

Relationship between soldiers' service performance and physical training volume

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Abstract

Background: To be able to improve soldiers' service performance it is essential to know what factors are an influence upon it.

Purpose: To examine the relationship between soldiers' service performance and physical training volume during an international peacekeeping mission.

Materials and Methods: Seventy-one male Norwegian infantry soldiers who had joined a 12-month mission in the Kosovo Force (KFOR) were included. Every soldier reported the daily physical training on a monthly report form, and the soldier's service performance was evaluated by the closest superior officer. An explorative factor analysis confirmed a four-factor model based on data from previous KFOR soldiers (n=1461). The factors describing soldiers' service performance were: I) professional skills, II) open mindedness, III) mental strength, IV) sociability. The internal reliability was adequate.

Results: Physical training volume positively predicted the soldiers' mental strength ($R^2 = 0.08$; $P = 0.012$). Soldiers with high mental strength had a 66% higher mean physical training volume than the soldiers with low mental strength ($P < 0.05$). No relationship was found between the other aspects of soldiers' service performance and physical training volume.

Conclusion: Soldiers' physical training volume is associated with soldiers' mental strength, a critically important aspect in stressful situations.

Keywords: army, peacekeeping mission, mental strength, physical activity

Introduction

Soldiers' military service performance depends on many factors, which vary according to the mission. During some missions, a soldier's service may be dominated by undemanding physical tasks like guard duty and office work. On the other hand, the average light infantry rifleman in the U.S army transports over 43 kg of critical combat equipment¹ indicating that, for these soldiers, good physical fitness is an essential factor affecting performance. Good physical fitness has been found to have both physiological and psychological benefits that

may reduce stress, illness and injuries²⁻⁵. Developing good physical fitness in soldiers may also improve morale in the unit, help build character, and improve soldiers' perception of being prepared for the mission⁶.

It is difficult to study human performance in complex environments such as wars or peacekeeping missions. The few papers that have been published have a "lesson learned" perspective where experience about altitude training, injury treatment, equipment and physical capacity is discussed⁷⁻⁹. When studying performance of elite athletes, a multitude of different disciplinary approaches including behavioural, physiological, biomechanical and psychological have been employed. Psychological approaches vary from more phenomenological approaches¹⁰ to traditional trait approaches¹¹. Such studies are seldom available in the military sciences.

One way to evaluate military service performance could be to study different factors that are perceived to be relevant by officers and military personnel with adequate experience. In the present study four aspects of soldiers' service performance, defined as professional skills, open mindedness, mental strength and sociability were evaluated with respect to the soldiers' physical training volume during an international peacekeeping mission in order to reveal possible relationships.

Methods

Seventy-one male Norwegian infantry soldiers, aged 20.5 ± 1.8 years, who served in the same unit during a 12-month mission in the Kosovo Force (KFOR) participated in the study. The soldiers were volunteers for Kosovo, and had the same training background, rank and experience as a soldier. The study was approved by the Regional Ethics Committee, and written informed consent was obtained from the soldiers.

Every soldier reported his daily physical training on a monthly report form for nine months. The monthly response rate was $85 \pm 8\%$. Training volume, frequency and type of activity were reported for all obligatory and voluntary physical training in sweatsuits. Registration of training volume started 45 days after arrival in Kosovo and ended 3 weeks prior to demobilization. Physical training volume is reported in hours per week.

Each soldier's service performance was evaluated at the end of the Kosovo mission by his closest superior officer. Each officer evaluated ⁷⁻⁸ soldiers whom he/she knew well. In fact, in most cases the officer and soldiers had been working together for almost two years. Evaluation was based on a 20-item questionnaire. Two of the questionnaire items were excluded due to lack of relevance for the factorial analysis, leaving 18 items to be used for the analysis. The questionnaire consisted of statements about different aspects of the soldiers' capabilities. The truth of the statements was rated using a 7-point scale (1 = low degree of truth; 7 = high degree of truth), and a higher composite subscale reflected higher levels of the capabilities being measured. The items in the questionnaire were developed in two main versions. The first version was originally developed for the evaluation of the introduction of a personality test¹². The initial goal was to create a questionnaire that was based purely on military experience and was relevant for international operations, was easy to use and was comprehensive. Twenty Norwegian officers with extensive experience from international missions were gathered at an expert conference in order to discuss and develop the content of the questionnaire. The officers served at the Army's headquarters or other relevant units. Their conclusions were transferred to items on the questionnaire. This transfer was carried out by military psychologists and psychometricians¹². Finally, the questionnaire was re-evaluated by the expert officer and then used for the evaluation of the service performances of military personnel at the NORBAT (Lebanon) and SFOR (Bosnia) missions. The evaluation had a longitudinal design, with the same measurements being repeated three times. The second version of the questionnaire was used during the KFOR (Kosovo) mission. The second version is an improved and expanded version of the original, integrating experiences from the SFOR mission and military operational knowledge by officers serving under this mission. This study analyses data collected with the second version of the questionnaire.

An explorative factor analysis, principal component analysis with varimax rotation, was applied and confirmed a four-factor model that accounted for 63% of the total variance. The four-factor model was created from a larger sample of previous KFOR soldiers ($n = 1461$). The factors were labelled: I) professional skills (five questionnaire items), II) open mindedness/flexibility (four items), III) mental strength (three items), and IV) sociability and ability to relate to people (four items).

A linear regression analysis was used to examine whether physical training volume predicted any of the four factors describing service performance.

After it was found that physical training volume positively predicted mental strength, a post hoc analysis

was conducted to determine the difference in training volume between a high mental strength group and a low mental strength group. The two groups were defined by an extreme median split, $\pm 0.25 \cdot \text{standard deviation}$ ¹³, and only data from soldiers who had reported their training volume throughout the service were included. The difference in the groups' physical training volume was determined by an independent sample T-test.

Results

Statement	Factor			
	I	II	III	IV
Shows professional skill	0.775			
Carries out requested tasks conscientiously and trustworthily	0.737			
Helps others to serve their duty	0.676			
Takes initiative	0.628			
Finds new and useful solutions	0.596			
Shows openness to change and development		0.748		
Collaborates and shows openness to other people's point of view		0.741		
Tolerates provocation		0.699		
Considers an issue from several viewpoints		0.684		
Stays calm in challenging and demanding situations			0.863	
Has strong mental health (is not anxious, depressed or lacking in self-confidence)			0.777	
Adjusts own aggression level to what is required in the situation			0.617	
Extroverted				0.826
Capable of negotiating				0.573
Considerate of other people				0.563
Affable and in a cheerful mood				0.560
Chronbach's alpha for each factor	0.82	0.79	0.74	0.73

Absolute values less than 0.5 were suppressed. One item was deleted because it was loading in two components.

Table 1. Factor loadings from the rotated component matrix analyses, and the factors Chronbach's alphas.

Table 1 shows the factor loadings for each item included in the four factors describing the soldiers' service performance, and the Chronbach's alphas. The overall score for soldiers' service performance was quite high. Weekly physical training volume was two hours (Table 2) and primarily consisted of voluntary strength training (73%) and endurance training (27%). The correlation matrix of the four factors of service performance showed that only mental strength was positively correlated to physical training volume (Table 3). Regression analysis showed that physical training volume positively predicted the soldiers' mental strength ($B = 0.20$; 95% CI: 0.035 - 0.373; $R^2 = 0.084$; $P = 0.019$). No other significant results were found between the other factors of soldiers' service performance and physical training volume.

	Mean score	Min-Max
Factor I: Professional skill	5.35 (0.71)*	3.83 - 6.67
Factor II: Open mindedness	5.01 (0.85)*	3.00 - 6.75
Factor III: Mental strength	5.38 (0.90)*	3.33 - 7.00
Factor IV: Sociability	5.22 (0.75)*	2.25 - 6.50
Physical training volume (h-week-1)	1.95 (1.28)	0 - 5.13
Number of physical training sessions per week	1.8 (0.2)	0 - 4.9

* Scale of 1 to 7 with 7 being the highest level of the capabilities being measured.

Table 2. Mean score with standard deviation for the different factors related to soldiers' service performance and weekly physical training volume with the number of training sessions.

The post hoc analysis conducted to determine the difference in training volume between the high mental strength group and low mental strength group showed that the high mental strength group had a higher physical training volume throughout the international military service (Table 4).

Period	Mental strength group	n	Physical training volume with standard deviation (hours week ⁻¹)
1: Sept, Oct, Nov	Low	23	1.19 (0.91)
	High	16	1.66 (1.39)
2: Dec, Jan, Feb	Low	23	1.82 (0.80)
	High	16	2.92 (1.86)*
3: Mar, Apr, May	Low	23	1.30 (1.44)
	High	16	2.36 (2.24)
Mean	Low	23	1.44 (0.84)
	High	16	2.39 (1.49)*

* Different from low mental-strength group ($P < 0.05$).

Table 4. Difference in mean weekly training volume between the high mental strength group and the low mental strength group during the 9-month international military mission.

Discussion

In this study we wanted to examine whether soldiers' physical training volume during a 12-month peacekeeping mission was related to their military service performance defined as professional skills, open mindedness, mental strength, and sociability/ability to relate to people. The overall finding of this study is that soldiers' mental strength is positively related to their physical training volume, and that soldiers with reported high mental strength have a much higher training volume than soldiers with low mental strength. One limitation in the study design is that the soldiers' service performance is derived from both the objective and subjective opinion of their closest superior officer.

Clough and Earle (2002) studied mental toughness, a concept thoroughly debated in the sport sciences and related to mental strength¹⁴. They reported that more mentally tough individuals could cope more easily with physical and mental demands. This finding suggests the possibility that soldiers' performance might improve if mental strength is increased. The

Pearson Correlation	Training volume	Professional skill	Open mindedness	Mental strength	Sociability
Professional skill	0.18				
Open mindedness	0.15	0.64**			
Mental strength	0.29*	0.38**	0.40**		
Sociability	-0.05	0.63**	0.57**	0.20	
Sum of all factors	0.19	0.83**	0.84**	0.67**	0.75**

$n=66$. *Correlation is significant at the 0.05 level. ** Correlation is significant at the 0.01 level.

Table 3. Correlation matrix for the factors included in service performance and physical training volume. Sum of all factors is mean score for the four factors of service performance.

relationship between physical training and mental strength found in the present study indicates that physical training could improve soldiers' mental strength, as mean training volume in the high mental strength group was significantly higher (66%) than in the low mental strength group. Although we cannot claim a causal relationship due to the correlational design of this study, it is plausible that a reciprocal relationship exists between physical training volume and mental strength. That is, that physical training increases mental strength, and/or that mentally strong individuals are able to value the benefits of staying fit and therefore prioritise physical exercise, even under difficult conditions.

From a practical point of view these results indicate that officers should be especially aware of soldiers with reported lower mental strength and their physical training during a military peacekeeping mission. Soldiers in this group will probably need more organised and individualised physical training.

The soldiers in the present study were involved in a peacekeeping mission with periods that varied from very tense in unstable areas to calm with ample training opportunity. This is reflected in the variation of the training volume (Table 4). Since several studies have shown that soldiers' physical training volume decreases after basic training^{15,16} it seems reasonable to recommend that the military emphasise the importance of continuous physical training, even during military missions.

Research has shown that soldiers returning from deployment are likely to have increased emotional problems and somatic complaints, and increased use of mental health services¹⁷. Sareen et al. (2008) found that most mental health problems among Canadian soldiers deployed on missions were attributable to a wide range of common civilian putative risk factors rather than combat¹⁷. Since a growing body of knowledge shows that physical training reduces both illness and stress⁴, physical training could also be effective for deployed soldiers. Therefore, physical training during a 12-month mission could enhance

the soldiers' physical and mental condition and possibly prevent the emotional and somatic problems some of the soldiers experience after the mission. If physical training can be conducted in such a way that it triggers all aspects of mental strength, the increased value of the physical training to the military would be multidimensional.

Conclusion

Mental strength seems to be related to physical training, and should be investigated further within a military context. It would be interesting to examine different methods of enhancing mental strength, including physical training and more traditional mental training methods used in elite-level sports. Overall, the results also illustrate the complex nature of a military service performance during a 12-month peacekeeping mission. Further investigation in this area is needed to improve the understanding of factors affecting service performance. Such an understanding could improve selection of soldiers for missions and facilitate individualised training of soldiers.

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