Navigating Occupational Challenges: First Responders' Perspectives on Dietary Intake and Behavior

Original Research

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Abstract

Introduction: This study aimed to investigate first responders' dietary beliefs, habits, and food choices.

Methods: Cross-sectional data were obtained from 21 first responders via validated questionnaires. Data were analyzed using SPSS version 29 software.

Results: 21 first responders, including 13 law enforcement officers and eight firefighters, participated (age=37.8±10.0 years, height=180.8±6.5 cm, body mass=94.3±13.1 kg, and body mass index=28.9±4.5 kg/m2). Most participants reported being very willing (n=8, 39.1%) or willing (n=7, 33.3%) to change their eating habits. Barriers to healthy eating included busy lifestyles (n=19, 95%), irregular working hours (n=13, 65%), and willpower (n=10, 50%). Participants also placed importance on several food choice factors.

Conclusions: First responders reported valuing healthy eating. However, unique barriers challenge them despite their willingness to improve their habits. These data may aid further investigation of healthy eating strategies in these populations.

Key Words: Firefighters, Law Enforcement Officers, Food Choice, Nutrition, Diet.

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Introduction

First responders (i.e., firefighters and law enforcement officers [LEOs]) have physically and mentally demanding occupations [1-4] and perform tasks to maintain public safety [1,2,5-10]. The intense and often unanticipated physical demands that first responders face have been shown to induce physiological stress [7], oxidative stress [11], inflammation [12-14], and cardiovascular strain [15,16], all of which exacerbate cardiovascular disease (CVD) risk [16-18]. Thus, first responders are at a higher risk of experiencing a significant cardiac event (i.e., sudden cardiac death) compared to the general population [15,17,19]. However, little is known about first responders' dietary behaviors and intake and the barriers they face.

Dietary modification has been shown to impact health outcomes positively [20-22], and a recent comprehensive review highlighted the need for more research, as little is known about nutrient intake or specific dietary habits and patterns of first responders [1]. Only a few studies have directly explored dietary patterns and habits among firefighters [23-25] and LEOs [26]. Soteriades et al. [25] noted that, among U.S. firefighters, CVD events on duty are strongly connected with poor lifestyle choices (e.g., suboptimal dietary habits). Further, Yang et al. [23] found that most career U.S. firefighters were

classified as overweight (body mass index [BMI] = 25-29 kg/m^2) or obese (BMI ≥30 kg/m^2) and desired to learn more about healthy eating [23]. In addition, less than 30% of the surveyed firefighters reported following a specific diet, with the majority (≈75%) open to receiving dietary education [23]. Christodoulou et al. [24] found that the Mediterranean diet was associated with more favorable cardiometabolic health outcomes compared to the standard American diet among a cohort of U.S. firefighters. Lastly, MacKenzie-Shalders and colleagues [26] assessed the factors and barriers influencing a cohort of 159 U.S. LEOs. They found that 80% of respondents were willing to change their dietary habits to be healthier. In addition, 91% and 80% of respondents placed high importance on consuming nutritious foods and foods high in vitamins and minerals, which highlighted that the cohort was knowledgeable about healthy eating [26]. Importantly, 60% and 41% of respondents noted that a busy lifestyle and irregular working hours were barriers to healthy eating practices [26]. It is important to note that first responder occupational demands vary greatly depending on specific job responsibilities, secondary jobs, stress exposure, and exercise training habits [1]. As such, the barriers to healthy eating may vary among the first responders. Therefore, research is warranted to understand these potential differences better. Taken together, these data suggest that certain cohorts of first responders are knowledgeable of healthy eating; however, there are barriers related to the busy lifestyles of the occupation that hinder their abilities to implement and adhere to healthy eating practices.

First responders need pragmatic lifestyle modifications that promote health while improving occupational performance and readiness. The first step in initiating change in an individual's diet is to identify their current patterns, habits, and barriers hindering healthy eating [1]. In addition, identifying the challenges they face could help implement wellness policies, set up supportive diet environments, encourage healthier eating, and better target the needs of specific fire and police departments [1]. This study aimed to investigate the dietary beliefs, habits, and food choices among a cohort of U.S. first responders and explore differences (if any) between firefighters and LEOs. The specific aims were to 1) explore the self-reported barriers toward optimizing one's diet, 2) report perceptions of factors influencing food choices, and 3) perform a rapid assessment of diet quality and willingness to change via a brief set of surveys suitable for administering among first responders [27-29].

Methods

Participants and Experimental Design

Participants were sampled from local fire and police departments in the south-central U.S. region. Inclusion criteria were that the participants: 1) must have been between 18 and 60 years old at the time of the study, 2) were current first responders within the south-central U.S. region, and 3) provided voluntary, informed consent to participate. If the potential participants did not meet these inclusion criteria, they were excluded from the study. It is important to note that recruitment for this study was conducted through email and social media flyer advertisements, as well as through the investigator's professional networks, across the south-central U.S. region – particularly across the states of Texas and Oklahoma. Self-reported demographic data were collected via an online survey, including height and weight, physical activity (i.e., resistance and endurance-based training frequency), and descriptive dietary data (i.e., current diet, who prepares food/meals). This study was carried out in full accordance with the declaration of Helsinki. All experimental produces subsequently described were approved by the Institutional Review Board of Texas A&M University (IRB-0649M) and the Bond University Human Research Ethics Committee (KM03179).

A cross-sectional survey study was conducted in 2021 (between the months of August and December), which evaluated data from local fire and police departments in urban and rural metropolitan areas in the south-central U.S. region. Interested participants were able to access the online survey via the provided link in the advertisements, where the informed consent portion of the online survey was provided. Once the individuals provided informed consent, they were prompted to click "next" and began responding to the online questionnaires, including the Rapid Eating Assessment for Participants, Shortened Version (REAP-S), the Food Choice Questionnaire (FCQ), and the Perceived Barriers to Health Eating. These questionnaires are designed to assess perceived barriers toward eating a healthy diet, individual attitudes and beliefs toward factors that influence dietary intakes, and dietary quality and willingness to change current eating habits/patterns. If the participants could not complete the surveys in one sitting, they were allowed to save their respondent progress and return later to complete the entire study.

Dietary Questionnaires

Data were obtained using validated surveys administered online via a Qualtrics survey link, which included the REAP-S, the FCQ, and the Perceived Barriers to Health Eating questionnaires. Previously reported internal consistency coefficient (ICC) data among various populations for the surveys are as follows: 1) the REAP-S has been reported to have an ICC of 0.71 [30]; 2) the FCQ has been reported to have an ICC between 0.781–0.918 across all factors [31]; and

3) the Perceived Barriers to Health Eating has been reported to have an ICC between 0.73–0.77. These questionaries have been previously published [27-29,32,33] and utilized to assess dietary intake and patterns among a similar population [26,34]. The REAP-S is a 13-item questionnaire developed at the Albert Einstein College of Medicine of Yeshiva University [35,36]. The questions of REAP-S focus on how often participants consume various foods or dietary patterns during the average week and are categorized as follows: 'usually/often,' 'sometimes,' or 'rarely/never.' The FCQ is a questionnaire used to measure multidimensional factors regarding food choice at the individual level and through factor analysis of health, mood, sensory appeal, price, weight control, convenience, familiarity, and ethical concern [29]. This 36-item questionnaire uses a five-point Likert Scale for responses ranging from 'not important' (score of 1) to 'very important'(score of 5). The FCQ has been utilized among various populations [35,37-39]. Lastly, the Perceived Barriers to Health Eating questionnaire [27], which contains a list of 22 possible barriers to engaging in healthier dietary behaviors, was utilized. Experts in attitudinal research developed this questionnaire to identify perceived barriers to healthy diets [27]. The survey scores indicate diet quality while noting participants' willingness to change eating habits, reflecting readiness to change.

Statistical Analysis

The questionnaire data were analyzed using IBM® Version 29 SPSS® statistical analysis software (IBM Corp., Armonk, NY, USA). Previous work from our group based the sample size on the total number of LEOs within a large metropolitan facility [26,34], while the present study sample size was based on the total number of respondents to the online survey. As such, the investigators sent out several email and social advertisements in an effort to increase respondent rate. A Shapiro-Wilk Test was used to assess normality for all continuous variables. Demographic data were analyzed for differences between the firefighters and LEOs via independent samples t-tests, while effect sizes were calculated via Cohen's d (i.e., small effect, d=0.2; medium effect, d=0.5; and large effect, d=0.8) [40]. For the demographic data, the probability of type I errors (p-level) was set at 0.05 or less, while statistical tendencies were also noted when p-values were between 0.05 and 0.10. All survey categorical data are reported as frequencies (n) and total percentages. Chi-square analysis was used to determine group independence for categorical variables ($p<0.05$) or a Fisher's exact test (two-sided) when results had ≥20% of cells with an expected count of less than five. Significant differences and associations were defined as $p<0.05$ a priori.

Results

Demographics

Twenty-one first responders (n=13 LEOs; n=8 firefighters) from the south-central U.S. participated in the cross-sectional survey study, and the participant characteristics can be viewed in Table 1. Trends were noted for weight ($p=0.066$, d=0.878) and BMI ($p=0.052$, d=0.931), wherein firefighters weighed more (101.0±15.2 vs. 90.2±10.2 kg) and had greater BMIs (31.3±5.7 vs. 27.4±2.9 kg/m^2) than the LEOs. No demographic differences were found between first responder groups for resistance and aerobic training, nor in their reported diets (data shown in the supplementary file, Table 1).

Table 1. Demographic data.

Variable	Occupation	N	Mean		SD	p-value	d
Age	Firefighter	8	40.3	±	10.2		
(years)	LEOs	13	36.2	±	9.9	0.383	0.401
	Total	21	37.8	±	10.0		
Height	Firefighter	8	180.0	±	6.0		
(cm)	LEOs	13	181.3	±	7.0	0.669	0.195
	Total	21	180.8	±	6.5		
Weight	Firefighter	8	101.0	±	15.2		
(kg)	LEOs	13	90.2	±	10.2	0.066	0.878
	Total	21	94.3	±	13.1		
BMI	Firefighter	8	31.3	±	5.7		
(kg/m^2)	LEOs	13	27.4	±	2.9	0.052	0.931
	Total	21	28.9	±	4.5		

Data represented as means ± standard deviation [SD]). The effect size was calculated as Cohen's d. BMI = Body Mass Index; LEOs = Law Enforcement Officers.

Food Choice Questionnaire Results

The FCQ results can be viewed in Table 2. The majority of participants placed importance or high importance on the following FCQ factors: keeps me healthy, is nutritious, is easily available, keeps me awake and alert, tastes good, helps control my weight, is high in protein, and makes me feel good. Secondary chi-square analysis revealed differences between firefighters and LEOs for the following FCQ factors: 'is low in calories' (p=0.046, $\chi 2$=7.956) and 'is low in fat' (p=0.050, $\chi 2$=7.798). The LEOs placed low importance on 'is low in calories' and 'is low in fat' compared to the firefighters (Table 2).

Table 2. Food choice questionnaire results.

FCQ Factors	Not Important	Low Importance	Neutral	Important	Very Important
Keeps me healthy[a]	0 (0%)	0 (0%)	1 (5%)	15 (75%)	4 (20%)
Is nutritious[a]	0 (0%)	0 (0%)	1 (5.3%)	15 (78.9%)	3 (15.8%)
Is easily available[a]	0 (0%)	1 (5%)	2 (10%)	8 (40%)	9 (45%)
Keeps me awake and alert[a]	1 (5%)	1 (5%)	2 (10%)	12 (60%)	4 (20%)
Is high in vitamins/ minerals[a]	0 (0%)	0 (0%)	6 (30%)	13 (65%)	1 (5%)
Tastes good[a]	0 (0%)	0 (0%)	1 (5%)	10 (50%)	9 (45%)
Is good value for moeny[a]	0 (0%)	0 (0%)	5 (25%)	7 (35%)	8 (40%)
Helps control my weight[a]	2 (10%)	0 (0%)	2 (10%)	11 (55%)	5 (25%)
Is high in protein[a]	0 (0%)	0 (0%)	2 (10%)	11 (55%)	7 (35%)
Is easy to prepare[a]	0 (0%)	0 (0%)	7 (35%)	8 (40%)	5 (25%)
Can be bought close to home or work[a]	1 (5%)	0 (0%)	7 (35%)	8 (40%)	4 (20%)
Is good for my skin/ teeth/ hair/ nails	4 (20%)	3 (15%)	8 (40%)	5 (25%)	0 (0%)
Contains natural ingredients	2 (0.1)	3 (0.15)	5 (0.25)	8 (0.4)	2 (0.1)
Can be cooked very simply[a]	0 (0%)	2 (10%)	8 (40%)	5 (25%)	5 (25%)
Makes me feel good[a]	0 (0%)	0 (0%)	4 (20%)	15 (75%)	1 (5%)
Is not expensive[a]	0 (0%)	2 (10%)	6 (30%)	8 (40%)	4 (20%)
Has no additives	2 (10%)	4 (20%)	7 (35%)	6 (30%)	1 (5%)
Has no artificial ingredients	3 (15%)	4 (20%)	5 (25%)	7 (35%)	1 (5%)
Is low in fat	7 (35%)	4 (20%)	7 (35%)	2 (10%)	0 (0%)
Is cheap	0 (0%)	4 (20%)	10 (50%)	4 (20%)	2 (10%)
Takes no time to prepare	1 (5%)	5 (25%)	10 (50%)	2 (10%)	2 (10%)
Helps me relax	2 (10%)	8 (40%)	7 (35%)	2 (10%)	1 (5%)
Helps me cope with stress	5 (25%)	9 (45%)	4 (20%)	2 (10%)	0 (0%)
Has a pleasant texture[a]	2 (10%)	1 (5%)	6 (30%)	9 (45%)	2 (10%)
Is low in calories	7 (35%)	5 (25%)	6 (30%)	2 (10%)	0 (0%)
Is high in fiber	7 (35%)	3 (15%)	7 (35%)	3 (15%)	0 (0%)
Is familiar to me	3 (15%)	1 (5%)	8 (40%)	7 (35%)	1 (5%)
Smells nice[a]	0 (0%)	2 (10%)	6 (30%)	11 (55%)	1 (5%)
Helps me cope with life	8 (40%)	4 (20%)	7 (35%)	1 (5%)	0 (0%)
What I usually eat	2 (10.5%)	2 (10.5%)	10 (52.6%)	4 (21.1%)	1 (5.3%)
Environmentally friendly packaging	8 (40%)	5 (25%)	6 (30%)	1 (5%)	0 (0%)
Country of origin clearly marked	8 (40%)	7 (35%)	4 (20%)	1 (5%)	0 (0%)
From countries I approve of politically	10 (50%)	4 (20%)	6 (30%)	0 (0%)	0 (0%)
Is like the food I ate when I was a child	8 (40%)	5 (25%)	5 (25%)	2 (10%)	0 (0%)
Cheers me up	4 (20%)	5 (25%)	10 (50%)	1 (5%)	0 (0%)

[a]Indicates the FCQ factor has an accumulative percentage ≥50% for 'important' and 'very important.' Data are presented as frequencies (n) and total percentages.

Rapid Eating Assessment for Participants Results

The REAP-S results can be viewed in Table 3. When asked, 'How willing are you to make changes in your eating habits in order to be healthier?', most participants reported being very willing (39.1%, n=8), followed by willing (33.3%, n=7), neutral (14.3%, n=3), not very willing (9.5%, n=2), and not willing at all (4.8%, n=1) to make changes, wherein a chi-square analysis revealed no differences between the firefighters and LEOs (Table 3).

Table 3. Rapid eating assessment for participants, shortened version results.

In an average week, how often do you? n (%)	Usually/Often	Sometimes	Rarely/Never
Skip breakfast?	6 (28.6%)	4 (19.0%)	11 (52.4%)
Eat 4 or more meals from sit-down or take out restaurants?	2 (11.1%)	6 (33.3%)	10 (55.6%)
Eat less than 2 servings of whole grain products or high fiber starchy carbohydrates a day?	6 (28.6%)	9 (42.9%)	6 (28.6%)
Eat less than 2 servings of fruit a day?	11 (52.4%)	8 (38.1%)	2 (9.5%)
Eat less than 2 servings of vegetables a day?	5 (23.8%)	14 (66.7%)	2 (9.5%)
Eat or drink less than 2 servings of milk, yoghurt, or cheese a day?	5 (23.8%)	5 (23.8%)	11 (52.4%)
Eat more than 7.5 oz of meat, chicken, turkey or fish per day?	16 (76.2%)	3 (14.3%)	2 (9.5%)
Use regular processed meats?	2 (9.5%)	7 (33.3%)	12 (57.1%)
Eat fried foods such as fried chicken, fried fish, fries/ chips?	2 (9.5%)	14 (66.7%)	5 (23.8%)
Eat regular potato chips, nacho chips, corn chips, crackers, regular popcorn, nuts instead of pretzels, low-fat chips or low- fat crackers, air-popped popcorn?	4 (19.0%)	9 (42.9%)	8 (38.1%)
Add butter, margarine or oil to bread, potatoes, rice or vegetables?	8 (38.1%)	6 (28.6%)	7 (33.3%)
Eat sweets like cake, cookies, pastries, donuts, muffins, chocolate and candies more than 2 times per day?	5 (25.0%)	6 (30.0%)	9 (45.0%)
Drink 16 oz or more of non-diet soda, fruit drink?	4 (19.0)	3 (14.3)	14 (66.7%)

Data are presented as frequencies (n) and total percentages.

Perceived Barriers to Healthy Eating Results

Table 4 shows the results for perceived barriers to healthy eating. The main barriers reported include a busy lifestyle, irregular working hours, and willpower. The secondary chi-square analysis did not reveal any differences between firefighters and LEOs (Table 4).

Table 4. First responders' perceived barriers to healthy eating results.

What barriers to healthy eating can you identify with? n (%)	Overall
Busy lifestyle	19 (95%)
Irregular working hours	13 (65%)
Lengthy preparation	5 (25%)
Price of healthy foods	8 (40%)
Cooking skills	5 (25%)
Not knowing enough about healthy eating	3 (15%)
Not enough food to satisfy hunger	1 (5%)
Limited choices when I eat out	4 (20%)
Giving up foods I like	9 (45%)
Willpower	10 (50%)
Unappealing food	7 (35%)
Taste preferences of family and friends	6 (30%)
Healthy food is more perishable	7 (35%)
Strange or unusual foods	2 (10%)
Experts keep changing their minds	5 (25%)
Storage facilities	0 (0%)
Limited cooking facilities	1 (5%)
Healthy options not available canteen/home	0 (0%)
I don't want to change my eating habits	3 (15%)
Healthy food is more awkward to carry from shops	0 (0%)
Too great a change from my current diet	1 (5%)
Feeling conspicuous amongst others	0 (0%)

Data are presented as frequencies (n) and total percentages. One participant did not fill out this questionnaire section and is not included in the analysis.

Discussion

The present study provides insight into the factors influencing dietary habits and patterns, food choices, and perceived barriers to healthy eating among a cohort of first responders from a south-central region of the U.S. In particular, 72.4% of the first responders expressed willingness to change their current dietary habits (very willing: 39.1% and willing: 33.3%) to be healthier. However, despite the desire to change, several key perceived barriers were reported, such as busy lifestyle (95%), irregular working hours (65%), and willpower (50%), among others. Importantly, these perceived barriers did not differ between the two subgroups of first responders (firefighters and LEOs). Several food choice factors were also identified, including 'keeps me healthy, 'is nutritious,' and 'is high in protein,' which influenced the foods eaten and diet(s) followed by the first responders (i.e., high protein diet). These data are critical to understanding first responder nutrition and how to best serve these populations with precision nutrition guidance (e.g., increasing protein intake or modulating dietary deficiencies).

The REAP-S questionnaire results demonstrate that first responders are willing to change their dietary habits, which mirrors other reports among LEOs [26,34]. In a study of U.S. first responders, MacKenzie-Shalders et al. [34] found that when asked whether participants would like to change what they eat, reserve police officers (60%), custody assistants (55%), and sworn deputies (34%) all agreed that they would like to change what they eat as opposed to disagreed (5%, 8% and 17% respectively). Furthermore, responses to the REAP-S reported in other work by MacKenzie-Shalders et al. [26] found that 94% of police officers were willing (14%) or very willing (80%) to change their eating habits to be healthier. Unfortunately, many LEOs believe their occupations are not conducive to healthy eating [41]. The findings of this study partly support this supposition.

For example, in the current study, the main barrier to healthy eating identified was a busy lifestyle (95%), exemplified by the sporadic occupation and the fact that many first responders have multiple jobs [42]. The first responders also reported irregular working hours (65%) and willpower (50%) as the other two main perceived barriers to healthy eating. Unfortunately, the nature of both firefighting and policing is unpredictable, and these first responders may be subject to multiple response/emergency calls throughout their shifts. The firefighters' dietary behaviors will likely be impacted by location (i.e., city, town, rural, or urban region), time, accessibility, and convenience, and over time, these dietary behaviors can become habits that persist and contribute to chronic disease risk [43]. Similarly, LEOs are subject to shift work and mandatory overtime. As a result, these first responders may struggle to adhere to conventional mealtimes. To this end, importance and high importance were placed on the FCQ factor 'is easily available' (40% and 45%, respectively) and 'is easy to prepare' (40% and 25%, respectively), supporting the notion that first responder will likely opt for convenience given the constraints of their occupation (i.e., shift work, overtime, sporadic response/emergency call volumes). While the cohort of first responders value nutritious foods (94.7%), there are factors beyond nutritional knowledge that may prevent dietary behavioral change, and further research is warranted to help unmask these factors.

One potential solution can be found in the work by Sotos-Prieto and colleagues [44], who assessed a cohort of U.S. firefighters via telephone interviews. In their study, the authors identified that incumbent and recruit firefighters valued culture within the firehouse to foster better nutrition. In other words, having peer support and a food environment with healthy food options may offer a solution to some of the perceived barriers. Furthermore, participants of the Sotos-Prieto et al. [44] study reported a need for more education on proper nutrition as another key barrier. Contrasting this, only 15% of the first responders in this study reported 'not knowing enough about healthy eating' as a perceived barrier, suggesting they believe that their knowledge is not a barrier to healthy eating. For example, when asked if they 'skip breakfast' or 'eat four or more meals from sit-down or take-out restaurants,' most participants reported rarely/never (52.38% and 55.55%, respectively). A majority also reported consuming more than 7.5 ounces from protein sources daily. It is also worth noting that the participants reported they tend to undereat fruits and vegetables (i.e., consuming less than two servings). While these responses were self-reported, previous research has demonstrated that an individual's perceived diet quality parallels their actual diet quality [45]. Taken together, the results of the REAP-S questionnaire highlight that the first responders are aware of their shortcomings regarding healthy eating. Considering the findings of other qualitative work, first responders and practitioners working with these populations need to ensure their job site (i.e., police or fire station) fosters strong peer support and provides easy access to healthier food options (e.g., fruits and vegetables in the kitchen or breakroom).

There are no clear nutritional standards or guidelines for first responders [1]. General energy and macronutrient provisions and timing are currently considered to mirror that of the general public; however, it is clear that first responders face specific physically and psychologically demanding conditions that augment their nutritional needs. In addition, eating environments for firefighters and LEOs may differ based on the sense of community among stations

within departments. For instance, firefighters may share meals or eat together when on shift, which may be an important factor for nutritional intervention and dietary adherence (i.e., implementing healthy eating that can be shared among the group rather than just the individual). In comparison, LEOS may not dine together as often, thus, dietary interventions must take this into consideration. Furthermore, care should also be given to the heightened risk of CVD among first responders [1]. It is also important to note that first responders are susceptible to various sedentary-related health conditions (e.g., diabetes) [1]. Interestingly, nearly 50% of the cohort of first responders in the present study reported engaging in 0-1 session(s) per week of aerobic training, while 33.3% and 28.6% of first responders reported engaging in 0-1 and 2 session(s) per week, respectively. These results suggest that most of the first responders in this study did not meet the healthy adult exercise guidelines, 30 minutes five times per week, recommended by the American College of Sports Medicine [46]. While this may not be indicative of the exercise training habits of other U.S. first responders [47,48], it is important to note, as there are data to suggest first responders are largely sedentary [49-52] and that they become less fit throughout their careers [53]. Considering the intense physical demands of these occupations (e.g., requirements to lift, carry, or drag heavy objects/people [5,6,8-10,54], it is important for first responders to engage in regular resistance and aerobic training, which may increase their nutritional demands.

This study has several limitations. First, only first responders within the south-central region of the U.S. were surveyed, and these results may not be indicative of other regions/areas across the U.S. or other countries. Therefore, these results should be interpreted with caution when generalizing to other groups of first responders from different regions or countries, as many of these dietary habits, patterns, and barriers will be influenced by the culture and surrounding environment of the station and department. Second, this study included a relatively small sample size. The survey questionnaires were shared via a Qualtrics survey link, which may be detected as phishing or spam filters by departmental email filters and may not have reached some employee emails. Furthermore, there were time constraints on obtaining a high response rate due to agency availability. Indeed, further work is needed to survey other regions across the U.S., which will likely increase the sample size included in future research. Lastly, the questionnaire answers are all self-reported; therefore, the continuous data (i.e., BMI, body weight) may not be accurate. However, the work by Dawes et al. [55] does suggest that self-reported height, weight, and derived BMI in these populations are accurate. A notable strength of this study was that the questionnaires included were validated and provided a broad description of the respondents' dietary habits, patterns, and perceived barriers.

Conclusions

Research suggests that first responders are willing to change their current dietary habits to be healthier; however, they face barriers (e.g., busy lifestyles and irregular working hours) that limit their ability to make changes. Of note, first responders do appear to have some knowledge of healthy eating habits (i.e., increasing dietary protein, not skipping breakfast). Thus, interventions to improve their healthy eating habits will likely benefit this population. First responders in this study reported falling short regarding fruit and vegetable consumption and meeting weekly exercise recommendations; thus, interventions should consider increasing fruit and vegetable consumption and enablers to increase daily exercise. Further, barriers within the respective stations, departments, cities, and regions influence the dietary habits of first responders (i.e., culture, peer support, food environment), and more research is needed to understand better what these barriers are and how to overcome them best. Lastly, minimal differences were noted (i.e., the FCQ factors 'is low in calories' and 'is low in fat') between the firefighters and LEOs. These first responder groups likely have similar barriers and habits. First responders and practitioners should consider these results when gauging their stations or departments' dietary needs in prioritizing healthy eating and better-fueling strategies to combat disease risk and improve occupational health, performance, and readiness.

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References

1. Gonzalez DE, McAllister MJ, Waldman HS, et al. International society of sports nutrition position stand: tactical athlete nutrition. *J Int Soc Sports Nutr*. 2022;19(1):267-315. doi:10.1080/15502783.2022.2086017
2. Gonzalez DE, Lanham SN, Martin SE, et al. Firefighter Health: A Narrative Review of Occupational Threats and Countermeasures. MDPI; 2024:440.
3. Irving S, Orr R, Pope R. Profiling the Occupational Tasks and Physical Conditioning of Specialist Police. *Int J Exerc Sci*. 2019;12(3):173-186.
4. Dawes JJ, Orr RM, Elder CL, Rockwell C. Association between body fatness and measures of muscular endurance among part-time swat officers. *Journal of Australian Strength & Conditioning*. 2014;22(4)

5. Scofield DE, Kardouni JR. The tactical athlete: a product of 21st century strength and conditioning. *Strength & Conditioning Journal*. 2015;37(4):2-7.
6. Orr RM, Pope RR, Johnston V, Coyle J. The operational load carriage context of the Australian army soldier. 2012:
7. Gonzalez DE, Dillard CC, Johnson SE, Martin SE, McAllister MJ. Physiological stress responses to a live-fire training evolution in career structural firefighters. *J Occup Environ Med*. Mar 13 2024;doi:10.1097/jom.0000000000003088
8. Dawes JJ, Kornhauser C, Crespo D, Elder CL, Lindsay K, Holmes RJ. Does body mass index influence the physiological and perceptual demands associated with defensive tactics training in state patrol officers? *International journal of exercise science*. 2018;11(6):319.
9. Davis MR, Easter RL, Carlock JM, et al. Self-reported physical tasks and exercise training in Special Weapons and Tactics (SWAT) teams. *The Journal of Strength & Conditioning Research*. 2016;30(11):3242-3248.
10. Abel MG, Palmer TG, Trubee N. Exercise program design for structural firefighters. *Strength & Conditioning Journal*. 2015;37(4):8-19.
11. McAllister MJ, Basham SA, Smith JW, et al. Effects of Environmental Heat and Antioxidant Ingestion on Blood Markers of Oxidative Stress in Professional Firefighters Performing Structural Fire Exercises. *J Occup Environ Med*. Nov 2018;60(11):e595-e601. doi:10.1097/jom.0000000000001452
12. Walker A, Keene T, Argus C, Driller M, Guy JH, Rattray B. Immune and inflammatory responses of Australian firefighters after repeated exposures to the heat. *Ergonomics*. 2015;58(12):2032-9. doi:10.1080/00140139.2015.1051596
13. Wolkow A, Aisbett B, Jefferies S, Main LC. Effect of Heat Exposure and Simulated Physical Firefighting Work on Acute Inflammatory and Cortisol Responses. *Ann Work Expo Health*. Jun 1 2017;61(5):600-603. doi:10.1093/annweh/wxx029
14. Mnatsakanova A, Andrew ME, Hartley TA, Fekedulegn D, Burchfiel CM. Stress and Inflammation Among Police Officers. *Annals of Epidemiology*. 2013/09/01/ 2013;23(9):596. doi:https://doi.org/10.1016/j.annepidem.2013.06.081
15. Smith DL, DeBlois JP, Kales SN, Horn GP. Cardiovascular Strain of Firefighting and the Risk of Sudden Cardiac Events. *Exerc Sport Sci Rev*. Jul 2016;44(3):90-7. doi:10.1249/jes.0000000000000081
16. Kales SN, Smith DL. Firefighting and the Heart. *Circulation*. 2017;135(14):1296-1299. doi:doi:10.1161/CIRCULATIONAHA.117.027018
17. Smith DL, Barr DA, Kales SN. Extreme sacrifice: sudden cardiac death in the US Fire Service. *Extreme Physiology & Medicine*. 2013/02/01 2013;2(1):6. doi:10.1186/2046-7648-2-6
18. Moffatt SM, Stewart DF, Jack K, et al. Cardiometabolic health among United States firefighters by age. *Preventive Medicine Reports*. 2021/09/01/ 2021;23:101492. doi:https://doi.org/10.1016/j.pmedr.2021.101492
19. Campbell R, Petrillo J. Fatal Firefighter Injuries in the United States. 2023.
20. Cena H, Calder PC. Defining a Healthy Diet: Evidence for The Role of Contemporary Dietary Patterns in Health and Disease. *Nutrients*. Jan 27 2020;12(2)doi:10.3390/nu12020334
21. Lichtenstein AH, Appel LJ, Vadiveloo M, et al. 2021 Dietary Guidance to Improve Cardiovascular Health: A Scientific Statement From the American Heart Association. *Circulation*. 2021;144(23):e472-e487. doi:doi:10.1161/CIR.0000000000001031
22. Kerksick CM, Wilborn CD, Roberts MD, et al. ISSN exercise & sports nutrition review update: research & recommendations. *J Int Soc Sports Nutr*. Aug 1 2018;15(1):38. doi:10.1186/s12970-018-0242-y
23. Yang J, Farioli A, Korre M, Kales SN. Dietary Preferences and Nutritional Information Needs Among Career Firefighters in the United States. *Glob Adv Health Med*. Jul 2015;4(4):16-23. doi:10.7453/gahmj.2015.050
24. Christodoulou A, Christophi CA, Sotos-Prieto M, Moffatt S, Kales SN. Eating Habits among US Firefighters and Association with Cardiometabolic Outcomes. *Nutrients*. Jul 4 2022;14(13)doi:10.3390/nu14132762
25. Soteriades ES, Smith DL, Tsismenakis AJ, Baur DM, Kales SN. Cardiovascular disease in US firefighters: a systematic review. *Cardiol Rev*. Jul-Aug 2011;19(4):202-15. doi:10.1097/CRD.0b013e318215c105
26. MacKenzie-Shalders K, Matthews C, Dulla J, Orr R. Law enforcement personnel are willing to change, but report influencing beliefs and barriers to optimised dietary intake. *BMC Public Health*. 2020/11/02 2020;20(1):1638. doi:10.1186/s12889-020-09716-z
27. Spence M, Livingstone MBE, Hollywood LE, et al. A qualitative study of psychological, social and behavioral barriers to appropriate food portion size control. *International Journal of Behavioral Nutrition and Physical Activity*. 2013;10:1-10.
28. Kearney M, Gibney MJ, Martinez JA, et al. Perceived need to alter eating habits among representative samples of adults from all member states of the European Union. *Eur J Clin Nutr*. Jun 1997;51 Suppl 2:S30-5.

29. Dellava JE, Hamer RM, Kanodia A, Reyes-Rodríguez ML, Bulik CM. Diet and physical activity in women recovered from anorexia nervosa: a pilot study. *International Journal of Eating Disorders*. 2011;44(4):376-382.
30. Shankar V, Thompson KH, Wylie-Rosett J, Segal-Isaacson CJ. Validation and reliability for the updated REAP-S dietary screener, (Rapid Eating Assessment of Participants, Short Version, v.2). *BMC Nutr*. Jul 19 2023;9(1):88. doi:10.1186/s40795-023-00747-4
31. Markovina J, Stewart-Knox B, Rankin A, et al. Food4Me study: Validity and reliability of Food Choice Questionnaire in 9 European countries. *Food Quality and Preference*. 05/14 2015;45:26-32. doi:10.1016/j.foodqual.2015.05.002
32. Johnston CS, Bliss C, Knurick JR, Scholtz C. Rapid Eating Assessment for Participants [shortened version] scores are associated with Healthy Eating Index-2010 scores and other indices of diet quality in healthy adult omnivores and vegetarians. *Nutr J*. Sep 28 2018;17(1):89. doi:10.1186/s12937-018-0399-x
33. Lam R, Riggs J, Sunseri M, et al. Nutritional assessment of the world trade center-health program fire department of New York cohort. *C43 COPD AND POPULATION HEALTH*. American Thoracic Society; 2019:A4877-A4877.
34. MacKenzie-Shalders KL, Lee KW, Wright C, Dulla J, Tsoi A, Orr RM. Dietary Intake in Law Enforcement Personnel: Occupation Is an Additional Challenge for Changing Behavior. *Nutrients*. Mar 23 2022;14(7)doi:10.3390/nu14071336
35. Segal-Isaacson C, Wylie-Rosett J, Gans KM. Validation of a short dietary assessment questionnaire: the Rapid Eating and Activity Assessment for Participants short version (REAP-S). *The Diabetes Educator*. 2004;30(5):774-781.
36. Gans KM, Ross E, Barner CW, Wylie-Rosett J, McMurray J, Eaton C. REAP and WAVE: new tools to rapidly assess/discuss nutrition with patients. *The Journal of nutrition*. 2003;133(2):556S-562S.
37. Kearney JM, McElhone S. Perceived barriers in trying to eat healthier–results of a pan-EU consumer attitudinal survey. *British Journal of Nutrition*. 1999;81(S1):S133-S137.
38. Dawes JJ, Orr RM, Siekaniec CL, Vanderwoude AA, Pope R. Associations between anthropometric characteristics and physical performance in male law enforcement officers: A retrospective cohort study. *Annals of occupational and environmental medicine*. 2016;28:1-7.
39. Cunha LM, Cabral D, Moura AP, de Almeida MDV. Application of the Food Choice Questionnaire across cultures: Systematic review of cross-cultural and single country studies. *Food quality and preference*. 2018;64:21-36.
40. Lakens D. Calculating and reporting effect sizes to facilitate cumulative science: a practical primer for t-tests and ANOVAs. *Front Psychol*. Nov 26 2013;4:863. doi:10.3389/fpsyg.2013.00863
41. Ramey SL, Downing NR, Knoblauch A. Developing strategic interventions to reduce cardiovascular disease risk among law enforcement officers: the art and science of data triangulation. *Aaohn j*. Feb 2008;56(2):54-62. doi:10.1177/216507990805600202
42. Rivard MK, Cash RE, Chrzan K, Panchal AR. The Impact of Working Overtime or Multiple Jobs in Emergency Medical Services. *Prehosp Emerg Care*. Sep-Oct 2020;24(5):657-664. doi:10.1080/10903127.2019.1695301
43. Joe MJ, Hatsu IE, Tefft A, Mok S, Adetona O. Dietary Behavior and Diet Interventions among Structural Firefighters: A Narrative Review. *Nutrients*. Nov 4 2022;14(21)doi:10.3390/nu14214662
44. Sotos-Prieto M, Jin Q, Rainey D, Coyle M, Kales SN. Barriers and solutions to improving nutrition among fire academy recruits: a qualitative assessment. *Int J Food Sci Nutr*. Sep 2019;70(6):771-779. doi:10.1080/09637486.2019.1570087
45. Powell-Wiley TM, Miller PE, Agyemang P, Agurs-Collins T, Reedy J. Perceived and objective diet quality in US adults: a cross-sectional analysis of the National Health and Nutrition Examination Survey (NHANES). *Public Health Nutr*. Dec 2014;17(12):2641-9. doi:10.1017/s1368980014000196
46. Garber CE, Blissmer B, Deschenes MR, et al. American College of Sports Medicine position stand. Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: guidance for prescribing exercise. *Med Sci Sports Exerc*. Jul 2011;43(7):1334-59. doi:10.1249/MSS.0b013e318213fefb
47. Langford E, Snarr R, Bridget M. Physical fitness initiatives in the fire service—barriers and benefits. *Tactical Strength Cond Rep*. 2019;54:4-7.
48. Agostinelli P, Hirschhorn R, Sefton J. Exercise habits and resources for southeastern US firefighters. *Journal of Occupational and Environmental Medicine*. 2023;65(5):e351-e357.
49. Kukić F, Heinrich KM, Koropanovski N, et al. Differences in Body Composition across Police Occupations and Moderation Effects of Leisure Time Physical Activity. *Int J Environ Res Public Health*. Sep 18 2020;17(18)doi:10.3390/ijerph17186825

50. Kales SN, Soteriades ES, Christoudias SG, Christiani DC. Firefighters and on-duty deaths from coronary heart disease: a case control study. *Environ Health*. Nov 6 2003;2(1):14. doi:10.1186/1476-069x-2-14
51. Guidotti TL. Human factors in firefighting: ergonomic-, cardiopulmonary-, and psychogenic stress-related issues. *Int Arch Occup Environ Health*. 1992;64(1):1-12. doi:10.1007/bf00625945
52. Dicks ND, Shoemaker ME, DeShaw KJ, Carper MJ, Hackney KJ, Barry AM. Contributions from incumbent police officer's physical activity and body composition to occupational assessment performance. *Front Public Health*. 2023;11:1217187. doi:10.3389/fpubh.2023.1217187
53. Orr R, Dawes J, Pope R, Terry J. Assessing Differences In Anthropometric And Fitness Characteristics Between Police Academy Cadets And Incumbent Officers. *Journal of strength and conditioning research*. 11/06 2017;32doi:10.1519/JSC.0000000000002328
54. Johnson QR, Goatcher JD, Diehl C, et al. Heart rate responses during simulated fire ground scenarios among full-time firefighters. *International journal of exercise science*. 2020;13(2):374.
55. Dawes J. Accuracy of self-reported height, body mass and derived body mass index in a group of law enforcement officers. *Nauka bezbednost policija*. 07/31 2019;24doi:10.5937/nabepo24-21191