

The Polypharma Study: Association Between Diet and Amount of Prescription Drugs Among Seniors

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Background

Polypharmacy is a public health dilemma where multiple medications are prescribed to one individual. There are multiple definitions of what polypharmacy is, and this remains to be debated and universally defined to decrease confusion among researchers and clinicians. Nevertheless, polypharmacy does refer to the use of a large number of medications, wherein certain fields the criteria is considered to be the use of five or more medications.^[1] It is initially essential to identify unnecessary drug prescriptions and then improve disease management with lifestyle modification to see if it is possible to diminish other medication when diseases are better controlled.

Individuals who take more than 5 medications daily have 88% higher risk of adverse drug events.^[2] In consequence, patients with adverse drug events stay longer in the hospital, cost more, and have higher mortality rates.^[3] Among homecare patients, this number can be much higher as it was observed in the ONEHOME study, with 51.5% of homecare patients in the polypharmacy group.^[4] The improvement in life expectancy is one of the main reasons there is a higher use in medications. People are living longer, and the proportion of people aged 65 years and older is expected to be 23% by 2060.^[5] The population growth is related to the baby boomer's generation with increasing life expectancy as a result of improved healthcare services worldwide.^[6] One issue that arises with multiple medication prescriptions is the potential adverse effects due to drug interactions. In older adults, polypharmacy increases the risk of fall injuries, hyperkalemia, hypokalemia, blood pressure issues, and heart failure.^[7] It is imperative to assess what can lower the rate of polypharmacy among older adults.

It was hypothesized that a plant-based diet is related to a reduction in the number of medications taken and the main purpose of the polypharma study was to analyze if there is an association between dietary patterns and the number of pills used.

Methods

This was a cross-sectional analysis of data collected by the Loma Linda University Drayson Center Office of Preventative Care in Loma Linda, California. A 40-item questionnaire was designed using selected questions extracted from the Adventist Health Study.^[8] The number of participants recruited was 328 individuals. The inclusion criteria included speaking English and being 60 years and older. Exclusion criteria included incomplete surveys and participants who were younger than 60 years old.

The outcome of interest was the number of pills (prescribed and over the counter) taken by the participants. Other lifestyle factors investigated were physical activity, diagnosed chronic conditions, BMI, and sociodemographic variables such as age, gender, marital status, and education level. The information on the number of pills and the presence of diseases was acquired through the questionnaire.

All data were analyzed with SPSS (version 25, IBM SPSS, Inc, Armonk, NY). Descriptive statistics were assessed for lifestyle and sociodemographic factors. Univariable analysis was performed to determine the association between the dietary pattern and individual predictors, using one-way ANOVA or chi-square where appropriate.

To determine the relationship between the outcome and exposure variables, we used a negative binomial regression model. Negative binomial regression is for modeling count variables, usually for overdispersed count outcome variables. Two models were run. The variables included in the first model include the type of diet as the main exposure variable, adjusted for age, gender, and BMI. For the second model, we further adjusted for exercise, education, and the presence of diseases.

The diseases included were CVD (ischemic heart disease, peripheral artery disease, angina pectoris, and stroke) and risk factors for cardiovascular disease (diabetes mellitus, hyperlipidemia, and hypertension). Multiple imputations were performed to deal with missing variables, and five new datasets were produced which were then summarized into averages.

Results

The total number of participants included in the analyses was 328. Descriptive statistics shown in [Table 1](#):

- The majority of participants were non-vegetarians (57%), followed by lacto-ovo vegetarians (21.6%), pesco-vegetarians (10.6%), and vegans (10.8%). The majority of participants were females, married, and had a college degree.
- The mean age of participants was 76.2 among the vegans and 70.3 years among the non-vegetarians.
- The average BMI was highest (28.2 kg/m^2) for the non-vegetarians compared to all other dietary patterns and the average number of pills taken was higher among lacto-ovo vegetarians and non-vegetarians (4.54 and 3.8, respectively).

Characteristics (N=328)	Vegan (N=35)	Lacto-Ovo (N=71)	Pesco-Vegetarian (N=35)	Non-Vegetarian (N=187)	p-value ^a
Gender					
Males, n (%)	6 (1.9%)	29 (8.8%)	12 (3.6%)	76 (23.2%)	.05
Females, n (%)	29 (8.9%)	42 (12.8%)	23 (7%)	111 (33.8%)	
Age in years (M, SD)	76.2 (8.2)	73.1 (6.9)	71.4 (6.5)	70.3 (6.8)	<.001
BMI (M, SD)	24.1 (5)	26.9 (4.7)	25.3 (3.0)	28.2 (4.7)	<.001
Risk Factors for Cardiovascular Disease					
Yes (% within type of diet)	29.4%	57.1%	36.4%	62.8%	<.001
No (% within type of diet)	70.6%	42.9%	63.6%	37.2%	
Number of pills per day (M, SD)	1.54 (2.6)	4.54 (4.5)	2 (2)	3.8 (3.4)	<.001

Note: Boldface indicates statistical significance (p<0.001).
^a P-values represent the univariate analysis result of Chi-square test or ANOVA, as appropriate.

The number of pills taken was analyzed with negative binomial regression, and the first model is presented in [Table 2](#).

- Vegan and pesco-vegetarian diet participants had a statistically significant reduced number of pills taken** when compared to non-vegetarians (IRR=.46 [95% CI: .28-.75] and .63 [95% CI: .40-.99, respectively).
- Variables that were significant in this model include age with a 3% increase in the number of pills for each increase in age (IRR=1.03 [95% CI: 1.01-1.06]) and BMI with an increase by 6% the number of pills taken for every increase in BMI (IRR=1.06 [95% CI: 1.03-1.09]).

In [Table 3](#), we observe the results of the negative binomial regression with a model with further adjustments. After controlling for exercise, education, and the presence of diseases, the results suggest that:

- Vegans decrease the number of pills by 58%** when compared to non-vegetarians (IRR=.42 [95% CI: .25-.70]). The other types of diet did not present a significant difference.
- Age and BMI remained significant in this model and were more likely to increase the quantity of pills, suggesting that the increase in one year of age increases the number of pills by 4%, and the increase in one point in BMI increases the number of pills by 5%.
- The absence of disease suggests a reduction in the number of pills by 56% (IRR=.44 [95% CI: .27-.73] (Table 3).

	IRR ^a	95% CI for IRR ^a	p-value
Type of Diet			
VEGAN	0.46	0.28; 0.75	.002
LACTO-OVO	1.21	0.89; 1.67	.21
PESCO	0.63	0.40; 0.99	.04*
NON-VEGETARIAN	Ref		
Gender			
Female	1.07	0.82; 1.41	.58
Male	Ref		
Age	1.03	1.01; 1.06	.001***
BMI	1.06	1.03; 1.09	<.001***

Note: Boldface indicates statistical significance (*p<.05, **p<.01, ***p<.001).
^a CI – Confidence Interval; IRR – Incidence Rate Ratio.

	IRR ^a	95% CI for IRR ^a	p-value
Type of Diet			
VEGAN	0.42	0.25; 0.70	.001
LACTO-OVO	1.37	0.97; 1.93	.07
PESCO	0.64	0.40; 1.02	.06
NON-VEGETARIAN	Ref		
Gender			
Female	1.14	0.86; 1.53	.35
Male	Ref		
Age	1.04	1.02; 1.06	.001
Exercise	1.00	0.99; 1.00	.83
BMI	1.05	1.02; 1.08	.001
Education			
High school or less	0.46	0.25; 0.84	.01
Some college/college	0.94	0.71; 1.25	.69
Master/doctoral degree	Ref		
Presence of Disease			
No	0.44	0.27; 0.73	.001
Yes	Ref		

Note: Boldface indicates statistical significance (ps.001).
^a CI – Confidence Interval; IRR – Incidence Rate Ratio.

Conclusion

A vegan diet showed the lowest amount of pills taken in this sample. We examined the impact of lifestyle factors such as type of diet, BMI, presence of disease, and exercise, as well as demographics (age, education, and gender) with polypharma.

Our results show that eating healthy, especially a vegan diet, may be protective in leading to a reduced number of pills taken, either by preventing the development of risk factors and/or cardiovascular disease or by helping on the controlling of such conditions. Although vegetarianism has been linked to a multitude of health benefits, such as lower BMI and less likelihood of chronic conditions, it is not a sustainable diet without proper planning. Higher BMI presented the increased likelihood of polypharmacy as a one-point increase in BMI leads to an increase in the number of pills by 5%.

Using a negative binomial model, even after adjusting for covariates, vegans had the lowest rate of number of pills when compared to non-vegetarians. This is a pilot project to understand the polypharmacy situation in our population. Future research is needed to better understand the association with pills and lifestyle for specific diseases such as diabetes and hypertension and ultimately design interventions to assess the effects of lifestyle on polypharmacy.

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Acknowledgements

The research presented in this poster was published in the American Journal of Lifestyle Medicine in October 2021.

The research presented in this poster is that of the authors and does not reflect the official policy of the NIH. The data collected had the approval from the Loma Linda University Institutional Review Board (IRB# 5150344), and the study was conducted with all the ethics and safety concerns.

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.