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1 **Training Load and Energy Expenditure During Military Basic Training Period**

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19 **Abstract**

20 **Purpose:** To compare training load and energy expenditure during an 8-week military BT  
21 period among individuals having different fitness level using objective measurements in an  
22 authentic environment.

23 **Methods:** Thirty-four voluntary male conscripts (age  $19.1 \pm 0.3$  years) were divided into three  
24 training groups (inactive, moderate, active) by their reported physical activity (PA) level  
25 evaluated by the International Physical Activity Questionnaire (IPAQ) prior to military service.  
26 Maximal oxygen uptake ( $VO_2\max$ ) and heart rate (HR) were determined by maximal treadmill  
27 test in the beginning and after 4 and 7 weeks of BT. During BT, HR monitors and  
28 accelerometers were used to measure PA and energy expenditure. HR data were used to  
29 calculate the training load (TRIMP, training impulse) for each day, week and the whole BT  
30 period.

31 **Results:** Training load of BT was comparable to training of competitive athletes at the highest  
32 level. The training groups differed ( $p < 0.001-0.05$ ) in terms of  $VO_2\max$  to each other (inactive  
33  $36 \pm 6$ , moderate  $42 \pm 6$ , active  $48 \pm 6$  ml/kg/min). The conscripts in the inactive group were the  
34 most loaded during the study period ( $TRIMP_{inactive} 12393 \pm 2989$  vs.  $TRIMP_{moderate} 10252 \pm 1337$ ,  
35  $p < 0.05$  and  $TRIMP_{active} 8444 \pm 2051$ ,  $p < 0.01$ ). The PA intensity of different military tasks  
36 during the BT period were low or moderate ( $< 6$ MET).

37 **Conclusion:** The remarkable training load during BT period is comparable to the training loads  
38 of professional athletes participating three weeks' cycling competition. The training load in  
39 basic training period was, however, primary due to duration of low intensity activities including  
40 only some high intensity military activities. In the future, measuring the training load during  
41 the military service is recommended in order to customize the physical training for conscripts  
42 regarding his/her fitness level as much as possible.

43 Key Words: Accelerometer, Heart rate monitoring, Military task, Physical activity, Training

44 impulse

45

46 **INTRODUCTION**

47 The aerobic fitness of young men entering military service has decreased during the last  
48 decades (1,2), and this sets additional requirements for the Armed Forces for to develop the  
49 physical fitness of conscripts. Individual fitness level influences the experienced training load  
50 during the basic training (BT) period. A person with good physical fitness can work longer at  
51 the same intensity compared to the person with lower physical fitness (3). The physical fitness  
52 of the conscripts thus has an effect on the individually experienced training load during the BT  
53 period. Training load of military training can be high during the initial weeks of BT. To  
54 maintain adequate performance, the mean training load during prolonged physical activity  
55 should not exceed 50% of maximal oxygen uptake (4,5). Exceed training load increases the  
56 likelihood of becoming fatigued and or getting injured (6,7). So far, the volume and intensity  
57 of training load, and energy expenditure (EE) during the BT period in not fully understood  
58 among the conscripts of varying fitness levels (8). The goal of the BT period is to improve  
59 basic military skills of all the conscripts and the physical performance of the conscripts,  
60 especially, among least fit individuals. Especially, conscript with the lowest fitness levels are  
61 prone to getting fatigued or even injured if the training load is not tailored enough. On the  
62 other hand, in order to enhance aerobic performance, an adequate amount and intensity of  
63 physical activity is required. Thus, the physical training volume increases notably after the first  
64 weeks of BT. Therefore, there is a need to objectively define, measure and track fitness levels  
65 throughout the training in order to monitor improvements, especially in a lower fit group.

66 The physical performance of conscripts during the BT period is achieved by combat (34%),  
67 marching (21%), sport-related physical training (36%), and close combat (6%) training, while  
68 only 3% of BT is general military education (9). Almost half of the eight week BT period (145  
69 hours) consists of physical training and the weekly physical training volume is approximately

70 25 hours (10). The risk for injury due to the training volume is at its highest at the beginning  
71 of the BT period (6,7). Thus, the intensity of the physical training during the BT period has  
72 been tailored for the conscripts in basic training period of the Finnish Defence Forces. In order  
73 to individualize the training, the conscripts are divided into training groups according to their  
74 initial physical fitness and skills in the beginning of the BT period (9,11). The physical training  
75 in the BT period is mainly endurance-based and low intensity military training, although it also  
76 includes training with higher intensities exceeding the anaerobic threshold and completed with  
77 extra load e.g. carrying personal combat gear of 25 kg (9). Environmental changes, such as  
78 temperature, relative humidity and terrain have also effects on the experienced workload (4).

79 Physical load during the BT period has earlier been explored using EE (8) in addition to  
80 endurance and muscular fitness measures (12,13). The physical activity (PA) dose can be  
81 explored as absolute or relative intensity of the activity or by measuring EE during days, weeks,  
82 and months (14). The absolute intensity describes the actual EE level, which can be expressed  
83 as metabolic equivalents (MET units). The MET unit is defined as the rate of EE during a  
84 specific physical activity in relation to a resting EE. The use of MET unit in defining EE enables  
85 the comparison of the different physical activities. The actual EE might remarkably differ  
86 between the physical activities and subjects since the body mass, fat percentage, age, sex,  
87 intensity, environment, and physical fitness level have been observed to have a substantial  
88 impact on EE in different modes of physical activity (15).

89 Maximal oxygen uptake has been observed to increase by 13.4% during the BT period (13).  
90 The improvement of maximal oxygen uptake is the greatest in conscripts with lowest preceding  
91 physical activity, approaching the aerobic fitness level of most active conscripts after the BT  
92 period (13,16). The physical load might be too low for some of the most active conscripts to  
93 achieve a positive response in maximal oxygen uptake (13). Similar results have been reported

94 by Rosendal et al. (2003) and Dyrstad et al. (2006) during the BT period of the military services  
95 in Norway and Denmark (17,18).

96 Low physical fitness prior to the BT period is related to the decreased muscular strength during  
97 the last four weeks of the BT period that might be due to too strenuous or too light training  
98 (12). The mean daily EE during the BT period varies from 9 MJ (2150 kcal) to 22 MJ (5250  
99 kcal) (4). During the most strenuous basic training weeks, the mean EE can be over 15.5 MJ  
100 (3700 kcal) (8).

101 Measuring individual training load and performance during the long-lasting military BT period,  
102 containing several different military activities, is challenging (8). The purpose of the present  
103 study was to investigate training load and EE during an 8-week military BT period using  
104 objective measurements in the authentic environment. The aim of the tailored physical training  
105 during the BT period is to optimize the physical load. The effective training program induces  
106 the development of fitness level over the course of the BT period. The results of this study can  
107 be utilized when investigating workload as well as physical performance, nutrition and  
108 hydration requirements during the BT period.

## 109 **METHODS**

### 110 **Subjects**

111 Initially 131 conscripts voluntarily participated in the study. In order to minimize  
112 interindividual variation and the impact of confounding variables, only male conscripts were  
113 studied. Conscripts (N=47) with cardiovascular, respiratory or musculoskeletal diseases were  
114 excluded from the study. Thus, 84 subjects were divided into the three training groups  
115 (inactive, moderate, active) by their reported physical activity level, which was evaluated by  
116 the International Physical Activity Questionnaire (IPAQ) (19) prior to their military service.

117 All the subjects received heart rate monitors and accelerometers were randomly given to 34  
118 subjects. Thirty-four voluntary male conscripts (age  $19.1 \pm 0.3$  years) wearing the both devices  
119 were included in the final investigation study (Table 1). The research protocol was approved  
120 by the Finnish Defence Forces and the Ethical Committees of University of Jyväskylä and the  
121 Kainuu region of Finland, in compliance with the Declaration of Helsinki and conformed to  
122 international ethical standards. Written informed consent was obtained from each subject  
123 prior to the study.

124 -insert table 1 here-

## 125 **Experimental protocol**

126 Physical load was studied using indirect EE measurements. During the BT period, the  
127 conscripts received the standard basic training of Finnish Defence Forces. The service day  
128 started at 5:45 a.m. and ended at 10:00 p.m. The daily activities were divided into periods of  
129 15 min. An individualized service schedule was created for each subject according to their  
130 actualized participation in the service (team, absence, testing days, marches, shooting camps).  
131 The activities were transferred and logged as numeral codes.

## 132 **Measurements**

133 Continuous measurements of the heart rate (HR) and physical activity (PA) were used to  
134 evaluate the training load during the BT period. The relationship between the oxygen  
135 consumption and HR in the maximal aerobic performance tests were utilized to determine the  
136 volume and intensity of task related PA, the total training load of military tasks and basic  
137 training period, and to compare the training load of three training groups based on IPAQ and  
138 fitness levels.



139 The volunteers participated in physical performance tests at the service weeks 1, 5, 8 and 10.  
140 The performance tests were always conducted at the same time of the day. Height, body  
141 mass, resting heart rate ( $HR_{rest}$ ), standing heart rate ( $HR_{standing}$ ), maximal oxygen uptake  
142 ( $VO_{2max}$ ), and maximal heart rate ( $HR_{max}$ ) were measured during the performance tests  
143 (Figure 1).

144 -insert Figure 1 here –

145 *Antropometrics* Body mass was measured in light clothing (t-shirt, pants) to the accuracy of  
146 0.1kg (Model 758CSV, Detecto, USA) and height to the accuracy of 0.5cm using a  
147 stadiometer.

148 *Resting and standing HR* were recorded at the frequency of 0.2 Hz (Polar810i; Polar Electro,  
149 Kempele, Finland) during five minutes in both sitting and supine positions, before the  
150 maximal aerobic performance test.

151 *Maximal aerobic fitness* ( $VO_{2max}$ ) was measured using a treadmill test. The warm-up  
152 included 3 min of walking at the speed of 4.6 km/h and 3 min jogging/walking at the speed of  
153 6.3 km/h. The load was increased every three minutes according to the theoretical oxygen  
154 consumption (6 mL/kg/min) (ACSM 2001) until exhaustion. Breath-by-breath ventilation and  
155 respiration gases were measured continuously (Jaeger Oxygen Pro; Viasys Healthcare  
156 GmbH, Hoechberg, Saks) and analysis was conducted in intervals of one minute. HR was  
157 recorded (Polar810i, Polar Electro, Kempele, Finland) every five seconds during the test.  
158 Blood lactate concentration (LactatePro®, Arkay, Japan) was measured one minute after the  
159 test. The criteria for maximal performance were defined as follows: stabilization of the HR  
160 despite the increase of speed or incline, respiratory quotient and blood lactate more than 1.1  
161 and 8 mmol/L, respectively (8).

162 *Heart rate* was recorded daily between 6 a.m. and 9 p.m. at the recording rate of 0.2 Hz  
163 (Polar810i, Polar Electro, Kempele, Finland). During the night training and camps HR was  
164 recorded at one-minute intervals. The data were manually corrected by deleting the single  
165 false beats and substituting the false data lasting less than 15 min by data values from  
166 adjacent data since the activity during that time was known. The individual activity schedule  
167 was utilized in the data corrections. The false or absent data longer than 15 min was excluded  
168 from the analysis.

169 *Physical activity* was measured using accelerometers (Polar AW200, Polar Electro, Kempele,  
170 Finland). The data were collected daily around the clock using a sampling rate of one-minute.

171 *Energy expenditure* was calculated from HR and accelerometer data across the 41 days  
172 during the eight weeks' BT period. Matlab software (Mathworks, Massachusetts, USA) was  
173 used to process the data. The individualized relationship between HR and EE was defined  
174 from the maximal performance tests at the weeks 1, 5, 8 and 10. Energy expenditure (EE)  
175 was calculated using equation 1 (20).

$$176 \quad EE \left( \frac{kcal}{min} \right) = 3.8455 \times \dot{V}O_2 \left( \frac{l}{min} \right) + 1.2064 \times \dot{V}CO_2 \left( \frac{l}{min} \right) \quad (1)$$

177 A third-degree polynomial function was generated to describe the relation between HR and  
178 EE values. The EE value for each HR value was calculated using the created polynomial. The  
179 individualized daily HR-EE-conversion matrix was created for each subject by interpolating  
180 the HR-EE-relations from the weeks 1, 5, 8 and 10.

181 Energy expenditure from the accelerometer data were calculated using curve-linear  
182 computation. The EE equation used to convert the activity pulses into the MET units was

183 created by utilizing the double-labeled water (DLW) measurement. The details of the method  
184 have previously been described (8).

185 *Physical Activity Energy Expenditure (PAEE)*. To evaluate EE of a certain physical activity,  
186 basal metabolic rate (BMR) was subtracted from the calculated HR- and activity-based EE  
187 values (Equations 2 and 3). BMR was calculated using Equation (4) (21). The daily weight  
188 and height values were interpolated using the measured values at the maximal treadmill test  
189 days.

$$190 \quad PAEE_{HR}(MET) = EE_{HR}(MET) - 1 \quad (2)$$

$$191 \quad PAEE_{AC}(MET) = EE_{AC}(MET) - 1 \quad (3)$$

$$192 \quad BMR \left( \frac{kcal}{min} \right) = (15.1 \times weight(kg) + 692) / 1440 \quad (4)$$

193 *Energy expenditure of the basic training activities*. The physical activities of BT were logged  
194 into the service program, and the 15-min mean values were calculated for EE evaluated from  
195 HR and PA data. In case the 15 min epoch included data less than 8 min, EE was not  
196 calculated. The service program and EE data were synchronized to enable the determination  
197 of EE of a single PA type.

198 *Total energy expenditure* was evaluated only if at least 70% of the daily data were available.  
199 In addition, total EE data were only included from the subjects who had appropriate data  
200 from 20 measurement days or more. The training impulse (TRIMP) during the BT period was  
201 computed from the HR data using equation 5 (22).

$$202 \quad TRIMP = A \times B \times C \quad (5)$$

$$203 \quad A = time(min), B = \frac{HR - HR_{rest}}{HR_{max} - HR_{rest}}, C = 0.64 \times e^{1.92B}$$

204 The daily  $HR_{max}$  and  $HR_{rest}$  values were interpolated from the maximal aerobic fitness test.  
205 The mean TRIMP values were calculated for each measurement day, week, and the whole BT  
206 period. The total load for each basic training task ( $TRIMP_{task}$ , METmin) were determined by  
207 multiplying the PA energy expenditure ( $PAEE_{HR}$ ,  $PAEE_{AC}$ ) with the total time spent in that  
208 activity task (Equations 6 and 7).

$$209 \quad TRIMP_{task_{HR}} = time(\text{min}) \times PAEE_{HR}(\text{MET}) \quad (6)$$

$$210 \quad TRIMP_{task_{AC}} = time(\text{min}) \times PAEE_{AC}(\text{MET}) \quad (7)$$

211 *Physical Activity Level (PAL)* i.e. absolute training load was evaluated from the  
212 accelerometer data throughout the BT period to compare the daily, service time, free time,  
213 and night time PA levels.

## 214 **Statistical analyses**

215 All data are presented as mean  $\pm$  SD. The level of statistical significance was set at  $p < 0.05$ .  
216 The Shapiro-Wilkinson test was used to test the normality of the data. The mean and standard  
217 deviations were calculated, and paired t-test was used to compare the activity types and  
218 TRIMP values. A one-way ANOVA was conducted to compare training and fitness groups.  
219 Post-hoc analyses were conducted using LSD pairwise comparisons. All statistical analyses  
220 were performed with SPSS (SPSS statistics 19; SPSS Inc., Chicago, USA).

## 221 **RESULTS**

### 222 **Intensity of military tasks**

223 The intensity of military task was determined for 72 activity types. The intensity of military  
224 tasks varied largely ranging from low to high intensity (see Appendix 1, supplemental digital

225 content, PAEE in military tasks during the BT period). The values measured by HR (1.9 - 6.2  
226 MET) were generally significantly higher ( $p < 0.001 - 0.05$ ) compared to the accelerometer-  
227 based values (1.6 - 4.7 MET). The HR based energy expenditure value was greater than the  
228 accelerometer based values in all measured military tasks. The statistically significant  
229 difference between HR and accelerometer based EE was observed in 94% of the military  
230 tasks. However, EE measured with these two methods associated in almost half of the  
231 military tasks. The highest correlation values were observed during the more steady-state  
232 activities.

### 233 **Training load**

234 The training load of military tasks varied from 13 to 15272 METmin (see Appendix 2,  
235 supplemental digital content, The training load of military tasks during the BT period). The  
236 highest training load was accumulated during the field shooting exercise. The “top 5” tasks  
237 were field shooting training, moving to the dining hall and meal, free time, transition and  
238 boot camp.

239 During the eight-week BT period, the mean ( $\pm$ SD) total training load (TRIMP) based on HR  
240 data was 10284 ( $\pm$  2609) ranging from 5576 to 17872. The weekly training load varied during  
241 the BT period remarkably (range: 991–1804) (Figure 2). The mean weekly training load was  
242 1371 ( $\pm$ 466). During BT weeks four and six, the training load reached its highest value and  
243 was significantly higher compared to other studied weeks. The lowest training loads were  
244 measured at the second and third training weeks. The mean daily training load was 255 ( $\pm$  71)  
245 ranging from 143 to 419.

246 - insert Figure 2 here-

### 247 **The effect of training group and fitness level on the training load**

248 The HR data based on total training load in training groups (pre-service IPAQ: inactive,  
249 moderate, active) was significantly higher in the inactive group ( $12392 \pm 3124$ ) compared to  
250 moderate ( $10252 \pm 1256$ ,  $p < 0.05$ ) and active ( $8444 \pm 1887$ ,  $p < 0.01$ ) groups. There was no  
251 significant difference in training loads between the groups divided by the pre-service fitness.  
252 (Figure 3).

253 -insert Figure 3 here-

254 The effect of the training group on weekly training impulse was observed during the first four  
255 BT weeks (Figure 4). The training load in the inactive group was greater than the moderate  
256 and active groups. The difference in the training load between the moderate and active groups  
257 was observed only at BT week 3.

258 -insert Figure 4 here-

259 The daily absolute training load (physical activity level, PAL) calculated from accelerometer  
260 data ( $2.1 \pm 0.1$  MET) was not observed to differ between the training groups during a total  
261 military service day (24h). However, free time PAL was significantly higher in the active  
262 group ( $2.6 \pm 0.2$  MET) compared to inactive ( $2.3 \pm 0.1$ ) or moderate ( $2.4 \pm 0.1$  MET) groups  
263 ( $p < 0.01$ ).

## 264 **DISCUSSION**

265 To our knowledge, there are no previous studies showing detailed training load of the  
266 military BT period measured by monitoring HR and recording physical activity objectively  
267 with an accelerometer. The mean training load (TRIMP) during the BT period was 10284,  
268 which is comparable to the training loads of professional cyclists participating in the three  
269 weeks' Tour of Spain (Vuelta), since the cumulative training load for a cyclist participating

270 the three weeks' tour is 6200-6600 (2000 per week) (24). During the BT period, the mean  
271 weekly and daily training loads were 1371 and 255, respectively. The weekly training load of  
272 professional cyclists during the rehearsal period varies from 1000 to 1500 (25), and among  
273 cross-country skiers and runners around 800 (26-28). In long-distance running, the mean  
274 daily training load ranges from 80-220 (26). Thus, the training load of conscripts in the BT  
275 period parallels with the training load of elite athletes.

276 Aerobic fitness has a substantial impact on physical performance and individually  
277 experienced training load that depends on the fitness level of the conscript. The present  
278 conscripts were divided into the three training groups (inactive, moderate, and active) based  
279 on their pre-service physical activity level by Finnish Defence Forces. The amount of  
280 physical activity that is required to enhance and maintain the aerobic fitness depends on an  
281 individual's fitness level at the baseline (29). The purpose of the training groups was also to  
282 compensate the training load between the conscripts.

283 The total training load in the inactive group was significantly higher compared to the  
284 moderate and active groups. The difference in training loads between the training groups was  
285 observed during the first four BT weeks. The attenuation of the difference in training load  
286 towards the end of the BT period might be due to improved aerobic performance and muscle  
287 strength in the inactive group. The conscripts with lower initial aerobic fitness typically  
288 improve their aerobic performance mostly during the BT period (16-18,30). The volume and  
289 intensity of the physical activity required to improve performance is known to be lesser in  
290 inactive subjects compared to the more active ones, since the dose-response relationship  
291 between the aerobic fitness and physical training load is highly progressive (31). In order to  
292 improve the performance in all of the training groups, physical training in the BT period  
293 should be customized even more regarding to conscripts' fitness level as much as possible.

294 Attention should be paid to the training load of the active group as well. Earlier studies have  
295 shown that the training load is too low to improve the maximal oxygen uptake in the active  
296 group (12,13,17,18).

297 Most of the military tasks in the present study was categorized as low or moderate intensity.  
298 Based on the HR measurement, 21% of the military tasks were conducted at low intensity  
299 (<3MET) and 78% at moderate intensity (3-6 MET). Only one military task (movement  
300 under fire) reached high intensity (>6 MET). The corresponding percentages for the  
301 accelerometer-based categorizing were 19% and 81%, respectively, and none of the military  
302 tasks reached the high intensity level. Thus, the high training load observed during the BT  
303 period was more likely caused by the long-duration than the high intensity of the activity.

304 The total duration of activity also has a major effect on the evaluated total training load of the  
305 military tasks ( $TRIMP_{task}$ , METmin). Interestingly, the general tasks such as moving from  
306 place to place (transition) and free time were observed to be among the most loading  
307 activities during the BT period. The training load of the ten most loading tasks accounted for  
308 64% of the total training load measured during BT.

309 The statistically significant difference between HR and accelerometer based EE was observed  
310 in 94% of the military tasks. However, EE measured with these two methods associated in  
311 almost half of the military tasks. The highest correlation values were observed during the  
312 more steady-state activities, which is in line with earlier studies comparing these methods  
313 (23). Several factors might cause the difference between the HR- and accelerometer-based  
314 EE. An accelerometer can measure only movement-related EE. Thus, the accelerometer  
315 underestimates EE during isometric muscle contraction or when a load is carried. Military  
316 tasks during BT also include the carrying of heavy loads (9). The environmental conditions  
317 i.e. altitude, terrain, and temperature may also affect actual EE without altering EE measured



318 by an accelerometer (32,33). These factors typically result in underestimation of EE by  
319 accelerometer. However, the double labelled water method based EE function for the  
320 accelerometer was formulated in authentic conditions during the BT period. This might  
321 improve the reliability of the accelerometer in this study. The HR measurement is also  
322 vulnerable to factors such as emotions, daily heart rate variability, hydration, nutrition status,  
323 smoking, body posture, used muscle group, and environmental factors such as temperature,  
324 humidity and altitude (34). The HR measurement commonly overestimates the actual EE.  
325 Furthermore, a linear relation between HR and EE has been observed only in moderate and  
326 high intensity activity levels (>30–100% VO<sub>2</sub>max). At the low intensity level, HR does not  
327 increase as steeply for a given change in EE, probably due to changes in stroke between  
328 lying, sitting and standing (35). However, during the present BT period, time was also spent  
329 at a low intensity level, which might have affected the measured EE.

330 Despite the manually conducted data correction, we were unable to substitute or fix some  
331 parts of the lacking or false data, which is one of the limitations of this study. The amount of  
332 the signal artifact was, however, marginal and most of it was corrected during the data  
333 processing. Furthermore, the time synchronization between HR and accelerometer data was  
334 observed to be partially inaccurate in two subjects, which might slightly have affected the  
335 data. The comparable high number of the subjects, continuous measurement of data and the  
336 long duration of the study period resulted in large amount of study data, which is one of the  
337 strengths of the present study.

338 The results of this study can be utilized when investigating workload as well as planning  
339 physical performance, nutrition and hydration requirements during military service. In the  
340 light of this study, the conscripts with lower preservice physical activity are experiencing  
341 greater training volume during the BT period compared to others. Further studies are called

342 for to determine if customized training based on baseline fitness levels will benefit conscripts  
343 in terms of performance, attrition, or injury. The most practical way to customize training in  
344 military settings during BT could be to share recruits in the level groups based on their initial  
345 fitness level.

## 346 **Conclusions**

347 The training load during the BT period was comparable to the daily and weekly training loads  
348 of professional athletes in pre-competition and competition periods. The high training load  
349 likely originated from long lasting military tasks instead of intensity. The results of this study  
350 can be utilized in evaluating the nutrition and hydration requirements during the BT period  
351 and planning tailored training to the conscripts.

352 The evaluation of physical load in authentic field condition is challenging. Both HR and PA  
353 measurement are suitable methods for the measuring of EE in field conditions, since the  
354 devices are small and do not disturb normal activity. Combining these methods may provide  
355 a more accurate estimate on the actual EE, since the accelerometer is prone to underestimate,  
356 and HR measurement typically overestimate EE.

357

## 358 **Acknowledgments**

359 The authors thank the conscripts who participated in this study.

## 360 **Conflict of Interest**

361 Author declare no conflicts of interest. The results of the present study do not constitute  
362 endorsement by ACSM and are presented clearly, honestly, and without fabrication,  
363 falsification, or inappropriate data manipulation.

#### 364 **Author Contributions**

365 Conceived and designed the experiments: MT, HKy. Performed the experiments: MT, HKy.

366 Analyzed the data: HJ, HKi. Wrote the paper: HJ, MT, HKy, MS, HKi

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461

462 **Supplemental Digital Contents**

463 Supplemental digital content 1. PAEE in military tasks during the BT period.

464 Supplemental digital content 2. The training load of military tasks during the BT period.

465

466 **Figure and Table captions**

467 Table 1. Demographics.

468 Figure 1. Study protocol. The study measurements were conducted at weeks 1, 5, 8 and 10.

469 Heart rate was measured during the daytime activities (6AM-9PM) and physical activity was

470 recorded continuously around the clock by accelerometer. HR= heart rate; VO<sub>2</sub>max=

471 maximal oxygen uptake.

472 Figure 2. TRIMP weeks. The training loads (TRIMP±SD) during the 8 weeks of basic

473 training period. As planned, the training impulse intensified during the basic training periods.

474 The weeks 4 and 6 were the most strenuous weeks, whereas the first three weeks were the

475 lightest weeks in the BT period. \*p<0.05, \*\*p<0.01

476 Figure 3. Total training load (TRIMP±SD) for the fitness (Low, Moderate, Good) and

477 training (Inactive, Moderate, Active) groups. The training load was significantly higher in the

478 Inactive group compared to Moderate and Active groups. \*p<0.05, \*\*p<0.01

479 Figure 4. Weekly training load (TRIMP±SD) in training groups (Active, Moderate, Inactive)

480 during the 8-week basic training period. \*p<0.05, \*\*p<0.01

481