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DIETARY INTAKE AND ENERGY EXPENDITURE OF PARARESCUEMEN DURING ROUTINE TRAINING

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2012

A thesis submitted in partial fulfillment
of the requirements for the

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ABSTRACT

PURPOSE: To determine the energy expenditure and dietary intake of Pararescuemen during routine training.

INTRODUCTION: United States Special Operations Forces undergo daily rigorous training to maintain excellent physical condition and to prepare for deployment operations. Pararescuemen are one group of Air Force Special Operations Forces who engage in vigorous routine training. This training can elicit high energy expenditures, yet few studies have investigated the energy expenditure of these groups while conducting routine training. In addition, adequate energy and nutrient intake to meet elevated energy expenditures is essential to maintain good health and well-being and to achieve optimal performance.

METHODS: Pararescuemen from a local Air Force base completed baseline assessments which included anthropometrics, resting metabolic rate assessment, and VO_{2max}. Following this session, subjects wore a heart rate monitor throughout two work days, which was used to estimate total daily energy expenditure using the flex-heart rate method. Dietary intake was also measured using six-day diet records to determine total daily energy and macronutrient intake. Total energy expenditure and total energy intake were compared using a paired sample t-test, and macronutrient intakes were compared to the current sports nutrition recommendations and the military dietary reference intakes using one sample t-tests.

RESULTS: The average total daily energy intake of Pararescuemen (2,288 kcal ± 645) was 43% less than total daily energy expenditure 4,021 kcal ± 890 during routine training, ($p<0.0001$, $d=2.0$). Average carbohydrate intake (2.9 g/kg ± 0.1) was significantly less than the recommendation for individuals performing ~1 hour of activity per day (5.0 g/kg) according to the most recent sports nutrition recommendations ($p<0.0001$, $d=-1.6$). Percent of total calories coming from carbohydrates was 39% ± 6.8%, which was 11% less than the MDRI (50-55%), ($p<0.0001$, $d=-21.0$). Fat intakes were high, with 35% of total calories coming from fat compared to the recommendation of $<30\%$ of total calories ($p=0.001$, $d=1.0$). Lastly, protein intake (1.7 g/kg ± 0.6) was within the recommended range for both the MDRI and the current sports nutrition recommendations.

CONCLUSION: Pararescuemen expend high levels of energy during routine training, similar to those of other elite military groups. Average energy intake of Pararescuemen was 43% lower than their energy expenditure. In addition, their carbohydrate and fat intakes did not align with the current sports nutrition recommendations and military dietary reference intakes. Excessive fat and low carbohydrate intakes have also been reported previously in other elite military groups. Carbohydrate intakes below the recommended levels can lead to earlier fatigue and decreased focus on mission specific training. Improving the energy and nutrient intakes of Pararescuemen to meet their demanding energy expenditures needs to be a focus when creating future personalized nutrition plans.

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LIST OF ABBREVIATIONS

BMR	basal metabolic rate
FFM	fat free mass
HR	heart rate
MDRI	military dietary reference intakes
PAEE	physical activity energy expenditure
REE	resting energy expenditure
RMR	resting metabolic rate
SEE	sedentary energy expenditure
SOF	Special Operations Forces
TDEE	total daily energy expenditure
TDEI	total daily energy intake
TEF	thermic effect of food
VCO_2	carbon dioxide production
VO_2	oxygen consumption

CHAPTER 1

INTRODUCTION

Battlefield Airmen are the Special Operations Forces (SOF) within the United States Air Force. One group of Battlefield Airmen are Pararescuemen (i.e. Pararescue Jumpers and Combat Rescue Officers), an elite combat force of highly trained trauma specialists tasked with personnel recovery. Pararescuemen are the only specifically trained personnel recovery specialists in the U.S. military and are trained to use air-land-sea tactics to treat and extract injured personnel.[1] In addition to personnel recovery, Pararescuemen also work alongside other SOF, such as Navy SEAL or Army Ranger teams, and therefore require similar day-to-day training. Unfortunately, no study has investigated the energy expenditure or dietary intake of these operational Battlefield Airmen.

SOF of the United States military undergo rigorous daily training to perform their jobs. Routine training for SOF includes daily physical training such as weight training, running, and calisthenics; oftentimes followed by simulated mission training exercises. Training days can be intense and lengthy, resulting in extremely high levels of total daily energy expenditure (TDEE).[2] Many studies have investigated the TDEE or dietary intakes of this unique population.[2–7] However, most of these studies are over a decade old,[2,3] or have only studied SOF during the few weeks or months of intense selection.[5,7] Few studies have investigated SOF while conducting routine training at their home station.[2,4]

Measuring energy expenditure and dietary intake during routine training is important to gather data on all SOF throughout various stages of their careers. Younger SOF personnel have likely experienced few injuries and are able to train at their full capacity day after day. In contrast, older, more experienced personnel may not be able to recover as well from an intense training session or may have injuries preventing full training status. Retaining SOF personnel in their career fields is extremely valuable as battlefield experience is difficult to replicate, and therefore assessing energy expenditure and dietary intake of both new and experienced SOF personnel is critical to maintain longevity. In addition, recent development of Human Performance Programs provides high-level resources to SOF in strength and conditioning, physical therapy, as well as nutrition, with the goal to promote improved preparation and recovery. These human performance teams can utilize expenditure and nutrient data collected on SOF to develop enhanced nutrition and recovery programs in the future.

SOF personnel expend higher levels of energy than their support counterparts, and total energy expenditure is higher during deployment than routine training at their home station.[2,8] It is important SOF meet their nutrient needs while in routine training, not only to support body function, but to promote optimal performance gains. Inadequate nutrition during periods of increased energy expenditure can result in decreased immune function[9] and an increased risk of injury.[10] Proper nutrition is also key for optimal recovery and body composition,[10] in addition to performance.[11]

Despite growing interest in nutrition and energy expenditure in SOF, no study has looked at the energy balance of Pararescuemen; the majority of research analyzing SOF involve Army Special Forces, Navy SEALs, or Army Rangers.[2–4,6,7] Pararescuemen have a unique role in rescue and special tactics missions, therefore understanding the energy intake and expenditure of this group will provide valuable information for developing personalized nutrition programs in the future. As a result, the purpose of this study was to determine the energy expenditure and dietary intake of Pararescuemen during routine training. This was achieved using detailed food and activity diaries in addition to a heart rate monitoring device. Specifically, this study sought to answer the following questions.

Research Question 1: Do Pararescuemen consume adequate energy to meet their daily energy expenditure?

H_0: Pararescuemen do not consume adequate energy to meet their daily energy expenditure.

H_1: Pararescuemen consume adequate energy to meet their daily energy expenditure.

Research Question 2: Do the macronutrient (i.e., carbohydrate, protein, and fat) intakes of Pararescuemen align with current sports nutrition recommendations?

H_0: The macronutrient intakes of Pararescuemen do not align with current sports nutrition recommendations.

H_1: The macronutrient intakes of Pararescuemen align with current sports nutrition recommendations.

Research Question 3: Do the macronutrient intakes of Pararescuemen meet the current Military Dietary Reference Intakes (MDRIs) for heavy workloads?

H_0: The macronutrient intakes of Pararescuemen do not meet the current MDRIs for heavy workloads.

H_1: The macronutrient intakes of Pararescuemen meet the current MDRIs for heavy workloads.

CHAPTER 2

LITERATURE REVIEW

Energy balance occurs when total energy intake meets total energy expenditure.[10] Maintaining energy balance is a vital component in achieving optimal performance. High energy expenditures require equally high energy intakes for proper recovery, prevention of illness and injury, and to avoid the loss of lean body mass. In addition, military specific tasks, such as marksmanship,[12] and performance tasks including peak power and maximal lifting strength,[11] can be affected by inadequate nutrition. Analyzing the energy expenditure and dietary intakes of elite military personnel provides a foundation for the development of new feeding strategies and individualized nutrition plans.

Energy Expenditure of Military Personnel

Throughout the military there are a variety of career fields associated with physical demands. Those that are more sedentary can result in low levels of TDEE, while other jobs require daily strenuous activity resulting in a greater daily energy expenditure. American military SOF are a group of highly trained military personnel that are equipped to conduct unconventional missions worldwide. Their job tasks can involve substantial mental and physical demands. To meet these demands, SOF must train rigorously and consistently.

The arduous training SOF endure during routine training elicit higher energy expenditures than other military personnel. The daily energy expenditures of Army SOF in routine training ranges from 14,154 kJ (3,383 kcal)[4] to over 24,000 kJ (5,736 kcal).[8] Typical daily activities include physical training such as running and weight training, as well as military tasks including weapons training, load carriage, mountain climbing and combat training. On the other hand, support personnel engage in standard physical training, assembly of equipment, driving vehicles, and office work.[8]

At times, the levels of energy expended by SOF have exceeded the recommended energy intakes set by the military for feeding during routine training. The MDRIs are nutrition standards established for meals served to military personnel during both normal operating conditions and while under simulated or actual combat conditions.[13] These standards are used in developing military food service programs and in determining appropriate operational and restricted rations. The current MDRI for energy for moderate activity is 3,250 kcal/day, and for heavy work, 3,950 kcal/day. These values are based on a 175 cm, 79 kg male,[13] which is smaller than most SOF personnel. In fact, majority of studies report the average weight of a special operator is 84 kg.[2,4,7,14,15] These differences in the recommended caloric intakes and the actual energy expended by SOF could result in underfeeding during routine training.

Similar levels of energy expenditure have been reported during selection schools. These schools are meant to be extremely physically demanding combined with limited food intake and sleep deprivation. Margolis et al., studied the energy balance and body composition of 52 Army Special Forces soldiers undergoing a 64-day small unit tactics training phase during the Special Forces Qualifications Course.[7] Participants were grouped into four cohorts that conducted various training events, ranging from classroom instruction to simulated squad raids and urban combat. Throughout the nine-week course, half of the participants expended more energy than they consumed on average. Those conducting simulated urban combat in field conditions expended the highest level of energy, with an average of 21,800 kJ/day (5,210 kcal/day).[7] In addition, this same cohort had the lowest total energy intake, resulting in a greater than 50% negative energy balance.[7]

Selection schools are purposefully intense to retain only the elite few who can endure the physical and psychological demands of special operations missions. After completion of selection school, physical activity remains higher in SOF than other military units. Although daily training requires intense physical fitness, few studies have analyzed the energy expenditures of SOF during routine training. One study conducted by Tharion et al., analyzed the energy expenditure and energy intake of a group of Army Special Forces soldiers (n=32) over nine days of routine training. Average energy expenditure was 17,150 kJ/day (4,099 kcal), which equated to approximately 50 kcal/kg/day.[2] Activities conducted throughout the study included simulated urban operations, mountain hiking with full load, rock climbing, and foreign language practice. Similar results were found in another group of Army Special Forces soldiers (n=15) conducting pre-mission training with an average energy expenditure of approximately 16,318 kJ/day (3,900 kcal or 46 kcal/kg/day).[4] In this study, subjects performed physical training, weapons familiarization, airborne operations, and simulated convoy operations. Findings from an earlier study of Army Rangers conducting routine training reported much higher levels of daily energy expenditure. On average these soldiers were expending over 18,828 kJ/day (4,500 kcal/day or 61 kcal/kg/day).[8] These results are comparable with those found during selection schools, indicating routine SOF training can elicit extremely high energy expenditures.

Understanding the job demands and associated energy expenditures of elite military personnel is a valuable aspect to a performance plan and adequate feeding strategies. Though SOF are similar in some respects, their energy expenditures may differ during routine training. Analyzing the energy expenditures of Pararescuemen will provide a foundation for future development of nutrition programs.

Energy and Nutrient Intakes of Military Personnel

Adequate energy intake is essential to support proper body function. When energy intake is less than energy expenditure, there is an inadequacy of energy to support normal body functions involved in optimal health and performance.[16] Over time, body systems begin to slow down and conserve energy causing hormonal imbalances, a reduction in metabolic rate, and other disrupted physiological functions. These physiological consequences can impair training and lead to an increase in illness and injury.[16]

Beyond consuming enough calories, appropriate distribution of both macronutrients and micronutrients is key for optimal performance.[10] SOF require higher levels of energy, carbohydrate, protein, and fluids to meet their increased energy expenditures and to support a demanding training regimen. Typically, with higher intakes of these macronutrients, consumption of necessary vitamins, minerals, and antioxidants also increases. However, this is only true if the diets are well-balanced. Diets high in processed foods with minimal intake of fruits, vegetables, and whole grains can lead to micronutrient deficiencies ultimately hindering performance.

The dietary profiles of SOF have demonstrated varying results. In some SOF personnel, total daily energy intake (TDEI) has been reported at levels below TDEE. In the aforementioned study of Army Special Forces expending approximately 17,155 kJ/day (4,100 kcal/day), energy intakes were reported at 11,874 – 15,381 kJ/day (2,838 – 3,676 kcal/day).[2] This negative energy balance, if continued, could lead to weight loss, compromised immune function and increased risk for injury. Other military personnel of similar caliber have reported adequate energy intakes, but also excessive fat and inadequate carbohydrate consumption.[3,15,17,18]

Carbohydrates are the key fuel for the brain and central nervous system and are used largely by the skeletal muscles over a range of intensities.[10] In contrast, fat is also a fuel source for working muscles, particularly at lower intensities when oxygen is abundant. An advantage of fat is the large storage of adipose tissue in the body whereas carbohydrate stores (liver and skeletal muscle) are limited. Sufficient carbohydrate stores are essential during routine training days when exercising at high intensities or over prolonged periods. Replenishing glycogen stores after intense physical training requires adequate daily carbohydrate intake.

Current sports nutrition recommendations, from the Academy of Nutrition and Dietetics, the American College of Sports Medicine, and Dietitians of Canada, recommend athletes consume 3-12 grams of carbohydrate per kg per day depending on training level. During exceptionally high levels of training, more than 4-5 hours per day, it is recommended individuals consume 8-12 g/kg/day.[10] Multiple studies have reported SOF consume inadequate carbohydrates compared to the current recommendations, with some reporting <5 g/kg/day.[2,6,15] At a minimum during moderate activity of approximately one hour per day, 5-7 g/kg/day of carbohydrate is recommended.[10] Failing to replenish depleted glycogen stores results in earlier fatigue, decreased performance, and difficulty concentrating.[10]

Inadequate carbohydrate stores combined with daily training can negatively affect military-specific tasks. Soldiers performing a load carriage exercise followed by marksmanship tests demonstrated decreased shooting accuracy when consuming a low carbohydrate diet.[12] Individuals consuming the low-carbohydrate diet (250 g), had a mean shot group tightness score of 36.3 ± 14.6 before load-bearing exercise. Their score significantly decreased following load-bearing exercise to 51.7 ± 18.4, $p<0.05$.[12] The low carbohydrate group scores also differed significantly from the other groups consuming a moderate carbohydrate diet (400g), $p<0.05$, and a high carbohydrate diet (550g), $p<0.01$.[12] The low carbohydrate intake led to faster skeletal muscle fatigue and decreased marksmanship performance.

Similar findings were reported in French special operations soldiers (n=27) conducting combat training over a 96-hour period. Low calorie (1,800 kcal/day), moderate calorie (3,200 kcal/day), or high calorie (4,200 kcal/day) diets were provided each day throughout the 4-day study. At the end of the 96-hour period, power output at exhaustion decreased significantly from 325 W to 278 W in the low-calorie group ($p<0.01$) with no significant change in the moderate or high calorie diets.[19] In addition, there was a significant 8% reduction in maximal oxygen uptake in the low calorie group from pre to post combat course.[19] These results indicate performance tasks commonly performed by SOF personnel are negatively impacted by inadequate energy and carbohydrate intakes.

Suboptimal intake of carbohydrates can be the result of diets too high in protein or fat. This has been demonstrated in multiple studies analyzing the nutrient intakes of various military populations.[3,6,15,18] Foods high in fat, specifically saturated and trans fats, tend to be found in energy dense foods that provide very little nutritive value. Tharion et al. reported the foods most commonly underreported in a group of Special Forces soldiers diet records were sweets, savory snacks, meat spreads, soft drinks, condiments, and high-fat spreads.[2] Diets high in these types of foods and beverages can negatively influence performance when they replace consumption of nutrient-dense foods.

The joint position stand on Nutrition and Athletic performance, recommends protein intakes of 1.2 – 2 g/kg for athletes.[10] Above 2 g/kg is only recommended for short periods of extremely intense training or when energy intake is restricted, to prevent loss of muscle tissue.[10] Previous studies investigating the dietary profiles of SOF indicate protein intake within the 1.2 –

2 g/kg range.[2,3,6] Protein supplementation is also popular among SOF personnel,[20] which may help them meet their needs or increase their protein intake above the recommended levels. In fact, whey protein supplements was the most common dietary supplement reported by Army Rangers, with over 60% consuming it regularly.[21] Though it was not determined why the subjects consumed protein supplements, more users (96.3%) than non-users (82.1%) were actively participating in weight training, suggesting their purpose was to increase muscle mass and/or strength. Additionally, a nutrition knowledge survey of Army Special Forces soldiers reported a lack of knowledge in understanding about the role protein plays in the body.[20] Balance of all macronutrients is necessary for optimal health and performance; excessive intakes of any macronutrient can lead to inadequate intakes of the others. Education on proper nutrient intake is critical within this population.

Adequate energy intake and appropriate macronutrient distribution during intense training periods is essential to sustain body function and promote optimal performance. The available studies within this population demonstrate SOF personnel can struggle to meet their increased energy needs. In addition, their macronutrient intake is disproportionate to the most recent nutrition recommendations for athletic populations.[10]

Performance Impairments Due to Suboptimal Energy & Nutrient Intakes

Inadequate energy and nutrient intakes negatively affect health and well-being by increasing the risk of illness and injury, altering mood, and decreasing concentration. Suboptimal intake may particularly hinder military performance by leading to earlier fatigue, reduced aerobic capacity, impaired judgement, decreased coordination, and loss of strength.[10] Low energy intake results in a loss of total body mass, fat mass and lean body mass, especially when paired with elevated levels of energy expenditure.[5,7,11,14] Loss of lean body mass can negatively affect military tasks due to a loss of muscle strength and power output. Nindl et al., analyzed the performance response during 72 hours of military operational stress. During the sustained operations, soldiers were sleep deprived and total energy was restricted to approximately 6,695 kJ/day (1,600 kcal/day). Total lean body mass and fat mass significantly declined ($p<0.05$) following the treatment period by 1.5 kg and 1.2 kg, respectively.[14] Squat jump power also significantly declined by approximately 7% throughout the sustained operations week, ($p<.05$).[14] Unlike previously reported research, rifle marksmanship was not affected by the sustained operations and calorie restriction.[14] These results indicate even short-term deficits in energy intake can negatively impact military specific tasks.

Overtime, small energy deficits can add up to considerable performance decrements. An 8-week US Army Ranger training course led to an average loss of total body fat of 8.5% and a lean body mass loss of 2.6%.[11] Over the 8-week course, maximal lifting strength, vertical jump, and peak power output all significantly declined by 20, 16, and 21%, respectively ($p<0.001$).[11] These changes in physical performance correlate with the relatively higher loss of lean body mass from the arms and legs than the trunk.

The findings from these studies validate the importance of adequate energy intakes to limit the loss of lean body mass. A loss of muscle strength and power output can have detrimental effects during simulated and real-world special operations demonstrating the need for adequate feeding in both situations. Feeding during a deployment is more difficult than during routine training and may result in a larger energy deficit. This emphasizes the value of adequate feeding provisions while in training to avoid sending SOF personnel on deployment in a negative energy balance.

To understand the necessary levels of energy, macro- and micronutrients needed during routine training it is imperative to analyze the energy expenditures and current energy intakes of all SOF personnel. At this time, studies have only assessed a small percentage of this unique population. Of these studies, many demonstrate a wide range of needs making it difficult to provide appropriate nutrition to all SOF.

Measuring Total Daily Energy Expenditure

TDEE is a culmination of energy expended while the body is at rest and during physical activity. TDEE includes basal metabolic rate (BMR), the thermic effect of food (TEF), and physical activity energy expenditure (PAEE). BMR is the minimal amount of energy the body expends at rest to maintain biological processes, including the digestion and absorption of nutrients, cardiovascular function, breathing, energy metabolism, and many other physiological functions. The TEF is defined as the energy expenditure above BMR due to the process of digesting, absorbing and storing nutrients. PAEE is the energy expended to perform activities of daily living and exercise.

Various techniques have been used to measure TDEE. In field experiments, TDEE is frequently measured using the doubly labeled water method. The doubly labeled water method is regarded as the gold standard for measuring total energy expenditure in real-world situations due to its accuracy of $\pm$ 2-3% in comparison with direct calorimetry.[22] This method is costly and requires subjects to ingest water enriched with stable isotopes while monitoring urine output for 8-14 days.[22] Other approaches to measuring real-world TDEE include the factorial method, accelerometry, heart rate monitoring, and a combination of various methods.

Heart rate monitoring has become a popular technique for measuring energy expenditure due to its relatively inexpensive and minimally burdensome approach. This method uses the linear relationship between heart rate (HR) and oxygen consumption (VO_2) to determine energy expenditure throughout the day. This relationship is accurate during moderate to high intensity activities but less accurate during low intensity activities and sedentary periods. To avoid this problem, the flex-HR method, developed by Spurr et al., is commonly used.[23] This method establishes a critical HR point (flex-HR point) which separates sedentary and physical activity HRs. This flex-HR point is determined through individual subject calibration. When HR exceeds this point, the individual HR-VO_2 linear regression is used to determine energy expenditure. At HRs below this point, predetermined resting energy expenditure (REE) is used. Following individual calibration, subjects wear a HR monitor throughout the study period. The monitor collects minute-by-minute HR data, which are then converted into expended energy (kcal/min) either using the linear regression equation or REE. The sum of these values is added to the individuals' BMR and TEF to determine TDEE.

Like all methods of measuring energy expenditure, the flex-HR method has limitations. Accurately determining the flex-HR point is critical in individuals who will spend large portions of the day above sedentary activity, particularly when these activities are not high-intensity. If the flex-HR point is predicted too high, energy expenditure will be estimated too low due to submaximal exercising HR not going above the flex-HR point. Administering individual calibration can also be a limitation in studies with many subjects. Another drawback is the use of a single calibration activity, such as running, which may not be as accurate for other activities.

Though the flex-HR method has limitations, it has been validated against indirect calorimetry and doubly labeled water.[23–25] In a study of 22 men and women, TDEE was determined over 24-hours in a calorimeter and then under normal conditions while wearing a HR monitoring belt. Subjects performed similar activities on each of the study days, which included cycling at three different workloads and activities of daily living. Results indicate the flex-HR method average difference in TDEE from the calorimeter was 57 kcal, a range of -445 – +476.[23] A similar study reported an average underestimation of TDEE by -1.2% compared to direct calorimetry, and most of the reported difference was due to the underestimation of BMR during sleep.[24]

Numerous monitors now exist for measuring HR in addition to other variables. One such device is the Zephyr™ BioHarness. The Zephyr™ BioHarness measures HR, R-R interval, breathing rate, posture, activity level, peak acceleration, and GPS.[26] The BioHarness monitor is positioned in a custom receptacle attached to a chest strap. An additional shoulder strap can be used to keep the chest strap in place. The Zephyr™ BioHarness has been validated against a 3-lead electrocardiogram in moderately trained men conducting three 5-minute exercises, static, walking and running.[27]

The BioHarness has also been tested for its accuracy of measuring HR while exercising in the heat. In the heat, the BioHarness measured HR at 78.5–133.6 b/m, which was not significantly different than the previously validated portable cardiopulmonary breath-by-breath gas exchange analyzer (COSMED) device at 81–137.5 b/m. In both ambient and heat conditions, the BioHarness was not significantly different than the COSMED.[28] Overall, the Zephyr™ BioHarness is an effective device for measuring HR during exercise and sedentary activities, and can be used to estimate energy expenditure in normal and hot, humid conditions.

Measuring Dietary Intake

Measuring the energy and nutrient intakes of various populations is frequently done to assess overall health, micronutrient deficiencies, and macronutrient distributions. Consuming a well-balanced diet that provides all the essential nutrients in adequate amounts will help SOF train at their maximum ability. Proper nutrition for those training at high volumes allows the body to recover from intense exercise and refuel for the next session. Assessing the typical dietary intakes of SOF provides insight into possible shortcomings or excesses that need modifying.

There are many techniques to measure dietary intakes. Some of these techniques are more burdensome on the subject, but provide important detail; others are relatively simple and broader. Most dietary analyses can be categorized as either prospective or retrospective. Prospective dietary assessments include diet records and are commonly used anywhere from one to seven days. Diet records require the subject to record all food and beverage intake over a period of days. Retrospective assessments look at recent intakes and include 24-hour recalls, diet history questionnaires, and food frequency questionnaires. In these assessments, subjects are cued by questions either from a trained individual or on paper, to recall their most recent or typical food intakes. In majority of studies measuring dietary intakes of athletes, a three or four day food record is the most commonly used.[29] In military populations, a 24-hour recall has been the most frequent method.[3,6,15,18,30]

It is likely that the 24-hour recall is used in military populations due to the limited burden put on the subject, unlike diet records, which require time and detail from the individual. 24-hour recalls can be beneficial as they are easy to administer, fast to complete, inexpensive, and there is minimal distortion of food intake.[29] The main disadvantage of a recall is that it does not give a good representation of the individual's typical intake. Alternatively, diet records for at least three days can provide a more accurate representation of the subjects' typical intake.[29]

Using a food record as a method for estimating typical daily intake also has a few drawbacks. Though recording more days provides a better idea of overall nutrient intake, compliance decreases as the period of recording increases.[29] Other downsides include the length of time and disruption of normal life, altering usual intake, and underestimating portion sizes. To improve the accuracy of diet records, some studies conduct a 24-hour recall with subjects prior to the recording period. This allows a trained interviewer to teach subjects how to measure portion sizes accurately and the appropriate details to provide in the food record such as time of day, brand, restaurant, and preparation method.

Choosing an appropriate number of days for subjects to record their intake is dependent on what information is desired and the risk of noncompliance. In athletic populations, a seven day food record is considered the gold standard.[29] This length of time can be burdensome for individuals but provides a more accurate interpretation of macro and micronutrient intakes. Shorter recording durations, such as three or four days are also commonly used to minimize subject burden and maintain compliance.[29] Although diet records can be time consuming for the subjects, they provide the best representation of what the individual usually eats. Ultimately, the goal of this study is to assess typical energy and nutrient intake, therefore measuring more than three days is the more appropriate choice when analyzing the diets of Pararescuemen.

Conclusion

All SOF personnel undergo intense physical training during selection school and this arduous training continues during routine training. Although no study has examined the energy expenditures of Pararescue selection, it is assumed to be no different. Pararescue training takes a minimum of 20 months to complete[31] assuming no setbacks due to injury, illness, or an inability to complete one of the eight courses. With an 80% attrition rate, Pararescue selection school is one of the most grueling throughout the military.[1] Selection school for Pararescuemen is challenging for multiple reasons. Like other SOF, they must undergo intense physical conditioning and be trained in tactics, weaponry, and survival training. They are also fully-trained paramedics, capable of performing emergency medical operations under combat conditions. Lastly, Pararescuemen are certified freefall parachutists, skilled in mountaineering and receive combat diver training since their missions can take them into various terrains around the world.

Wide ranges of energy expenditures of SOF personnel conducting routine training have been reported. Particularly studies have focused on Army and Navy SOF, with no studies examining Air Force SOF. The inconsistencies in energy expenditure could be due to the vast skillset SOF personnel must maintain and therefore training results in varying workloads. Regardless of the training, adequate nutrition is paramount to optimal performance, recovery, and health. Analyzing the energy expenditures and dietary intakes of all SOF is critical for future development of performance nutrition plans. Pararescuemen are one group of Air Force SOF that require investigation. This data will provide a new perspective of potential nutrition gaps leading to improvements in training and preparedness of all SOF.

CHAPTER 3

METHODOLOGY

Subjects

Active-duty Pararescuemen (n=25) were recruited from the U.S. Air Force 58th Rescue Squadron stationed at Nellis Air Force Base, Las Vegas, Nevada. Inclusion criteria for participation included being a healthy, injury free active-duty Pararescuemen between the ages of 18 – 45 years. Based partially on the data reported by Wierniuk, A. and Wlodarek, D., using the conservative effect size value of 0.7 in a two-tailed, two-sample t-test, with 80% power, indicated 20 subjects would be needed to demonstrate statistical significance at ($p \leq 0.05$).[32]

The subjects were recruited through live briefings using PowerPoint™ slides (appendix A) in the weeks before the study. All participants were informed of the purpose and detailed protocol of the study. After the briefing and prior to data collection, written informed consent (appendix B), along with a medical questionnaire (appendix C), were completed by each subject. Throughout the study subjects were conducting routine training, which involved daily physical training, administrative tasks, marksmanship, small unit tactics, rock climbing, and simulated full mission profile scenarios. Prior to initiating data collection, the study protocol was approved by both the UNLV Institutional Review Board and the U.S. Air Force Research Laboratory Institutional Review Board (appendix D).

Procedures

Initial Visit: Subjects were asked to arrive to the exercise physiology lab at least one hour after their last food or beverage intake. A Registered Dietitian Nutritionist conducted an in-depth 24-hour dietary recall with each subject to instruct them how to accurately record all food and beverage intake during a typical day. Starting with the most recent intake, all food and beverages consumed in the previous 24 hours were recorded. Specific questions were asked including time of consumption, amount, preparation method, and brand name. These questions were to increase accuracy and to provide an example of what subjects were to record on their dietary logs (appendix E) throughout the study. Examples of portion sizes, including food models and measuring utensils, were used to improve accuracy of the amount consumed.

After the 24-hour recall, subjects were taught how to accurately record physical activity. A physical activity log (appendix E) was used to collect information on the type, duration, and intensity of activities conducted during training. These activity logs were used to get a range of activities performed during typical training days.

Demographic information was assessed through a questionnaire (appendix F) and included questions about age, time in the military, time since graduation from selection school, deployment history, recent weight history as well as dietary supplement use. Height was measured to the closest 0.1 cm using a standard wall stadiometer. Weight was measured and body composition estimated using a bioelectrical impedance analyzer (InBody™ 770, InBody USA,) to estimate fat mass and lean body mass.

Each subject was individually assessed to determine REE, resting HR, initial exercising HR, and HR-VO_2 linear equation. To determine REE and resting HR, simultaneous measurements of oxygen consumption (VO_2), carbon dioxide production (VCO_2), and HR, were measured in three resting positions: supine, sitting and standing. Subjects were measured for five minutes in each resting position after three minutes to reach steady state.

Throughout the calibration period, VO_2 and VCO_2 were measured using the Parvo metabolic analysis system (Parvo Medics TrueOne 2400, Sandy, UT). Subjects wore a nose clip and a non-rebreather mouthpiece, which was connected to an O_2 and CO_2 analyzer and computer interface. The mouthpiece allows the subject to breathe in room air, of known concentrations of oxygen (20.93%), carbon dioxide (0.03%), and nitrogen (79.04%). The analyzer measures the rate air is expired as well as the concentrations of oxygen and carbon dioxide. The amount of energy being used by the body is reflected as the difference in the amount of oxygen and carbon dioxide between inspired and expired air. Gas concentrations are used to calculate VO_2 and VCO_2. A HR monitor was used to measure HR during this period as well.

To calculate REE the average VO_2 and VCO_2 from all resting positions were used in the simplified Weir equation[33]:

EQUATION 1: $REE\ (kcal/min) = ([3.9(VO_2) + 1.1(VCO_2)] \times 1.44)$

After resting measurements were completed, subjects walked on a treadmill at 2.7 km/h at a 10% gradient for six minutes to determine initial exercising HR. Again, the first three minutes of treadmill walking was discarded to allow for steady state to be reached. To determine each subject's VO_2–HR linear equation, an incremental maximal treadmill test was conducted. Prior to the start of the test, subjects were allowed to become accustomed to running on the treadmill. Due to the high fitness level of the subjects, an athlete-led protocol was administered.[34] The initial speed was set at 10 km/h (6.2 mph) and was increased 1 km/h each minute until a comfortable pace was achieved. Once at a comfortable pace, the treadmill was increased by 1% gradient each minute until volitional exhaustion was reached. A respiratory exchange ratio $\geq$ 1.10, HR > 90% age predicted maximal HR (220 – age), plateau in VO_2 despite further increase in workload, and volitional fatigue were used as criteria to confirm achievement of VO_{2max}. Two of the four criteria were met in all subjects. VO_2 and HR were used to determine the individual linear equation for each subject using the following equation:

EQUATION 2: $VO_2 = a + HRb$

In-field Data Collection: During two separate days, subjects wore the Zephyr™ BioHarness (Zephyr™ Performance Systems, Annapolis, MD) during all waking hours to measure minute-by-minute HR. For optimum monitoring, the sensor pad surfaces were lightly moistened with water to aid in conductivity. The chest strap was placed tightly around the subject's chest and the additional shoulder strap was used to keep the chest strap in place. The monitoring device was located under the subject's left arm as instructed in the product manual. The device was turned on to log HR throughout the day. If at any time the monitoring device or the strap came off, subjects were instructed to replace it to its proper positioning as quickly as possible. At the end of each day prior to going to bed, subjects were asked to remove the BioHarness and turn off the device.

Initially, it was determined two separate training days would be chosen to measure HR to establish a range of energy expenditure values. First, a typical low activity day, which would include physical training in the morning and various administrative tasks in the afternoon. Second, a physically demanding day, which would include a simulated full mission scenario. Due to scheduling conflicts and as a result of initial analysis, the days were not distinct and thus were averaged.

Throughout the same two training days when HR was recorded, subjects also recorded their physical activity using the activity log. Subjects were asked to include the type, time of day, and duration of any physical activity performed throughout the day.

Each subject was asked to record all food, beverages and dietary supplements consumed over two 3-day periods. Initially, we asked subjects to record their dietary intake the day before, the day of, and the day after each of the two days' TDEE was measured. Due to last minute schedule changes, this was not possible for all subjects. Therefore, subjects were asked to simply record their dietary intake for six days in a row. In most cases, these six days were in concordance with both days of HR monitoring, but in others it was during a separate, but similar work week. Once completed, the food logs were entered in a dietary analysis software program (Food Processor Nutrition Analysis version 11.2.274, ESHA Research, Salem, OR) to determine total energy and macronutrient breakdown of each subjects' daily intake.

Determination of Total Daily Energy Expenditure

For this study, TDEE was calculated as:

EQUATION 3: TDEE = BMR + TEF + PAEE + SEE

BMR was estimated from the Schofield equations, which is comparable to direct calorimetry.[23]

Males 18-30 years:

EQUATION 4: BMR (kcal) = 15.057 weight (kg) + 692.2

Males 30-60 years:

EQUATION 5: BMR(kcal) = 11.472 weight (kg) + 873.1

BMR was divided by 24 to get kcal per hour and multiplied by the total number of hours slept. The TEF has been reported as approximately 10% of total energy intake, though this varies slightly depending on diet composition.[35] In this study, TEF was calculated as 10% of the total energy intake for each subject. PAEE and SEE are the most variable components of TDEE as individuals differ greatly in their level of physical activity. The flex-HR method, described previously, was used to determine PAEE and SEE throughout both days. Using minute-by-minute HR data of total time subjects are awake:

HR $\leq$ flex-HR point → SEE (assumed to be equal to REE)

HR > flex-HR point → PAEE (determined by individual HR – VO_2 linear equation)

Total PAEE was calculated as the sum of energy expenditure values determined from each subjects HR–VO_2 equation:

EQUATION 6: PAEE (kcal/min) = (a + HRb) x 4.9

Total SEE was calculated as the REE (kcal/min) multiplied by the total number of minutes HR was below the flex-HR point. An additional computer program was written to calculate PAEE and SEE from HR data.

Statistical Analysis

Analyses were performed using Statistical Package for the Social Sciences (SPSS Version 24.0, Armonk, NY). All descriptive data are reported as a mean ± standard deviation

(SD), and effect sizes were determined for pairwise comparisons. TDEE and TDEI were compared using a paired samples t-test.

TDEI was compared to the current MDRI for personnel doing heavy and exceptionally heavy work using a one-sample t-test. Macronutrient intakes were compared to the current sports nutrition recommendations[10] and the most recent MDRI.[13] using one sample t-test comparisons. Significance was set *a priori* at $p<0.05$.

CHAPTER 4

RESULTS

Demographics

Of the 25 subjects who consented, 20 subjects completed the initial visit protocol including anthropometrics, demographics questionnaire, REE assessment, and a VO_{2max} test (Table 1). Due to scheduling conflicts, only 18 subjects completed the six-day food record and 12 subjects completed both days of energy expenditure measurement. Thus, separate analyses were performed for these groups. There was no attrition due to the study procedures themselves.

TABLE 1. DEMOGRAPHICS

	N=20	N=12	N=18
Age (years)	27 ± 3	27 ± 3	27 ± 3
Height (cm)	178.5 ± 6.5	177.8 ± 5.6	177.7 ± 6.2
Weight (kg)	84.7 ± 9.2	84.3 ± 5.8	84.7 ± 9.6
Body fat (%)	16.0 ± 0.6	16.7 ± 0.1	16.0 ± 0.1
Time in career (years)	4 ± 3	5 ± 4	5 ± 3
VO_{2max} (ml/kg/min)	51.6 ± 4.7	51.2 ±4.2	51.8 ± 4.8

Values are mean ± SD.

Energy Balance

Throughout a typical week of training (including one weekend day), subjects (n=12) reported an average TDEI of 2,288 kcal ± 645. These intakes were significantly below TDEE (4,021 ± 890), $t(11)=4.9$, $p=0.001$, CI_{diff} (947.51 – 2518.3). Further, Cohen's effect size ($d=2.0$) suggested a very large difference in the estimated intakes and expenditures.

Of the 12 subjects who completed the entire study, 10 reported being weight stable (±3 lbs.) over the last 6 months. Two subjects reported a weight gain of 10 or more pounds in the last

6 months but both subjects reported they were intentionally trying to gain weight. No subjects reported a weight loss.

Nutrient Intake

Macronutrient distributions of Pararescuemen (n=18) did not align with the most current sports nutrition recommendations (Table 2). Average carbohydrate intake (2.9 ± 0.1 g/kg) was significantly less than the recommendation for moderately active (~1-hour exercise/day) individuals (5.0 g/kg) ($p<0.0001$, $d=-21$). In this population, daily physical training, outside of physically demanding job duties, typically exceeds one hour, and therefore the recommended levels of carbohydrate intake range from 6-10 g/kg/day. Only one subject reported an average daily carbohydrate intake of 5.0 g/kg; all other subjects reported lower intakes. Carbohydrate intakes were also significantly lower than the MDRI recommended 50-55% of total calories ($p<0.0001$, $d=-1.6$). Pararescuemen reported an average of 39% ± 6.8% of total energy from carbohydrates. Only one subject met the recommended 50-55%, and two subjects fell below 30%. Commonly reported carbohydrate foods included starchy carbohydrates such as rice, pasta, breads, tortillas and potatoes. Many of these items were from restaurants and fast food establishments in the form of tacos, burritos, pizza, sandwiches and sushi. High fat intakes were reported which exceeded the recommended 30% of total energy by the current MDRI. The average percent of calories coming from fat reported by Pararescuemen was 35% ($p=0.001$, $d=1.0$). Meat, primarily beef, was the most common high-fat food reported by subjects during a typical week. Many of the high fat foods were also consumed at restaurants or as take-out. Examples of common high-fat foods included hamburgers and other high-fat meats, burritos, pizza, and chicken wings. High-fat foods eaten in the home were foods high in unsaturated fats such as nuts, oils, and avocados.

Average protein intake (1.7 g/kg ± 0.6) was within the recommended ranges for both the sports nutrition recommendations and the MDRIs. Protein food sources included meat, fish, poultry and eggs. In addition to food, protein supplements were also commonly reported and included whey protein powder, protein bars, and protein shakes.

TABLE 2. NUTRIENT INTAKES

	Mean ± SD	Sports Nutrition Recommendations[a]	MDRI	Effect Size Cohen's D
TDEI	2416 ± 591	-	3950[c]	-2.6**
		-	4600[d]	-3.7**
CHO (%)[e]	39.3 ± 6.8	-	50	-1.6**
		-	55	-2.3**
Fat (%)[f]	35.1 ± 5.2	-	30	1.0*
CHO[g]	2.9 ± 0.1	3.0	-	-1.0
		5.0	-	-21.0**
		6.0	-	-31.0**
Protein[h]	1.7 ± 0.6	1.2	1.2	0.83*
		1.6	-	0.17
		2.0	2.0	-0.50*

Values are mean ± SD. $n = 18$. CHO – carbohydrate. **$p<0.0001$, *$p<0.05$. [a]Sports Nutrition Recommendations presented in g/kg. [b]TDEI presented kcal/day. [c]Energy MDRI for heavy work. [d]Energy MDRI for exceptionally heavy work. [e]CHO presented as % of total kcal. [f]Fat presented as % of total kcal. [g]CHO presented as g/kg. [h]Protein presented as g/kg.

Dietary Supplement Intake

Dietary supplement intake and knowledge surrounding supplements was assessed in the initial 20 subjects, half of which reported currently taking at least one dietary supplement. The most common supplement reported was protein (90%), followed by pre-workout supplements

(33%) and branch chain amino acids (33%). The top two reasons for taking a supplement were for general health and wellness (67%) and to increase strength (67%). Seven subjects (78%) reported only being somewhat confident the supplements they were taking did as they claimed.

CHAPTER 5

DISCUSSION

Our results indicate Pararescuemen expend high levels of energy similar to those in other SOF,[2,4,8] which greatly exceed reported daily energy intake. In addition to inadequate energy intake, Pararescuemen consume suboptimal carbohydrate and excessive fat intakes compared to the current sports nutrition recommendations and the MDRI. Over time, inadequate energy and disproportional macronutrient intakes can lead to unwanted weight loss and decreased training and mission performance.[36]

Energy expenditure in Pararescuemen ranged from 2,400 kcal to more than 7,000 kcal per day. This wide range of energy expenditures demonstrates the variety of training days that Pararescuemen experience on a regular basis. Though most days include some sort of physical training in addition to mission specific training, other days are more sedentary and involve only administrative tasks. This can make getting adequate nutrition difficult, especially during long or intense training days. Lack of time to eat and limited access to food likely impacted the subjects' ability to consume enough calories to meet their elevated expenditures. Additionally, many subjects reported frequent consumption of convenience foods, such as protein supplements and fast food, further suggesting limited access to whole foods from a cafeteria or grocery store.

The dietary records show total energy intakes that were 43% lower than energy expenditures. Though a few subjects came close to meeting their energy expenditure, most of the subjects did not. Average energy intake (n=12) was 2,288 kcal per day, ranging from 1,385 to 3,624 kcal per day. High energy expenditures and inadequate nutrient intakes have been reported in other SOF across the military (Table 3). Though the mission of each SOF is different, daily training can elicit high energy expenditures which can be difficult to meet with adequate nutrition. The energy expenditures measured in Pararescuemen were similar to other SOF including Army Special Forces and Army Rangers. In this study, Pararescuemen conducted routine physical training, administrative tasks, weapons training, rock climbing, and simulated full mission profile trainings. Activities reported in the Army SOF were similar and included physical training,[4,8] weapons familiarization, airborne, urban and convoy operations[4], foreign language practice, mountain hiking, rock climbing, and small weapons handling,[2,8] inventorying, and packing/loading equipment.[8] Many of these activities require having good cardiorespiratory endurance and aerobic fitness. The maximal aerobic capacity of SOF reflect results that are considered excellent or superior compared to adult males.[37] The relative VO_{2max} of SOF range from 50 – 55 ml/kg/min (Table 3). Pararescuemen were within that range, with an average VO_{2max} of 51 ml/kg/min.

Military specific tasks can stress the body in both a physically and mentally demanding way. Large deficits in nutrition combined with the physical stress of training can lead to detrimental effects such as loss of strength and power.[19,36] Our study indicated a very large difference between energy expenditure and energy intake which if continued, could lead to poor training performance and ultimately affect real-world missions. Particularly in this group of Pararescuemen, carbohydrate intake was far below even the minimum recommendations. This deficit may negatively impact long training hours or intermittent high-intensity training, as carbohydrates are an efficient fuel source for activities across all intensities.[10]

Though there was a large energy deficit found during typical training days, no subject reported any weight loss over the last six months. Instead, majority of subjects (83%) reported being weight stable (± 3 lbs); and two subjects reported an intentional weight gain within the last six months. Weight stability in the presence of an energy deficit, over time could be the result of physiological adaptations to conserve body fat stores and down regulate metabolic rate. A decrease in metabolic rate is one consequence of Relative Energy Deficit in Sport (RED-S) – a syndrome described as inadequate energy availability to support normal body function in addition to large energy expenditures from physical activity.[16] Energy availability is calculated as the energy intake minus the energy expenditure of physical activity relative to fat-free mass (FFM). In healthy adults, 45 kcal/kg FFM/day equates energy balance.[16] When this value is not met, body systems begin down regulating leading to impaired physiological functions including metabolic rate, bone health, immunity, protein synthesis and cardiovascular health.

In this study, Pararescuemen had low energy availability with an average of 32 kcal/kg FFM/day. Low energy availability can have serious negative health and performance effects, including nutrient deficiencies, chronic fatigue and an increased risk of illness and injury.[16] Other reported potential performance implications due to low energy availability include impaired judgement, decreased coordination, depression, and decreased training response. Increasing energy intake throughout the day, and limiting the amount of high-fat, convenience foods SOF must rely on at the end of the day to try and meet their energy needs, will help improve energy balance and limit performance detriments caused by poor nutrition.

The macronutrient distributions of Pararescuemen were consistent with other military populations, including SOF.[3,6,15,17,18] High fat, low carbohydrate and adequate protein intakes are commonly seen in these populations. Excessive intake of foods high in fat may be replacing foods high in carbohydrate which can lead to decreased physical performance. Foods high in carbohydrate include whole grains, fruits, vegetables, and legumes. Besides being an excellent source of carbohydrates, these foods contain vitamins and minerals that are essential to good health and tactical performance. The results from this study indicate nutrition education and provision of nutritious foods during intense training days should be implemented into the units of Pararescuemen to improve nutrition and optimize performance.

It is unclear why carbohydrate intake was lower and fat intake was greater than the recommendations. This could be because of a lack of knowledge surrounding the importance of carbohydrates for training, limited access to carbohydrate foods throughout the day, a desire for higher-fat foods, or any number of reasons. The dietary records of subjects indicated frequent consumption of convenience foods such as fast food and dietary supplements including meal replacement shakes, bars, and protein powders. The protein supplements were consumed more during the day whereas fast food consumption was frequent in the evening. This suggests subjects likely have limited access to whole food options such as a grocery store or cafeteria during the day and therefore rely on convenience foods for calories. In addition, eating fewer calories during the day, when energy expenditure is highest, can lead to excessive hunger at the end of the day resulting in subjects resorting to fast, convenience-type foods such as frozen meals, fast food, or supplements. In this study, subjects reported intakes of high-calorie, high fat foods after work compared to during the day, but the overall energy deficit indicates subjects are unable to meet their energy expenditure demands even with consumption of high calorie foods at night. Improving energy and nutrient intake from whole foods during training hours may lead to healthier choices after work and a more even energy balance day-to-day.

Dietary supplement use has been reported in military populations, and men in elite military groups (such as Army and Navy SOF) report higher intakes than the general military population.[38] Half of the Pararescuemen in this study (n=20) reported taking at least one type of dietary supplement regularly. This is less than the reported supplement use in Navy and Army SOF,[38] though the sample size in this study was much smaller. Pararescuemen reported high intakes (90%) of protein supplements (i.e. whey and casein protein powder) compared to a group of Army SOF (n=119) who reported only 23% use protein supplements regularly.[20] Pararescuemen reported taking dietary supplements for general health and wellness and to increase strength. Consumption of adequate protein, particularly essential amino acids, immediately following resistance training has been shown to promote an increase in muscle mass, though improvements in strength are not as well-defined.[10] Dietary supplements are meant to supplement a diet, in elite military groups that engage in long training days with limited access to food may benefit from supplements such as protein powders as they are convenient and provide necessary nutrients. Dietary supplements can also pose a health risk if they contain adulterated substances or illegal substances. SOF should be made aware of these concerns if they are consuming dietary supplements.

Strengths

The main strength of this study is the unique sample of Pararescuemen during routine training. This study analyzed both; and the results demonstrated Pararescuemen need increased energy intakes specifically from carbohydrates to meet their energy expenditures. This study also captured six days of dietary intake which is more days than most studies looking at dietary intake of SOF that only assessed 1-day.[3,6] In addition, more days of dietary recording leads to an increased accuracy of typical intake, particularly when both week days and weekend days are assessed.[29] Subjects also underwent a 24-hour in-depth dietary recall and were provided detailed instructions on how to accurately record total intake which has been shown to improve dietary recording accuracy.[29]

Limitations

Though this study had many strengths, there were also some limitations. The first limitation was scheduling issues which decreased the number of subjects able to complete the entire study. Routine training for Pararescuemen includes frequent trainings away from their home station, which made it difficult to assess energy expenditure and dietary intake on the same two days which was the initial plan. The second limitation of this study was the use of the HR based estimation method, since there are other methods of measuring energy expenditure which are considered more accurate. While methods such as doubly labeled water and the combination of HR monitoring and accelerometry are often used, these methods are expensive and can be difficult to utilize in field conditions.[22] To improve the accuracy of using HR monitoring to measure energy expenditure, the flex-HR method was used in the current investigation. This method involves establishing individual calibrations to determine the flex-HR. From the flex point, energy expenditure can be more accurately measured by differentiating between PAEE and SEE.

With any dietary recording method, there is a chance of error due to purposeful or accidental omission, lack of understanding of portion sizes, or changing dietary habits. These are all possibilities in this study as it was completely up to the subjects to record their intake. In this study, steps were taken to minimize these errors by instructing subjects on portion sizes using food models and measuring utensils, providing visual instructions with their food records, and asking subjects to complete an in-depth 24-hour recall with a Registered Dietitian Nutritionist.

Future Directions

Future studies should investigate why Pararescuemen are unable to meet their daily energy needs. In addition, assessing the impact of nutrition education on dietary intake would be beneficial as a lack of knowledge of appropriate nutrition could be one reason for inadequate intake. Beyond education interventions, future studies should also investigate different interventions to increase energy intake such as providing food, supplements, or meals ready-to-eat on longer training days. Lastly, including more subjects and measuring energy expenditure on more days should be considered in future research.

Conclusion

Pararescuemen do not consume adequate energy to meet their elevated energy expenditures during routine training days at their home station. These insufficient energy intakes are largely due to low carbohydrate intakes, which are less than current recommendations. Inadequate energy intake in SOF can be detrimental to their overall health as well as military specific training. Future nutrition plans and feeding regulations should be tailored to meet the energy expenditures Pararescuemen experience during typical training. In addition, nutrition education should focus on appropriate macronutrient intakes to meet the various training demands of Pararescuemen.

TABLE 3. ENERGY EXPENDITURE AND NUTRIENT INTAKES OF DIFFERENT SPECIAL OPERATIONS FORCES

Population	n	Method	VO_{2max} (ml/kg/min)	Total Energy Expenditure (kcal/day)	Total Energy Intake (kcal/day)	Total CHO (g/kg)	Total Protein (g/kg)
U.S. Air Force Pararescuemen	12	Heart rate monitors + dietary food logs	51.2 ± 4.2	4021 ± 890	2288 ± 645	2.6 ± 0.9	1.6 ± 0.6
U.S. Army Special Forces[2]	32	DLW + visual estimation & food records	55 ± 4[39]	4099 ± 740	3203 ± 944	-	-
U.S. Army Special Operations Forces[4]	31	DLW	-	4208 ± 556	-	-	-
U.S. Navy SEALS[6]	215	24-hour dietary recall	50.1 ± 6.6[40]	-	2775 ± 883	3.7 ± 1.4	1.78 ± 0.8
U.S. Army Rangers[8]	8	DLW	-	4518 ± 621	-	-	-

All studies represent training in garrison.
Values are mean ± SD. DLW – Doubly Labeled Water. Effect size (Pararescuemen) = 2.0. Effect size (Special Forces) = 1.0.
[6]Tharion WJ et al. Adequacy of garrison feeding for special forces soldiers during training. *Mil Med.* 2004;169(6):483-490. [8]Margolis ML et al. Energy requirements of U.S. Army special operation forces during military training. *Nutrients.* 2014;6(5). [10]Darnell ME et al. Navy SEALs dietary intakes compared to sports nutrition recommendations and 2010 dietary guidelines for Americans. 2013. [13]Tharion et al. Energy requirements of military personnel. *Appetite.* 2005;44(1):47-65. [42]Muza, SR et al. Elite special forces: physiological description and ergogenic influence of blood reinfusion. *Aviat Space Environ Med.* 1987;58(10):1001-1004. [43]Eagle, SR et al. *Evaluation of Musculoskeletal and Physiological Performance Differences in Sea, Air and Land (SEAL) Operators Grouped by Age.*

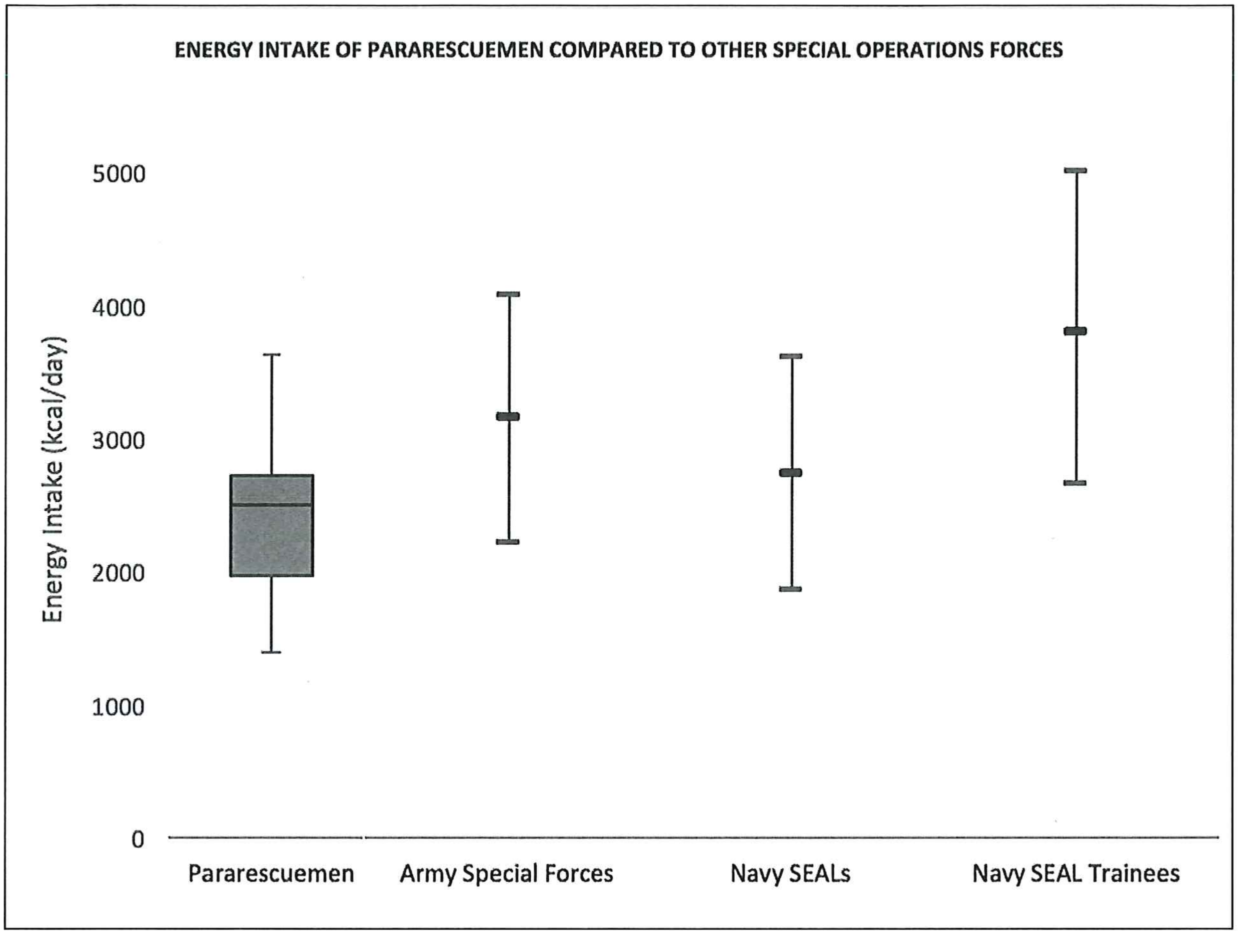

FIGURE 1. ENERGY INTAKE OF PARARESCUEMEN COMPARED TO OTHER SOF.
Air Force Pararescuemen presented as a box and whisker plot. Solid line in center of box is the median. Top and bottom of the boxes represent the 75th (top) and 25th percentile (bottom). The whiskers are data points that lie at the 90th (top) and 10th percentile (bottom). Army Special Forces & Navy SEALs presented with a solid middle line (mean) and the SD (top and bottom error bars). [6]Tharion WJ et al. Adequacy of garrison feeding for special forces soldiers during training. *Mil Med.* 2004;169(6):483-490. [7]DeBolt JE et al. Nutritional survey of the US Navy SEAL trainees. *Am J Clin Nutr.* 1988;48(5):1316-1323. [10]Darnell ME et al. Navy SEALs dietary intakes compared to sports nutrition recommendations and 2010 dietary guidelines for Americans. 2013.

APPENDIX A

RECRUITMENT SLIDES

Energy Intake & Expenditure of Operational Battlefield Airmen During Routine Training

Purpose of Research Study

To determine energy intake & expenditure of Battlefield Airmen during routine training

Criteria to Participate

- Active duty BA stationed with the 58th RQS at Nellis AFB
- Healthy, injury free
- Ages 18 – 45 years
- Currently NOT taking prescribed blood pressure medication, alertness altering medications, or other contraindicated medications
- Currently NOT suffering from a musculoskeletal injury that would limit your ability to engage in heavy resistance and/or aerobic exercise
- Currently NOT suffering from a cardiovascular and/or respiratory disease that would limit your ability to engage in heavy resistance and/or aerobic exercise

Methods

- **Study Day 1:**
  - Location: UNLV
  - Duration: 2.5 hours
  - Details: Anthropometric measurements, demographic information, 24-hour dietary recall, resting energy expenditure, resting heart rate, VO_2max treadmill test
- **Study Days 2-6:**
  - Location: 58th RQS
  - Duration: entire day
  - Details: you will be asked to wear a heart rate monitor during all waking hours for **2 days**, record all physical activity for the same **2 days**, record all food & beverage intake for a total of **6 days**

Risks

- Skin irritation from heart rate monitor chest strap
- Perceived training limitation from wearing heart rate monitor
- Feeling inconvenienced with dietary & physical activity recording
- Injury during VO_2max treadmill test

Benefits

- You will be provided a personalized analysis of your data collected during the study, including:
  - Body composition (% body fat, % fat-free mass, total mass)
  - Maximal aerobic capacity
  - Total energy expenditure during typical training days
  - Total energy expenditure during full mission profile training exercise
  - Analysis of dietary intake (including macronutrient and micronutrient breakdowns)

Questions?

APPENDIX B

CONSENT FORM

Consent to Participate in Research
For
Energy Intake and Expenditure of Operational Battlefield Airmen during Routine Training

<u>Principal Investigator</u>: Adam Strang/Research Associate, 711 HPW/RHCP, 937-938-3607, DSN: 798 3607, adam.strang.1@us.af.mil

1. INTRODUCTION

Previous research has studied the energy expenditure and nutrient intakes of military Special Operations Forces (SOF). Most of these studies have focused on intense training periods, such as selection. No study has examined the energy expenditure or nutrient intake during 'routine' training of Battlefield Airmen (BA).

Obtaining this type of information is important for developing personalized nutrition programs. These programs can help ensure that optimal performance and training gains are achieved when SOF operators have the direct support of unit human performance teams (e.g., strength coaches, physical therapists, sports medicine doctor, etc.).

This research will serve as a first step toward developing personalized nutrition profiles for Battlefield Airmen (BA) stationed at Nellis AFB, NV.

2. PURPOSE

To determine the total energy expenditure and nutritional intake of BA during routine training at their home station.

You are being asked to participate in this study because you meet the criteria of a healthy, injury free BA at Nellis AFB. At least 20 subjects will be participating in this study. The FDA-approved Zephyr BioHarness will be used to measure heart rate throughout this study.

3. PROCEDURES

If you decide to take part in this study, the research team will ask you to do the following:
<u>INITIAL VISIT</u> (approximately 2.5 hours) at the University of Nevada, Las Vegas

- You will be asked to arrive to the initial visit at least 1 hour after your last food or beverage intake
- Complete a 24-hour dietary recall with a Registered Dietitian Nutritionist and learn how to accurately record food and beverage intake *(approximately 1 hour)*
- Complete questionnaires about your military background, weight history, and dietary supplement use *(approximately 20 minutes)*

- You will be shown how to wear, turn on, and charge the Zephyr BioHarness *(approximately 5 minutes)*
- Have your height, weight, and body composition assessed (body composition will be measured using the InBody™ bioelectrical impedance analyzer) *(approximately 10 minutes)*
- Have your resting metabolic rate and resting heart rate assessed using a metabolic cart and the Zephyr BioHarness *(approximately 30 minutes)*
- Complete a VO_2max treadmill test. During the test, you will wear a heart rate monitor and a VO_2 mask to measure heart rate and oxygen consumption *(approximately 30 minutes)*

<u>IN-FIELD DATA COLLECTION</u> (2-6 days) – at Nellis Air Force Base
- Wear the Zephyr BioHarness from when you wake up to when you go to bed *(2 days)*
- Record all physical activity performed inside and outside of the work day *(2 days)*
- Record all your food and beverage intake *(6 days)*

4. POTENTIAL RISKS and/or DISCOMFORTS

Below is a summary of possible risks from taking part in the study:

- **Zephyr BioHarness:** You will be wearing the BioHarness for two normal work days. There is a possibility of skin irritation from wearing the BioHarness. To minimize this risk, you will be instructed on proper fitting for the device. In addition, a member of the research staff will be present to fix any issues with the use of this monitor. Also, it is possible that the BioHarness could be perceived to interfere with training performance due to form factor (e.g., when worn while wearing a ruck sack or while performing physical exercise in a prone position). If this is the case, you will be instructed to take off the device until it is no longer interfering.
- **Dietary Recording:** You will be recording all food and beverages you consume during the six-day study period. There is a possibility of feeling inconvenienced with this process. A food log will be given to you with clearly marked headings to minimize the amount of information needed to obtain accurate data. In addition, you will be taught how to record food and beverage intake so you are comfortable with the procedure.
- **VO_2max Treadmill Test:** *Physical Tests and Exercise Programs.* During physical tests and the exercise program you may have discomfort from:
    - Physical exertion.
    - Blood pressure changes.
    - Shortness of breath.
    - Muscle aches.
    - Lightheadedness.
    - Headaches.

In rare instances, heart attack, stroke, or death can occur from exercise. You are also at risk for physical injuries, including sprains, strains, tears, and broken bones. These risks are no greater than those normally experience during AF mandatory physical training.

Your risk of discomfort and injury will be lessened by:

1. The Medical Monitor's review of medical records and medical screening document.
2. Having you perform a warm-up and cool-down prior to the test session.
3. Being supervised during each test session by a member of the research staff.
4. Ensuring that all supervising personnel are familiar with the laboratory emergency procedures.

- ***Note:*** *Any sign of discomfort or injury, including your desire to stop a test or exercise will result in the test or exercise being stopped immediately*

5. BENEFITS

If you agree to participate in this study you will receive a personalized nutrition and performance report. This will include: body composition (% body fat, % fat-free mass, and total mass), maximal aerobic capacity (VO_2max), ventilatory threshold, total energy expenditure during typical training days, and analysis of your dietary intake including macronutrient breakdown. This data can be of high value to the BA to pinpoint areas that need improvement to optimize training and performance in the field.

6. COSTS

There will be no cost to you if you choose to participate. You will be responsible for your transportation and parking fees if applicable.

7. ALTERNATIVES TO PARTICIPATION

Your alternative is to choose not to participate in this research study. Refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled. You must notify one of the investigators of this study to discontinue.

8. YOUR PARTICIPATION IS VOLUNTARY/SIGNIFICANT NEW FINDINGS

The decision to participate in this research is voluntary on your part. No one may coerce or intimidate you into participating in this program. Participate only if you want to. Dr. Adam Strang or a research associate, should adequately answer all questions you have about this study, your participation and the procedures involved. If you have any further questions, Dr. Adam Strang can be reached at (937) 938-3607. Dr. Adam Strang or a research associate will be available to answer any questions concerning procedures throughout this study. You may withdraw from this research study at any time without penalty.

If significant new findings develop during the course of this research, which may relate to your decision to continue participate or may affect the risk involved, you will be informed. Additionally, the investigator or Research Monitor of this study may terminate your participation in this study if she or he feels this to be in your best interest. If you have any questions or concerns about your participation in this study or your rights as a research subject, please contact the AFRL Institutional Review Board (IRB) at (937) 904-8100 or AFRL.IR.ProtocolManagement@us.af.mil. The IRB is an independent committee that has reviewed this study.

9. **COMPENSATION**
There is no monetary or other compensation for participation in this study.

10. **RESEARCH-RELATED INJURY**
Your entitlements to medical and dental care and/or compensation in the event of injury are governed by federal laws and regulations. If you desire further information you may contact the legal office (711 HPW/JA, COMM 937 656-5666 DSN 986-5666 at Wright-Patterson AFB). In the event of a research related injury, you may contact the Principal Investigator, Adam Strang/Research Associate, of this research study at (937) 938-3607) [or Research Monitor if applicable].

In the event of a mishap, an AF Form 978, Supervisor Mishap Report, will be completed by the injured government personnel's supervisor, or the supervisor of the damaged government property, and returned to the appropriate government safety office within five (5) workdays following the mishap or notification of the mishap, whichever is earlier.

If an unanticipated event (medical misadventure) occurs during your participation in this study, you will be informed. If you are not competent at the time to understand the nature of the event, such information will be brought to the attention of your next of kin or other listed emergency contact.

Emergency contact information:

Name____**Phone#**________________

11. **DATA MANAGEMENT/CONFIDENTIALITY**
Protocol Specific Data Management Plan:
Personal information collected during this research includes height, weight, body composition, weight history, dietary intake, heart rate, maximal aerobic capacity and energy expenditure. All data collected will have identifiers removed and a code will be used to differentiate between subjects. Your personal information will be stored in a locked cabinet in an office on UNLV campus. Electronic files containing your personal information will be password protected and stored on a secure server. Only the primary investigator and associate investigators will have access to this information.

General Confidentiality Requirements:
Records of your participation in this study may only be disclosed according to federal law, including the Federal Privacy Act, 5 U.S.C. 552a, and its implementing regulations and the Health Insurance Portability and Accountability Act (HIPAA), and its implementing regulations, when applicable, and the Freedom of Information Act, 5 U.S.C. Sec 552, and its implementing regulations when applicable.
Organizations that may look at and/or copy research records for research oversight, quality assurance and data analysis:

- the researchers named above,
- the study's Research Monitor or Consultant,
- the AFRL IRB,

- the Air Force Surgeon General's Research Oversight and Compliance Division,
- the Director of Defense Research and Engineering office or
- other IRB(s) involved in the review and approval of this protocol.

Complete confidentiality cannot be promised, in particular for military personnel, whose health or fitness for duty information may be required to be reported to appropriate medical or command authorities. If such information is to be reported, you will be informed of what is being reported and the reason for the report.

Additional Data Management Plans:

After the study is completed, the de-identified data may be placed in a central storage location. The purpose is to make study data available to other researchers. These data will not include your name or other information that can identify you.

12. STUDY PARTICIPATION AGREEMENT/CONSENT

Taking part in this research study is completely voluntary. Your signature below indicates:

- You agree to be in this study
- The researcher has explained the study to you and you have read and understand the information you have been given
- You were given the opportunity to ask questions about the study and all of your questions have been answered to your satisfaction
- You understand that signing this consent does not take away any of your legal rights

You will be given a copy of this signed consent form for your records

Volunteer Signature ______________________________ Date __________

Volunteer Name (printed) ______________________________

Advising Investigator Signature ______________________________ Date __________

Investigator Name (printed) ______________________________

Witness Signature ______________________________ Date __________

Witness Name (printed) ______________________________

Privacy Act Statement

<u>Authority:</u> We are requesting disclosure of personal information. Researchers are authorized to collect personal information on research subjects under The Privacy Act-5 USC 552a, 10 USC 55, 10 USC 8013, 32 CFR 219, 45 CFR Part 46, and EO 9397, November 1943.

<u>Purpose:</u> It is possible that latent risks or injuries inherent in this experiment will not be discovered until sometime in the future. The purpose of collecting this information is to aid researchers in locating you at a future date if further disclosures are appropriate.

<u>Routine Uses:</u> Information may be furnished to Federal, State and local agencies for any uses published by the Air Force in the Federal Register, 52 FR 16431, to include, furtherance of the research involved with this study and to provide medical care.

<u>Disclosure:</u> Disclosure of the requested information is voluntary. No adverse action whatsoever will be taken against you, and no privilege will be denied you based on the fact you do not disclose this information. However, your participation in this study may be impacted by a refusal to provide this information.

APPENDIX C

MEDICAL QUESTIONNAIRE

Medical Questionnaire

Note: it is in your best interest to report medical history accurately and honestly to help reduce injury risk exposure that is associated with your participation in this study.

Are you currently on a medical profile? YES NO

Do you currently experience, and/or are you being treated by a medical provider (e.g., MD, physical therapist, chiropractor etc.), for any of the following: infection, anemia, diabetes, allergic reaction to adhesives/tape, swelling, musculoskeletal pain/injury (including back or joint pain), sleep disturbances?

If yes, please explain: ______________________________

____

____

Have you experienced, or are you currently experiencing, any medical symptoms or complaints (e.g., back pain, joint pain, headaches, persistent nausea, light headedness, etc.) that have not been evaluated by a medical provider?

If yes, please explain: ______________________________

____

____

Are you currently taking alertness altering medications? YES NO

If so, please list and/or describe: ______________________________

____

Are you currently taking blood pressure medication? YES NO

If so, please list and/or describe: ______________________________

____

APPENDIX D

IRB APPROVAL

IRBNet ID: 1016300-2 USER PROFILE LOGOUT

IRBNet

Welcome to IRBNet
Andrea Woita

Help

- My Projects
- Create New Project
- My Reminders

Project Administration

- Project Overview
- Designer
- Share this Project
- Sign this Package
- Submit this Package
- Delete this Package
- Send Project Mail
- Reviews
- Project History
- Create a New Package
- Messages & Alerts

Other Tools

- Forms and Templates

Project Overview

[1016300-2] Energy Intake & Expenditure of Operational Battlefield Airmen During Routine Training

You have Full access to this project. (Edit)

Research Institution	University of Nevada Las Vegas (UNLV), Las Vegas, NV
Title	Energy Intake & Expenditure of Operational Battlefield Airmen During Routine Training
Principal Investigator	Schilling, Brian, PhD
Keywords	Energy expenditure, energy intake, battlefield airmen

The documents for this project can be accessed from the Designer.

Project Status as of: 10/18/2017

Reviewing Board	Initial Approval Date	Project Status	Expiration Date
UNLV Biomedical IRB, Las Vegas, NV	05/22/2017	Active	05/21/2018

Package 1016300-2 is: Locked - Revisions Complete

Package 2 of 2 | Jump |

Submitted To	Submission Date	Submission Type	Board Action	Effective Date	
UNLV Biomedical IRB, Las Vegas, NV	05/25/2017	Revision	Acknowledged	06/20/2017	Review Details

Shared with the following users:

User	Organization	Access Type
Schilling, Brian	University of Nevada Las Vegas (UNLV), Las Vegas, NV	Full
Woita, Andrea	University of Nevada Las Vegas (UNLV), Las Vegas, NV	Full

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DEPARTMENT OF THE AIR FORCE
AIR FORCE RESEARCH LABORATORY
WRIGHT-PATTERSON AIR FORCE BASE OHIO 45433

MEMORANDUM FOR 711 HPW/RHCP (ADAM STRANG)

FROM: 711 HPW/IR

SUBJECT: IRB Approval for the Use of Human Volunteers in Research

1. Protocol title: Energy Intake and Expenditure of Operational Battlefield Airmen during Routine Training

2. Protocol number: FWR20170083H

3. Protocol version: v1.00

4. Risk: Minimal Risk

5. Approval date: 22 May 2017

6. Expiration date: 21 May 2018
   Your renewal submission date is ***one month prior*** to your expiration date. The renewal is due 21 April 2018

7. Review Category:

☐ 32CFR219.110(b)(1)	☐ 32CFR219.110(b)(2)	☐ 32CFR219.110(b)(3)
■ 32CFR219.110(b)(4)	☐ 32CFR219.110(b)(5)	☐ 32CFR219.110(b)(6)
☐ 32CFR219.110(b)(7)		☐ 32CFR219.109: Full Board

8. Assurances and Agreements with Expiration Dates:
   a. AFRL DoD Assurance 50002: 31 Mar 2019
   b. UNLV FWA00002305: 21 Aug 21
   c. Infoscitex FWA00008359: 20 June 18
   d. ORISE FWA00005031: 18 June 18

9. The purpose of this study is to obtain accurate profiles of energy expenditure and nutritional intake using minimally invasive procedures for Battlefield Airmen engaged in routine training at the ACC 58th RQS at Nellis, AFB, NV. The primary objective of this study is to quantify the total daily energy expenditure and dietary intake of pararescuemen using wearable physiological sensors (e.g. Zephyr Bioharness) and keeping a nutritional diary. In order to meet the study objectives, approximately 20 subjects will be recruited to participate.

10. All inquiries and correspondence concerning this protocol should include the protocol number and name of the primary investigator. Please contact the 711 HPW/IR office using the

organizational mailbox at AFRL.IR.ProtocolManagement@us.af.mil or calling 937-904-8094 [DSN 674].

22 MAY 2017

KIM E. LONDON, JD, MPH
Chair, AFRL IRB

1st Indorsement to 711 HPW/RHCP (ADAM STRANG), 22 May 17, Approval for Use of Humans in Research, Expedited Review, FWR20170083H

MEMORANDUM FOR AFMSA/SGE-C

This protocol has been reviewed and approved by the AFRL IRB. I concur with the recommendation of the IRB and approve this research.

22 MAY 2017

TIMOTHY R. SAKULICH
Vice Director
711th Human Performance Wing

APPENDIX E

FOOD AND ACTIVITY RECORD

Meal (time)	Food/Beverage	Amount	Brand/Restaurant	Preparation method	Notes
Activity: Please specify the time of day, duration, and type of the activity					

APPENDIX F

DEMOGRAPHIC QUESTIONNAIRE

Demographics Questionnaire

Thank you for taking time to complete this questionnaire. Please complete all questions to the best of your ability by circling the most accurate answer, when asked to explain please provide a brief explanation. The information from this questionnaire will only be used for this research project. You may leave any questions blank if you choose not to disclose that information.

Subject ID: ______________________ **Age:** ___________ **Date:** ________________

Please specify your ethnicity:
Hispanic or Latino
Not Hispanic or Latino

Please specify your race:
American Indian/Alaska Native
Asian
Black or African American
Native Hawaiian and other Pacific Islander
White
Other: ____________________________

Years of military service: ____

Current military rank: ____

Total time as a Battlefield Airmen: ____

Total number of deployments: ____

Time since most recent deployment: ____

Weight History

Have you been weight stable for the past 6 months? **(meaning you have been the same weight within 3 lbs. over the last 6 months)**
Yes
No

If no, how much weight have you gained or lost? **(please specify if you lost or gained weight)** _

____

Was this weight change intentional? **YES** **NO**

How often do you check your weight?
Daily
Once a week
Once a month
Only when required

Are you currently trying to lose weight? **YES** **NO**

If yes, how are you attempting to lose weight?
Total calorie restriction
Carbohydrate restriction
Fat restriction
Protein restriction
Increased physical activity outside of work
Both dietary restriction & increase in physical activity outside of work
Dietary supplements
Other (please explain): ______________________________

Are you currently trying to gain weight? **YES** **NO**

If yes, how are you attempting to gain weight?
Increase in total calories
Increase in protein only
Increase in fat only
Increase in carbohydrates only
Dietary supplements
Other (please explain): ______________________________

Dietary Supplement Use

Do you currently use any dietary supplements? (including protein supplements)
Yes
No

If yes, please list any supplements you are currently taking: ____________________

____

____

____

Please indicate how frequently you consume dietary supplements:
Daily
Few times per week (2-6 days)
Once a week
Once a month
Never

What are your reasons for taking these supplements? (circle all that apply)
General health & wellness
Increase muscle mass
Decrease fat mass
Increase strength
Prevent fatigue/give more energy
Not sure
Other: ____

How confident are you that your dietary supplements will do as they claim?
Extremely
Very confident
Somewhat confident
Not confident

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CURRICULUM VITAE

ANDREA C. WOITA, RDN, LD
woita@unlv.nevada.edu

EDUCATION

2016 – Present **M.S. Kinesiology:** Exercise Physiology
University of Nevada, Las Vegas, Las Vegas, NV
July 2014 **Certified Registered Dietitian Nutritionist**
Commission on Dietetic Registration, Chicago, IL
2008 – 2012 **B.S. Nutrition Sciences:** Dietetics
University of Wisconsin – Madison, Madison, WI

PROFESSIONAL EXPERIENCE

May 2017 – Present: Sports Nutrition Intern
Ultimate Fighting Championship Performance Institute

- Manage fueling station for UFC athletes
    - Educate athletes on pre- and post-workout food choices, dietary supplements, and general nutrition for athletic performance and recovery
- Consult with athletes on nutrition and weight management
    - Conduct, evaluate, and review nutrition diagnostics including resting metabolic rate assessments and Dual Energy X-ray Absorptiometry
    - Assess, diagnose, and provide appropriate nutrition interventions
    - Develop personalized nutrition meal plans specific to training cycle, body composition goals, and food preferences

January 2016 – May 2017: Graduate Assistant
University of Nevada, Las Vegas

Instructor of UNLV Nutrition Center

- Develop and teach nutrition presentations on various topics:
    - Sports Nutrition
    - Diabetes
    - Cardiovascular Wellness
    - Weight Management
    - Healthy Eating on a Budget
    - Nutrition Workshops
- Coordinate with UNLV Athletics staff to provide interactive nutrition education series and grocery store tours for various athletic teams
- Coordinate grant-funded grocery store tours
    - Manage scheduling of tours at 3 different locations
    - Manage publicity – flyers and email announcements
    - Manage and schedule 13 dietetic interns to lead tours at multiple locations

- Manage and organize demographic data for grant maintenance
- Provide sports nutrition education presentations to UNLV physical education classes

Undergraduate Kinesiology Instructor

- Assist in undergraduate exercise physiology laboratory classes
    - Teach undergraduate exercise physiology laboratory classes
    - Grade and provide feedback of undergraduate lab reports and exams
    - Help students during data collection and analysis

Undergraduate Nutrition Sciences Coordinator

- Oversee over ten undergraduate Teaching Assistants
    - Coordinate bi-monthly meetings, office hours, and quarterly exam reviews
    - Instruct on proper grading procedures for Food Tracking and Nutrient Analysis Project
- Copy, print, organize, and grade undergraduate student exams
- Communicate with undergraduate students in response to questions on course material, exam information, and grades
- Review exams with undergraduate students on an as-needed basis

October 2016 – March 2017: Guest Undergraduate Lecturer
University of Nevada, Las Vegas

Physical Activity and Health – Nutrition, Health, & Fitness; KIN 175

- Educated kinesiology undergraduate students on basic nutrition including macro and micronutrients, dietary guidelines for a healthy diet and nutrient needs for various populations

December 2014 – October 2016: Clinical Registered Dietitian/Nutritionist
University Medical Center of Southern Nevada

- Assessed, diagnosed, and provided appropriate nutrition interventions, including determining and monitoring nutrition support for patients in a variety of medical and intensive care units
- Coordinated with other healthcare professionals, including physicians, nurses, and speech therapists to develop and implement individual diet and nutrition plans to promote healing

December 2014 – January 2016: Registered Dietitian/Nutritionist
CareMore Medical Group

- Educated individuals on proper diet and nutrition for chronic disease management and weight loss
- Led group nutrition education classes focusing on diabetes, heart disease, and kidney disease

August 2011 – May 2012: Sports Nutrition Student Intern
University of Wisconsin – Madison Athletic Department

- Led athletes on guided tours of local grocery stores and promoted healthy food choices for pre- and post-workout meals

- Directed athletes through a nutrition based cooking seminar and educated them on healthy cooking methods

PROFESSIONAL PRESENTATIONS

April 2016 – Present: Rebel Skills Sports Nutrition Presentation
University of Nevada, Las Vegas Athletics

ABSTRACTS & SCIENTIFIC PRESENTATIONS

Woita, Andrea C., Young, Jack, Navalta, James W., Bodell, Nathaniel G., Montes, Jeffrey, Tanner, Elizabeth A., MacDonald, Grace A., Thomas, Camille, Manning, Jacob W., & Taylor, Julie. (2016). *Mechanical efficiency during repeated attempts of indoor rock climbing.* Poster presented at the Southwest American College of Sports Medicine Annual Conference, Costa Mesa, CA.

Woita, Andrea C., Young, Jack, Navalta, James W., Bodell, Nathaniel G., Montes, Jeffrey, Tanner, Elizabeth A., MacDonald, Grace A., Thomas, Camille, Manning, Jacob W., & Taylor, Julie. (2016). *Mechanical efficiency during repeated attempts of indoor rock climbing.* Poster presented at the Annual Meeting of the National American College of Sports Medicine, Denver, Colorado.

PROFESSIONAL AFFILIATIONS

2012 – Present	Academy of Nutrition and Dietetics
2014 – Present	Sports, Cardiovascular, and Wellness Nutrition Dietetics Practice Group
2016 – Present	American College of Sports Medicine – Southwest Chapter
2017 – Present	American College of Sports Medicine
2017 – Present	College and Professional Sports Dietitians Association

CERTIFICATIONS & TRAINING

2013 Certificate of Training in Child and Adolescent Weight Management
2016 Collaborative Institutional Training Initiative

REFERENCES

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