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Perceived stress, exercise habits, and exercise addiction in Israeli army reserves: A pilot study

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ABSTRACT

Being an army reservist involves stress and uncertainty. While some individuals use exercise to cope with stress, no previous research has ever studied the relationship between army reservists exercise habits and perceived stress. The current study examined the hypothesis that Israeli army reserves in combat roles would report greater perceived stress and (to cope with the stress) exhibit more intensive exercise habits, as well as higher risk for exercise addiction, than the army reserves who are in a non-combat (i.e., office job) role and controls who are not in the army reserve. Participants (n = 277) completed questionnaires assessing their regular exercises habits, perceived stress, and risk for exercise addiction. The results showed that combat reserves scored higher on all dependent measures than non-combat reserves and controls. Perceived stress accounted for 38.8% to 56.6% of the variance in the risk of exercise addiction. Findings suggest that Israeli army reserves in combat role exercise more, for longer episodes, with greater reported intensity, and are at a greater risk for exercise addiction than the reserves in non-combat roles and controls. The higher risk for exercise addiction in the combat reserves, accompanied by a lower predictive power of the perceived stress, reflects a weaker association between these two variables in this group, most likely because combat reserves feel obliged to be physically fit in case of active deployment. This is the first study to show that differences in reservists' roles is associated with different levels of risk for exercise addiction.

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KEYWORDS
Army exercise; chronic stress; exercise addiction; exercise dependence; military exercise; soldier exercise

What is the public significance of this article?—Israeli army reserves exercise more and are more prone to exercise addiction if they have a combat role. This is the first study to reveal that subjectively perceived stress is a strong predictor of the risk of exercise addiction.

Introduction

Army reserves all over the world play an important role in numerous military operations. While waiting in uncertainty for being mobilized for deployment, reservists can experience a range of life stresses (Bartone, 1999). Stress escalates at times of political uncertainty, danger of war, and/or in geographical regions of permanent, or unresolved, conflict. While earlier studies exposed the harsh effects of stress on these individuals (e.g., Griffith, 2010), few studies have explained how combat and non-combat reservists cope with the daily stress especially in conflict zones in which deployment may happen from one moment to another, such as that in Israel.

Israel Defense Forces (IDF) reserves

The Israeli military is built from three general populations; regulars (mandatory service for men is 32 months and for women is 24 months), officers and professionals, and army reservists. According to Israel's "Defense Service Law" (Reserves Service Law, 2010), every permanent resident man (but not woman) may be called for annual military duty of 54 days during a three-year period until he reaches the age of 40 years (non-commissioned soldier) or 45 years (officers). In reality, because of war (or military operations that take place regularly over the years or for training and military operations such as patrolling the borders, special missions etc.) many Israelis are being called for longer periods of reserve duty under a special arrangement that they get compensated for loss of working days and the service does not harm their work. Such a preparation is a direct response to Israel's need for optimal exploitation of her manpower in order to counterbalance the numerical dominance of countries

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that it is surrounded by (Horowitz & Kimmerling, 1974). Whereas the reservists must always be prepared for an immediate call-up, they are required to be well trained and organized which means that men must know each other and know their own defined role within the hierarchical order of the unit. Moreover, by continually moving back and forth between civilian- and military life, reservists are exposed to changing identities and, therefore, dynamic social relations (Lomsky-Feder, Gazit, & Ben-Ari, 2008), that could contribute to their perceived stress. Indeed, several emergent identities, stemming from the reservist role, yield major conflict begging for continuous coping (Griffith, 2009). Finally, actual and anticipated deployment characteristics, such as region and duration, have noteworthy effect on reservists' level of stress (Allison-Aipa, Ritter, Sikes, & Ball, 2010).

Stress in military reserves

After being assigned, reservists advance through similar deployment stages as do active-regular forces. Yet, they face supplementary challenges associated with being "citizen soldiers", such as arranging extended leaves of absence from work, taking care of family issues, and/or planning their recuperation upon their return to their civilian life (Lane, Hourani, Bray, & Williams, 2012). Since its establishment in 1948, Israel has fought eight documented wars, two Palestinian intifadas, and a series of armed conflicts in the broader Arab–Israeli conflict (i.e., the Protective Edge operation in Gaza; Siboni, 2014). These historical facts and the still unresolved conflict in the area predispose Israeli reservists to ongoing stressful experiences.

Although research attention has been dedicated to post-traumatic stress disorder in the Israeli soldiers (e.g., Benotsch et al., 2000; Solomon, Neria, Ohry, Waysman, & Ginzburg, 1994), research on the stress of reservists in Israel is almost non-existent. In a study with American reservists, results showed that the strongest predictors for stress among them was deployment uncertainty, exaggerated workload, and organizational constraints (equipment and physical readiness; Stetz, Castro, & Bliese, 2007). Israeli reservists, especially those who serve in combat units, are more exposed to stress in their daily life compared to reservists in most other countries, because of their uncertainty about when they will be called next and their constant need to stay fit for that, even in their civilian life (Horowitz & Kimmerling, 1974).

Stress and exercise

McEwen (2007, p. 874) asserted that "*stress is a word used to describe experiences that are challenging emotionally and physiologically*." These may vary in different levels and times such as being acute or chronic, small in magnitude (e.g., waiting for a delivery) or traumatic (Wagner, Compas, & Howell, 1988) and there are many moderators of stress including social support, personality variables, meditation, and exercise (Ganster, Fusilier, & Mayes, 1986; Gerber & Pühse, 2009; Korotkov & Hannah, 1994; Van Gordon, Shonin, Zangeneh, & Griffiths, 2014). Exercise is a behavioral subset of physical activity and is defined as "*physical activity that is planned, structured, and repetitive and has as a final or intermediate objective the improvement or maintance of physical fitness*" (Caspersen, Powell, & Christenson, 1985, p. 128). In general, the literature directs more focus on the influence of exercise on stress and other physiological parameters, rather than the other way around (e.g., Blair et al., 1996; Brown et al., 2003; Wei, Gibbons, Kampert, Nichaman & Blair, 2000). In this aspect, the Behavioral Risk Factor Surveillance System (BRFSS) database, demonstrated that the 175,850 unhealthy days reported by adults was inversely associated with physical activity (Brown et al., 2003). In a 2014 literature review examining the impact of stress on indicators of exercise, 168 studies were identified in the scientific literature. Although the studies varied in their theoretical orientations, results showed that three-quarters of the studies (76.4%) found that psychological stress predicts less exercise, whereas a minority of studies (18.2%) reported that exercise was positively impacted by stress (Stults-Kolehmainen & Sinha, 2014). The present paper focuses on those who use exercise as a way of coping with stress based upon the model formulated by Szabo (2010) – the Cognitive Appraisal Hypothesis (Szabo, 1995). This model states that some exercisers may engage in exercise as a mean of coping with stress (i.e., they exercise every time they experience a sudden stressor or experience ongoing stress). Furthermore, this model explains the consequences of these mechanisms and suggests that some individuals who use exercise as a means of coping with stress, may experience their healthy exercise turning into an addiction (Egorov & Szabo, 2013).

Exercise addiction

The idea of addiction to exercise was first posited by Sachs and Pargman (1984). They proposed the term "running addiction" to describe the foundation of withdrawal symptoms that appear during periods of running deprivation (e.g., anxiety, tension, irritability,

muscle twitching). Established clinical cases of exercise addiction in all varieties of sports – martial arts, weight lifting, and bodybuilding – were only reported later (e.g., Griffiths, 1997; Hurst, Hale, Smith, & Collins, 2000; Murphy, 1994). These clinical cases are characterized by loss of control over the exercise behavior, which is done as a "duty" rather than for pleasure, thus, having negative physical and psychosocial consequences for the individual (Egorov & Szabo, 2013). This viewpoint is in accord with Israeli combat reservists who may be expected to have an above normal level of fitness (Israelashvili, 1992). Exercise addiction symptoms may include all components of addictive disorders including salience, withdrawal, mood modification, conflict, tolerance, and relapse (Griffiths, 2005). Taking these consequences into account, pathological exercisers can be distinguished from the other high-volume exercisers, like athletes, who sustain control over their training and may rarely or never experience harmful or negative consequences because of their intensive training (Szabo, 2010).

While this topic has had relatively narrow focus in the research community, it is certainly an important phenomenon worthy of further evaluation in this population because of the large number of reservists, where in a country like Israel, such individuals have a crucial role in defending the country's security. No previous study has ever examined the relationship between army reservists in terms of exercise habits as a coping strategy with perceived stress (neither in Israel or anywhere else in the world). Consequently, the present study examined the perceived stress, exercise patterns, and the risk for exercise addiction among Israeli combat and non-combat reservists, while also including a control group comprising individuals who were not in the Israeli army reserve. The study tested the hypotheses that combat reservists would experience greater stress than the other two groups while also showing more intensive exercise patterns, as well as a greater risk for exercise addiction, in their effort to cope with the everyday stress they face.

Methods

Participants

Participants were recruited via a call for participation posted on various social media platforms. The snowball method (Goodman, 1961) was also employed to increase the sample size. Ethical clearance for the study was obtained from the Research Ethics Committee of the Faculty of Education and Psychology in a large urban University. A total of 277 individuals volunteered to participate in the study. The majority were men (n = 243) and a small minority were women (n = 34). Their age ranged between 22 and 45 years ($M = 30.47$ years ± $SD = 4.97$). Participants had completed between two to three years of mandatory service in the Israeli Defense Forces (IDF). At the time of the study 150 participants were engaged in reserve service in a combat unit, 75 in a non-combat unit (i.e., office job) and 52 in neither (they served as controls for the present study). All 277 participants attested that they exercised at least three times a week for at least 30 minutes each time.

Materials

The survey questionnaire was divided into four sections. In the first section, demographic information (i.e., gender, age, exercise habits, and type of military reserves) were gathered. The remaining three sections comprised three psychometrically validated instruments (described below) assessing exercise dependence, exercise addiction, and perceived stress.

Exercise Dependence Scale Revised (EDS-R; Downs, Hausenblas, & Nigg, 2004). The revised EDS is a 21-item instrument which was originally modeled on the Diagnostic and Statistical Manual of Mental Disorder-IV (DSM-IV) criteria for substance dependence. The responses are given on a 6-point Likert scale, ranging from 1 (*never*) to 6 (*always*). The ratings provide a total score for exercise dependence which comprises the sum of ratings of seven components. The originally reported internal consistencies ranged between 0.78 and 0.95 (Cronbach's alpha [α]). The present study was interested in the overall score of the EDS to assess the congruent validity of the modified Exercise Addiction Inventory (see below). The internal reliability of the EDS in the current sample was 0.98.

Exercise Addiction Inventory Revised (EAI-R; Griffiths, Szabo, & Terry, 2005; Szabo, Pinto, Griffiths, Kovacsik, & Demetrovics, 2019; Terry, Szabo, & Griffiths, 2004). The original EAI is based on Griffiths' (2005) "components model" of addiction and was designed to gauge six common symptoms of addiction. In the original EAI (Terry et al., 2004), six items were rated on a 5-point Likert-scale. The present study used the newly revised and validated 6-point scale (Szabo et al., 2019). that yielded three *agree* and three *disagree* answers with three levels of each (1 = strongly disagree; 2 = disagree, and 3 = slightly disagree, and then 4 = slightly agree, 5 = agree and 6 = strongly agree). The idea behind this change was to eliminate the midpoint uncertainty from the original scale. The modification resulted in higher internal consistency of 0.90 (Cronbach's α) versus 0.84 reported by Terry et al. (2004). The modified scale's concurrent

validity with EDS-R was also slightly greater ($r = 0.87$) in the present sample than that reported for the original scale ($r = 0.81$; Griffiths et al., 2005). Furthermore, a principal components analysis confirmed that the six EAI-R items represent a single component explaining 68.12% of the variance, which again is larger than the value reported for the original scale (55.9%; Griffiths et al., 2005). Finally, the EAI-R's shared variance with the weekly frequency of exercise was higher ($r^2 = .38\%$) than in the original study ($r^2 = .29$). Therefore, the modified 6-point rating scale of the revised EAI-R resulted in relatively more robust psychometric properties than those reported in the original scale (see Appendix A for EAI-R).

Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983). The PSS is a widely used psychological instrument for assessing the perception of stress. It consists of 10 items with each item rated on a 5-point Likert type scale ranging from 1 (*never*) to 5 (*very often*). The PSS assesses the degree to which situations in one's life are evaluated as stressful. In the present study, the questionnaire's internal reliability was found to be high in spite of the relatively small sample (Cronbach's $\alpha = 0.95$).

Procedure

The participants completed the study anonymously on the *Qualtrics* online research platform (Qualtrics, 2017; Snow, 2013). To access the survey's demographic questions and psychometric instruments described in the previous section, participants had to read a consent form and agree to participate by selecting the "I agree" button. Only the fully completed (100%) responses were included in the present study. The data were downloaded in a Statistical Package for Social Sciences (SPPS v. 24) data file and analysed with the same statistical software.

Data analysis

To test the research hypotheses, the data were analysed with a Multivariate Analyses of Covariance (MANCOVA) using the three participant groupings (combat, no-combat, control) and testing six dependent measures including exercise addiction, exercise dependence, perceived stress, weekly exercise frequency, average exercise duration, and perceived exercise intensity. Age and gender were added as covariates. This is because individual's exercise habits vary with age and because only 34 women participated in the study. Controlling for the effect of gender was therefore warranted. Subsequently, regression analyses were performed to determine the predictive power of perceived stress on exercise addiction measures across the three groups.

Results

To results of the MANCOVA yielded a statistically significant multivariate main effect for the reserve groups (Pillai's Trace = .450, $F_{12,\ 536} = 12.99$, $p < .001$, effect size: partial Eta squared [$p\eta^2$] = .225, $1 - \beta = 1.0$). Both gender and age turned out to be statistically significant covariates (Pillai's Trace = .183, $F_{6,\ 267} = 9.95$, $p < .001$, $p\eta^2 = .183$, $1 - \beta = 1.00$, and Pillai's Trace = .080, $F_{6,\ 267} = 3.88$, $p = .001$, $p\eta^2 = .080$, $1 - \beta = .967$, respectively). The univariate tests demonstrated that after controlling for gender, which affected all variables ($p \leq .001$) except the weekly exercise frequency, and age, which affected perceived stress, exercise dependence, and average duration of exercise ($p = .32$, .13, and .12, respectively), group differences emerged in all the six dependent measures ($p < .001$ in all instances). The summary of the univariate tests is presented in Table 1. Post-hoc Bonferroni tests showed that combat reserves scored higher than non-combat, or control group, on all the six dependent measures ($p < .001$ in all instances, see the means in Table 1). The non-combat reserves and control groups only differed in the reported average duration of exercise ($p = .03$) with the former scoring higher than the latter, but not on any other of the dependent measures.

Linear regressions examining the predictive power of perceived stress on the risk for exercise dependence and addiction (EDS-R and EAI-R), were performed separately for the three groups: combat reserves, non-combat reserves, and controls. These analyses demonstrated that perceived stress accounted from 38.8% to 56.5% of the variance in the risk for exercise addiction in the three groups. The slopes of the regressions lines differed statistically significantly in the results obtained with the EAI-R, between the combat and non-combat reserves (t (219) = 2.98, $p = .003$), as well as between combat reserves and controls (t (196) = 2.38, $p = .018$). However, the slopes of the regression lines obtained when examining the EDS scores did not differ from each other. The results of the regression analyses are summarized in Table 2.

Discussion

The results of the present study confirmed the hypothesis that reservists in combat units reported higher perceived stress and showed profoundly greater engagement in exercise than those who serve in non-combat units and the control group. These findings cannot be compared to earlier research, either in general or in the Israeli reserves' context, because (to the best of the authors' knowledge) no previous studies have ever been carried out. Consequently, the present

Table 1. Descriptive statistics (means [M] and standard deviation [SD]) for the six dependent measures in the three groups, also showing the F values (df = 2, 272) of the univariate tests, their significance level (p) and the effect sizes (partial Eta squared [$\mathbf{p\eta^2}$].

Dependent Measure	Group	M (SD)	F	p	$p\eta^2$
Perceived stress	Reserve combat	27.54 (8.61) [a]	43.04	.001	.240
	Reserve no-combat	19.77 (7.25) [b]			
	Control	19.86 (7.57) [b]			
Exercise addiction	Reserve combat	23.74 (6.25) [a]	51.02	.001	.387
	Reserve no-combat	15.86 (7.46) [b]			
	Control	13.51 (7.26) [b]			
Exercise dependence	Reserve combat	66.37 (25.90) [a]	85.95	.001	.273
	Reserve no-combat	44.72 (20.22) [b]			
	Control	38.82 (18.80) [b]			
Weekly frequency of exercise	Reserve combat	4.20 (1.41) [a]	21.79	.001	.138
	Reserve no-combat	3.45 (.85) [b]			
	Control	3.19 (.62) [b]			
Average duration of exercise	Reserve combat	70.00 (28.94) [a]	40.91	.001	.231
	Reserve no-combat	51.66 (25.97) [b]			
	Control	39.80 (17.12) [c]			
Perceived intensity of exercise	Reserve combat	16.96 (2.06) [a]	57.88	.001	.299
	Reserve no-combat	14.43 (3.09) [b]			
	Control	13.81 (3.36) [b]			

Superscripts indicate statistically significant differences between the groups as based on Bonferroni-corrected post-hoc tests: ([a − b], $p < .001$; [a − c], $p < .001$; [b − c], $p = .03$).

Table 2. The predicting power of perceived stress on exercise addiction as based on two instruments, the Exercise Addiction Inventory (EAI) and the Exercise Dependence Scale (EDS). The table presents the results of the regression analyses performed separately for the three groups.

	EAI						EDS					
Group	*β*	*St. Error*	*R*	R^2	*F*	*p*	*β*	*St. Error*	*R*	R^2	*F*	*p*
Combat Reserve	.452[a]	.047	.623	.388	93.706	.001	2.261	.163	.752	.565	192.211	.001
Non-combat Reserve	.739[b]	.084	.718	.516	77.700	.001	1.788	.250	.641	.411	51.007	.001
Control	.700[c]	.093	.730	.533	57.069	.001	1.696	.256	.683	.466	43.714	.001

The slopes of the regression line differed between combat reserves and no combat reserves ([a − b], $p = .003$), as well as between the combat reserves and controls ([a − c], $p = .018$) on the EAI measures only.

study is the first to show that differences in combat reservists' roles is associated with different levels of risk for exercise addiction, as demonstrated with two reliably psychometrically validated instruments.

The expected and demonstrated differences in the perceived stress between the groups is most likely attributable to the uncertainty and/or lack of control over when the combat reservists will be deployed (because it could occur at any time). This finding is in accord with the results of an earlier study with US reservists (Lane et al., 2012). Unexpectedly, non-combat reservists who also experienced uncertainty and a lack of control over deployment, did not report greater stress than control participants not performing any reservist roles. This finding suggests the "combat" aspect of the reservist role may be the reason for the observed differences in the perceived stress. However, the greater perceived stress in the combat reservists was accompanied by significantly more frequent exercise, longer durations of exercise, and more intensive exercise in contrast to the other two groups. This finding leads to two possible explanations. One is that combat reservists might feel a need for more exercise to be fit and physically resilient when deployed for duty. Thus, their intensive exercise involvement is a form of simulation training that could provide mental relief concerning reserve status. The other is that they use exercise to cope with the high perceived stress. This explanation also accounts for the heightened risk for exercise addiction, compared to the other two groups. In the former case the exercise behavior secures control, so it is a form of gain, whereas in the second case exercise is necessary to avoid the negative consequences of stress. This explanation is in full accord with the role of positive and negative reinforcement beyond the risk for exercise addiction (Szabo, 2010).

In all three groups, perceived stress accounted from 38.8% to 56.6% of the variance in the risk for exercise addiction as based on the two instruments. These figures are high and indicate that regardless of the reservist role, Israelis in general, may rely on exercise to cope with stress. It is noteworthy to mention, that to the best of the authors' knowledge, despite the many studies on exercise addiction, the predictive power of the perceived stress has not been examined in any study to date and is therefore another novel addition to the literature. Consequently, it is not known whether the range of the obtained figures for the reservists and Israeli controls are low, medium, or high in contrast to other population values. Nevertheless, the

finding that about half of the total variance in the risk for exercise addiction was accounted for by the perceived stress provides support for many etiological models of exercise addiction in which stress forms the core of an individual's motivational incentive for the exaggerated behavior (i.e., Szabo, 2010; Szabo & Egorov, 2016).

The predictive power of perceived stress on exercise addiction differed between combat reserves and no-combat reserves on one of the exercise addiction risk assessing instruments (the EAI-R), but not on the other (EDS). Given the different theoretical background in the development of these two instruments, slight differences in their outcome have previously been reported including the only using a nationally representative sample (i.e., Mónok et al., 2012). Nevertheless, the lower predictive power of perceived stress in the risk for exercise addiction among combat reserves compared to the other two groups may be explained through antagonistic effects. Exercise helps overcome the greater perceived stress in this group, but combat reservists already do more exercise at baseline. They get used to intensive exercise training during the mandatory three years of military service and maintain high levels of exercise to generate physical readiness and resilience while living in uncertainty.

Limitations and implications

The present study is not without limitation. One limitation is the reliance on volunteers providing self-reports, which is a general problem in the psychological literature. This is because any such data may be exposed to recall bias and social desirability bias. Another limitation is the lack of assessment of the participants' English language skills given that the study was conducted in English. Participants' first language may have been Hebrew, and while studied in Israeli schools, the English proficiency of the participants cannot be guaranteed. A third limitation is the self-selecting nature of the sample (which was modest in size). More representative populations utilizing bigger sample sizes is this warranted. The fact that the data were collected via social media may have also biased the results although participants were guaranteed absolute anonymity and confidentiality. Finally, while statistically accounting for the possible gender differences, there were too few women to examine gender differences in the present work. The preliminary results emerging from this research should provide incentive for more comprehensive studies in which questionnaire data are followed up with interviews, if not random (which is very difficult within a special population such as that examined here), at least randomized participant selection should be employed, and the motivation beyond the exercise behaviour should also be determined.

In terms of practice – the findings presented here may help countries that count on their army reserves, to better cope with the tendency of their reservists to feel stressed about being called up to serve any time. For instance, developing evidenced-based structured programs for this population which could help the affected individuals to learn new ways of coping with their stress. This novel investigation of reservists will hopefully facilitate further research on the same type of population in other countries – such as US. In terms of theory, the study provides a totally new perspective on the exercise addiction-related phenomena, showing that perceived stress has a moderating influence on it, which warrants further investigation.

Conclusions

This first ever empirical investigation of the relationship between perceived stress and exercise habits among Israeli army reserves demonstrated that reservists in combat roles experience greater stress, adopt more intensive exercise routines, and are more prone to the risk for exercise addiction than reservists in non-combat roles and non-reservist controls. The results also show that while experiencing greater stress than the others, the predictive power of the perceived stress in reservists in a combat role was lower, based on at least one instrument, than in the other two groups. This finding may be explained in terms of greater exercise which is not only used for stress buffering, but also for conditioning and physical resilience to face more confidently deployment into combat when the time comes. Finally, this is the first study in the literature showing that a significant proportion of the variance in the risk for exercise addiction is accounted by perceived stress. This finding should shape future research on exercise addiction.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Appendix A. The Revised Exercise Inventory (EAI-R) (Szabo et al., 2019).

	Strongly disagree (1)	Disagree (2)	Slightly Disagree (3)	Slightly Agree (4)	Agree (5)	Strongly Agree (6)
Exercise is the most important thing in my life.	○	○	○	○	○	○
Conflicts have arisen between me and my family and/or my partner about the amount of exercise I do.	○	○	○	○	○	○
I use exercise as a way of changing my mood (e.g. to get a buzz, to escape etc.).	○	○	○	○	○	○
Over time I have increased the amount of exercise I do in a day.	○	○	○	○	○	○
If I have to miss an exercise session, I feel moody and irritable.	○	○	○	○	○	○
If I cut down the amount of exercise I do, and then start again, I always end up exercising as often as I did before.	○	○	○	○	○	○