ORIGINAL PAPERS

Self-Administration of Exercise and Dietary Supplements in Deployed British Military Personnel During Operation TELIC 13

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Abstract

Objectives: Recent operational experience has led to the identification of several potentially serious adverse events related to the use of dietary and exercise supplements among British Army personnel. This study aimed to establish the point prevalence of dietary and exercise supplement usage in British soldiers on Op TELIC during January 2009.
Methods: A cross-sectional questionnaire-based study of British military personnel located at the Contingency Operating Base (COB), in Basra, was performed during the sixth week of Op TELIC 13.
Results: From 1544 questionnaires (target population) issued, a total of 1017 (65.9%) completed questionnaires were evaluated. The mean population age was 29.5 years (range 18-58) of which 87.4% were male. 417/1017 persons (41.0%) admitted to a history of supplement use of which 32.0% were current users and 9.4% were previous users. Of these current users, 66.0% started taking them on their current deployment. The most commonly taken supplements were whey protein (18.8%), amino acids (17.9%), and creatine (13.2%). There were 14 persons (1.4%) who admitted to current use of anabolic steroids. The most-frequently given reasons for taking supplements were either to 'increase muscle bulk' (40.4%) or to aid training and recovery (20.8%).
Conclusions: This is the first study to investigate the use of exogenous nutritional supplements within the British Military and has identified their widespread use during operational deployment. The use of anabolic steroids is particularly worrying, given both their illegality and their well-recognised and deleterious health effects. There is a need for greater awareness and education regarding potential benefits and dangers of supplement use in order to maximise any potential benefits and minimise clinical risk.

Introduction

Clinical experience during Op TELIC 13 suggested that several hospital admissions may have been precipitated by the use of exercise and dietary supplements. These cases included a 32-year old male civilian (former soldier) who sustained an anterior ST elevation myocardial infarction whilst in Iraq. His only apparent risk factor was recent use of anabolic steroids. Additional cases included a soldier presenting with an acute psychosis secondary to a significant excess of simultaneous caffeine and exogenous stimulants and a case of severe constipation, precipitated by the consumption of excessive whey protein[1]. It was unknown whether these were merely isolated cases or whether they were representative of a much greater clinical issue and the widespread use of potentially dangerous supplements amongst British military personnel.

The promotion and sale of exercise and nutritional supplements to potentially improve exercise performance, muscular definition and/or increase fat metabolism is considerable, despite a lack of robust clinical data to support the efficacy of a number of agents[2]. The sale of creatine supplements alone in the USA during 2004 was worth over 400 million dollars[3]. Whilst many of the available products are harmless, several have the potential to cause significant morbidity and indeed potential mortality. In particular, anabolic steroid use is particularly dangerous and would result in a "fail" under the British army compulsory drug testing programme[4]. Similarly, ephedrine, previously present in many supplements, was banned due to its association with a number of adverse effects including acute myocardial infarction, exertional heatstroke, rhabdomyolysis and seizures[5]. Further, excessive testosterone supplementation has been linked to azoospermia, prostatic hypertrophy, dyslipidaemia and abnormalities in haematocrit and liver function[6].

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A recent study of deployed US military personnel revealed that as many as 60% were augmenting their diets with supplements intended to in some way improve the response to exercise[7]. A literature search conducted up to January 2009 found no reported data in British military personnel. Therefore, a questionnaire-based survey was carried out in order to establish the point prevalence of nutritional supplement use in a large sample of British military personnel on Op TELIC 13. In addition information regarding the type of substances taken, the reasons for their use and their side effect profile was collected.

Methods

Population and Patients

Data collection used an anonymous cross sectional designed questionnaire which had previously been satisfactorily piloted (Figure 1). Subjects were asked to report if they had ever taken any "dietary/exercise supplements". Variables recorded included baseline demographics, smoking history, caffeine consumption, exercise intensity and the use of any supplement(s) intended to enhance performance or response to physical training. Details regarding the type of supplement consumed and the frequency of consumption were recorded. In addition the reason for taking the supplement and any apparent side-effects were documented

This study aimed to target all British Military Personnel based at the Contingency Operating Base (COB) in Basra. Questionnaires were distributed to all British Military personnel attending for their mid-day meal at all three dining facilities at the COB during the sixth week of Op Telic 13

Completed questionnaires were collected at the exits of the dining facilities.

Ethics

As previously utilised on operational deployments[8] an investigational review board consisting of a total of eight clinicians and non-clinicians was convened and approved the final study protocol.

Use of Dietary and Exercise Supplements in the British Military

This questionnaire is anonymous and is being conducted for health research only

1. Age	yrs	2. Sex	Male ☐	Female ☐
3. Month of arrival in theatre	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	4. Status	Regular ☐	Reservist ☐
5. Rank	Officer ☐	Senior NCO ☐	Junior NCO ☐	Other Ranks ☐
EXERCISE SUPPLEMENTS				
6. How many sessions in an average week do you exercise?				
7. Have you ever taken any dietary / exercise supplements (eg creatine, caffeine, stimulants)?				
Yes ☐ (please proceed to Question 8)		No ☐ (please proceed to Question 13)		
8. If YES to Q.7, do you currently take any supplement/s?	Yes ☐	No ☐		
9. Which supplement(s) do you use?				
10. How long have you been taking supplements?				
11. Where did you get your supplements from? (e.g. online, on COB, in transit)				
12. Why did you start to take supplements?				
OTHER FACTORS				
13. What is your smoking status?	Current ☐	Ex Smoker ☐	Never smoked ☐	
14. How many cups of the following caffeinated drinks do you consume in the average day?				
Coffee	Tea	Cola drinks	Red Bull®	
Other(s)				
ASSOCIATED SYMPTOMS				
15. Which of the following symptoms have you experienced with any substance on this questionnaire?				
None ☐	Double vision ☐	Racing Heart ☐	Sleeplessness ☐	
Anxiety ☐	Flushing ☐	Low mood ☐	Other(s)	
Additional comments:				

Figure 1. *Supplement Questionnaire*

Statistical Analysis

Data were analysed using GraphPad InStat version 3.05 (GraphPad Software, San Diego California USA, www.graphpad.com). The Komolgrov-Smirov test was used to assess for normality on all continuous variables. Data are presented as the mean ± standard deviation for normally distributed variables and as median ± inter quartile range or range for non-parametric data. An unpaired t test and Mann-Whitney was used for unpaired two group comparisons of parametric and non-parametric data respectively with the Fisher's exact test used for categorical comparisons A p value < 0.05 was considered statistically significant for all comparisons.

Results

Study Population

From a target population of 1544 persons, 1017 (65.9%) accurately filled in questionnaires were used for analysis. The baseline demographics are shown in Table 1. The mean population age was 29.5 (7.3) years (range 18-58) of which 87.4% were male. 47.0% had a smoking history and 27.4 % were current smokers. The median number of caffeinated drinks consumed per day was 4.0 (range 0-30) and the weekly number of exercise sessions undertaken was 5.0 (range 0-21).

	Number	%
Age (mean, SD)	29.5 (7.3)	
Age range	18-58	
Sex		
-Males	889	87.4%
-females	128	12.6%
Status		
-Reservists	26	2.6%
-Regular	991	97.4%
Smoking history		
-Current	278	27.4%
-Ex	199	19.6%
-Never	537	53.0%
Rank		
-Other	247	24.3%
-JNCO	355	34.9%
-SNCO	218	21.5%
-Officer	196	19.3%
Supplement use		
-current	325	32.0%
-previous	96	9.4%
-never	596	58.6%
Caffeine Intake(number of drinks per day)		
0	114	11.2%
1-5	524	51.5%
6-10	310	30.5%
11-15	51	5.0%
16-20	13	1.3%
>20	5	0.5%
Exercise sessions/week		
0-3	222	22.0%
4-6	616	61.1%
7-10	148	14.6%
>10	23	2.3%

SD, standard deviation; JNCO, junior non-commissioned officer; SNCO, senior non-commissioned officer

Table 1. *Population study demographics*

Use of Supplements

From the inclusion cohort of 1017 persons, 421 personnel (41.4%) admitted to having taken dietary and exercise supplements at some stage, with 325 (32.0%) admitting to their current use. Of these current users, 66.0% admitted to having commenced them on their current deployment. The median duration of supplement use was 3.0 (IQR: 1-12) months. The most commonly taken supplements were whey protein (18.8%), amino acids (17.9%), and creatine (13.2%), with 14 persons (1.4%) admitting to anabolic steroid use with 12 persons admitting to actively using them (Table 2) whilst on active deployment. Among supplement users, the mean number of differing supplements consumed was 1.6 (0.7; range 1-5). The main sources of supplement supply were from local purchase at the COB in Basra (43.2%), via the PX (Iraq and Kuwait), local UK and Germany purchase (13.8%) and online (10.8%).

Supplement	Percentage (number)
Whey protein	18.8 % (191)
Amino acids	17.9% (182)
Creatine	13.2% (134)
Chromium polynicotinate	9.9% (101)
Caffeine	4.1% (42)
Multivitamins	2.0% (20)
Testosterone boosters	1.6% (16)
Anabolic steroids	1.4% (14)
Vasodilators	1.0% (10)
Synephrine	0.9% (9)
Ephedrine	0.1 % (1)
Unclassified	0.8% (8)

Table 2. *Summary of the most commonly used supplements*

Factors influencing Supplement Use

The most commonly declared reasons for supplements use were to increase muscle bulk / strength (40.4%) and to improve fitness / training (20.8%) (Table 3). Supplement use was significantly higher amongst non commissioned officer ranks (privates, JNCOs and SNCOs) compared with Officers (relative risk 1.13; 95% CI 1.05 to 1.21: p=0.001) and amongst lower ranks and JNCOs compared with SNCOs and officers (RR1.16; 96% CI 1.05 to 1.3: p=0.004). Individuals who were currently taking regular supplements, compared with non users, were younger (27.4 [6.3] vs 30.5 [7.5] years; p<0.0001), exercised more frequently ((6 [5-7] vs 5.0 [3-6] vs sessions per week; p<0.0001) and drank less caffeine (4.0 [2.0-6.0] vs 5.0 [2.0-7.0]; p=0.003). There was a non-significant trend to greater supplement use amongst men compared with women (relative risk 1.05; p=0.057). There was no relationship between supplement use to either smoking status and/or whether persons were regular or reservists. Users of anabolic steroids were significantly younger, compared with non users, (24.4 [6.4] years vs 25.6 [7.3]; p=0.002) and were all male. Persons currently taking anabolic steroids exercised (non significant trend) more regularly (6.3 [2.2] vs 5.0 [2.3] exercise sessions per week; p=0.07) However, there were no other identifiable factors that predicted their use.

Reason for taking supplement	Percentage
Increase muscle bulk / strength	40.4%
Increased fitness and training	20.8%
Weight loss	12.5%
Aid post exercise recovery	10.9%
Tone up / look good	3.5%
General heath and nutrition	5.4%
Pan relief / reduce aches	1.6%
Peer pressure	1.0%
Other	2.2%

Table 3. *Reasons for taking supplements*

Side Effects

20% of persons with a history of supplement use reported adverse effects. The most common side effects were insomnia (26.3%), mood changes (25.6%, predominantly depression), palpitations (17.5%) and anxiety (10.6%) (Table 4).

Symptom	No. of times reported
Insomnia	26.3%
Mood changes	25.6%
Palpitations	17.5%
Anxiety	10.6%
Flushing	6.3%
Double vision	4.3%
Increased libido	2.5%
Gastrointestinal symptoms	2.5%
Other	4.3%

Table 4. *Adverse effects relating to supplement uses*

Discussion

This is the first study to investigate the use of dietary and exercise supplements in the British Military. It has shown that a significant proportion of deployed British military personnel either take, or have taken, dietary or exercise supplements, with the majority commencing them on or just prior to deployment. The point prevalence of supplement consumption (32.0%) is somewhat less than the 60% reported in a recent study of US military personnel[7].

There was relatively high use of chromium polynicotinate-based products ("Hydroxycut"). Hydroxycut, a supplement that alleges it can enhance weight-loss, has previously been associated with rhabdomyolysis including a case in the US military[9-11]. It has also been implicated in seizures12 and hepatic failure[13], including the case of a soldier in Iraq[14]. Hydroxycut originally contained ephedrine but fortunately this ingredient has subsequently been banned. However, even ephedrine-free hydroxycut has recently been reported with adverse effects including hypertensive retinopathy[15] and the US Food and Drug Administration (FDA) very recently (May 1st 2009) ordered the withdrawal of 14 Hydroxycut products secondary to 23 reports of liver problems, including one fatal case (source: www.fda.gov)[16].

The active use of anabolic steroids on deployment in 12 subjects (1 in 85 persons) is of grave concern. They are Class C drugs and would not only result in a failed random CDT (compulsory drug test) but are also linked to a large number of deleterious side-effects including psychological disturbance, tendon rupture, hypertension, atherosclerosis, cardiomyopathy, impaired glucose tolerance and frank diabetes mellitus[4]. Indeed, steroid use was the only identifiable risk factor in the MI suffered by the 32 year-old ex-soldier mentioned in the introduction. Apart from the fact that steroid users tended to be younger and exercise more regularly no further definite statistical inferences could be made which might have related to the relatively small, yet clinically important, sample size of this group.

Although the use of androgenic (testosterone) based oral supplements (taken by 16 [1.6%] subjects) may improve strength by 5-20% and possibly increase lean body mass by 2-5 kg[6] these effects are likely to be short-lived as the body's own production of gonadotrophs (and therefore endogenous testosterone) will reduce to compensate for the exogenous testosterone. In addition, there is no reduction in fat mass or improvement in endurance performance. A prolonged period (months) of reduced endogenous testosterone production will result following drug withdrawal with associated reductions in sperm production that may affect fertility and testicular atrophy (as reported by one subject).

Ephedrine-based products have now largely been banned, due to a number of published serious adverse effects[5]. However, even 'ephedra-free' stimulants such as synephrine and xenadrine and caffeine-based products are also prone to cause side-effects[1,17]. It is well recognised that caffeine is the most widely used stimulant worldwide and can lead to a number of unwanted side effects when used in excess including tachycardia, insomnia, anxiety and psychosis[18]. Caffeine consumption was also recorded and its use appears excessive with 37.3% subjects drinking in excess of 6 caffeinated drinks per day. Furthermore, this survey preceded the widespread introduction, among US Soldiers, of two free carbonated soft drinks per soldier per meal which creates the capacity for even greater caffeine consumption (eg in Coca-Cola®).

Fortunately, the commoner supplements used may be less potentially harmful. Whey protein, a dairy extract, was the most popular supplement consumed in our survey. It is generally taken during and after resistance training to allegedly improve recovery of muscle force-generating capacity[19] and muscle protein synthesis[20]. However, comparisons have only been made versus placebo rather than dietary protein. It is a relatively benign supplement, although the main side effect of constipation did result in hospital admission for one subject during Op TELIC.

Substances such as amino acids and creatine (the second and third most popular supplements respectively) have generally been found to be safe. In particular creatine has not been associated with any significant deleterious effects in renal, hepatic, cardiac or muscle function[21]. There is little data, however, regarding long-term effects. Whilst there has been previously published evidence to suggest that creatine may result in muscle cramps and dehydration, more recent randomized data has shown no evidence to support this or an association with heat injury[7]. In fact, creatine supplements, in general, appear to have only minor or negligible effects on renal function in the majority[22,23] and may even offer some benefits during exercise[24]. Furthermore, there is some evidence, from one study, to suggest that its combination with carbohydrate supplements may increase body mass of 5.4% although there were no differences reported compared to carbohydrate and protein supplement in fat-free mass, muscle fibre area, and isokinetic strength (the features likely to be of interest to the military personnel taking them)[25]. Other studies have however suggested an increase in muscle hypertrophy and strength with creatine based supplements, particularly when taken in combination with additional protein and carbohydrate during resistance training programmes[26].

Many (40.4%) subjects were taking supplements in the belief that it would increase muscle bulk, despite a lack of evidence to support this. It is perhaps not surprising that misinformation is rife in relation to the benefits of supplements: the American International Society of Sports Nutrition position statement states that "during intense exercise, regular consumption of carbohydrate/electrolyte solution delivering 6 – 8% carbohydrate (6 – 8 g/100 ml fluid) should be consumed every 15– 20 min to sustain blood glucose levels"[27]. Of course, in any reasonably nourished individual this process is regulated perfectly adequately by the pancreas, liver and skeletal muscle.

This study has identified that the self administration of dietary and exercise supplements is widespread amongst deployed military personnel. Supplement users tended to be younger with two thirds commencing them as part of their deployment. Furthermore, given their identified potential deleterious effects, if not used appropriately, there is a need to incorporate a section specifically on nutritional supplements in our existing educational packages (particularly pre deployment) within the Services. Smoking related education should form part of this package as despite prohibitive smoking legislation and previous publication on the subject[28] smoking rates (27.4%) among deployed personnel remains unacceptably high. It is also timely to remember that direct enquiry about supplement use should be part of every routine medical

history. "Op MASSIVE," as physical training with supplements is colloquially known, may be a worthwhile aspect of operational tours. However, moderation and the avoidance of potentially harmful, or just plain unnecessary, supplements should be advocated.

Study limitations

As questionnaire completion was done in the dining facility some personnel, who were based at the COB, may have been on patrol, during the meal when the questionnaire was performed, and would not have been recruited. It is quite likely that our findings represent an under-estimate of supplement use because such subjects are possibly more likely to skip meals. We cannot discount the fact that the real number of active supplement users is likely to have been higher rather than lower. This is particularly true of banned or dangerous substances and is supported by data from a recent clinical study comparing urine toxicology versus actual questionnaire reported answers. The reasons for this under reporting in questionnaire based surveys may in part relate to fears of retaliation and the potential negative impact on the soldier's career[29]. Furthermore, this study applies to deployed personnel only and it is unknown what proportion of persons who commenced supplement use on deployment would have stopped them post deployment.

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