400	0.18 (±0.05)	0.0008	0.17 (±0.05)	0.0005	0.13 (±0.05)	0.01
Mother-daughter	477	0.21 (±0.05)	<0.0001	0.13 (±0.05)	0.008	0.23 (±0.05)	<0.0001
		Siblings					
Brother-brother	599	0.14 (±0.05)	0.006	-0.004 (±0.04)	0.9	0.13 (±0.05)	0.007
Sister-sister	752	0.18 (±0.05)	0.0001	0.13 (±0.05)	0.004	0.17 (±0.05)	0.0005
Brother-sister	1150	0.13 (±0.04)	0.0004	0.06 (±0.03)	0.1	0.13 (±0.04)	0.0005

Use was analyzed according to the number of tablets taken. N reflects the number of relative pairs; r: Pearson correlation; SD: standard deviation.

Table 4

Adjusted measures of association between supplement use and medication use in Old Order Amish study participants from Lancaster County in whom dietary supplement and medication use was assessed in a cross-sectional study.

	Odds Ratio	95% CI	P
Number of any supplement	0.96	0.92 to 1.00	0.047
Number of vitamins/minerals	0.99	0.90 to 1.09	0.8
Number of herbal supplements	0.94	0.89 to 0.99	0.025

Odds ratios represent the results of adjusted ordered logistic regression models with medication and supplement counts as ordinal variables. Models are adjusted for age, sex, body mass index, hypertension, diabetes, and hyperlipidemia.