

## **ABSTRACT**

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### **The use of military food rations in the reconnaissance military field exercise**

#### **Introduction.**

In military field training and operations soldiers are at times required to operate under energy deficit. During long and sustained operations energy supplement can only be used with carrying food rations. Therefore, the development of food rations is important in order to maintain combat readiness of the soldiers. Military operational rations have been developed for decades. Rations are nowadays lighter, tastier and easier to use than few years ago but some studies have reported that soldiers do not consume all of the available energy even if they are suffering from energy deficit (Salonen 2008, Tanskanen 2012). The reasons for inadequate food intake have not been extensively studied in Finnish Defence Forces before. Conscripts eat over 100 000 ration packages every year, and the total cost of the rations is more than 2 million euros. Meals and groceries that are not eaten cause also significant economic losses to Finnish Defence Forces. Therefore the aim of the present study was to evaluate how much of the rations soldiers eat under field conditions and what are the main reasons not eating the rations. In addition, the aim was to evaluate what factors are associated with weak and efficient energy consumption.

#### **Methods.**

One hundred and fourteen conscripts (age  $19.5 \pm 0.6$  year, height  $180 \pm 6$  cm, weight  $76.2 \pm 8.6$  kg, BMI  $23.5 \pm 2.3$  kg/m<sup>2</sup>) in Reserve Officer School volunteered to participate the study. During the study, the participants completed two 4-days reconnaissance military field exercises. The conscripts trained and conducted typical military tasks like patrolling, working in the command post, forward observing, hasty ambush etc. During the military field training participants carried equipment weighing  $49.8 \pm 5.0$  kg including their backpacks, assault rifles, clothes, rations etc. Equipment weighted

$66 \pm 9$  % of participants' body mass. They slept average  $187 \pm$  minutes/day.

For studying energy and water intake, the conscripts kept food diaries. They were allowed to eat only delivered rations and extra nutritional supplements were not permitted. Food rations were made up of several standard components including a main dish (e.g. beef stew, spaghetti Bolognese, chicken and rice), snacks (peanuts, protein bars, energy bars, crackers, biscuits, bread), beverages and accessory items such as hot sauce, sugar, tea, coffee and creamer. The main dish was prepared by pouring some cold or hot water into a plastic pouch and let the meal simmer. In order to compare the opinions about food rations and the food intake, the participants were offered food rations manufactured by Leijona Catering Oy, Blå Band and Drytech. The participants were divided in the three groups according to the food they offered.

The diaries, packaging materials and rations which were not consumed were collected every evening. The handwritten diaries were replicated to the computer. Body mass and body composition was measured with the bio impedance method (Look inbody 720, Biospace Co. Ltd, Seoul, Korea) before and after exercises. During the field exercise heart rate was continuously measured with a Firstbeat Bodygard portable heart rate monitor. The estimated energy expenditure was determined from the Firstbeat software (Firstbeat Inc., Jyväskylä, Finland).

All statistical analyses were performed with PASW Statistics software (Version 22.0.0; SPSS Inc., Chicago, IL).

## **Results.**

The average daily energy intake was  $3316 \pm 747$  kcal/day. Fat intake was  $134 \pm 31$  g (36 % of the total reported daily energy intake), protein intake  $106 \pm 28$  g (13 %) and carbohydrate intake  $414 \pm 108$  g (50 %). Participants consumed  $80 \pm 17$  % from the offered energy. The estimated energy expenditure during this study was  $4807 \pm 1139$  kcal/day. The energy expenditure ranged from 2204 to 7971 kcal per day. Energy balance was negative ( $-1491$  kcal/d). Body mass decreased  $1.5 \pm 1.0$  (2.0 %), fat free mass decreased  $0.4 \pm 1.2$  (0.6 %), fat mass decreased  $1.2 \pm 0.8$  (12.4 %) and body fat decreased  $1.3 \pm 1.0$  percentage (10.3 %) (all  $p < 0.001$ ). Water intake was  $5.7 \pm 1.8$  l/d. The signs of water deficit was

not noticed. Studies before (Salonen 2008, Tanskanen 2012) have improved that water deficit do not exist when soldiers consume water approximately 3 liters per day.

The participants abandoned 27 % of breakfasts (B), 13 % of lunches (L) and dinners (D), 21 % of snacks (S) and 43 % of beverages (BE). Two most common reasons to abandon main dishes were that the taste was unpleasant (B 32 %, L and D 13 %) and the participants were not hungry (B 20 %, L and D 23 %). The snacks were returned because of unpleasant taste (27 %) and the beverages because participants had no interest to prepare and drink them (29 %). The second common reason was “I don’t know” (S 22 % and BE 18 %). The participants couldn’t explain why they didn’t eat the snacks or drink the beverages.

Drytech’s food rations proved to be the best according to taste and energy intake. The group that ate Drytech’s rations ingested more energy and was more satisfied than groups that ate Leijona’s and Blå Band’s rations.

Body mass, fat free mass, BMI, energy expenditure or weight of equipment (kg / %) didn’t correlate between energy intake. There was weak but significant correlation between energy intake and offered energy ( $r=0.33$ ,  $p<0.001$ ) water consumption ( $r=0.17$ ,  $p<0.001$ ), satisfaction with the rations ( $r=0.201$ ,  $p<0.001$ ) and flavor of the main meals ( $r=0.16$ ,  $p<0.001$ ). Participants who consumed almost all the offered energy consumed more water ( $p<0.001$ ), estimated that the taste was better ( $p<0.01$ ) and were more satisfied ( $p<0.01$ ) that the energy consumption than participants whose energy consumption was weak. The group with efficient energy intake was offered more energy ( $p<0.001$ ) than group with weak energy intake.

## **Discussion.**

The main findings of the present study were that the consumption of food rations and energy intake has increased because of better taste and usable meals (“add only water”) compared to previous studies. Reconnaissance military field exercise caused energy deficit which was reflected as decreased body weight, fat mass and fat free mass. The most common reason for not eating the content of food rations was the bad taste. The eating habits of conscripts divided them into two groups. Some of the participants consumed energy efficiently and ate almost all energy they were offered: others ate little

during the whole military field exercise. Those participants who consumed energy efficiently ingested more energy, consumed more water and were more satisfied with rations.

## **Conclusions.**

Rations offered in Finnish Defence Forces have developed in right direction. It is useful to highlight the importance of eating and consequences of nutritionally inadequate diet. If average energy expenditure in the military field training is less than 5000 kcal, an adequate amount of energy may be approximately 3700 kcal/ration. However, the various energy requirements, military tasks and environmental conditions should take into account when developing new rations. Meal and groceries which tasted bad or were impractical should be replaced with products which taste good and are more suitable for ration packages. More studies are encouraged to investigate the soldiers' perceptions to different food rations for developing tasteful, practical food rations with adequate nutritional content.