

Utilizing Focus Groups to Identify Nutrition Education Needs and Implementation Strategies
for the Wildland Firefighter

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Abstract

Wildland firefighters (WLFFs) often participate in sustained, mental and physical efforts throughout the work shift. (Cuddy et al., 2015) This shift is typically upwards of 12 hours or more and includes working in heat, smoke, and uneven terrain. As fire seasons increase in length and intensity greater strain is placed upon the wildland firefighter who is being asked to perform at a higher level, for longer. It is becoming increasingly important to ensure the WLFF is offered adequate quantity as well and quality of nourishment while working. It is also evident the nutrition education of the WLFF should be emphasized to support the workforce in making health promoting choices during the fire season, and beyond.

The purpose of this study is to identify specific nutrition education needs and guide future nutrition education development for the wildland firefighter. This research aimed to describe the current state of wildland firefighter nutrition education, identify topics of importance for future nutrition education, and describe implementation strategies for tailored nutrition education. This qualitative research gathered focus group interview sessions as well as demographic data on participants like resource type and seasons of fire. Recruitment represented the diversity in resource types and wildland firefighter experience levels. The Constant Comparative Strategy was used to generate themes from the transcriptions of focus group interviews. Results indicate interest in early introduced, multimodal, and specific nutrition education tailored to the demands of the wildland firefighter. The findings from this project provide ways to structure education regarding nutrition for wildland firefighters on fire assignment and may be used to develop educational materials for future fire seasons.

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Dedication

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CHAPTER 1: Introduction to the Wildland Firefighter

Wildland firefighters often participate in sustained, mental and physical efforts throughout the work shift. (Cuddy et al., 2015) This shift can be upwards of 12 hours and include working in heat, smoke, and uneven terrain and last fourteen consecutive days or more. Some of the physical requirements include extensive walking, climbing, hiking and kneeling while wearing multiple pieces of equipment in very loose, rocky, muddy surfaces. Listed also in the description are occupational environmental exposures such as extreme heat, airborne particles, falling rocks and trees, holes and drop-offs, snakes, insects, and poisonous plants, among others. Duties and physical fitness standards vary greatly between individuals of different crew and employment types. Wildland firefighters may be employed as permanent full-time, permanent part-time, permanent seasonal, or temporary seasonal employees. Employment opportunities depend upon workload fluctuations, which may vary greatly from year to year (*WF: Working in Wildland Fire - Fire (U.S. National Park Service)*, n.d.). In the United States, several agencies employ WLFFs at the federal level: Bureau of Indian Affairs (BIA); Bureau of Land Management (BLM); Fish and Wildlife Service (FWS); Forest Service (USFS); National Park Service (NPS); and United States Fire Administration (USFA), among others (*Wildland Fire Position Descriptions*, n.d.) State, tribal, territorial, local, and private agencies also employ WLFFs.

Energy demands can vary greatly depending on the WLFFs role on the incident. From some of the more sedentary positions, which play a vital role in incident management, planning, communication, and providing logistic support, but not necessarily engaging in as strenuous physical activity to greater energy demands from the type 1 crews such as smokejumpers, rappellers, and hotshots, who are deployed by air or ground into remote areas, carrying heavy loads for long distances, serving as first responders in fire suppression in inaccessible areas, and performing physically strenuous tasks for long periods of time. (*Wildland Fire | US Forest Service*, n.d.)

The use of hand tools to dig a fireline, hiking, lifting and carrying loads are physically taxing tasks that WLFFs must be able to perform for several hours at a time, often under strenuous conditions. In order to carry out their duties safely, WLFFs must build work

capacity, which is defined as the "ability to accomplish production goals without undue fatigue, and without becoming a hazard to oneself or coworkers. It is a complex composite of aerobic and muscular fitness, natural abilities, intelligence, skill, experience, acclimatization, nutrition, and—of course— motivation" (Sharkey, 1997) As fire seasons increase in length and intensity greater strain is placed upon all wildland firefighters who are being asked to perform at a higher level, for longer. Since nutrition falls under the definition of “work capacity”, it is becoming increasingly important to ensure adequate quantity as well as quality of nourishment is provided to the wildland firefighter while on assignment.

This workforce may be provided with food and drink under the guidance of incident management teams while on large fires or may be required to self-select meals when given per diem while traveling or on smaller or more remote fires. Additionally, individuals use personal funds in the offseason to self-select meals that support the physical preparation and proper recovery for the arduous job. While proper nutrition is important for the health and safety of the wildland firefighter, there is currently no widely taught human performance course to offer guidance on nutritional requirements and recommendations within the required training for qualifying as a wildland firefighter. (*Fit for Fire, RT-130, Wildland Fire Safety Training Annual Refresher (WFSTAR) / NWCG*, n.d.) This poses a significant problem to this population that relies on their body as a critical tool to complete their job, but is not given any instruction on the fueling, care, or maintenance of mind and body. Multi-day courses are offered on the care and maintenance of tools such as the portable pump or chainsaw, for example, with field demonstrations included, therefore a large emphasis is placed overall on equipment maintenance. (NWCG, 2019) This project will demonstrate the desire and necessity for a nutrition education component in training for the wildland firefighter, as well as suggest avenues for implementation as targeted by current research and the responses of wildland firefighters themselves.

Problem Statement

The purpose of this study is to identify specific nutrition education needs and guide future nutrition education development for the wildland firefighter.

CHAPTER 2: Review of Literature

Physical Demands of the Wildland Firefighter

Wildland fire positions (resource types) include hand crews, helitack helicopter or rappel crews, hotshot crews, engine crews, equipment operators, smokejumpers, dispatchers, and fire prevention specialists. These roles are often performed in primitive, backcountry conditions. Each resource type encounters different rigors of the job depending on their assignment on the fire as well as how they get to and from the work environment. For example, an engine crewmember typically drives to the fire and utilizes water from their engine as a suppression tool, while a rappeler may be aurally delivered and may be expected to be self-sustained with what they have on their person for the duration of the initial attack of the incident. Although there are specific training requirements for each position, it is essential that every wildland firefighter be in top physical condition for this demanding work. (NWCG, 2019) The wildland firefighting occupation is a unique combination of strength, speed but also endurance, and at times high-intensity work that are highly energy consumptive. There is great variability in this dependent on many factors some of which include the resource type, complexity of the incident, fire behavior, and task assigned. (West et al., 2020) To better understand the energy requirements of the job the daily energy expenditure was determined using doubly labeled water methodology. Results suggested a range of 2946-6083 kcals per day. (Cuddy et al., 2015) A blanket nutrition recommendation as outlined in the national mobile food service contract has the potential to nourish the majority of this population, but nutrition education is needed to tailor consumption to the uniqueness of the job demands for each person on their specific shift.

Meeting Wildland Firefighter Nutrition Needs

Wildland firefighting can be a physically demanding field, but the demands of the job can vary greatly day-to day. (West et al., 2020) Much like the military, the unpredictability of the job, remote nature of the work, and large number of personnel creates a complex situation regarding widespread meal planning. Unless there is consumer acceptance of the food, it will not be consumed, and nutrition in the field could be compromised. Meeting all the nutritional requirements is predicated upon consumption of the rations. Many of the challenges that arise

with dietary estimation of dietary adequacy in the military population are encountered in wildland firefighter population. Accurately understanding the nutritional requirements to sustain the health and performance of wildland firefighters is integral to ensuring their physiological and psychological wellbeing and operational readiness, much like the military. (Ahmed et al., 2017) An interested person above the age of eighteen can complete the required coursework and physical fitness standards and qualify to fight wildland fire. Therefore, there are many combinations of age, gender, lifestyle and physical fitness level, and education when considering who is entering the field. (NWCG, 2019) Over 34,000 individuals are employed as wildland firefighters in the United States and asked to engage in arduous, high-risk duty. (Noonan et al., 2020) This creates a unique challenge to those in charge of feeding the workforce. Currently, caterers on the largest incidents must create meals to meet specifications outlined in the National Mobile Food Services Contract. (Robillard, n.d.) This contract is a detailed outline of requirements for each meal for the wildland firefighter. Meals served on the largest incidents include breakfast, shift provisions, and dinner. “Shift provisions” are the rations distributed for the work shift, designed to encompass the “lunch” meal but are intended to be eaten periodically throughout the shift rather than one sit-down meal mid-day. There is detailed information on what categories are required and the quality and serving size of categories in each meal. Due to the variability in the workforce, the meals outlined in the food contract may or may not satisfy the needs of the individual. Therefore, there is a need for empowering the individual to self-select nutritious options. Particularly because the workforce will not be guaranteed to be placed in a work environment with catered food. There are many situations where the worker is tasked with feeding themselves on often limited resources. The current educational framework does not contain content related to self-selecting meal components nor periodization of nutrition.

Training Priorities and Opportunities for the Wildland Firefighter

The large number of personnel employed as wildland firefighters, and urgency of the growing intensity and longevity of fire seasons does not permit prolonged training. Wildland firefighters have limited time to become “red-carded” and qualify before becoming available to leave their home units and work on active wildfire incidents. There are currently five required courses for the wildland firefighter’s basic academy, known as “guard school”.

These courses include Introduction to the Incident Command System, Human Factors in the Wildland Fire Service, Firefighter Training, Introduction to Fire Behavior, and an Introduction to the National Incident Management System.

In the “Human Factors in the Wildland Fire Service”, topics include situational awareness, basic communication responsibilities, attitude and stress barriers, decision-making process, and teamwork principles. The objective of this course states “Students will demonstrate an understanding of their responsibilities to address human performance issues so they can integrate more effectively into crews/teams operating in high-risk, dynamic work environments.” (*Firefighter Type 2 (Crewmember) / NWCG*, n.d.) As the course is written there is no content related to the health and physiology of the worker. The course titled “Firefighter Training” has a unit titled “Demands of the Position” which recommends a ten-minute video titled “Fit for Fire”. Of the ten minutes, four of them are spent discussing nutrition for the wildland firefighter. Namely energy demands, carbohydrate importance, and hydration. (*Fit for Fire, RT-130, Wildland Fire Safety Training Annual Refresher (WFSTAR) / NWCG*, n.d.)

As the wildland firefighter advances in their career, a select few are given opportunities at courses focused on wildland firefighter health and wellness. For example, the wildland firefighter apprentice program is designed to enhance and develop future fire and aviation managers. Upon successful completion of all the requirements of the Apprenticeship Program, the apprentice will reach journey-level status as a wildland firefighter. (*Course: Wildland Firefighter Apprenticeship Program , Topic: Memos & Announcements*, n.d.) Of the 33,000 wildland firefighters in the United States, around 500 complete the apprenticeship program each year. (*WFAP / Apprentice*, n.d.) During their training and work experience, wildland fire apprentices take a three-day course titled “Human Performance Optimization” or “HPO”. Apprentices are placed in a two-month residential academy, of which five hours of instruction and activities are spent discussing the nutrition piece of human performance and on-the-job success. HPO is instructed by experts and professionals in their respective fields who have a mixture of operational experience and/or advanced academic training. The course is a total of three days and starts out with the "Amazing Race" to demonstrate how physical and mental fitness affects performance. The second day is spent in the classroom in

a lecture-style setting, followed by a third day where the class is divided into smaller groups for "iterations" and individualized instruction in each subject area. (*WFAP / Apprentice*, n.d.)

Another course, Comprehensive Wellbeing and Resilience is offered Forest Service-wide if there is a local offering and the interested WLFF has supervisor approval. It covers topics in nutrition, exercise, stress, mindfulness, and other healthy habits such as sleep. Introductory Principles and Techniques of Physical Fitness Development is offered when a forest wants to host, and a cadre is available to teach it. In 2019, three iterations of this course were offered. This is a week-long course that emphasizes exercise programming and proper lifting and training techniques based on training goals with very little nutrition education. The final agency led trainings with topics related to nutritional demands of the wildland firefighter are Introductory Principles and Techniques of Physical Fitness Development. This course is available to all employees, but according to Martin are more utilized by permanent employees due to the classes being advertised via email, which only permanently employed individuals have access to. (Martin, 2021) The proportion of wildland firefighters exposed to these trainings is small when considering the perceived importance and potential benefit. Courses like these have specialized teaching cadres and can be displaced in the wildland firefighter training framework due to other trainings and refreshers taking priority, as well as lack of support or resources.

A small exposure to discussions around nutrition may come from the learning opportunity provided at the end of the daily briefing. The "Six Minutes for Safety" is an opportunity for the wildland firefighter community to incorporate a variety of subjects into the safety intention for the day. Prompts are provided at the end of the daily published "Situation Report", put out by the National Interagency Fire Center. Of the 223 topics, Nutrition is included as one of the discussion points. (*Six Minutes for Safety / NWCG*, n.d.)

Qualitative Data Methods Worth Considering

A variety of data collection methods are used in the study of human nutrition and the education thereof. (Clifford & Curtis, 2016). Surveys have been utilized in other works researching the wildland firefighter population. The results from a 2003 survey on nutritional perceptions and beliefs of the wildland firefighter concluded there is a strong misconception of many nutrition concepts, and information sourcing is scattered and inconsistent. (Kodeski,

2003) The research being proposed will confirm the ongoing need for this type of education for the wildland firefighter, and illicit specific strategies for the future consideration of nutrition education content building. Similar instruments to the one Kodeski developed may give supportive, but similar information to what has already been collected. One-on-one interviews may provide rich information from confident participants, but the group interview dynamic of the focus groups is anticipated to make speaking up easier for participants who do not feel comfortable in the individual interview setting. Focus group discussions are a useful form of qualitative market research that can easily be used to provide feedback on the future acceptability of programs by identifying opinions, attitudes, perceptions and beliefs about specific behaviors, the factors influencing those behaviors, program ideas and intervention strategies, and for fine tuning actual program components prior to program implementation. (Cullen, 2000; Krueger & Casey, 2009) Oftentimes work is done by the WLFF population as a crew, therefore group interviewing may provide the most natural way for participants to respond, and therefore provide richer responses.

CHAPTER 3: Methodology

Purpose

The purpose of this study was to identify specific nutrition education needs and guide future nutrition education development for the wildland firefighter.

This was accomplished through the following three specific aims.

Specific Aims / Objectives

1. Describe the current state of wildland firefighter nutrition education.
 - a. who wildland firefighters currently receive nutrition information from
 - b. how education is delivered
 - c. topics covered
2. Identify topics of importance for future nutrition education.
 - a. as self-identified by the wildland firefighter
 - b. as determined by previous research, that are overlooked in the current educational framework
3. Describe implementation strategies for tailored nutrition education for the wildland firefighter.

Study Design

Focus groups and an online survey were used to capture qualitative data and gain insights into perceptions, opinions, attitudes, and behaviors of wildland firefighters in relation to nutrition education. This study produced qualitative data in the form of transcriptions of focus group interview sessions derived from audio recordings. In-person focus groups following all COVID-19 protocols was the primary method of data collection, with the alternate option to conduct the focus groups via Zoom.

Study Population and Recruitment

Individuals aged 18 years and older who were or had been employed as a permanent or seasonal wildland firefighter were recruited to participate in this study. Subjects were targeted for recruitment with assistance from the Exercise Physiology and Health research

module at the United States Forest Service National Technology and Development Program. Subjects were recruited by phone calls and face-to-face interactions with crew supervisors and other managers. Research was based out of the University of Idaho campus in Moscow, Idaho. Therefore, location of crew was considered while recruiting. While recruitment was based somewhat on convenience, experience level and resource type was also considered when recruiting as well as assigning subjects to a specific focus group. The goal was to recruit subjects from a variety of resource types (type one and two handcrews, engine modules, helicopter crews, as well as smokejumpers) and experience levels. This allowed for a broader understanding of the state of nutrition education and awareness in the wildland firefighter population. Focus groups consisted of 5-10 participants. Researchers prioritized grouping modules or crews to allow for some familiarity throughout the likely foreign process.

Informed Consent and Demographic Information

This study was approved by the University of Idaho Institutional Review Board. Prior to completing any data collection, subjects were provided with an informed consent document (see Appendix A) that described the study in detail along with any risks or benefits. A demographic survey (see Appendix C) was completed in conjunction with the focus group sessions to gather background on the population being interviewed. Some examples of demographic questions include “What is your current GS level?” and “How many seasons have you been a wildland firefighter?”.

Focus Group Questioning Scheme Development

The focus group questions for this study were taken from a larger set of questions about nutrition education and personal protective equipment (PPE) that were developed with the purpose of identifying the most effective ways to provide education to wildland firefighters on fire assignment and to investigate some of the key educational needs in the areas of nutrition and apparel. This analysis focused on the data relevant to nutrition education, although there were some responses that relate to both topics. During the focus group session, a researcher moderated the discussion using the set of pre-prepared questions. Questions followed the script and started general and became more targeted as the discussion progressed. Examples of questions include “How do you choose when and what you eat on

fire assignment?” or “If you could change one or two things about your required PPE clothing, what would it be?”. The entire focus group question set can be found in the Appendix B.

Focus Group Moderating

The entire process was allotted 2.5-3 hours. The discussion was audio recorded using a primary and secondary audio recording device. Participants were encouraged to answer questions asked by the moderator, but also comment on or continue discussions with other participants in the focus group. The primary moderator had an understanding of some of the terminology used by the population of interest. The second moderator was utilized when possible. This person was tasked with note-taking and assuring the discussion was flowing. The second moderator also took real-time notes, and a discussion between the primary and secondary moderator occurred as immediately after the focus group session as possible. This assisted in recalling important ideas or preliminary themes.

Participant Compensation

The research team provided refreshments in the form of individual snack boxes (see Figure 1) Items were selected considering results of preferred shift food surveys (Roe et al., 2022). Items included the following: jerky, nut butter, protein cookie, oat bites, mixed nuts, granola, waffle cookie, meal bar. Total cost of the food box items was less than \$10.00 per participant. A “thank you” note was also included in the food box. Upon completion of the focus group session, participants’ names were entered into a drawing for a Jetboil Flash Cooking System amongst the other participants in their session. Estimated odds of winning were 1:10. The Jetboil® was selected to incentivize the wildland firefighter because of its function as a lightweight gas-fueled portable stove, used primarily for backpacking.



Figure 1. Participant Compensation Box

Data Analysis

Focus group audio recordings were transcribed in their entirety. The program Otter (Otter.ai) was used with assisted prediction of the transcript. A researcher listened to the recording and confirmed the validity of the predicted transcript. A thematic approach was used to analyze the focus group session recordings. The transcriptions were then printed and coded by two researchers using the Constant Comparative Strategy with note of general themes that emerged (Krueger & Casey, 2009). A follow-up conversation between coders allowed for discussion and final code designation agreement amongst coders, and the development of subthemes. The specific aims for this study served as a starting point for anticipated themes as follows.

Aim 1: Describe the current state of wildland firefighter nutrition education. It was anticipated that researchers would identify themes related to specific sources of nutrition information. The sources were coded as well as the information delivery method and also the

topics mentioned. The results coded under this aim highlight the current state of nutrition education for the wildland firefighter.

Aim 2: Identify topics of importance for future nutrition education. It was anticipated that two primary themes related to nutrition education topics would emerge, those topics that wildland firefighters mention as important to them as well as topics that are identified as important based on previous literature, but which are not brought up as part of the current educational framework. Both these self-identified and overlooked nutrition education topics were important to identify in order to provide guidance on future nutrition education that is engaging and relevant for this specific population. Another anticipated subtheme in this category was “misinformation”.

Aim 3: Describe implementation strategies for tailored nutrition education for the wildland firefighter. Themes related to implementation strategies were anticipated to emerge from statements made by individuals. Results coded under this aim suggest avenues for nutrition education content delivery for the wildland firefighter.

Other considerations for thematic analysis included differences by resource type. The different forms of media or avenues to target the population were considered by resource type and position within their career to determine when, where, and how to reach the wildland firefighter with relevant content to the point they are at in their career.

Limitations

Participation was coordinated with daily work schedule and fire dispatches. Availability varied based on fire preparedness level, with one focus group session being cancelled because of a fire dispatch the crew was called to. There was also the potential of dispatch or reassignment during the focus group session. Responses may have been limited or swayed because of the hierarchical structure of the field of wildland firefighting. This was mitigated as much as possible through encouragement and assurance of an environment free from judgement or reprimand. Participants were asked to respond in a group setting with their superiors. Although it may have had an influence on responses, different ranks and positions within the module were not separated in focus group sessions since the team has to face challenges and answer questions as a mixed unit in their daily operations.

Timing of participation with consideration for the fire season should be considered. The focus group session conducted after the bulk of the operational fire season resulted in responses with reduced enthusiasm and an overall tone of exhaustion amongst participants. When this group was asked the final question, “Of all the things discussed today, what mattered the most to you?”, one participant responded “Does anyone have the capacity to have anything be important this time of year (the end of the fire season)?”.

CHAPTER 4: Results

Five focus groups were held with a total of twenty-seven participants (n=27). A sixth focus group was recruited but was dispatched to an incident and could not conveniently reschedule. A total of 6 hours and 55 minutes of interviews were recorded and transcribed. Demographic characteristics of focus group participants are summarized in Table 1. Eighteen of twenty-seven participants were male. The majority of participants were 18 to 34 years of age and all participants were white.

Participants

Table 1. Participant Demographic Characteristics

Demographic Information		Mean \pm SD
Weight, kg		75.7 \pm 11.8
Height, m		1.7 \pm .33
		N(%)
Age		
18 – 24 years		10 (37)
25 – 34 years		11 (41)
35 – 44 years		5 (19)
45 – 54 years		1 (4)
Gender		
Male		18 (67)
Female		9 (33)
Race/Ethnicity [†]		
White		27 (96.)
Hispanic or Latino		1 (4)
Highest Level of Education		
High school diploma or GED		7 (26)
Some college		5 (19)
Associate's degree		1 (4)
Bachelor's degree		14 (52)
Current Employment Status		
Employed full-time (40+ hours per week)		20 (74)
Employed part-time (less than 40 hours per week)		1 (4)
Unemployed		0
Student		5 (19)
Other*		1 (4)
Marital Status		
Single (never married)		18 (67)
Married		6 (22)
In a domestic partnership		2 (7)

Continuation of Table 1. Above

1 (4)

Divorced

†Multiple race/ethnicities could be selected

*Other employment status – hired for a full time position this summer

Participants from various crew types including smokejumper, helitack, engine, and handcrews attended the focus group sessions. An attempt was made to recruit a type 1 interagency hotshot crew (IHC), but the escalating fire season took priority. Table 2 summarizes participants' wildland fire work experience. Eighteen of twenty-seven participants were temporary employees and nine were permanent. Several focus group participants were currently assigned to smokejumper, helitack, engine, and type two handcrew resources, but had type one IHC experience. Number of years of wildland firefighting experience varied from their first season to 24 seasons fighting fire. There was also representation of wildland firefighting experience from each Forest Service region across the United States.

Table 2. Participant Wildland Fire Experience

Wildland Fire Work Experience	
	Mean ± SD
Number of Seasons Working in Wildland Fire	7.6 ± 6.8
	N(%)
General Schedule Pay Grade	
GS2 – GS4	13 (48)
GS5 – GS8	12 (44)
GS9 – GS11	2 (7)
Employee Status	
Temporary	18 (67)
Permanent	9 (33)
Number of Fire Assignments Lasting 7 Days or Longer	
0 to 1	2 (7)
2 to 5	10 (37)
5 to 10	2 (7)
More than 10	13 (48)
Regions Fought Fire†	
Northern Rockies	18 (13)
Rocky Mountains	17 (13)
Southwest	16 (12)
Great Basin	20 (15)
California	17 (13)
Northwest	19 (14)

<i>Continuation of Table 2. Above</i>	10 (7)
Southeastern	
Eastern	13 (10)
Alaska	13 (10)

†Multiple regions could be selected

A variety of resource types were recruited to represent the various opinions on nutrition, wildland firefighter education, personal protective equipment and more. Each crew type has slightly different roles within the incident or modes of transportation to get there, but all undergo the same initial training and share many mission objectives while working therefore a representative sample of the opinions of various resource types was collected.

Current State of WLFF Nutrition Education

Table 3 summarizes the results from the pre-focus group survey question, “In general, where do you receive information about food and nutrition?”.

Table 3. Surveyed Wildland Firefighter Food and Nutrition Information Sources

	N(%)
Ways of Receiving Information About Food and Nutrition†	
Websites (please specify)*	9 (14)
6-minute Briefing	3 (5)
Other Wildland Firefighters	12 (19)
Friends	20 (32)
Magazines	6 (10)
Personal Trainer	1 (2)
Nutritionist/RD	3 (5)
Other (please specify)*	9 (14)

†Multiple sources could be selected

*Specific websites – “Internet articles as I run across them,” “Dylan Johnson YouTube channel,” “Instagram, Pinterest,” “Various,” “The New York Times Cooking section,” “Youtube,” “Wildfiretoday.com”; Other – “Various podcast on nutrition with different doctors or personal trainers,” “The ready state podcast Found my fitness podcast,” “I don’t know,” “Books (The Booated Belly Whisperer), I am also a personal trainer and working on my nutrition coach certification. And then just finding healthy recipes on Pinterest or Instagram.” “A lot of the info is unsolicited and not followed, lol” “My wife” “Documentaries, books” “Intuition and recipes on Pinterest”

Focus group participants identified three primary sources they turn to for information related to nutrition and physical wellbeing. These included online sources, knowledgeable individuals, and printed materials. Table 4 provides a summary of responses to the question, “Where do you currently source information about nutrition and well-being?”.

*Table 4. Focus Group Sources of Information **

Main Theme	Sub-Themes	Select Quotes †
Online	Not for Profit Resources, Credentialed Source, YouTube, Podcasts, Macro Calculators, Pinterest, Trends Across Multiple Sources	<p>“Does it sound like they’re trying to sell you something?” (Smokejumper, 6)</p> <p>“Kind of see what their profile is. What they have accomplished.” (Smokejumper, 5)</p> <p>“Not really looking at any specific websites. Try to notice a trend over multiple sources.” (Engine, 0)</p>
People	Family, Peers, Professionals, Past Athletic Coaches	<p>“My uncle does Ironman a lot. So, I talked to him a little bit because you have to have good nutrition for that. Period.” (Engine, 1)</p> <p>“I had an old strength coach and I stayed in touch with him quite a bit. I don’t know where he gets his information but obviously, I trust it.” (Smokejumper, 5)</p>
Print Material	Popular Press	<p>“The only thing I can think of is like the New York Times cooking thing. That’s probably the only thing consistently that tells me what’s going on with food and nutrition.” (Engine, 10)</p>

*Themes presented in this table were generated from the focus group discussion surrounding the question, “Where do you currently source information about nutrition and well-being?”

†Source of quote noted by individual’s resource type and years of experience following each quote.

When looking at information online, there were a few mentions of finding a “trend” across a few sources to come up with what seemed realistic and believable. An engine crewmember of three years stated, “I just try to find trends, rather than just hit one site. I’ll hit a couple and see if they’re talking about the same thing.” Online sources of information participants reported viewing included YouTube, podcast recordings, not-for-profit resources, articles with credentialed authors, Pinterest, and other tools online such as macro calculators. When considering if a website had legitimate information, the group of

smokejumpers asked themselves “Does it sound like they are trying to sell you something?” or they would “Kind of look at their profile and see what they have accomplished related to the topic.”

Those who discussed receiving information from a knowledgeable individual often mentioned a professional. Some crews had visits from personal trainers while others noted seeking out professional athletes who shared training plans online. Sometimes WLFFs noted staying in touch with past athletic coaches as well. Family and peers were also popular sources of information on the topic of firefighter wellness. Some participants had siblings very invested in their health. One participant relied heavily on an uncle, who completed in triathlons, as a source of information. Others felt the information shared amongst the crew members themselves was vetted, legitimate, and helped them achieve fitness goals.

Identification of Nutrition Education Topics

Self-Identified

Several wildland firefighters mentioned not really knowing where to begin regarding learning more about nutrition. Other respondents reported a few topics within nutrition education they were interested in learning more about. These topics included definition of basic nutrients and their roles, nutrition relevant to the wildland firefighting job, electrolytes, and supplementation, as well as nutrition information for the crew supervisor role. Table 5 provides a summary of responses to the question, “We would like you to think about receiving nutrition information on a fire assignment. What would you like to know?”.

*Table 5. Identification of Nutrition Education Topics**

Main Theme	Sub-Themes	Select Quotes [†]
General WLFF Recommendations	Performance Nutrition, Hindrances to Performance, Energy Balance, Nutrition Goal Setting, Energy Maintenance, Electrolytes, Nutrition for Recovery	<p>“I do not do well in grocery stores.” (Engine, 2)</p> <p>“Purchasing for food boxes is around the corner and maybe more thoughtful purchasing can happen after you get all pumped on a nutrition talk.” (Smokejumper, 12)</p>

Continuation of Table 5. Above

Navigating Shopping for Food	Grocery Store Stops, Purchasing for Crew	<p>“How to look at your snack and look at the label and see what it’s got in there.” (Handcrew, 2)</p> <p>“If you know what fuel you’ve got and what you’re doing for the day you can decide what and when you want to eat.” (Engine, 1)</p>
Nutrition Facts	Understanding the Nutrition Fact Panel, Nutrition Facts for Provided Meals	<p>“Differentiating between eating in your everyday life versus eating for performance and setting yourself up for success in this line of work.” (Wildland Fire Module, 18)</p> <p>“How many calories did I burn? How much do I need to use today? How do I prevent a deficit?” (Helitack, 3)</p>
Nutrient Periodization	Throughout the Year, During the Shift	<p>“Nutrition is pretty overwhelming, kind of a bunch of nutrients and how much of what you should get every day. I just look at what I am eating and try to get vegetables and stuff like that.” (Engine, 1)</p> <p>“People who do this line of work are mostly outdoors people who have a general idea. Like excess carbs are bad for you and you’re gonna turn and go fat.” (Wildland Fire Module, 1)</p>
We Don’t Know What We Don’t Know	Overwhelmed, Carrying Misconceptions	

*Themes presented in this table were generated from the focus group discussion surrounding the question, “We would like you to think about receiving nutrition information on a fire assignment. What would you like to know?”

†Resource type and years of experience following each quote.

WLFF = wildland firefighter

When asked about specific nutrition topics they would like to learn more about, it was apparent many WLFFs “didn’t know what they don’t know”. An engine crewmember stated, “I feel like I know enough to keep myself healthy during the job, but I don’t know very much.” They continued to say “I know I need to spread things (nutrients) out, but I don’t focus on a lot of specific nutrients. I could definitely use a lot more education on it, it would definitely help.” Many WLFFs felt they had a basic working knowledge and ate based on their intuition, but many felt it would be useful to know more about fueling specifically for

the job they do. A first-year engine crewmember said “Nutrition is pretty overwhelming, kind of a bunch of nutrients and how much of what you should get every day. I just look at what I am eating and try to get vegetables and stuff like that.”

Many felt a good starting point would be learning about nutrients. They wanted more information on how to read a nutrient facts panel since many of the items in the provided meals are packaged with this information. They wanted to know how to use it to their benefit, such as how it could help them when shopping and planning meals in the off-season. They also were curious about the nutrition of meals provided on incidents and if there is a way more information on the nutrition facts of those meals could be made available. An Engine crewmember said “It would be helpful to have that information about what you’re eating at camp. I think that would be pretty helpful especially if you are going on different dispatches all summer.” Some WLFFs were interested in the concept of nutrition periodization and tailoring their intake to their output. “How I should eat when I am trying to cater to a performance-based workout versus light work.” They were interested in this concept and how it could help them adjust their nutrition for a shift, but also how to adjust their consumption for different-natured assignments and into the offseason. Many WLFFs wanted a plan for store stops. They felt education about how to use their time in the store and per diem wisely and nutritiously would relieve some of that frantic “Grab what you can” feeling.

Recommendations specific to the WLFF came up frequently. Many wanted “some generalization (on nutrition) to go about in the fire career specifically.” Another engine crewmember of one year felt “There is definitely a lot I don’t really think about, especially when on fires.” Specific topics they were interested in under the theme “performance nutrition” included energy balance, energy maintenance, electrolytes, recovery, and when it comes to nutrition “what not to do”. One participant who had not yet fought fire yet but was hired on for the upcoming season said “Being a really skinny guy and a guy who burns a lot of calories, I am a little worried that this summer some days I might burn more than I take in. And so to be pretty mindful of that I think I will probably have to ask for some help around me.” They also wondered about energy balance as one participant said, “how to gain weight” which was quickly followed by another participant saying, “how to lose weight” and a good laugh from the group about the dichotomy in those statements. Another engine crewmember

of 2 seasons was interested in the finer points of energy balance as well as nutrition information for provided meals as they said “It would definitely be helpful to know how many calories are in each meal that we kind of split it up throughout the day. (for me) It’s not really a question of ‘how many?’ it’s ‘how can I do it the best to keep up my energy levels?’ That would be really good. “ WLFFs also wanted to know about the significance of electrolytes in their diet. Some wondered why it is so emphasized for them, and others wondered what they could do when water “doesn’t really help that much.” They also found it interesting this was one topic out of their limited nutrition discussions, that was emphasized. Therefore, they were looking for more information than one crew member put it “overhead just saying drink water, drink Gatorade.” Finally, one person said learning about some of the “Don’t do’s resonates more” than a flood of information about what they should implement when learning about something new.

Finally, some personnel in the crew overhead position mentioned nutrition information related to their managerial tasks. For example, doing purchasing of items for shelf-stable food boxes. This same group of smokejumpers also felt “It’s like teaching people to make the right choices is a separate issue from what we are being supplied with.”

Factors Influencing Dietary Choices

Potential nutrition education topics emerged related to factors influencing dietary choices during the shift or workday as well as during the entirety of the assignment. Table 6 provides a summary of responses to the question, “How do you choose when and what you eat on a fire assignment?”

*Table 6. Factors Influencing Dietary Choices**

Main Theme	Sub-Themes	Select Quotes [†]
What? - Assignment Overall	Job Duties, Resource Type, Daily Assignment, Logistics, COVID, Fire Complexity Classification, Source of Meals, Food Box, Caterer, Per Diem, Supplemental Items	<p>“A lot is dictated by what is in the food boxes or the government-issued food.” (Smokejumper, 24)</p> <p>“What’s provided unless I bring something but depends on how far long in the assignment it is and whether or not I have used it.” (Engine, 2)</p>

Continuation of Table 6. Above

What? – During Shift	Accessibility to Rations, Storage Space per Crewmember, Pocket Snacks, Weight, Personal Preferences, Extras/Trades, Performance Considerations, “Running and Gunning”, Recovery, Food Safety	<p>“The engine is so nice because we have more space. Like crew life I feel like my eating was way different than being on an engine. I have a little more autonomy.” (Engine, 10)</p> <p>“It’s situation dependent. Like what you think is going to happen that day. The pace of the fire. If it’s gonna be a rippin’ day I’m just gonna take sugar I can dump in my mouth.” (Smokejumper, 6)</p>
When? – During Shift	Fire Intensity, Whenever I Get a Chance, Encouragement from Overhead, Hunger Cues, Boredom, Rationing Throughout Shift, Prevention of Deficit, Preparation Required, The Elements	<p>“So, we say ‘eat when you can’. That’s a common phrase in this job.” (Engine, 15)</p> <p>“It’s more opportunistic. So if you’re driving to a drop point or a division, you’re eating as you go. But then a lot of times you’re not eating until you’re like so hungry it becomes noticeable. Then you’re already in that deficit.” (Helitack, 3)</p> <p>“Well, the things that are going to take preparation like things that require boiled water or a spoon to eat I generally won’t put those in my pack to take with me for lunch during the day.” (Smokejumper, 6)</p>

* Themes presented in this table were generated from the focus group discussion surrounding the question, “How do you choose when and what you eat on a fire assignment?”

† Source of quote noted by individual’s resource type and years of experience following each quote.

The eating patterns over the course of an assignment were most influenced by the job duties as well as the logistics of mealtime and the source of the meals. The job duties theme arose from the emphasis on the eating strategies changing depending on the resource type, as well as the nature of the assignment. A helitack crewmember recalled staging and purchasing much of his food from a grocery store and spending the two weeks on per diem but recalled times when he had been assigned to another resource looking different. Other crew types spoke of being highly influenced by the complexity type of the fire and support that came with that when they were more reliant on the incident providing meals. An engine crewmember with fifteen years of experience recalled how their consumption patterns on assignment vary greatly stating, “If you are working really hard it makes it easy to shovel food in your mouth in the morning and at night, but if it’s a slower assignment and you are patrolling or something, it makes it really hard to eat those larger meals on both ends of the day.” The logistics of the meal support also played a role in the patterns during an assignment. The coronavirus pandemic brought new challenges to mealtime logistics with the individual packaging of meals. This was well intentioned, but participants reported meals being later than anticipated and numbers of meals being miscounted. They also reported on the completeness and quality of the meals being compromised due to the pandemic and new, more laborious system of meal delivery.

The source of meals influenced patterns on assignment as well. The sources mentioned included shelf stable food boxes, fire camp caterers, per diem, and supplemental items. Those who often consume shelf stable items on assignment provided an idea of the menu within those food boxes. One smokejumper reported “The first day everybody’s got a pretty good menu of options and from there it’s what’s available.” Those who spoke of the caterer’s influence on what and when they eat during an assignment mentioned “limited flexibility.” Due to the limited flexibility many WLFFs spoke about the supplemental items they bring on assignment with them. “The when is mainly whenever I get a chance, honestly, and the what is like he said, what’s provided, unless I bring something. But it depends on how far along in the assignment it is and whether or not I have used it up.” Some resources are prepared to be more self-sufficient and are used to operating on per diem during an operational assignment. Crews like helitack crews and fire use modules sometimes fall into this category. A fire use module member with eighteen years of fire experience mentioned

the different styles of self-sufficient meal planning. Some crews purchase groceries together and collaborate and cook communally. Others plan and purchase their own individual meals while on an incident and do not rely on a caterer.

Dietary habits during the work shift were dependent on accessibility to rations, athletic performance considerations, weight considerations, personal preferences and palatability, and food safety. The accessibility to rations relates to the source of meals being provided, but also the crew type and transportation of the crew. The crew type was discussed due to space for personal gear depending on transportation by engine, buggy, helicopter, parachute, and more. One engine crewmember with 10 years of fire experience discussed how “nice” it was because “...we have more space. I feel like my food and stuff (supplemental items) are way different than being on a crew. Being on an engine I have more autonomy and more options (weight, refrigeration, more quantity).” A fire use module member echoed that and mentioned time allotted to eat being resource dependent as well, saying “I felt like maybe we had a little bit more time around the engine to eat or have a snack.” Continuing to say, “So that was kind of different than coming here (to the fire use module), just having snacks in your pocket.” What was eaten also depended on access to these pocket snacks, according to focus group discussion. The accessibility to the pocket snacks proved to dictate how often and what was consumed. Nearly every focus group session discussed what qualities a good “pocket snack” exhibits. The mentioned items that are “easy to carry”, “not going to get crushed”, “dry food items that keep you going through the day”, “some form of a lot of sugar to keep me from crashing” and mentioned avoiding “something that gets really melty in the heat”. Some participants brought up considering performance when choosing what to eat throughout the day. Mentioning items being good “pick me ups” as well as multiple responses alluding to the effect simple carbohydrate has on physical performance. One smokejumper stated, “if it’s going to be a rippin’ day, I’m just gonna take sugar that I could dump in my mouth.” While a few respondents altered the items they chose when they anticipate the fire “running and gunning”, this is an important topic for widespread wildland firefighter nutrition education content creation.

Another aspect of dietary intake on fire assignment was the “when” WLFFs choose to eat during the shift. Some of the main themes that surfaced included fire intensity and the

elements, opportunities, encouragement from overhead, boredom and hunger cues, rationing throughout shift and work readiness, as well as the preparation time required for food items.

Fire intensity can dictate when items are consumed because of the sometimes-pinch opportunities to eat. The “vibe” and “workload” were pointed out by a fire use module member as being key drivers to how often they stop to eat something. One helitack crewmember mentioned not eating on a busy shift until “you’re so hungry it becomes noticeable. And then you’re kind of already in that deficit.” They continued to state you have to “hope you have pocket snacks or something you can eat as you’re moving.” The accessibility to rations allowed firefighters to have greater choice in when they consumed items during a shift. One handcrew member confessed “you’re honestly just coated in snacks” continuing to say, “sometimes you might not have time you just have to grab what’s in your pocket.”

Prevention of the deficit as mentioned above drove some to choose when to eat. An engine boss with 15 years of fire experience elaborated and said, “We say ‘eat when you can’ that’s a common phrase in this job”. This individual explained it is encouraged to always eat meals to ensure readiness for the unexpected. This was emphasized around the breakfast meal as many participants reported not being the “breakfast person”, but consuming part of the meal because they knew they would need the jump start for their potentially arduous day. Hunger cues were also a part of “when” items were consumed, but as mentioned, sometimes hunger cues were noticed after individuals felt there were “already behind”. Some participants wanted to make a point to “ration throughout the shift” and chose to break up their shift provisions and consume them periodically throughout the shift. There was mention of certain weather conditions making eating throughout the shift unappealing. For example, one engine crewmember stated “it’s hard for me to want to eat because it’s just so hot some days. And I don’t like eating (during those times) unless it’s a piece of fruit. Then I will eat the fruit kind of early because I don’t want it to go bad, but then it’s all I want later in the day when it’s hot. But then I just have dry granola bars.”. A few individuals mentioned serving temperature and food safety as considerations for both what and when they eat during the shift. One stated “I try to eat my cold things in the morning”. One engine crewmember had worked in foodservice and mentioned the outside temperature and lack of refrigeration

turning them away from many of the premade salads with mayonnaise-type dressing. Crewmembers also reported on less intense days, hunger cues were noticed and with “not doing anything and with nothing really else to do you’re just kind of sitting there and start to get hungry.” With the less intense shifts comes eating out of boredom and some eating “challenges” mentioned by focus group participants using less desirable shift food components or gas station purchases.

Part of interpretation of the “vibe” dictating when WLFFs consume meals considering the patterns of the crew around them, and the culture around snacking and taking breaks within the crew. Encouragement from overhead was classified as a theme after numerous responses imply eating “if your squaddies (squad leaders) and sups (supervisors) are hungry too.” The engine module focus group members all recognized their supervisor for checking in with them throughout shifts and encouraging them to “grab a bite”. Another supervisor who participated mentioned when the mission is fairly critical and there is less time to take more formal lunch break, he opts to “sit one or two people down and rotate folks out” to continue progress on the task. There may be limited time to break from the work the crew is completing, so the preparation time for the meal item is heavily considered when choosing when and what to eat. The simple consideration of putting condiments on a sandwich may keep a wildland firefighter from assembling and eating that item due to time constraints. Especially things that “take preparation like things that require boiled water or things that would require a spoon to eat with I generally don’t put in my pack to take with me for lunch. That would be a breakfast or dinner when we have the opportunity to take a bit more time”.

Self-Selected Food Items

Wildland firefighters chose items on the basis of personal preference as well as perceived physical performance benefit. In some responses, both themes were considered when selecting items. Table 7 provides a summary of responses to the question, “In the survey when you arrived you listed food items that you bring from home when you head to an assignment. Please tell me your reasons for choosing those items.”

Table 7. Self-Selected Food Items*

Main Theme	Sub-Themes	Select Quotes †
Personal Preference	Morale Boost, Familiar Items, Widely Available, Alternatives to What is Provided, Taste Fatigue, Cooler Considerations, Nature of Assignment, Supply and Demand	<p>“Enjoyment too... like buying the candy or something you’re looking forward to. A little sugar ‘pick me up’.” (Wildland Fire Module, 3)</p> <p>“If you are going to a fire assignment you know there’s going to be food provided so it’s more of ‘what am I going to be craving later?’. So little treats here and there, some healthy some not for sure.” (Engine, 3)</p> <p>“Because the demand for coffee is high.” (Smokejumper, 12)</p>
Performance Nutrition	“Go Better”, Balancing Out Diet, Additional Supplements, “Quick Draw”, Bridge Between Meals, Targeting Certain Macronutrients, Carbohydrates, Protein	<p>“If I leave the house knowing I’m going to a fire I always bring a bag of salad at least then I’m getting some fresh greens. I just always go better if I have vegetables, fruits, and salty protein-type things.” (Engine, 10)</p> <p>“I always hit the bar aisle. I like the protein bars. They’re easy to put in your pocket as long as you don’t pick a ‘melty’ one. Fig bars are another good one for quick carbs and 200 calories for both bars. And they’re good squished!” (Handcrew, 2)</p>

* Themes presented in this table were generated from the focus group discussion surrounding the question, “In the survey when you arrived you listed food items that you bring from home when you head to an assignment. Please tell me your reasons for choosing those items.”

† Resource type and years of experience following each quote.

WLFFs discussed food items they bring from home and the reasons why. One theme that emerged was personal preference for those items. This was sometimes because it was something different than what was provided on the incident. Fatigue of other commonly furnished items was another reason for bringing items from home. For some WLFFs the items they choose to purchase or augment their diets with act as a morale boost. They reported these items giving them “something to look forward to”.

Items chosen on the basis of perceived performance improvements was another theme that emerged related to self-selected food items. Personal performance increases were reported by some items brought, such as “Some beet powder, some greens powder, and some collagen powder just because I feel like that stuff helps me function a bit better.” reported by a smokejumper, talking specifically about supplemental items when he was assigned on a type 1 hotshot crew. An engine crewmember with 10 fire seasons under their belt mentioned

items to balance out their diet while on fire assignment, mentioning their own personal performance needs for saltier items for the electrolytes and taste, and less sugary items. They also mentioned bringing fresh produce items above and beyond what might be provided when it was an option. Other participants mentioned additional electrolytes being a focus as well. Many mentioned beverage additives like salt tablets or products such as nuun, liquid IV, and other performance nutrition products such as Clif bar GU items with added electrolytes. Other respondents sought more particular macronutrients. One purchaser of additional protein said they also considered carbohydrate when choosing a protein bar, recognizing some protein bars utilize non-nutritive sweeteners. “Quick draw” items were mentioned by a few of the groups. Something they can store in an accessible place and “grab really easy”. Items that provided energy, convenience, and no prep.

Shelf stable food boxes are intended to support in the case of the crew we interviewed, two people for three days. Shelf stable items are purchased, and these food boxes are constructed prior to the dispatch to the incident, and delivered to WLFFs who then choose how to ration the items throughout the following shifts. Supply and demand were mentioned related to the food boxes provided to some resources like smokejumpers, for example. Personal purchases included additional protein-type meal bars as well as additional coffee. This was sometimes because of the demand and limited supply, but also because some wildland firefighters had preference for a specific brand or variety of for example, coffee or bar. The integrity of the items purchased is considered heavily by the WLFF. The durability in a pack or pocket, as well as the lifespan outside of refrigeration.

The type of assignment often dictated what would be purchased and how much. An engine crewmember said, “it depends if it’s like a severity assignment or like a fire assignment, we know what we’re doing severity like definitely will have more food kicking around we get to spend most of our money buying food instead of just eating at the fire.” If they do have a quick store stop before heading to an active incident, she continued on to list items like Chex mix, jerky, gummy bears and salted snacks and “stuff I know will give me some energy and make me feel good.” One of the smokejumpers mentioned jerky since you may “hit the ground and not know where you’re going to be, near your food bags or not, so jerky is a big one for me. Another group had a unanimous agreement with the statement

“Jerky.” And continued to justify their choice because it was a widely available, satisfying item agreeing items they chose to bring from home were, “Nothing substantial and that I couldn’t get from a gas station on the way.” Therefore, they may bring less from home if they know the store is an option.

When the opportunity does arise to stop at a store, various crewmembers of differing resource types and experience levels mentioned defaulting to purchasing to familiar items. One fire use module member said, “you don’t have a plan before you go in there.” This individual noted that the pressure makes them opt for “quesadillas and hot dogs” when they are asked to provide dinner for themselves. Another participant felt “so stressed” when the time came for quick store stop.

Logistics of Accessing Food on Assignment

Themes emerged related to where WLFFs store food on shift, and how often they access that food. Table 8 provides a summary of responses to the question, “Where do you store your food items when on shift and how frequently do you access your shift food on a fire assignment?”

*Table 8. Logistics of Accessing Food on Assignment**

Main Theme	Sub-Themes	Select Quotes [†]
Where?	Body of Pack, Brain of Pack, Water Bottle Pockets, Front Shirt Pocket, Side Pants Pockets, Waist, In the Vehicle	<p>“I just shove everything in the body.” (Engine, 10)</p> <p>“Mainly just pants pockets, cargo pockets. For like a granola bar or two or sunflower seeds if there’s room for them, but usually a pack or the truck.” (Engine, 1)</p>

Continuation of Table 8 Above

How often?	Depends on Energy Demand, Job or Assignment, When I'm Hungry, Regular Intervals, Sporadic Breaks, People Checking In, "Read the Room"	<p>"Depends on what you're doing. There's also a practice known as sport eating." (Smokejumper, 6)</p> <p>"I would say for me, you need about once an hour at least." – (Smokejumper, 7)</p> <p>"There were times on the most recent fire my supervisor would check in on us 'are you drinking water? Are you eating food?' And I would think to eat when he said that because you don't really think about it when you're focused on something." (Engine, 3)</p>
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* Themes presented in this table were generated from the focus group discussion surrounding the question, "Where do you store your food items when on shift and how frequently do you access your shift food on a fire assignment?"

† Resource type and years of experience following each quote.

Many WLFFs had some combination of food items stored in the clothing they wear including the front shirt pocket and side pants pocket. These often were used for the more "quickdraw" type items like "a granola bar or two or sunflower seeds if there's room for them." If not stored on their person, participants indicated storing items "in a pack or the truck." Many of the packs wildland firefighters use have similar features and basic components such as a main body, water bottle pockets on both sides, a "brain" pouch, and sometimes waist strap storage. Within the body of the pack, items that required more preparation were often placed in there "for times when I think we will get a break to sit down for a little bit and eat." Others put "the big stuff" in the main body and snacks in empty pockets. Other considerations of what to put in the body of the pack depended on the refrigeration or durability of items. An engine crewmember mentioned putting items more exterior that "aren't going to get hurt getting hot" but "if it's anything cold that I want to keep cold I will shove it deep in the pocket and try to make a point to eat it before it gets

hot.”. Therefore, the more accessible items are often those that are going to hold up in pockets and heat are placed in easier to reach places for the active parts of the shift. At times, the work requires transport by vehicle or aircraft when items in the pack are kept more “reserved” and the shift’s rations are kept in the vehicle.

When asked how often participants access food items considerations about hunger and bodily needs were mentioned. Energy demands lent to more frequent consumption on some occasions, but sometimes the more pressing missions lead to less access of items. One participant said “sometimes I’m not good at it. If we are trying to accomplish a task, I think it’s hard if we are mission focused... I find that if I have pocket snacks, I am better at it. I need to eat every few hours or I don’t do well.” Others consider energy demands more in the prevention of deficit. One helitack crewmember mentioned eating items in anticipation of a bout of hard work, and stashing items in their flight helmet bag in preparation. Others called it “snacking” between meals and eating more frequently or at more “regular intervals”.

Other decisions about how frequently food is accessed were centered around breaks. Since the unpredictability of the work lends to unpredictable break opportunities, one wildland firefighter responded “How often do I access? Whenever there’s time?”. Others felt the need to “read the room” and paid close attention to the “appropriateness” of the timing and others around them saying “That’s what it is like, I don’t want to look like the one person that’s snacking.”. With the culture around snacking, some wildland firefighters felt they accessed food more frequently when others checked in on them. “I definitely I remember on the Big Summit Fire, there were definitely a couple of times where my supervisor would check in. Like, ‘are you guys drinking water? Are you eating food?’ And I’d eat food when he said that because like you just don’t really think about it when we’re focused on something. And I don’t know, if you’re not like starving, then it’s hard to think like, ‘Oh, I should eat some food.’ But So he has like said that I remember a couple times where I’m like, ‘Oh, yeah, I should probably eat something super quick.’ So like him or other people checking in helps I think a lot.”

Implementation Strategies

Self-Identified

Some main themes emerged surrounding nutrition education delivery method. Participants brought up ideas for nutrition education both during the fire season and in the more off-season and shoulder season period. Some participants were thinking more of the timing during their career and mentions were made of implementing this education early in a wildland firefighter's career. Table 9 provides a summary of responses to the question, "How would you like to receive that (nutrition) information?"

*Table 9. Implementation Strategies**

Main Theme	Sub-Themes	Select Quotes [†]
Off Season & Shoulder Season	Refresher Training, Hands-on Workshop, Self-directed Study, Specific and Unique Human Performance Course, Nutrition Professionals	<p>"The trade-off is the inundation of PowerPoints and all these things in this line of work where it could become just another meeting. 'Yeah, took one thing out of it, passed around doughnuts.'" (Smokejumper, 21)</p> <p>"People will be a lot more willing and open to learning about stuff if it's hands-on. If you had something to do I think people would be a lot more interested." (Engine, 1)</p>
Early in Career	Guard School	"I think that guard school is a structured environment where you can bring in someone qualified to be giving that information, and provide it well to a captive audience." (Helitack, 3)
Incorporated Into Pre-Established Sources of Information	Podcasts, Social Media	"I think the more effective tool would be a social media campaign or something like that. Really concise information from a source they already follow in a way that people could retain." (Helitack, 3)

Continuation of Table 9. Above

During the Fire Season	At Camp, Shift Provision Labeling, Food Unit Leader (FUDL), Nutrition Professional Visit, Visual Posted at Mealtime, Fun, Light, Eye-Catching	<p>“Posted meal specifications would be useful, but you have to know what that means. You have to tie it all together with what is taught at guard school and related to fire.” (Handcrew, 2)</p> <p>“They could put information on the board like ‘this is your protein content, this is your carbs, this is what you’re getting.’ Instead of just ‘it’s chicken with rice and cake and whatever’ could be a potential way to do it.” (Wildland Fire Module, 3)</p> <p>“Have some sort of education posted and ‘Questions about this? See Food Unit Leader.’ And have them there available for discussion.” (Engine, 15)</p> <p>“I think it has to be after shift. If it was before briefing, I would just tune it out.” (Engine, 10)</p>
At the Base	From Peers, Six Minutes for Safety, Cork Board Information	<p>“It almost has to be catered to specific groups who already have an interest in it.” (Smokejumper, 21)</p> <p>“The community. We’re not all competing with each other in the end, but we’re trying to get better and so we are all bouncing ideas off each other.” (Handcrew, 2)</p> <p>“Lots of people do like reading content on the cork board.” (Engine, 15)</p>

* Themes presented in this table were generated from the focus group discussion surrounding the question, “How would you like to receive that (nutrition) information?”

† Resource type and years of experience following each quote.

During the fire season, the participants saw opportunities for nutrition education occurring while on an assignment, as well as at their home bases. Ideas about this content being shared at camp included information from a designated person on an active incident. Focus group participants mentioned the Food Unit Leader role being a potential source of nutrition guidance. An engine crewmember with fifteen seasons of experience felt the Food Unit Leader could engage with the firefighters by being more present during the meal for food and nutrition related questions. The crewmember also said “A quick-hitter visual aid or chart with the ratio of needs for carbs, fats, and protein, in line before you get there and make decisions about your food... and ‘If you have questions, Food Unit Leader’”. An engine crewmember saw value in the placement of a prompt in the chow line to get the conversation going within the line, “you stand there, you can read and talk about food while you’re waiting to get it.”. Other participants mentioned the “chow line” as a useful place to think about nutrition on an incident since there are many other factors throughout the day that might make it hard to pay attention to during the shift. “It has to be after shift rather than in the morning. If it was before morning briefing, I would just tune it out. I am thinking ‘it is important to think about what we are doing today’. I think in the nighttime when you can let go of the day a little bit would be the time to be able to receive that information”. They also mentioned their capacity to absorb much in peak season or at the end of the season being limited. With this, participants also emphasized the nutrition education that will be best received in this environment on an assignment has to be fun, light, and eye-catching. Other mentions were made of a nutrition professional on-site, manning a booth and fielding questions. According to some wildland firefighters, information is shared on incidents on a large board. They felt some fact sheets or quick bits of information or visuals would fit with the other postings like current events, the Incident Action Plan (IAP), weather, and more.

More nutrition information made available to the wildland firefighter while in fire camp was in high demand. “Even something simple like having the nutrition information of meals available. They maybe could put protein content and some other basics on the sandwich board.” As one smokejumper said, “People have to know what that means. Like, to some people, that means nothing. So, you have to tie it all together with it being taught elsewhere like guard school, and then related to fire.” Other nutrient facts of interest were

those in the lunches. While many realize the packaged items often have nutrient facts labels, some “wish there was more clarity of nutrients and ingredients.”

Nutrition information is shared amongst crews during fire season, according to some participants. One said “I get info sometimes just from peers.” A handcrew member mentioned “community” being built within the crew including talks about “trying to get better” which included “a lot of bouncing ideas off each other”. This includes conversations at the base. Some interviewees mentioned fact sheets or nutrition content being posted at their home bases on cork boards or crew common areas. Every focus group interview mentioned the nutrition education received during the morning briefing in the “6 Minutes for Safety”. This time in the briefing is spent covering elements of one of many safety topics in the database. Of the topics, nutrition has one spot. This seemed to be a memorable conversation amongst crews and an avenue wildland firefighters felt more information about nutrition could be shared through. They also considered a specific portion of the morning briefing for “some time for nutrition? Just a little tidbit on how to fuel yourself depending on what you’re doing for the day?”.

The timing of nutrition education dictated how wildland firefighters wanted to receive the information. During the “shoulder season” when the more seasonal employees are working, but more time is spent in training and doing project work than fighting wildfire, participants felt nutrition content might be introduced early in the career at guard school or shared at the annual refresher training, in self-directed study, in a specific human performance course, in a hands-on workshop, or incorporated into pre-established sources of information such as podcasts they already listen to or other social media platforms they follow.

There were responses from each group, smokejumpers, handcrew, helitack, and engine crewmembers and those who had not yet fought fire about the importance of nutrition information being shared early in the wildland fire career. “When you are learning about all the basics at firefighting guard school, they can put a class in about nutrition.” A more senior crewmember on the fire use module said “I think instilling it early in a career because like for me, I never thought about any of this stuff. And getting it done early before it gets too late or starts affecting you. Throughout my 20s I feel like I can eat anything I want throughout the

winter and PT a little bit and come back and just kill it. And now that's changing, and I have to take care of myself a little more." Another response to "How would you like to receive that information was "Guard school... I mean this is the first in 14 years we have sat down and talked about it. I mean, other than periphery, like an actual organized thing I can't think of a time."

A wildland fire module member said "I've never had that conversation before (nutrition for the wildland firefighter). Never in eighteen years have I witnessed a nutrition presentation. That would have been very valuable at 18 or 19 getting into this line of work opposed to being 38 and already having 20 years of education on how to eat by trial and a lot of error." And a helitack crewmember who put it, "When you're doing your entry level-training because this is a huge life change for people coming into this industry. Part of that change is your nutrition needs and caloric requirements and supporting a higher level of fitness than you may have been required to have in your life. 'This is how you need to eat to be successful increase your longevity, feel better, and meet the needs of your crew'". They then went on to say, "I think the earlier the better and shifting the responsibility onto someone like a crew boss who is going to be able to reach more students, but ideally someone like a dietitian teaching it would be a really good resource to have there for questions."

Multiple mentions were made of a nutrition professional teaching the content directly. Someone who understands the population but has the training to field questions related to nutrition and metabolism. There was recollection by some participants of outside groups with presentations, or outside content shared, which some participants felt was "better information" than what was provided by the 6 minutes for safety alone. They also felt that maintaining the uniqueness of the content was important and not allowing it to become "another required class". Many emphasized this would be better received if it were optional and from an outside source. "Not necessarily the Forest Service sending someone (from the agency) in to train you about how it is. I don't know if they did that it might be to your detriment because you might start to question all the things you are already given more than you already do.". Some saw that playing out with "a preseason workout and nutrition talk, to get people ready for the fire season where they have the time to do it. Stuff that you could

handle at home. That's what people care about, related to how and what you're training for." Other participants felt this would be a useful topic to spend time during the annual refresher training learning about. "So, it's not like you're just going through guard school and getting that information once, it's being reinstalled every year. Because everyone does the refresher or critical week-type stuff." Some felt "A hands-on workshop where you make nutritious food and learn about what is in it, since sitting down and learning about it is not very fun. Well, a lot less, what's the word?" would be a way to get people interested. Rather than what they saw being the other delivery, "Hey guys, come here we're gonna have a two-hour Powerpoint about nutrition". They felt students might not invest in it as much due to the familiar training format making it feel like "every other required class". Other elements of firefighter health were mentioned, and a specific human performance course was of interest to the participants. This would include elements of nutrition as well as other topics like fitness, sleep, recovery and others.

There was interest in an online platform and a centralized location for information on the health and well-being of the wildland firefighter. "Having a website available with more specific information for firefighters about nutritional needs and calories and stuff might be a useful tool. Something that folks could access on their own time, but isn't a structured class so it doesn't seem tedious or like a chore." Another said "yeah that might be a way that you direct people who first get into fire. 'Hey you don't know anything about this but here is a site that can teach you with videos and stuff like that.' That is more interactive and something that we maybe do as a crew as another box we check but that actually addresses more of what we do." Another followed with "Yeah and making sure the resources as accessible, like you're saying in the offseason to seasonal that aren't government employees so it is widely accessible." An assistant supervisor said, "I think it'd be neat to have more of a centralized location to find information as a firefighter on like nutritional stuff, as well as PT. You know, if we had more transparency there and explained it and explain what a good diet is, maybe for different types of diets or restrictions that people have. And also on the PT side, I mean, we're given an hour and a half to PT every day, but there's no guidance. I've never had any guidance. It's always been like 'hey! You're doing PT today', like, Okay, I'm supposed to be physical trainer? You know we get better at it right as we go on. But I think it'd be cool if there was more like workouts suggested for the job that, you know, are training

you into that. So that's a little bit less thought on our side. And we can have a little more consistency in how we are training all across the fire community. I mean, what's the only thing, we have a pack test and the BLM fitness challenge. And you still have to search around to find that information. It's not like in a centralized location that's focusing on our health and bettering ourselves. I think that'd be pretty cool.”

Wildland firefighters suggested incorporating nutrition education content into platforms they already follow. For example, podcasts are listened to and shared amongst peers according to one smokejumper who continued to say, “ There are more specific wildland firefighter podcasts that I know a lot of people listen to pretty religiously. They invite people on so maybe have a group go on there. That would hit a large group of people I would probably say one of the biggest ways to reach us.”. Another mentioned social media platforms. “I think the more effective tool would be a social media campaign with succinct information. Ag learn is miserable, we all know that. It’s really hard to pay attention. And social media would be a lot easier to retain that stuff. And then it would be your (the content creator) responsibility to boil down ‘what do they need to know?’ and ‘what is most pertinent?’.”. And finally, one suggested Instagram as a way to easily introduce information to the “community”.

Trusted Sources of Information

This question drew out two main themes. WLFFs considered who was available to answer the question, and the type of question that was being asked as determinants to how they might proceed. Table 9 provides a summary of responses to the question, “Tell me what would you do if you had a question about wildland firefighting while on fire assignment. “

*Table 10. Trusted Sources of Information**

Main Theme	Sub-Themes	Select Quotes [†]
Who is Available to Answer	Supervisor/Overhead, Peer, Incident Response Pocket Guide IRPG, Chain of Command, Specific Person, More Experienced WLFF	<p>“Crewmembers before I ask a supervisor, kind of work up the chain of command.” (Handcrew, 2)</p> <p>“Experience. Who you think has a good chance of knowing whatever it is you need to know.” (Smokejumper, 21)</p>

Continuation of Table 10. Above

The Type of Question	Crew Dynamics /Openness, Consideration of Consequences, Timing When to Ask	“If everyone is busy and there is stuff you need to be doing, save it for later. But, if it’s a safety concern I’ve never felt uncomfortable asking right then.” (Engine, 2)
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* Themes presented in this table were generated from the focus group discussion surrounding the question, “Tell me what would you do if you had a question about wildland firefighting while on fire assignment.”

† Resource type and years of experience following each quote.

Many responses included starting with the peer level and either asking there, or if it was not able to be answered there, following the hierarchy or “chain of command”. Some stated they would go directly to their crew supervisor, but much emphasis was placed on not jumping steps in the hierarchical structure of the wildland fire organization. The Incident Response Pocket Guide (IRPG) was mentioned as well. According to the national wildfire coordinating group, “The NWCG Incident Response Pocket Guide (IRPG) establishes standards for wildland fire incident response. The guide provides critical information on operational engagement, risk management, fire environment, all hazard response, and aviation management. It is a collection of guidelines, checklists, and best practices that have evolved over time within wildland fire operations.”(NWCG, n.d.). Some participants stated a specific person on their crew. Potentially this mentioned person is a very savvy wildland firefighter, or too they could be approachable, knowledgeable, and respected within the crew. “A more experienced person” was also mentioned. When asked this question a smokejumper with twenty-two seasons in fire said “Experience. Who you think has a good chance of knowing whatever it is you feel like you need to know,” and continued to say “he knows more about pumps than anyone here because of where he worked prior.” Indicating it is not always the more experienced person on the crew but depending on the question someone of higher rank would be willing to ask someone “below” them for advice on something they have better understanding of.

Another theme that emerged was the type of question. The subtheme of timing stemmed from when to ask the question at hand. Consideration of consequences of not asking the question was taken into account. An entry-level engine crewmember stated “I

usually ask questions pretty frequently because I don't want to not do something. I don't want to do something bad or hurt someone because of it." For some respondents, asking a question was dependent on the crew dynamics and openness to questions. The question culture of the crew clearly determines what, when and if a question is asked. This openness to discussion and the vulnerability of not knowing something may translate to other teaching and learning opportunities, as well as more peer education.

CHAPTER 5: Discussion

The aims of the research were accomplished using the focus group methodology and constant comparative strategy. The breadth and depth of the results was in large part due to the ability to capture verbatim quotes in detail. One unique aspect of focus group research is the interaction amongst the participants. This group dynamic and the connections in responses are unique to focus group research compared to surveys and individual interviews.

As mentioned, the wildland firefighting workforce is structured much like the military. They are taught early about the incident command system and follow a hierarchical “chain” of command. Due to this, interesting dynamics may have been introduced to the group interview setting, like that of the focus group. (“Conducting Focus Groups with Military Populations: Lessons Learned from the Field,” 2015) The nature of the discussion may have caused some participants of a lower rank to reserve their statements and exhibit fear of being reprimanded or looked down upon for what was said within the discussion. Those of a higher rank within the organization may have brought some context to the questions asked for the less experienced participants. Special consideration of these dynamics was considered when rostering the focus groups. The modules contained various ranks and positions, but special efforts to group crews who work together on a regular basis was taken since they were used to communicating amongst each other. This recruitment pattern of keeping crews together may have provided some comfortability in the process and could have lent to more in-depth discussions and collaboration of thoughts when answering the focus group prompts.

The intricacy in the focus group data obtained came with a need for a solid understanding of the population. The glossary of wildland fire includes 1,947 terms within the wildland fire and incident management terminology. (*NWCG Glossary of Wildland Fire, PMS 205 / NWCG*, n.d.) The use of a moderator familiar with some of the common terminology used by WLFFs proved to be beneficial in keeping the flow of the discussion. There was complexity in picking up the nuances of the discussion, in maintaining conversation when spontaneity was lost, and in ensuring that interpretation accurately reflected what was said in the discussion. (Willis et al., 2009) The moderator was able to witness the group dynamics and how they effected the responses and conversational topics

throughout each group session. The dynamics of the discussions informed not only the strength of views held, and the level of consensus, but the way that consensus or disagreement was achieved. A moderator with experience in the wildland firefighting field allowed for an establishment of rapport and level of comfortability amongst participants, as well as deeper insights into the results and the following discussion of those results.

Sources of Wildland Firefighter Nutrition Information

Participants identified three primary sources they turn to for information related to nutrition and physical wellbeing. These included online sources, knowledgeable individuals, and printed materials. Much of this online education was sought out in the off-season by way of independent research on topics of interest. Wildland firefighters sought trends in online sources, but recognized the overwhelming amount of information and opinions in the field of nutrition. This would often lead them to ask questions to someone they knew who had experience in the area they were focusing on. This information came from previous athletic coaches, relatives, fellow crewmembers, and friends. Kodeski's survey on nutritional attitudes and beliefs concluded most WLFFs derived their information from the catering system and food unit leader, the crew supervisor, other crew members, magazines, and friends and family. (Kodeski, 2003) Kodeski's survey data ranked the "Catering System" as the number one source for information on food and nutrition. This may indicate the possibility of the decisive nature of surveys forcing that answer even though the respondents did not actually receive information from the catering system. This is also worth reassessment since wildland firefighter focus group participants made no mention during the survey nor the interview session of obtaining education from the catering system nor the food unit leader. This may also indicate a change in sourcing information over time, but focus group participants with 20 years or greater of fire experience made no mention of the catering system providing education either. Focus group participants did make numerous mentions of someone like the Food Unit Leader as an impactful source for nutrition education.

During focus group sessions, wildland firefighters reported limited reference to printed materials. Therefore, using this avenue for disseminating information should be a focus, but not the sole source of nutrition content for the WLFF. A few had mentioned

scattered articles in newspaper publications and some food-related books, but none mentioned text written on the topic of human nutrition by nutrition professionals.

How Education is Delivered and Topics Covered in Current Educational Framework

Every focus group interview mentioned the nutrition education received during the morning briefing in the “6 Minutes for Safety”. This time in the briefing is spent covering elements of one of many safety topics in the database. Of the topics, nutrition is the focus of the discussion in one of 223 topics. This did seem to be a memorable conversation amongst crews and an avenue wildland firefighters felt more nutrition information could be shared through. They also pondered the idea of a specific portion of the morning briefing for “some time for nutrition? Just a little tidbit on how to fuel yourself depending on what you’re doing for the day?”. Outside of the topic covered once per season in the morning briefing, wildland firefighters did not report any other structured nutrition education related to their work. None of the participants mentioned the Human Performance Optimization course nor the Comprehensive Wellbeing and Resilience training offering from the Forest Service. Three of the focus groups did mention guest talks from outside personnel at annual refresher trainings on the subject of nutrition and firefighter health as being memorable sources of nutrition information related to the job and something they would like to see more of.

The only structured nutrition education the wildland firefighters reported was the discussions surrounding the Six Minutes for Safety briefing. The discussion is intended to last around six minutes, and the person leading the morning briefing is given the following nutrition content to share: energy estimates for the WLFF; a basic recommendation about each macronutrient (carbohydrate, fat, and protein); as well as recommendation to consume 150 to 200 kcals every two hours. Emphasis is placed on carbohydrate for performance. A few nutrition discussion prompts are included at the end to promote further discussion. That concludes the only widespread, mandated nutrition education mentioned by focus group sessions related to the wildland firefighting job demands. According to the 6 Minutes for Safety calendar for the 2022 fire season this topic was rotated in for the month of January, when seasonal employees were still laid off, therefore unless it is selected by overhead specifically, WLFFs will not benefit from the educational opportunity this upcoming fire season. (*Firefighter Nutrition / NWCG, n.d.*)

Topics of Importance in Nutrition Education as Self-Identified by the WLFF

The themes generated from the question “We would like you to think about receiving nutrition information on a fire assignment. What would you like to know?” included: General WLFF Recommendations - Performance Nutrition, Hindrances to Performance, Energy Balance, Nutrition Goal Setting, Energy Maintenance, Electrolytes, Nutrition for Recovery. Navigating Shopping for Food - Grocery Store Stops, Purchasing for Crew. Nutrition Facts - Understanding the Nutrition Fact Panel, Nutrition Facts for Provided Meals. Nutrient Periodization - Throughout the Year, During the Shift. We Don’t Know What We Don’t Know - Overwhelmed, Carrying Misconceptions.

These established themes and subthemes would provide numerous nutrition education modules for the wildland firefighter. Further research may provide a better understanding of the themes: We Don’t Know What We Don’t Know - Overwhelmed, Carrying Misconceptions. Indicating a broad range of options for developing beneficial content, but a need for more research regarding the prioritization of nutrition education topics and development.

Wildland firefighters are interested in the basics of nutrition as a starting point for their nutrition education. “Even something simple like having the nutrition information of meals available. They maybe could put protein content and some other basics on the sandwich board.” Many felt this would help them make decisions on “what?” and “how much to consume?”. While some WLFFs believe they have some knowledge in nutrition, it would also need to be paired with some background education on nutrient needs to connect the nutrient values to something useful for the wildland firefighter’s toolbox of information.

There is interest in education about energy balance. This is a particularly relevant topic for the WLFF since energy demands can be upwards of 6000 kcals per day but can be followed by an assignment with much lighter demands. Or as the WLFF advances in their career, their role on the incident may change to less physically demanding and more sedentary but mentally taxing when getting into a more overhead position. WLFFs want to know how to manage this fluctuation in needs. One participant who had not yet fought fire yet but was hired on for the upcoming season said “Being a really skinny guy and a guy who burns a lot of calories, I am a little worried that this summer some days I might burn more

than I take in. And so to be pretty mindful of that I think I will probably have to ask for some help around me.” This coincides with work by Gaskill et. al. that reported body mass and lean mass decreasing over the course of a fire season. (Gaskill et al., 2020) This quote highlights an area of concern and also the peer education opportunities that are shared within crews.

Another topic wildland firefighters wanted nutrition information related to was how to best navigate store stops. One fire use module member said, “You don’t have a plan before you go in there (the grocery store).” This individual noted that the pressure makes them opt for “quesadillas and hot dogs” when they are asked to provide dinner for themselves. Another participant felt “so stressed” when the time came for quick store stop. This may be an avenue for nutrition education as store stops are utilized widely independent of resource type and experience level, and often bring rushed decisions and with little nutrition education, potential default to familiar and convenience items.

Those who often consume shelf stable items on assignment provided an idea of the menu within those food boxes. It included many canned items and dehydrated meals as well as snack bars and dried fruit and meat products. One smokejumper reported “The first day everybody’s got a pretty good menu of options and from there it’s what’s available.” This preparation is crucial and fueling strategies specific to reliance on shelf-stable items may be a useful education component to this population since they are expected to ration their own meals for multiple days from the prepackaged cargo load of food.

Finally, one person said learning about some of the “Don’t do’s resonates more” than a flood of information about what they should implement when learning about something new. This request for “what not to do” could be an effective way of teaching fueling strategies for hard shifts. For example, why not to eat three large meals, then explain the mitigation of this action by splitting the shift provisions into more frequent eating episodes. Targeting this behavior is justified by findings of infrequent eating episodes by Marks (Marks et al., 2020).

As Determined by Previous Research or Overlooked in Current Educational Framework

Nutrition education topics identified based on misinformation presented or behaviors reported were identified as potential areas for change to improve health and wellbeing.

Wildland firefighters reported sharing information amongst themselves as a way to foster the feeling of community. A few comments in the focus group discussions highlighted some of the information being shared as misinformation. These provide avenues for education to debunk some misinformation shared amongst this population. The comment “excess carbs are bad for you, you are going to turn and go fat.” Is true in the sense of energy excess leading to weight gain, but the focus on solely carbohydrate as the culprit for weight gain is alarming especially in this population where adequate carbohydrate intake is crucial for optimal performance. (Jeukendrup, 2008) Potential nutrition education topics might inform WLFFs that rather than focusing on eliminating one macronutrient, a diet that creates a negative energy balance and focuses on good food quality to promote health is better to consider when striving to lose weight. (Freire, 2020) Also, informing WLFFs that each macronutrient is energy contributing. Basic tactical athlete nutrition education topics would be a beneficial place to start in developing content to debunk many common diet fads.

The survey conducted by Kodeski suggests that the respondents did not understand the role of protein and amino acids in the body. (Kodeski, 2003) According to some of the focus group responses observed, some wildland firefighters would benefit from education on the roles of each macronutrient in their performance. One participant said, “If it were up to me I’d have like, five protein bars instead of like Cheezits or trail mix. I’d rather have five protein bars.” Further investigation is needed to clarify whether this is because of a demand for additional protein in the diet, or if it is because a sub-group of WLFFs is striving to avoid carbohydrate or fat-rich foods. Kodeski also reported less than half of the respondents understood or were knowledgeable about the role of carbohydrates during extended exercise and the purpose of carbohydrate loading. Another comment regarding protein bars was related to a brand of protein bar formulated with non-nutritive sweeteners. “Quite a bit of calories and a little bar to carry.” This was an interesting statement since the bar itself likely tasted sweet but provided minimal calories in the form of carbohydrate. The WLFF may have

sought the additional protein but seemed a bit misled based on their claim “quite a bit of calories” because although it is difficult to quantify what they meant by “quite a bit”, the bar they mentioned is a poor source of readily available, carbohydrate-rich energy for arduous work. This could also stem from the lack of knowledge on nutrient facts interpretations. This coincides with the request from WLFFs to learn more about reading and interpreting the nutrient facts panel.

Another quote that caught the attention of the focus group analysts was, “We don’t have a Whole Foods here.” This gave the focus group moderator the impression this participant felt nutritious shopping could only be done at a higher-end, more specialty foods market. This highlights the utility of an educational module focused on navigating grocery stores with per diem funds, and wholesome shopping habits to practice on a time crunch or in even the most rural locations.

The National Mobile Food Services (NMFS) contract consists of dietary specifications for the use of multiple Mobile Food Service Units (MFSU) for deployment on wildfires. The meals provided under contract on large incidents were a significant topic of conversation amongst all focus groups held. Currently overlooked in the educational framework, as well as the contract specifications laying out how to feed wildland firefighters on incidents, is the focus on micronutrient adequacy. A recent study showed that provided and consumed micronutrients in meals provided on wildfires were below the recommended dietary allowance (RDA) for vitamins D and E, magnesium, and manganese (Brooks et al., 2021). Micronutrients (vitamins and minerals) are necessary to sustain growth and development and support metabolic, immune, and cognitive functions. Specifically, during periods of increased activity, micronutrients are responsible for energy and macronutrient metabolism, oxygen and nutrient delivery, as well as skeletal muscle repair (Gombart et al., 2020). Therefore, greater emphasis should be placed on the consideration of micronutrients when updating contract specifications, so they are provided with micronutrient-dense options and the WLFF has the ability to reach those RDAs when relying solely on provided meals. This should coincide with nutrition education since as one focus group participant said, “But you have to know what that means. You have to tie it all together with what is taught.” This

creates an avenue for nutrition education for the wildland firefighter informing them on sources of these micronutrients and their importance in WLFF health.

Weight is also considered when choosing what to eat and how much food to carry during shift since the wildland firefighter is already expected to carry a heavy load. According to Sol and colleagues, this load averages 24 ± 9 kg for type II handcrews, and 28 ± 6 kg for interagency hotshot crew (Sol et al., 2018). Adding heavy meal components, especially ones that are not palatable to the WLFF would add a greater burden to the individual. Items that are nutrient-rich, but packaged in cans or require additional water to rehydrate may be left at the spike camp or at the vehicles during the operational shift for the same reason. The combination of weight and adversities to items in the shift provisions may lead to items being left behind that may have provided crucial calories in the prevention of an energy deficit, as well as micronutrients. If the majority of items are not widely accepted, or if wildland firefighters do not see the benefit in having these items on hand to prevent nutrient deficit, they will not be carried on the fireline, leaving no chance at the wildland firefighter benefiting from them. This may contribute to weight loss that has been seen over the season, or nutrient deficiencies if omitting shift provision items from the pack occurs repeatedly (Collins et al., 2018; Gaskill et al., 2020).

Many individuals took the focus group sessions as an opportunity to express their frustration with the provided meals on large incidents. The chief complaints in the focus group sessions were the repetitive nature of the “snack packs” given at large fires and the perceived quality of the fruit provided as well as the overall quality of meal components of the meal being low. There is of course no meal that can please everyone, and participants discussed how there is often someone on the crew interested in trading meal components. Wildland firefighters of various crew types and backgrounds discussed the common practice of trading items they found to be less appetizing, as well as saving extras in a “santa bag of leftover snacks” for individuals on their crews who were less picky, sought additional calories, didn’t like the waste, or had children at home. These discussions were significant considering wildland firefighters will only benefit nutritionally from the items in the shift provisions if they are eaten. Wildland firefighters deserve more nutrition education to guide decisions, but also a variety of palatable options to make choices that sustain them

throughout the taxing fire season. This may be an avenue for nutrition education for those providing the meals such as the caterers, as well as those overseeing the catering operations, the food unit leaders. Emphasizing education for these parties on the physical demands of the job and what items meet those nutrition needs, as well as general preferences and the WLFFs need for variety, reasonable quality, and packability and how these may improve WLFF nutrition status as well as morale.

Participants made thoughtful points surrounding nutrition considerations in the short-term. There were no mentions made of nutrition considerations for long-term health and prevention of chronic disease, which may be particularly beneficial to the career WLFF. Chronic non-communicable diseases (NCDs) are the leading causes of morbidity and mortality in the United States and globally, and are attributable largely to poor nutrition and suboptimal lifestyle behaviors. (Kimokoti & Millen, 2016) Nutrition habits related to short term performance and health were identified by WLFFs as topics of importance, but consideration of nutrition for longevity and habits relevant to the health of the WLFF throughout their evolving career and into retirement are topics proposed for future education modules.

Implementation Strategies for Tailored Nutrition Education for the WLFF

The wildland firefighter population is rich with diversities in age, race, experience, educational background and more. They share the title “wildland firefighter”, but they are all individuals. The American education system as well as the general public has come to believe that optimal learning occurs if individuals are taught in their preferred learning style and preferred method of delivery. (Dekker et al., 2012) This diversity in the population justifies a multi-faceted approach when educating the WLFF population since with the individual comes diverse learning styles and the need for options when learning nutrition concepts. This multi-modal approach will increase the ability of the WLFF population to share information and absorb that information, and thus, the success of the educational program.

There was interest in an online platform and a centralized location for information on the health and well-being of the wildland firefighter. “Having a website available with more specific information for firefighters about nutritional needs and calories and stuff might be a

useful tool. Something that folks could access on their own time but isn't a structured class so it doesn't seem tedious or like a chore." There are online platforms with information as described, for example, "The Black" which was evaluated by Cueto at the University of Montana. The Missoula Technology and Development Center of the U.S. Forest Service partnered with exercise physiologists, biomechanists, and athletic trainers at the University of Montana's Health and Human Performance Department to create an evidence-based program that addresses the physical fitness needs of WLFFs (Cueto, n.d.). The Black not only offers physical training routines that are specific to the needs of WLFFs, but also includes educational material about physical performance, stress tolerance, nutrition, and injury prevention. Other features on the website include, outreach emails, social media platforms, a nutrition log, and recommendations to improve the body's mobility and flexibility. These are all topics of interest to the wildland firefighter focus group participants, but none mentioned this resource when asked where they sourced this sort of information. A participant stated, "And also on the PT side, I mean, we're given an hour and a half to PT every day, but there's no guidance. I've never had any guidance. It's always been like 'hey! You're doing PT today', like, Okay, I'm supposed to be physical trainer? You know we get better at it right as we go on. But I think it'd be cool if there was more like workouts suggested for the job that, you know, are training you into that. So that's a little bit less thought on our side. And we can have a little more consistency in how we are training all across the fire community. I mean, what's the only thing, we have a pack test and the BLM fitness challenge. And you still have to search around to find that information. It's not like in a centralized location that's focusing on our health and bettering ourselves. I think that'd be pretty cool." Therefore, if programs such as The Black were developed further, supported, and communicated to the WLFF they may be utilized more to improve overall fitness level and WLFF health.

There was common reference to asking nutrition-related questions to fellow crewmembers known for taking an interest in nutrition and health. Focus group participants made mention of these individuals being healthy eating role models for the rest of the crew. This individual was not always the most senior person on the crew, indicating it is not always the more experienced person on the crew, but depending on the question someone of higher rank would be willing to ask someone "below" them for advice on something they have better understanding of. In the context of nutrition education this could open opportunity at

wildland firefighter nutrition education for entry-level and early career wildland firefighters with the intention they would become “nutrition champions”. Apart from benefits to themselves, nutrition peer educators appear to be most proud of their capacity to contribute to the nutritional health of the broader community (Mehta et al., 2020). In the field of wildland firefighting where camaraderie appears to be a large social element, this role may have a significant impact. Validated and specific educational materials shared would have a large crew influence even if those receiving shareable nutrition education were the more junior employees. The question culture of the crew clearly determines what, when and if a question is asked. This openness to discussion and the vulnerability of not knowing something may translate to other teaching and learning opportunities, as well as more peer education amongst crews.

The field of nutrition is an ever-changing area of study with new recommendations and findings coming out frequently. This provides justification for a credentialed nutrition professional, such as a registered dietitian nutritionist (RDN), to be involved in the development of nutrition education for the WLFF population, as well as the updates this content may need as recommendations evolve as more information is gathered.

Focus groups are merely a snapshot of information. No two are alike. Like a photo taken, the individual participants make the picture, and removing or replacing one person may adjust the image. In the application of focus group results to a larger population, it may be useful to consider a mixed methods approach. This research in combination with the work of Kodeski (2003) confirmed there are still many misled nutrition attitudes and beliefs held by the WLFF, but this research and more may guide the creation of a wholesome nutrition education program to offer to wildland firefighters early in their career, as well as boosters of information to develop their knowledge relevant to the nutrition demands in their unique line of work. Supporting the effort to expand wildland firefighter nutrition education is supporting firefighter health, well-being, and safety. As one WLFF put it, “I think it is extremely important to learn about nutrition in this job. I think it’s as valuable part of the job as learning to package a patient for Medevac, or the basic tactics used in fighting fire. You get out what you put in your body, and your body is a tool just like a Pulaski is a tool. We

need to spend as much time and more talking about the maintenance of our own well-being like we spend time maintaining other tools in this work because it is extremely important.”

Conclusion

Focus groups were held with the interest in researching what wildland firefighters see as beneficial nutrition education, and how they might receive this information. WLFFs want and need nutrition education delivered in a variety of formats, and more research needs to be done to identify which specific topics to prioritize. Involvement of the USFS along with other agencies, as well as the wildland firefighter population will ensure the content is tailored to the population, and the education developed is delivered so the WLFF may benefit. Continued evaluation of curriculum and communication with WLFFs will help to tailor the education to meet their needs and learning styles, as well as publish the most up-to-date recommendations for the tactical athlete population.

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Appendix A: Informed Consent

Wildland Firefighter Focus Groups for Nutrition and PPE Education Informed Consent for In-Person Focus Groups

Dr. Annie Roe and Dr. Sonya Meyer, from the Department of Family and Consumer Sciences at the University of Idaho are conducting a research study. The purpose of the research is to identify the most effective ways to provide education to wildland firefighters on fire assignment and to investigate some of the key educational needs in the areas of nutrition and apparel. You are being asked to participate in this study because you are a wildland firefighter.

Your participation will involve attending one focus group session. University of Idaho Healthy Vandals protocols will be in place <https://www.uidaho.edu/vandal-health-clinic/coronavirus/healthy-vandal-pledge>, including wearing face coverings, maintaining 6 feet of distance between individuals, applying hand sanitizer upon entering the focus group room, and cleaning and disinfecting the room in between focus groups. Each focus group will consist of 5-10 participants. After agreeing to the following procedures and signing this form, you will complete a demographic survey. During the focus group, a researcher will moderate the discussion using a set of pre-prepared questions. Examples of these questions include “How do you choose when and what you eat on fire assignment?” or “If you could change one or two things about your required PPE clothing, what would it be?” The discussion will be audio recorded. The entire process will take 2.5-3 hours. Refreshments will be provided in the form of individual snack boxes. Your involvement in the study is voluntary, and you may choose not to participate. You can refuse to answer any of the questions at any time. There are no names or identifying information associated with your responses. There are no known risks in this study, but some individuals may experience discomfort or loss of privacy when answering questions. Audio recordings will be stored on a secure UI server with access only by study personnel. Paper documents will be stored in the Primary Investigator’s locked office in a locked file cabinet. Upon completion of the focus group, your name will be entered into a drawing for a Jetboil Flash Cooking System (estimated odds of winning are 1 in 10).

The findings from this project will provide information on the most effective ways of providing education regarding nutrition and apparel to wildland firefighters on fire assignment and may be used to develop educational materials for future fire seasons. If published, results will be presented in summary form only.

If you have any questions about this research project, please feel free to contact Dr. Annie Roe at (208) 885-1709 aroe@uidaho.edu or Dr. Sonya Meyer at (208) 885-5778 sonyam@uidaho.edu. If you have questions regarding your rights as a research subject, or about what you should do in case of any harm to you, or if you want to obtain information or offer input you may contact the Office of Research Assurances at (208) 885-6340 or irb@uidaho.edu.

By signing below, you certify that you are at least 18 years of age and agree to participate in the above described research study.

IRB NUMBER: 20-025
IRB APPROVAL DATE: 04/22/2021

Name of Adult Participant	Signature of Adult Participant	Date
Name of Research Team Member	Signature of Research Team Member	Date

Appendix B: WLFF Focus Group Questions

Introduction:

Thank you for coming today, my name is (name) and I am a/an (undergraduate student, graduate student, faculty member) at the University of Idaho and my name is (name) and I am a/an (undergraduate student, graduate student, faculty member) at the University of Idaho.

Today we'd like to ask you some questions about your experiences while on fire assignment for the US forest service.

We are going to ask you questions about nutrition and clothing. When we say nutrition information, we are referring to information about the food you eat and how it helps you do your job while on fire assignment.

When we say clothing, we are referring to your PPE on fire assignment.

1. Tell us who you are, where you fight fire, how long, what you enjoy

most Transition

2. Tell me what you would do if you had a question about wildland firefighting while on fire assignment.

Key Questions

3. How do you choose when and what you eat on a fire assignment?
4. In the survey when you arrived you listed food items that you bring from home when you head to an assignment. Please tell me your reasons for choosing those items.
5. We would like you to think about receiving nutrition information on a fire assignment – what would you like to know,
6. How would you like to receive that information?
7. Where do you store your food items when on shift and how frequently do you access your shift food on a fire assignment?
8. Is there a way that this process could be made easier?
9. What do people most commonly modify or not wear while on fire assignment?
10. If you could change one or two things about your required PPE clothing, what would it be and how would that be beneficial?

Concluding Questions

11. We want to know the most effective way to give educational information to WLFF. Is there anything you came wanting to say that you didn't get a chance to say?
12. Of all the things we discussed, which was the most important to you?
13. This is the first in a series of groups like this that we are doing. Do you have any advice for how we can improve?

Appendix C: Demographic Survey



Wildland Firefighting Information

Thank you for taking the time to complete this short survey about your wildland firefighting experience and personal demographic information. This questionnaire will take about 5-10 minutes to complete.

What is your current GS level?

- GS 2
- GS 3
- GS 4
- GS 5
- GS 6
- GS 7
- GS 8
- GS 9
- GS 10
- GS 11
- GS 12
- GS 13

Are you a temporary or permanent employee?

- Temporary
- Permanent
- Other (please specify)

How many seasons have you been a wildland firefighter?

How many fire assignments lasting 7 days or longer have you been on?

- 0-1
- 2-5
- 5-10
- More than 10

Which regions have you fought fire in? (Please select all that apply)

- R1: Northern Rockies
- R2: Rocky Mountains
- R3: Southwest
- R4: Great Basin
- R5: California
- R6: Northwest
- R8: Southeastern
- R9: Eastern
- R10: Alaska

In general, where do you receive information about food and nutrition? (Select all that apply)

- Websites (please specify)
- 6-minute briefing
- Other wildland firefighters
- Friends
- Magazines
- Personal trainer
- Nutritionist/RD
- Other (please specify)

Please list the food items you typically bring from home when you go on a fire assignment.

Where do you get your PPE?

- Government issued
- Purchase own
- Some government issued, some purchased myself

Demographic Information

What is your age?

- Under 18 years old
- 18-24 years old
- 25 - 34 years old
- 35 - 44 years old
- 45 - 54 years old
- Over 55 years old

What is your gender?

- Male
- Female
- Other (please specify)
- Prefer not to say

What is your ethnicity? (Choose all that apply)

- White
- Black or African American
- American Indian or Alaska Native
- Asian
- Native Hawaiian or Pacific Islander
- Other (please specify)

What is the highest degree or level of school you have completed? (If you are currently enrolled in school, please indicate the highest degree you have received)

- Less than a high school diploma
- High school degree or equivalent

- Bachelor's degree (e.g. BA, BS)
- Master's Degree (e.g. MA, MS, MEd)
- Doctorate (e.g. PhD, EdD, JD)
- Other (please specify)

What is your current employment status?

- Employed full-time (40+ hours per week)
- Employed part-time (less than 40 hours per week)
- Unemployed
- Student
- Other (please specify)

What is your marital status?

- Single (never married)
- Married
- In a domestic partnership
- Divorced
- Widowed

What is your height in inches?**What is your weight in pounds?**