ORIGINAL RESEARCH

Seventy-Five Percent of Total Energy Intake Comes From Ultra-Processed Foods Among a Sample of Veterans With Overweight and Obesity: An Exploratory Analysis of Three-Day Food Records

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Background: About 55% of total energy intake (TEI) comes from ultra-processed foods (UPF) in the United States; however, UPF intake among veterans is unknown. The objective of this study was to quantify UPF consumption in a sample of US veterans.
Methods: An analysis was conducted of 3-day food records from 79 veterans with overweight or obesity at the Phoenix Veterans Affairs (VA) Health Care System. Food items were categorized using the NOVA food classification system (minimally processed, culinary processed, processed, and UPF). The percentage of TEI for each group was analyzed using an analysis of variance ($\alpha = 0.05$).
Results: For the 79 veterans sampled, the mean (SD) TEI in 3-day food records was 75% (14%) from UPFs and 14% (12%) from minimally processed foods ($P < .001$).
Conclusions: Most TEI of the veterans in this sample was derived from UPFs, which is higher than the US population as a whole. Given the positive relationship between UPFs and various chronic diseases, further efforts to promote diet improvements among veterans is warranted.

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Roughly 8.6% of the 17.4 million US veterans live in poverty. About 11.1% are considered food insecure (ie, unable to acquire adequate food for ≥ 1 household members), with another 5.3% considered very food insecure (ie, eating patterns of ≥ 1 household members were disrupted and their food intake was reduced at least some time during the year). Compared with nonveterans, veterans are 7.4% more likely to be food insecure.[1] This high prevalence of food insecurity and poverty has a negative impact on veteran diets.

Veterans' diets contained more added sugars and solid fats and scored lower compared with nonveterans when assessed for diet quality with the Healthy Eating Index.[2] Veterans have a higher prevalence of diet-related chronic disease, including diabetes, hypertension, and obesity compared with the nonveterans.[3-5] Given the critical role of diet in health and disease risk, enhancing diet quality among veterans has garnered significant attention and calls to action.[2,6,7] While there are many factors that contribute to diet, any veteran can receive a consultation or self-refer to receive nutrition counseling effective for improving diet quality, within the US Department of Veterans Affairs (VA).

The NOVA food classification system describes diet quality by categorizing food items by processing methods and ingredients into 4 food groups.[8] The first is unprocessed and minimally processed items (MPFs) such as fresh fruits, vegetables, and meats. MPFs consist of whole foods which can also be minimally processed (eg, chopping, drying, grinding, heating, chilling). Culinary processed foods (CPFs) are processed foods for cooking (eg, salt, butter, and vinegar) and are typically eaten in small quantities along with MPFs. Processed foods (PRFs) include canned and smoked foods, while ultra-processed foods (UPFs) are distinguished by industrial ingredients, requiring specialized tools and processing techniques, and hyper-palatability related to color, flavor, and packaging.[8] Examples of UPFs include mass-produced breads found at grocery stores, prepackaged snacks and meals, and hydrogenated oils. UPF consumption is associated with higher risk for negative cardiometabolic outcomes, common mental disorders, and all-cause mortality.[9] To date, only a study by Powell et al has used the NOVA classification system in a veteran population, and it was limited to a comparison of the price of UPFs and veteran body mass index (BMI).[10] Therefore, it remains unknown what percentage of total energy intake (TEI) comes from UPFs in the diets of veterans.

This study sought to quantify the proportion of TEI from UPFs among a sample of

patients from the VA Phoenix Health Care System (VAPHCS). Results from a 2021 global meta-analysis reveal that the US and United Kingdom have the highest intakes of UPFs in the world.[11] Specifically, within the US, 15 studies with 234,890 participants reveal that the majority of TEI (about 55%) comes from UPFs.[11] We hypothesized that this veteran sample would have a higher proportion of TEI from UPFs, possibly due to a higher prevalence of poverty and food insecurity among veterans compared with nonveterans.[1] If the percentage of TEI coming from UPF is higher or even similar to nonveterans, further efforts to increase veterans' use of the available nutritional services would be warranted to minimize nutrition-related disease among veterans.

METHODS

This is a cross-sectional, secondary data analysis of baseline 3-day food records collected from 2017 to 2020 from 92 patients recruited at VAPHCS to participate in a whole-food plant-based diet study.[12] The original study was reviewed and approved by the VAPHCS Institutional Review Board (1593830). Recruitment methods included clinician recommendation, a recorded advertisement played while phone calls were on hold, and flyers distributed throughout VAPHCS. Patients were included if they were aged 18 to 90 years, had a BMI 25.1 to 39.9, had a diagnosis of nutrition-related chronic disease (hypertension, diabetes, or hyperlipidemia), an interest and desire to make a lifestyle change, active telephone contact information (either landline or cell phone), no contraindication to be on a whole-food plant-based diet, access to transportation and a functioning kitchen, ability to prepare meals independently, access to a computer or tablet with internet access, and a digital camera or smartphone. Exclusion criteria included significant unplanned weight loss within 6 months, uncontrolled insulin-dependent diabetes with a current hemoglobin A_{1c} > 9%, pregnancy/lactation, taking prescribed weight loss medication, currently following a diet (eg, plant-based diet, vegan, or medical weight loss program diet), celiac disease diagnosed within 6 months, end-stage hepatic disease or renal disease requiring dialysis, active cancer or receiving chemotherapy or radiation therapy, active alcohol or substance use disorder, history of eating disorders, fasting triglyceride level > 350 mg/dL, any psychological issues that prevent adherence, inability to speak English, limited mobility, and homeless or in housing with limited kitchen access. A baseline 3-day food record was collected from the participants and used in this secondary analysis.

TABLE 1. Baseline Demographics of Study Participants (N = 79)

	Results
Age, mean (SD), y	61.1 (13.0)
Sex, No. (%)	
Female	20 (25)
Male	59 (75)
Race, No. (%)	
African American	10 (13)
American Indian	3 (4)
White	64 (81)
Pacific Islander	1 (1)
Other	1 (1)
Ethnicity, No. (%)	
Hispanic	3 (4)
Non-Hispanic	76 (96)
Body mass index, mean (SD)[a]	34.8 (4.7)

[a]Data missing from 2 patients.

Diet Analysis

Food records were analyzed using Esha Research Food Processor 4.0 to identify calorie and macronutrient information. To limit bias, food items were coded independently by 2 researchers into 4 food processing groups determined by the NOVA classification: MPF, CPF, PRF, and UPF.[8] When possible, specific ingredient information was collected using internet searches for brand product websites. Initial coding had an 89% agreement rate for food item coding between the 2 researchers. As coding was done in duplicate, a third researcher resolved disagreements. The number of food items for each processing group was determined and the mean (SD) percentage of TEI for each NOVA group was provided across participants. A 1-way analysis of variance and Tukey Multiple Comparisons Test were used to determine significance between groups with an $\alpha = .05$ using Prism V9.

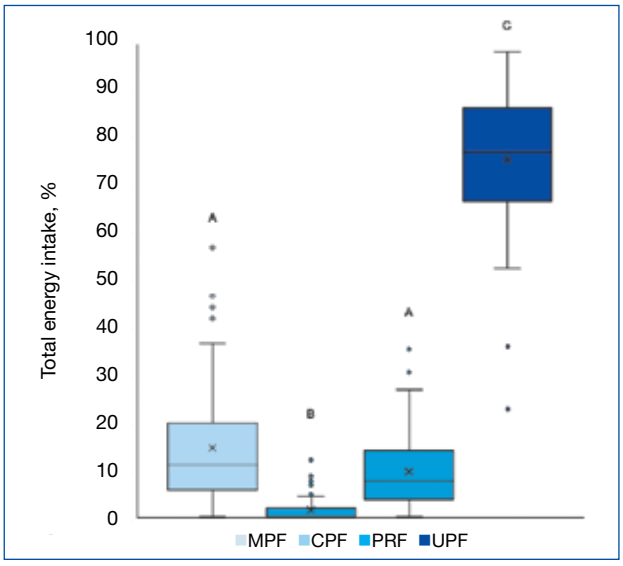

FIGURE. Total energy intake by food processing group from 79 veteran 3-day food records examined with analysis of variance ($P < .001$) and Tukey Multiple Comparisons Test (minimally processed foods [MPFs] vs culinary processed foods [CPFs]; ultra-processed foods [UPFs] vs MPF; CPF vs PRF, CPF vs UPF, PRF vs UPF, $P < .001$; MPF vs PRF: $P = .01$). Box, first and third quartile; median, line in box; mean, X; whiskers, minimum and maximum; circles, outlier results. Data with different letters are significantly different from each other.

RESULTS

Of the 92 participants in the original study, only 79 met inclusion criteria and had baseline diet data. The 79 veterans had a mean (SD) age of 61 (13) years and 59 (75%) were male (Table 1). Mean (SD) TEI was 1921 (815) kcal. The mean (SD) percentage of calories from carbohydrate, fat, and protein were 46% (21%), 39% (20%), and 16% (6%), respectively (Table 2).

A mean (SD) of 36 (12) food items were analyzed from the 3-day food records. The majority of food items were UPFs (56%), 33% were MPFs, 8% were PRFs, and 3% were CPFs. In total, 75% of TEI came from UPFs ($P < .001$); only 14% of TEI came from minimally processed foods (Figure).

DISCUSSION

To our knowledge, this is the first analysis of UPF consumption among US veterans. TEIs coming from UPFs appear to be about 20% higher among veterans compared to nonveterans: 75% vs 55%.[11] Coupled with high UPF consumption, MPFs (14%) and PRFs (9%) represent smaller sources of TEI among surveyed veterans. Top caloric sources of UPFs in the US include sandwiches (including burgers), sweet bakery products, savory snacks, pizza, sweetened beverages, and breads, rolls, and tortillas, and likely reflect the major sources of UPFs in the veteran diet.[13] As the statistical comparison between the veteran data and nonveteran data is not feasible in the present study, a future study with a much larger sample size would be needed for a direct comparison.

While the exact cause of higher UPF consumption among sampled veterans remains unknown and likely multifactorial (eg, cost, food insecurity, access, cooking skills, nutrition knowledge), veterans can receive a consult or self-refer to a registered dietitian nutritionist (RDN) for nutrition education. Counseling has been shown to be an effective way to improve diet quality and increase daily fruit and vegetable intake.[14] High consumption of UPFs, which are generally energy-dense and nutrient-poor, contributes to the low diet quality observed in veterans, and future research examining the relationship between UPF intake and overall diet quality among veterans is warranted.[2,15] As nutrition knowledge is associated with higher diet quality among veterans, increased use of nutrition services (ie, nutrition education or food supplement programs) has the potential to influence consumption of MPFs and decrease consumption of UPFs.[16] Subsequently, UPF-targeted interventions developed by VA RDNs hold the promise to decrease consumption of UPFs and increase intake of MPFs and PRFs.

Veterans have a high prevalence of diabetes, hypertension, and obesity.[9] The high UPF intake observed in this sample of veterans may increase the risk for these chronic diseases and overall mortality. The high percentage of TEI from UPFs among veterans is also of concern not only due to potential negative health outcomes, but also associated costs of treating veterans with multimorbidities.[17] Targeting UPF intake via nutritional education may promote health and decrease the financial burden needed to support the health of veterans.

Improving veteran health and well-being, including enhancing health care accessibility in underserved areas, are pivotal objectives of the VA strategic plan for 2026 to 2030. Public policy aims to tackle food insecurity within the veteran population during the first 5 years of civilian life.[18] In alignment with the White House Strategy on Hunger, Nutrition, and Health, VA established a Food Security Office (FSO) in 2023. The FSO mission is to use an interdisciplinary approach to provide resources to ensure veteran food security and create an environment where all veterans are food and nutrition secure.

Limitations

This study has several limitations. As the Food Processor software database does not include all brand items, similar brands were used to mirror the nutrient profile. While food records are common among veteran diet studies, accuracy may be reduced due to self-reporting bias.[19] Different interpretation of the NOVA classification designation for various food items is possible, however, 89% of foods were coded the same by the research team which suggests high accuracy in food coding. Specific ingredient information was not collected from the 3-day food records; thus, these records were not produced in such a way to improve the accuracy of the NOVA classification designation. This study was limited by its small sample size (N = 79); although, this analysis is larger than other studies of UPF consumption in the US.[20,21] In addition, the generalizability of this study is limited as this population sample was from a single VA hospital and may not reflect the overall veteran population. Participants in this study were recruited only from those receiving VA care, thus their diet quality may not represent the quality consumed by veterans not participating in VA services. Further research on UPF consumption among veterans is warranted with a larger, more representative study sample size.

CONCLUSIONS

As this is the highest observed UPF intake documented in the US, these results should be of concern for the VA and its RDNs. More research is needed to better understand why UPF consumption is so high among veterans, what barriers veterans face to decreasing UPF consumption, and what intervention(s) veterans would welcome to improve their diet quality. Presently, veterans are provided with access to a variety of effective nutrition education and counseling options and should be encouraged to use these services. VA RDNs should be aware of the high intake of UPFs in the veteran population and familiarize themselves with education and counseling strategies that promote behavior change to replace UPFs with more nutrient-dense foods choices.

TABLE 2. Daily Total Energy Intake of Study Participants (N = 79)

Dietary intake	Mean (SD)
Total energy intake, kcal	1921 (815)
Carbohydrate, %	46 (21)
Fat, %	39 (20)
Protein, %	16 (6)
Carbohydrate, g	219 (101)
Fat, g	83 (43)
Protein, g	76 (31)

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Author disclosures

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Disclaimer

The opinions expressed herein are those of the authors and do not necessarily reflect those of *Federal Practitioner*, Frontline Medical Communications Inc., the US Government, or any of its agencies.

Ethics and consent

This study was approved by the Veterans Affairs Phoenix Health Care System Institutional Review Board. Consent was collected from each study participant.

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