

I. Title: Evaluation of daily energy intake and factors affecting food intake of military recruits from the Canadian Armed Forces during Basic Military Qualification

II. Rationale for importance of the project

The Canadian Armed Forces (CAF) are responsible to defend and protect our nation as well as supporting international military and humanitarian operations (1). To stay employed, meet physical requirements and be able to carry out multiple missions, military members are expected to maintain good overall health and fitness levels. If those levels are suboptimal, it can inhibit soldiers' performance (1,2). Generally, military personnel have higher energy needs during training and deployments than the general civilian population (2). It is therefore crucial for them to meet their energy requirements to optimize their performance. Indeed, during intensive training and missions, soldiers must quickly consume the necessary food intake to offset their high energy expenditure and meet their daily nutritional needs. When the energy needs are not met, it can lead to weight loss, reduced physical and cognitive performance, physical injury, and attrition (3,4).

When civilians enroll into the CAF, they must get through the Basic Military Qualification (BMQ), which consists of several mandatory courses and practical trainings. The average energy expenditure required during basic training in the U.S. Army is about 3238 kcal/day, which is high compared to regular office jobs (5,6). Nutrition quantity, quality and timing of food intake have a significant impact on the performance of soldiers, improving physical and mental performance, as well as limiting their risk of injury (3). CAF StratJ4 Foodservice conducted a snack trial with recruits in 2019 and concluded that the extra energy intake from snacks would be beneficial to help recruits have access to sufficient nutrition to promote optimal health and performance (7). Indeed, recruits had identified food-related concerns including hunger between lunch and dinner, hunger in the evening, limited time to eat at lunch, and limited and poor choices at vending machines (7). Unfortunately, it has been reported in other countries that military recruits do not meet their energy requirements (8). It is unknown whether the high daily energy expenditure of CAF recruits is compensated for by a sufficient average daily energy intake to prevent a sustained negative energy balance, as it does not seem to have been objectively assessed yet.

Factors affecting dietary intake of military can be multiple (9) and influence one another in a complex manner (10,11). The "Three Factor Model" by Meiselman (9) presents different categories of factors influencing food intake of military members, like individual factors (age, sex, dietary influences, etc.), the food (portion size, variety, etc.), and the environment (appropriateness, time of day, weather, etc.) (9). It is known that BMQ is difficult and can represent a period of great physical and mental stress (12). Lack of sleep, along with stress and anxiety are also reported during BMQ (12,13). These elements can have an impact on physical performance, cognitive retention capacity, mental health status and risk of injury (14). They can also negatively influence dietary intake and nutritional status (15,16). Many factors may have an influence on the food intake of recruits, but there is a lack of data regarding factors influencing dietary intake of recruits during BMQ, especially in the CAF. Therefore, a research project documenting the daily energy intake of CAF recruits as well as factors affecting their food intake during BMQ would be highly beneficial to formulate specific and appropriate recommendations for this population.

III. Research project objectives

The research questions for this project are:

- 1) During BMQ, are recruits' energy needs being met by their food intake?
- 2) What individual, environmental, and food-related factors influence recruits' food intake?

There will be two main objectives for this mixed method research project:

- 1) To assess the average daily energy intake of military recruits during BMQ compared to their average daily energy requirements,
- 2) Document CAF recruits' perception of individual, environmental, and food-related factors affecting their food intake during BMQ.

IV. Description of approach/methodology for the project

This interdisciplinary mixed-methods research project in partnership with the CAF StratJ4 Foodservices dietitians and other health professionals (e.g. kinesiologists, psychologists, etc.) will have two components. For the quantitative component, demographic data via a questionnaire and energy intake of 100 CAF military recruits will be collected at each of the three daily meals consumed at the cafeteria for four days using a food photography method (17,18). Consumption of evening snacks will also be collected using a snack questionnaire. Both food photos and snacks questionnaires will allow to determine the average daily energy intake and compare it to the recruits' requirements, which will be based on their daily energy expenditure, collected by kinesiologist collaborators from the recruit school using GENEActiv accelerometers. Data on energy expenditure for the same four days of nutrition data collection will be shared with us for comparison purposes. Quantitative data will be analyzed by two dietitians using ESHA Food Processor software, using nutritional information from meals served at the recruit school cafeteria. The average daily energy intake (kcal/day) will then be calculated for each participant. Data from all participants will be compiled, verified, and analyzed in Microsoft Excel to determine the average energy intake of each participant and the overall average energy intake of the group of recruits (kcal/day). A results table with descriptive statistics including means and standard deviations will be prepared to summarize the results which will be integrated into a manuscript.

For the qualitative component, a purposive sample of 30 recruits will be invited to semi-structured virtual interviews of 60-90 minutes via Microsoft Teams, allowing to understand their perceptions and experience on the factors that influenced their food consumption during the BMQ, which will also help to explain and interpret the results of quantitative data collection. A bilingual interview guide containing open questions has been created and modified from the interview guides used in previous studies with the military (1,10). Before each interview, participants will fill a short demographic and health survey. Interview recordings will be transcribed verbatim and checked for accuracy. The analysis of the interview transcripts will be carried out by two independent coders from the research team using NVivo qualitative data analysis software. The thematic content analysis approach will be used for coding, and the collected data will be analyzed until the main themes are saturated. Demographic data from participants will also be analyzed with mean +/- standard deviation using Microsoft Excel and integrated into a second manuscript.

V. Significance/relevance of the project findings to the dietetic practice

Concerns about meeting energy requirements during BMQ, as well as the presence of multiple factors affecting recruits' energy intake, have led to the need to collect such data, which is lacking, particularly within the CAF. The results of this study will document the relevance for the CAF and their dietitians to improve the provision of nutritional education to recruits and instructors to better help them understand the nutritional needs of recruits and the importance of diet for their performance, physical and mental health, and to optimize their resilience during the BMQ as well as during their military career. The results of this study will also enable CAF StratJ4 Foodservices dietitians to adjust the food supply to support the physical and mental health of recruits across the country. This under-researched topic in Canada is of great interest to dietitians given their expertise

in developing menus tailored to unique populations, therefore aiming to reduce injuries and optimize performance of military recruits and future military personnel. In addition, results from this study (including two manuscripts) will be helpful for other populations, such as athletes and military personnel working in extreme environments, where feeding can be sub-optimal.

VI. Time required to complete the project

This project was approved by the Office of Research Ethics and Integrity of the University of Ottawa. It will contain two phases, each with data collections planned. For Phase 1, quantitative pilot data collection was obtained during the fall of 2021 and data collection will be finalized by October 2023. Data analysis will occur between July and November 2023. For Phase 2, the qualitative data will be obtained between September 2022 and February 2023. Qualitative interviews will be conducted virtually, making them more feasible into the timeframe. Data analysis will be made by September 2023. Other than the two manuscripts to be written, the results from this research will also be presented at conferences (e.g. Dietitians of Canada Conference). A Masters' thesis related to the project will be submitted by the end of December 2023, which also is the time for completion of the project.

VII. Budget projections for 2023

Category	Amount allocated	Detail of expenses
Salary	\$7000	Two registered dietitians will be hired to assist with the analyzes of the nutritional data from July-October 2023. - Professional dietitian fees: \$35/h x 10h/week x 10 weeks x 2 dietitians = \$7000 Dietitians will be hired because of their knowledge of the ESHA Food Processor analysis software, NVivo analysis software and clinical judgment to make the interpretations.
Supplies and services	\$350	Questionnaire printing costs for quantitative data collection = 100 questionnaires x 4 days of data collection x 4 pages/questionnaire x \$0.20/copy = \$320 + service costs = approximately \$350
Fieldwork travel	\$1646.92	- Travel costs for 2 data collections between July-October 2023 = \$0.57/km x 2 round trips between Ottawa and the Military Recruit School in Saint-Jean-sur-Richelieu (approximately 450km) = \$513.00 - Accommodation at the Exacta Center at the Military Recruit School = \$25.87/night (taxes included) x 4 nights x 4 people = \$413.92 - Food costs = 3 meals/day x \$15/meal x 4 days of quantitative data collection x 4 people = \$720.00 The quantitative data must be collected in person at the Recruit School located in Saint-Jean-sur-Richelieu, Quebec, therefore requires one of the principal investigator and research assistants to travel from Ottawa for data collection. Indeed, 2 data collections of 2 days will be carried out. Assistants will use the same car to travel to the data collection location.
Conference travel and dissemination	\$1000	This includes the costs of sharing the research gathered during conferences as well as publications of the qualitative and quantitative manuscripts in scientific journals.
Total	\$9996.92	

References:

1. Lavergne, F., **Laroche-Nantel, R.**, Prud'homme, D., **Giroux, I.** Energy intake, weight, and body composition of Canadian soldiers participating in an Arctic training | Journal of Military and Strategic Studies. J Mil Strateg Stud [Internet]. 2021 [cited 31 Oct 2021];21(1). Available on: <https://jmss.org/article/view/71123>
2. Tharion WJ, et al. Energy requirements of military personnel. *Appetite*. Feb 2005;44(1):47-65.
3. Bartlett CG, Stankorb S. Physical Performance and Attrition Among U.S. Air Force Trainees Participating in the Basic Military Training Fueling Initiative. *Mil Med*. Jan 2017;182(1):e1603-9.
4. Margolis LM, et al. Effects of winter military training on energy balance, whole-body protein balance, muscle damage, soreness, and physical performance. *Appl Physiol Nutr Metab*. Dec 2014;39(12):1395-401.
5. Coopoo Y, Constantinou D, Rothberg AD. Energy expenditure in office workers with identified health risks. *South Afr J Sports Med*. 2008;20(2):40-3.
6. McAdam J, McGinnis K, Ory R, Young K, Frugé AD, Roberts M, et al. Estimation of energy balance and training volume during Army Initial Entry Training. *J Int Soc Sports Nutr*. Dec 2018;15(1):55.
7. CAF Strat J4 Food Services Initiative. Snack Trial Recommendations - St-Jean Garrison. 2019.
8. Chapman S, Rawcliffe AJ, Izard R, Jacka K, Tyson H, Smith L, et al. Dietary Intake and Nitrogen Balance in British Army Infantry Recruits Undergoing Basic Training. *Nutrients*. July 2020;12(7):2125.
9. Meiselman H. NATO Characteristics likely to increase/decrease consumption. Annex K in Nutrition Science and Food Standards for Military Operations. NATO RTO Technical Report TR-HRM-154. P. K-1 - K47, March 2010. NATO Research & Technology Organisation; 2010.
10. Lavergne FV, Prud'homme D, **Giroux I.** Soldiers' Perception of Combat Ration Use During Arctic Training: A Qualitative Study. *Mil Med*. 30 Jan 2021;186(1-2):127-36.
11. Lavergne, F. V., **Laroche-Nantel, R.**, Prud'Homme, D., & **Giroux, I.** (2022). Facteurs influençant l'apport alimentaire en rations des soldats canadiens dans l'Arctique: Un sondage national. *Canadian Journal of Dietetic Practice and Research*, 1–4. <https://doi.org/10.3148/cjdpr-2022-021>
12. Adler AB, et al. NATO Survey of Mental Health Training in Army Recruits. *Mil Med*. July 2013;178(7):760-6.
13. The Director of Force Health Protection (DFHP). Directorate of Force Health Protection Visit to Canadian Forces Leadership Recruit School - Summary Report. 2020.
14. Chaput J-P, et al. Sleep duration and health in adults: an overview of systematic reviews. *Appl Physiol Nutr Metab*. Oct 2020;45(10 (Suppl. 2)):S218-31.
15. Forsys-Donahue KL, Brooks RD, Beymer MR, Pecko J. The association between nutrition and behavioural health in a US Army population. *Public Health Nutr*. Dec 2020;23(17):3059-66.
16. Ismaeel A, Weems S, Ellor JW, Crow J, Myers D, Dolan S, et al. Association Between Negative Emotional States and Unhealthy Nutritional Behaviors in Soldiers. *Mil Behav Health*. 2 Jan 2018;6(1):66-74.
17. McClung HL et al. Digital food photography technology improves efficiency and feasibility of dietary intake assessments in large populations eating ad libitum in collective dining facilities. *Appetite*. 1 Sept 2017;116:389-94.
18. Martin CK, Nicklas T, Gunturk B, Correa JB, Allen HR, Champagne C. Measuring food intake with digital photography. *J Hum Nutr Diet*. Jan 2014;27:72-81.