Use of dietary supplements among active-duty US Army soldiers[1–4]

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ABSTRACT

Background: US Army soldiers engage in strenuous activities and must maintain fitness and body weight to retain their jobs. Anecdotal reports suggest that the use of dietary supplements (DSs) by soldiers may reflect their unique occupational requirements and the complexity of their job and family responsibilities.

Objective: We assessed the use of DSs by soldiers.

Design: We conducted a survey of 990 randomly selected soldiers at 11 army bases globally. Data were weighted by age, sex, rank, and Special Forces status to represent the active-duty army.

Results: Overall, 53% of soldiers reported the use of DSs ≥1 time/wk; 23% of soldiers used sports beverages, 6% of soldiers used sports bars or gels, and 3% of soldiers reported the use of meal-replacement beverages. Most commonly used DSs were multivitamins or multiminerals (37.5%), protein and amino acids (18.7%), individual vitamins and minerals (17.9%), combination products (9.1%), and herbal supplements (8.3%). Many soldiers reported the use of performance-enhancement and weight-reduction products, and 22% of soldiers consumed ≥3 different DSs/wk. Logistic regression modeling indicated that older age, educational attainment, higher body mass index, and strength training were associated with DS use ($P < 0.05$). Reported reasons for DS use were to improve health (64%), provide more energy (31%), increase muscle strength (25%), and enhance performance (17%). Among DS users, mean monthly expenditures on DSs were $38, whereas 23% of soldiers spent >$50/mo.

Conclusions: Soldiers, like civilians, use large amounts of DSs, often in combination. Soldiers use more DSs purported to enhance performance than civilians use when matched for key demographic factors. These differences may reflect the unique occupational demands and stressors of military service. *Am J Clin Nutr* 2010; 92:985–95.

INTRODUCTION

More than one-half of the US adult civilian population use dietary supplements (DSs) regularly, including products such as sport drinks, bars, and gels and meal-replacement beverages (1). However, the medical and scientific communities have vastly divergent opinions regarding the risks and benefits of DSs, and attempts to reach a consensus have yielded differing recommendations (2, 3). Despite the conflicting information available to consumers from health care providers, other experts, the popular press, and advertising, including the Internet, ≈$25 billion was spent on DSs in the US in 2008, and sales continue to increase (4).

Substantial information is available on DS use in the general population through nationally representative surveys, but less information is available on specific occupational groups (1, 5, 6). The information available on population subgroups suggests that those with certain conditions, such as breast or prostate cancer, use more DSs than healthy individuals from the same demographic strata (7–11). The prevalence of DS use is also higher among individuals who engage in greater amounts of physical activity and other healthy behaviors and lower in individuals engaged in unhealthy behaviors such as smoking (1, 9, 12, 13).

Certain groups, such as soldiers, may have patterns of DS use that differ from the general population. In particular, US Army soldiers have unique occupational requirements associated with their chosen profession. Physical fitness and weight status are regularly assessed in all soldiers, and the failure to meet army standards can lead to adverse career actions and, eventually, dismissal. Some manufacturers market DSs and related products that they claim enhance physical performance and aid weight loss. To the extent that soldiers believe DSs and related products can assist them in meeting their unique occupational requirements, they may be more likely to use performance-enhancing DSs and weight-loss supplements and willing to commit substantial personal financial resources to potentially achieve career-related objectives.

The use of certain, but not all, DSs by soldiers is of concern because adverse health events that result from use of a DS or a combination of DSs may be exacerbated by the stressors that soldiers experience and include sustained and extensive physical demands, environmental stress, sleep loss, and repeated deployment to combat theaters. For example, even during training exercises that simulate combat conditions, soldiers are exposed to high heat or cold, sometimes receive inadequate food and fluid, and rarely have the opportunity to get sufficient sleep (14–16). A recent report by the US Government Accountability Office noted that 948 reports of various types of health problems associated with the use of DSs were reported to the US Food and Drug

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TABLE 1
Weighted population estimate and prevalence of reported use ≥1 time/wk over the 6 mo before the survey of any dietary supplement (DS), sports drink, sports bar or gel, and meal-replacement beverage among US Army active-duty personnel and the amount and prevalence of money spent on DSs by demographic and lifestyle characteristics defined in the Dietary Supplement and Caffeine Intake Survey of US Army Active-Duty Personnel[1]

Characteristic	Sample	Estimate of total army personnel[2]	Any DS[3]	Any sports drink[4]	Any sports bar or gel[5]	Any meal-replacement beverage[6]	Dollar amount spent on DSs in past 3 mo	≥$50 spent on DSs/mo
	n	*n*	% ± *SE*	% ± *SE*	% ± *SE*	% ± *SE*	$\bar{x}$ ± *SE*	% ± *SE*
Total	990	504,422	53.2 ± 1.59	23.4 ± 1.35	5.7 ± 0.74	3.4 ± 0.58	38 ± 3	23.3 ± 1.34
Sex	—	—	—	—	—	—	—	**
M	859	437,734	52.6 ± 1.69	23.2 ± 1.43	6.0 ± 0.80	3.3 ± 0.60	38 ± 3	24.9 ± 1.46
F	131	66,688	57.3 ± 4.65	24.4 ± 4.04	3.9 ± 1.83	4.3 ± 1.90	36 ± 10	12.3 ± 3.09
Age	—	—	**	—	—	—	—	*
18–24 y	406	206,957	41.4 ± 2.49	23.3 ± 2.14	5.5 ± 1.15	2.1 ± 0.72	30 ± 4	20.0 ± 2.02
25–29 y	213	108,590	57.3 ± 3.48	28.0 ± 3.16	5.8 ± 1.65	4.8 ± 1.51	41 ± 6	27.1 ± 3.13
30–39 y	259	132,068	64.0 ± 3.14	20.4 ± 2.64	4.9 ± 1.41	5.4 ± 1.48	47 ± 7	26.6 ± 2.90
≥40 y	112	56,807	63.4 ± 3.83	21.5 ± 3.27	8.1 ± 2.17	1.2 ± 0.86	39 ± 9	19.9 ± 3.18
Education	—	—	**	*	**	**	—	—
Some high school/high school	339	172,800	40.7 ± 2.72	18.4 ± 2.15	3.1 ± 0.96	1.2 ± 0.62	32 ± 4	22.5 ± 2.32
Some college or associate degree	428	218,068	55.5 ± 2.29	25.5 ± 2.00	5.7 ± 1.07	3.4 ± 0.83	41 ± 5	23.5 ± 1.95
Bachelor or graduate degree	223	113,554	68.0 ± 3.40	26.9 ± 3.23	9.7 ± 2.16	6.8 ± 1.84	41 ± 7	24.0 ± 3.11
Marital status	—	—	—	—	—	—	—	—
Single or not married (widowed or divorced)	428	222,053	53.0 ± 2.42	22.9 ± 2.04	5.8 ± 1.14	2.6 ± 0.77	41 ± 4	24.6 ± 2.09
Married	550	280,947	53.4 ± 2.11	23.6 ± 1.79	5.6 ± 0.97	3.8 ± 0.81	35 ± 4	22.3 ± 1.76
Rank	—	—	**	—	—	*	***	**
Enlisted E1–4	442	225,063	43.0 ± 2.34	23.0 ± 1.98	5.2 ± 1.05	1.8 ± 0.63	31 ± 4	20.9 ± 1.92
Enlisted E5–9	385	196,174	59.0 ± 2.54	22.6 ± 2.16	5.1 ± 1.13	3.8 ± 0.99	47 ± 6	26.1 ± 2.26
Warrant Officer	27	13,733	57.4 ± 4.97	15.4 ± 3.62	4.8 ± 2.14	4.1 ± 1.99	19 ± 4	15.0 ± 3.59
Officer	136	69,452	69.1 ± 5.91	28.6 ± 5.78	9.3 ± 3.73	7.5 ± 3.38	37 ± 9	24.6 ± 5.51
Member of Special Forces	—	—	*	—	—	—	—	—
No	973	495,595	52.8 ± 1.68	23.2 ± 1.42	5.7 ± 0.78	3.3 ± 0.60	37 ± 3	23.0 ± 1.42
Yes	17	8,827	77.1 ± 4.06	32.4 ± 4.53	7.2 ± 2.51	9.8 ± 2.88	63 ± 9	37.8 ± 4.69
Occupation[7]	—	—	—	—	—	—	—	*
Combat arms	333	169,371	54.6 ± 2.64	20.9 ± 2.16	7.1 ± 1.36	3.4 ± 0.96	40 ± 5	24.6 ± 2.28
Combat support	300	152,974	51.5 ± 2.85	22.8 ± 2.39	6.1 ± 1.37	3.9 ± 1.10	37 ± 5	25.9 ± 2.50
Combat service support	348	177,278	54.0 ± 2.81	26.8 ± 2.50	4.2 ± 1.13	3.1 ± 0.98	37 ± 5	19.9 ± 2.25
BMI[8]	—	—	**	—	—	—	*	—
18.5–24.9 kg/m^2	351	184,209	43.3 ± 2.69	22.6 ± 2.27	6.2 ± 1.31	2.7 ± 0.87	31 ± 4	19.5 ± 2.15
25–29.9 kg/m^2	488	248,448	56.8 ± 2.21	25.6 ± 1.95	6.4 ± 1.10	3.0 ± 0.76	36 ± 4	24.2 ± 1.91
≥30 kg/m^2	134	68,206	62.9 ± 4.22	19.4 ± 3.45	2.5 ± 1.36	5.7 ± 2.03	53 ± 10	27.7 ± 3.91
Tobacco use	—	—	**	—	—	—	—	—
Current	429	218,429	46.9 ± 2.43	21.5 ± 2.00	5.8 ± 1.14	2.7 ± 0.79	43 ± 5	24.3 ± 2.09
Former	177	90,380	58.3 ± 3.72	25.9 ± 3.30	7.5 ± 1.98	5.3 ± 1.68	28 ± 4	19.2 ± 2.97
Never	379	192,940	58.0 ± 2.52	24.2 ± 2.19	4.8 ± 1.09	3.0 ± 0.87	37 ± 4	24.3 ± 2.19
Mean aerobic exercise duration[9]	—	—	—	*	**	*	—	***
0–60 min/wk	69	35,248	47.9 ± 6.20	15.1 ± 4.44	7.7 ± 3.31	1.8 ± 1.67	22 ± 8	12.3 ± 4.08
61–314 min/wk	404	205,989	52.5 ± 2.45	22.1 ± 2.04	2.5 ± 0.76	1.9 ± 0.66	35 ± 5	21.0 ± 2.00
315–464 min/wk	262	133,639	52.2 ± 3.13	21.2 ± 2.56	8.0 ± 1.70	6.1 ± 1.50	36 ± 6	20.4 ± 2.53
≥465 min/wk	247	125,794	56.6 ± 3.19	30.6 ± 2.97	8.0 ± 1.75	3.5 ± 1.19	49 ± 5	33.0 ± 3.03

(Continued)

TABLE 1 (*Continued*)

Characteristic	Sample	Estimate of total army personnel[2]	Any DS[3]	Any sports drink[4]	Any sports bar or gel[5]	Any meal-replacement beverage[6]	Dollar amount spent on DSs in past 3 mo	≥$50 spent on DSs/mo
	n	*n*	% ± *SE*	% ± *SE*	% ± *SE*	% ± *SE*	$\bar{x}$ ± *SE*	% ± *SE*
Participate in strength training each week[10]	—	—	***	—	**	—	**	***
No	278	141,379	33.9 ± 2.99	18.5 ± 2.45	0.9 ± 0.59	2.0 ± 0.89	26 ± 7	10.5 ± 1.93
Yes	706	359,433	60.7 ± 1.81	25.5 ± 1.61	7.6 ± 0.98	4.0 ± 0.73	42 ± 3	28.4 ± 1.67

[1] Wald chi-square tests were used to assess significant differences among multiple characteristic levels; *t* tests were used to assess significant differences among bivariate characteristics: $*P < 0.05$, $**P < 0.01$, $***P < 0.001$.

[2] Study sample was weighted by sex, age, and rank to represent the full army composition as of January 2007.

[3] Included all DSs defined by the Dietary Supplement Health and Education Act of 1994 (20) legislation that were reported as used ≥1 time/wk over the past 6 mo before the survey. This category excluded sports drinks, sports bars or gels, and meal-replacement beverages.

[4] Included persons who responded that they drank sports drinks ≥1 time/wk over the 6 mo before the survey as identified in the survey question or self-named and validated as sports drinks by the research team.

[5] Included persons who responded that they used sports bars, sports jelly beans, or sports gels ≥1 time/wk over the 6 mo before the survey as identified in the survey question or self-named and validated by the research team.

[6] Included persons who responded that they used meal replacement drinks ≥1 time/wk over the 6 mo before the survey as identified in the survey question or self-named and validated as meal replacement beverages by the research team.

[7] Self-reported area of assignment at the time of the survey as follows: combat arms (Infantry, Armor, Field Artillery, Air Defense, and Special Forces), combat support (Engineer, Chemical, Military Intelligence, Military Police, Signal, Aviation, and Civil Affairs), and combat service support (Ordnance, Quartermaster, Transportation, Adjutant, Medical, Finance, Chaplain, Judge Advocate General, and Inspector General).

[8] Calculated from self-reported height and weight.

[9] Included the percentage of individuals who reported nonstop running, cycling, stair climbing, swimming, and road marching either within their army unit or on their own time each week for the following duration ranges: low (0–314 min), moderate (315–464 min), and high (≥465 min).

[10] Included the percentage of individuals who reported lifting weights or other forms of strength-condition exercise within their army unit or on their own time each week.

Administration (FDA) in the first 10 mo of 2008 (17). However, most adverse events associated with DS use are unreported, as the FDA estimates that >50,000 minor and serious health problems related to DS use occur in the US each year (17).

Active-duty military personnel are not usually included in US government-based national health-surveillance studies, and as a result, limited data exists on the use of DSs and the adverse events associated with the use of DSs among these individuals. Army soldiers are a large, diverse, and unique population. Severe adverse events associated with the use of DSs have been reported in military populations (18, 19). The purpose of this survey was to assess use of DSs, sports drinks, bars, gels, and meal-replacement beverages, the reasons for their use, and DS expenditures among active-duty army personnel. In addition, we compared army DS use with the DS use of the general population.

SUBJECTS AND METHODS

Sample population

The final sample included 990 respondents from 11 locations that included 9 US installations and 2 overseas sites. The eligible population included all active-duty US Army personnel (ie, 504,422 individuals as of 1 January 2007) (**Table 1**). Survey sites were selected on the basis of the distribution of the soldier population and their availability. Several of the sites were installations that included army training schools. We sampled at these schools because they attract a diverse array of soldier ranks and job descriptions. Individuals who were on temporary or transitional status, including individuals who were absent without leave, incarcerated, or moving between permanent duty stations were excluded. We did not survey soldiers enrolled in Basic Combat Training or Advanced Individual Training because they were prohibited from consuming DSs. The estimated response rate of individuals that were attempted to be recruited was 80%. Users and nonusers of DSs were included in the sample. The study was approved by the Institutional Review Board of the US Army Research Institute of Environmental Medicine (Natick, MA).

Variables

A total of 43 questions were included on the survey instrument, and of these questions, 15 questions directly addressed the use of DSs and closely related topics. The survey instrument included questions on types of DSs used, frequency of use, reason for use, and money spent on DSs. Ninety-two individual supplements were listed on the survey instrument (for a complete list of supplements, *see* supplemental Table 1 under "Supplemental data" in the online issue). Of these supplements, 55 supplements were general supplement types such as multivitamins, combination antioxidants, and specific vitamins and minerals, and 37 supplements were specific-named products. Supplement category definitions are provided in **Table 2**. Participants were instructed to write in supplements that they used that were not listed in the survey. We included specific DS products in the survey instrument on the basis of their current patterns of DS purchases at the Army Air Force Exchange System and General Nutrition Center stores located on or near army installations. Before data analysis, individual supplements and supplement types were grouped into the following categories: multivitamin and multiminerals, protein and amino acids, individual vitamins and minerals, combination products, botanical and herbal supplements, and purported steroid analogs (**Table 3**). Those DSs that could not be placed in another category were termed other. The survey instrument also queried the use of sports drinks, sports bars or gels, and meal-replacement beverages. These products are not classified as DSs by the Dietary Supplement Health and Education Act of 1994 [21 USC §401 (q)(5)] but are used by many soldiers (20).

The survey included questions on the frequency of DS use (never, 1 time/mo, 1 time/wk, >1 time/wk, and daily) for each

TABLE 2
Dietary supplement (DS) categories defined in the Dietary Supplement and Caffeine Intake Survey of US Army Active-Duty Personnel

Category	Definition
Dietary supplement	Any DS defined by DSHEA legislation[1]
Multivitamin	DSs that contained ≥2 vitamins and no additional supplement ingredients
Multimineral	DSs that contained ≥2 minerals and no additional supplement ingredients
Protein and amino acid	Amino acid mixtures, protein powders, and similar products where the intention was to provide a single or complex protein source (and did not include any additional supplement ingredients)
Individual vitamins or minerals	DSs that were single-nutrient ingredient supplements, such as calcium or vitamin D
Combination products	DSs with mixtures of ingredients from any of the above categories; included ≥2 categories and multiple ingredients
Herbal supplements	DSs that included one or more herbal ingredients with no nutrients or other supplement ingredients; also included plant-derived ingredients
Purported steroid analogs	Steroid hormones or herbal substitutes for hormones that were marketed as DSs and listed on the product label in the supplement facts panel
Sports drink	Sports drinks such as Gatorade[2] and Powerade[3]
Sports bar or gel	Sports bars, gels, and similar food products such as PowerBar[4], Tiger's Milk[5], PowerBar Gel[4], and Sport Beans[6]

[1] DSHEA, Dietary Supplement Health and Education Act of 1994 (20).
[2] Pepsico, Purchase, NY.
[3] The Coca-Cola Company, Atlanta, GA.
[4] Nestlé, Glendale, CA.
[5] Scniff Nutrition International, Salt Lake City, UT.
[6] Jelly Belly, Fairfield, CA.

TABLE 3
Prevalence of reported use of number and type of dietary supplements (DSs) ≥1 time/wk over the 6 mo before the survey by demographic and lifestyle characteristics among active-duty US Army personnel who used DSs as defined by the Dietary Supplement and Caffeine Intake Survey of US Army Active-Duty Personnel[1]

					DSs taken ≥1 time/wk						
	No. of supplements taken ≥1 time/wk										
Characteristic	Any DS[2]	1–2	3–4	≥5	Multivitamin or multimineral[3]	Protein and amino acids[4]	Individual vitamins or minerals[5]	Combination products[6]	Herbal[7]	Purported steroid analogs[8]	Other[9]
Total (n = 990)	53.2 ± 1.59	31.1 ± 1.47	9.9 ± 0.95	12.2 ± 1.04	37.5 ± 1.54	18.7 ± 1.24	17.9 ± 1.22	9.1 ± 0.92	8.3 ± 0.88	2.7 ± 0.51	11.7 ± 1.02
Sex	—	*	—	—	—	**	—	**	—	—	—
M (n = 859)	52.6 ± 1.69	29.8 ± 1.55	10.0 ± 1.01	12.8 ± 1.13	37.0 ± 1.63	20.2 ± 1.36	17.1 ± 1.27	10.1 ± 1.02	8.6 ± 0.95	3.1 ± 0.58	12.0 ± 1.10
F (n = 131)	57.3 ± 4.65	39.2 ± 4.59	9.2 ± 2.72	8.9 ± 2.67	40.6 ± 4.62	9.0 ± 2.69	23.2 ± 3.97	2.4 ± 1.45	6.4 ± 2.30	0.1 ± 0.36	9.8 ± 2.79
Age	**	***	***	—	***	***	—	—	—	—	—
18–24 y (n = 406)	41.4 ± 2.49	24.2 ± 2.16	4.8 ± 1.08	12.4 ± 1.67	23.7 ± 2.15	13.6 ± 1.73	17.2 ± 1.91	8.8 ± 1.43	6.2 ± 1.22	3.5 ± 0.93	9.5 ± 1.48
25–29 y (n = 213)	57.3 ± 3.48	29.9 ± 3.22	13.0 ± 2.37	14.4 ± 2.47	44.9 ± 3.50	21.3 ± 2.88	21.1 ± 2.87	7.9 ± 1.90	9.4 ± 2.06	1.7 ± 0.90	11.7 ± 2.27
30–39 y (n = 259)	64.0 ± 3.14	37.4 ± 3.17	13.0 ± 2.21	13.5 ± 2.24	50.8 ± 3.28	27.6 ± 2.93	15.2 ± 2.35	11.5 ± 2.09	9.2 ± 1.89	2.9 ± 1.11	15.0 ± 2.34
≥40 y (n = 112)	63.4 ± 3.83	43.8 ± 3.95	15.2 ± 2.85	4.5 ± 1.65	42.3 ± 3.93	11.4 ± 2.53	20.6 ± 3.22	6.9 ± 2.02	12.2 ± 2.60	1.0 ± 0.81	12.2 ± 2.61
Education	**	**	—	*	***	—	—	—	—	—	—
Some high school/high school (n = 339)	40.7 ± 2.72	19.9 ± 2.22	7.3 ± 1.44	13.5 ± 1.89	23.8 ± 2.36	16.2 ± 2.04	17.3 ± 2.10	8.3 ± 1.53	6.1 ± 1.33	3.9 ± 1.07	9.6 ± 1.64
Some college or associate degree (n = 428)	55.5 ± 2.29	31.3 ± 2.13	10.4 ± 1.40	13.8 ± 1.58	40.2 ± 2.25	19.2 ± 1.81	19.5 ± 1.82	10.1 ± 1.38	9.8 ± 1.37	2.7 ± 0.75	14.3 ± 1.61
Bachelor or graduate degree (n = 223)	68.0 ± 3.40	47.6 ± 3.64	12.9 ± 2.44	7.5 ± 1.92	53.0 ± 3.64	21.5 ± 2.99	15.8 ± 2.66	8.5 ± 2.03	8.9 ± 2.08	0.8 ± 0.64	9.8 ± 2.17
Rank	**	***	*	—	***	**	—	—	*	—	**
Enlisted E1–4 (n = 442)	43.0 ± 2.34	24.7 ± 2.04	6.7 ± 1.18	11.6 ± 1.51	26.6 ± 2.08	14.2 ± 1.65	17.3 ± 1.78	8.5 ± 1.31	6.4 ± 1.16	2.6 ± 0.75	8.7 ± 1.33
Enlisted E5–9 (n = 385)	59.0 ± 2.54	32.1 ± 2.41	12.3 ± 1.70	14.5 ± 1.82	43.4 ± 2.56	22.7 ± 2.16	18.7 ± 2.01	9.7 ± 1.52	11.5 ± 1.65	3.8 ± 0.99	16.5 ± 1.91
Warrant Officer (n = 27)	57.4 ± 4.97	37.9 ± 4.88	11.6 ± 3.22	7.9 ± 2.71	44.4 ± 4.99	14.7 ± 3.56	16.1 ± 3.70	7.9 ± 2.71	6.5 ± 2.48	0.7 ± 0.84	14.0 ± 3.49
Officer (n = 136)	69.1 ± 5.91	47.4 ± 6.39	13.0 ± 4.31	8.7 ± 3.61	54.7 ± 6.37	22.5 ± 5.35	18.0 ± 4.92	9.9 ± 3.82	5.9 ± 3.02	0.0 ± 0.00	7.5 ± 3.37
Member of Special Forces	*	—	*		*	**	—	—	—	—	—
No (n = 973)	52.8 ± 1.68	31.1 ± 1.56	9.6 ± 0.99	12.1 ± 1.10	37.0 ± 1.63	18.2 ± 1.30	17.8 ± 1.29	8.9 ± 0.96	8.3 ± 0.93	2.6 ± 0.54	11.5 ± 1.08
Yes (n = 17)	77.1 ± 4.06	31.7 ± 4.50	24.1 ± 4.13	21.3 ± 3.96	64.4 ± 4.63	47.0 ± 4.82	22.9 ± 4.06	18.8 ± 3.78	10.1 ± 2.91	5.5 ± 2.21	22.9 ± 4.06
Occupation[10]	—	—	—	—	—	**	—	—	—	*	—
Combat arms (n = 333)	54.6 ± 2.64	31.6 ± 2.46	8.7 ± 1.49	14.3 ± 1.86	39.7 ± 2.59	23.4 ± 2.24	17.7 ± 2.02	11.9 ± 1.72	7.0 ± 1.35	4.8 ± 1.13	11.0 ± 1.66
Combat support (n = 300)	51.5 ± 2.85	31.0 ± 2.64	9.5 ± 1.67	11.1 ± 1.79	34.8 ± 2.71	19.5 ± 2.26	17.6 ± 2.17	8.0 ± 1.55	10.0 ± 1.71	2.2 ± 0.84	10.6 ± 1.75
Combat service support (n = 348)	54.0 ± 2.81	31.1 ± 2.61	11.6 ± 1.81	11.2 ± 1.78	37.9 ± 2.74	14.0 ± 1.96	18.4 ± 2.19	7.6 ± 1.50	8.4 ± 1.57	1.1 ± 0.60	13.7 ± 1.94
Deployment status	—	*	—	—	*	—	—	—	—	—	—
In continental United States (n = 851)	54.2 ± 1.70	32.7 ± 1.60	9.6 ± 1.01	11.8 ± 1.10	39.1 ± 1.66	18.7 ± 1.33	18.0 ± 1.31	9.0 ± 0.98	8.3 ± 0.94	2.6 ± 0.55	11.5 ± 1.09
Outside continental United States (n = 70)	45.7 ± 6.23	17.3 ± 4.73	14.4 ± 4.39	13.9 ± 4.32	27.0 ± 5.55	11.6 ± 4.00	24.2 ± 5.35	11.3 ± 3.95	8.5 ± 3.48	4.1 ± 2.47	11.1 ± 3.93
Iraq (n = 70)	48.8 ± 6.40	25.1 ± 5.55	8.2 ± 3.51	15.5 ± 4.64	27.7 ± 5.73	25.6 ± 5.59	10.9 ± 3.98	8.1 ± 3.49	8.7 ± 3.62	2.0 ± 1.80	14.4 ± 4.50
BMI[11]	**	**	—	*	**	**	—	—	***	—	*
18.5–24.9 kg/m^2 (n = 351)	43.3 ± 2.69	23.1 ± 2.29	8.9 ± 1.55	11.3 ± 1.72	30.2 ± 2.49	13.8 ± 1.87	16.8 ± 2.03	7.7 ± 1.45	3.7 ± 1.02	3.3 ± 0.97	10.7 ± 1.68
25–29.9 kg/m^2 (n = 488)	56.8 ± 2.21	35.3 ± 2.14	10.6 ± 1.37	10.9 ± 1.39	39.7 ± 2.19	20.6 ± 1.81	19.2 ± 1.76	9.0 ± 1.28	10.7 ± 1.38	2.1 ± 0.64	10.7 ± 1.38
≥30 kg/m^2 (n = 134)	62.9 ± 4.22	32.7 ± 4.10	11.3 ± 2.76	18.9 ± 3.42	46.3 ± 4.36	23.9 ± 3.73	14.4 ± 3.07	12.8 ± 2.91	11.6 ± 2.80	2.5 ± 1.36	18.2 ± 3.37
Mean duration of aerobic exercise per week[12]	—	—	—	***	—	***	—	***	*	**	—

(Continued)

TABLE 3 (*Continued*)

Characteristic	No. of supplements taken ≥1 time/wk				DSs taken ≥1 time/wk						
	Any DS[2]	1–2	3–4	≥5	Multivitamin or multimineral[3]	Protein and amino acids[4]	Individual vitamins or minerals[5]	Combination products[6]	Herbal[7]	Purported steroid analogs[8]	Other[9]
0–60 min/wk (n = 69)	47.9 ± 6.20	34.3 ± 5.89	8.5 ± 3.46	5.2 ± 2.74	36.9 ± 5.98	8.7 ± 3.49	14.9 ± 4.41	1.8 ± 1.63	3.5 ± 2.29	0.0 ± 0.00	7.2 ± 3.20
61–314 min/wk (n = 404)	52.5 ± 2.45	33.7 ± 2.32	10.6 ± 1.51	8.1 ± 1.34	37.2 ± 2.37	14.9 ± 1.75	17.9 ± 1.88	6.3 ± 1.19	7.4 ± 1.29	1.0 ± 0.49	12.1 ± 1.60
315–464 min/wk (n = 262)	52.2 ± 3.13	31.4 ± 2.91	7.2 ± 1.62	13.6 ± 2.14	34.7 ± 2.98	19.5 ± 2.48	17.9 ± 2.40	8.8 ± 1.78	7.2 ± 1.61	2.5 ± 0.98	11.8 ± 2.02
≥465 min/wk (n = 247)	56.6 ± 3.19	25.1 ± 2.79	12.1 ± 2.10	19.4 ± 2.55	41.4 ± 3.17	27.4 ± 2.87	17.6 ± 2.45	16.3 ± 2.38	12.7 ± 2.15	6.4 ± 1.58	12.5 ± 2.13
Participate in strength training each week[13]	***	***	**	**	***	***	—	**	—	**	***
No (n = 278)	33.9 ± 2.99	20.9 ± 2.57	5.3 ± 1.42	7.6 ± 1.68	22.1 ± 2.62	3.8 ± 1.21	16.7 ± 2.35	3.7 ± 1.18	6.2 ± 1.52	0.3 ± 0.37	5.8 ± 1.48
Yes (n = 706)	60.7 ± 1.81	34.9 ± 1.77	11.8 ± 1.19	14.0 ± 1.29	43.7 ± 1.84	24.7 ± 1.60	18.0 ± 1.42	11.4 ± 1.18	9.3 ± 1.08	3.6 ± 0.69	14.1 ± 1.29

[1] All values are percentages ± SEs. The study sample was weighted by sex, age, and rank to represent the full army composition as of January 2007. Wald chi-square tests were used to assess significant differences among multiple characteristic levels; t tests were used to assess significant differences among bivariate characteristics: $^{*}P < 0.05$, $^{**}P < 0.01$, $^{***}P < 0.001$.

[2] Included all DSs defined by the Dietary Supplement Health and Education Act of 1994 (20) legislation that were reported as used ≥1 time/wk over the 6 mo before the survey. This category excluded any sports drinks, any sports bars or gels, and meal-replacement beverages.

[3] Included DSs that contained ≥2 minerals or vitamins and no additional supplement ingredients that were reported as used ≥1 time/wk over the 6 mo before the survey. This category did not include ingredients used in the manufacturing process as preservatives or colorants.

[4] Included, eg, amino acid mixes and protein powders for which the intention was to provide a single or complex protein source that was reported as used ≥1 time/wk over the 6 mo before the survey. These supplements did not include any additional supplement ingredients.

[5] Included DSs that were single-nutrient ingredient supplements such as calcium or vitamin D and reported as used ≥1 time/wk over the 6 mo before the survey.

[6] Included DSs with mixtures of ingredients from the categories above that were reported as used ≥1 time/wk over the 6 mo before the survey. Combination supplements included 2 or more categories and multiple ingredients.

[7] Included ≥1 herbal DS ingredient with no nutrients or other supplement ingredients and were reported as used ≥1 time/wk over the 6 mo before the survey. This category also included plant-derived ingredients such as citric acid.

[8] Included steroidal hormones or herbal substitutes for hormones that were marketed as DSs and included the supplements facts panel on the label and were reported as used ≥1 time/wk over the 6 mo before the survey.

[9] Included those products marketed as DSs that included the supplement facts panel on the label that did not meet the definitions for the other 6 DS categories and were reported as used ≥1 time/wk over the 6 mo before the survey. Examples included melatonin, lycopene, caffeine, α-lipoic acid, coenzyme Q10, and General Nutrition Center fish body oils (Nutra Manufacturing Inc, Greenville, SC).

[10] Self-reported area of assignment at the time of the survey as follows: combat arms (Infantry, Armor, Field Artillery, Air Defense, and Special Forces), combat support (Engineer, Chemical, Military Intelligence, Military Police, Signal, Aviation, and Civil Affairs), combat service support (Ordnance, Quartermaster, Transportation, Adjutant, Medical, Finance, Chaplain, Judge Advocate General, and Inspector General).

[11] Calculated from self-reported height and weight.

[12] Included the percentage of individuals who reported nonstop running, cycling, stair climbing, swimming, and road marching either within their army unit or on their own time each week for the following duration ranges: low (0–314 min), moderate (315–464 min), high (≥465 min).

[13] Included percentage of individuals who reported lifting weights or other forms of strength-condition exercise within their army unit or on their own time each week.

DS or other product consumed. The instrument included questions on the following reasons for use of each DS product: performance enhancement, general health, promoting energy, weight loss, increasing endurance, improving muscle strength, unsure, and other. The survey collected information on demographic and lifestyle factors that included sex, age, military rank, being a member of Special Forces, deployment status, education, military occupation, marital status, tobacco use, aerobic exercise duration, and strength-training participation. We calculated the body mass index (BMI; in kg/m^2) from survey of self-reported height and weight. A pilot survey was conducted a few weeks before distribution of the final survey at the US Army Research Institute of Environmental Medicine with 30 army soldiers to assess their comprehension of study questions and to determine the time required to complete the survey.

Survey administration

This survey, the Dietary Supplement and Caffeine Intake Survey of US Army Active-Duty Personnel, was conducted from September 2006 to November 2007. At each study site, a contact, typically a dietitian or other health care professional, administered the questionnaire. The contact arranged a time and place to distribute the survey through a unit commander or class leader. In most cases, the contact administered the survey in person in a classroom setting. The contact began the survey session by using a standard presentation that described the purpose and contents of the survey, its confidential and voluntary nature (no identifying data were collected), and procedures for completing multipart questions. Approximately 80% of soldiers who attended a briefing completed the survey. The contacts returned completed surveys to the project team who scanned and tabulated responses with ScanTools Plus with ScanFlex (version 6.301; Scantron Corporation, Eagan, MN), SPSS (version 15.0; SPSS Inc, Chicago, IL), and SAS (version 9.2; SAS Institute, Cary, NC) statistical software programs.

Sample weighting and statistics

Weighting

To partially account for the nonrepresentative nature of the sample compared with the overall army composition, we calculated sample weights on the basis of sex, age (<20, 21–29, 30–39, and ≥40 y), rank (Enlisted E1–4 and E5–9, Warrant Officer, and Officer), and Special Forces status (Special Forces enlisted or not Special Forces). The weights were based on demographic data obtained from the Defense Manpower Data Center (www.dmdc.osd.mil/) and the characteristics of survey respondents.

Statistics

We used SAS statistical software program (version 9.2; SAS Institute) for data analysis (21). We added weights for the overall calculations of DS use and for analyses on the basis of solider characteristics: age, rank, Special Forces status, education level, BMI, and use of tobacco. Weighted data were used for analyses of the use of specific types of DSs and related products, number and types of DSs taken, reasons for DS use, and expenditures on DSs. SEs were estimated by using a Taylor series linearization method that incorporated sampling weights by using the SAS procedures mean, *t* test, and logistic regression (version 9.2; SAS Institute). Wald chi-square tests were used to assess significant differences among multiple characteristic levels, and *t* tests were used to assess significant differences among bivariate characteristics. We used logistic regression models to examine relations between measures of DS use and the following soldier characteristics: sex, age, education, marital status, BMI, tobacco use, exercise, and strength training. Odds ratios were computed, and 95% CIs of the odds ratios from these models are presented.

RESULTS

Over 50% (53.2%) of soldiers reported using a DS, excluding sports drinks, sports bars or gels, and meal replacements, ≥1 time/wk for the 6 mo before the survey. Approximately 23% of soldiers used sports drinks, and only 6% and 3% of soldiers, respectively, reported using sports bars or gels and meal replacements (Table 1). Among soldiers who used DSs, the mean monthly expenditure on DSs was $38, and almost one-quarter (23.3%) of soldiers spent >$50/mo on DSs. Although there was no significant difference between male and female soldiers in the overall use of any DS, sports drinks, bars or gels, or replacement beverages, ≈25 ± 1.46% of men but only 12 ± 3.09% of women spent >$50/mo ($P < 0.01$). In general, the prevalence of DS use was higher among soldiers who were older, had attained a more advanced level of education, were officers (all $P < 0.01$), and were members of the Special Forces ($P < 0.05$). The prevalence of the use of sports drinks, sports bars or gels, and meal-replacement beverages was higher for soldiers who had attained a bachelor or graduate degree than for other army personnel (sports drinks: $P = 0.05$; sports bars or gels: $P < 0.01$; meal-replacement beverages: $P < 0.01$). Users of DSs had a higher BMI ($P < 0.01$), were less likely to use tobacco ($P < 0.01$), and were more likely to participate in strength training ≥1 time/wk ($P < 0.001$).

Overall, 31.1% of respondents reported taking 1–2 different supplements ≥1 time/wk, 9.9% of respondents reported taking 3–4 supplements/wk, and 12.2% of respondents reported taking ≥5 different supplements/wk in the 6 mo before the survey (Table 3). Younger soldiers were less likely to take ≥1–2 different supplements/wk than their older counterparts. Soldiers with a bachelor's degree were more likely to take 1–2 supplements/wk and less likely to use ≥5 supplements/wk. Higher-ranking soldiers reported taking fewer different DSs per week than did enlisted soldiers. Soldiers who reported taking a greater variety of DSs each week engaged in aerobic exercise for longer durations and weekly strength training (significantly higher for all reported amounts of different DSs per week (1–2, 3–4, and ≥5 DSs/wk: $P < 0.01$ or 0.001) (Table 3).

More soldiers reported taking multivitamins or multiminerals ≥1 time/wk (37.5%) than other DS types (Table 3). Protein and amino acids were consumed by 18.7% of the population; 17.9% of the population used individual vitamins or minerals, and 9.1% of the population reported taking combination products, such as Hydroxycut, Nitrotech, CellTech, and Xenadrine (Iovate Health Sciences, Inc, Oakville, Canada). Herbal supplements, such as garlic, were consumed by 8.3% of soldiers, and 2.7% of soldiers reported the use of purported steroid analogs (22). Approximately 12% (11.7%) of respondents reported using a DS type that was categorized as other. The most frequently used supplements in

TABLE 4
Association of number and type of dietary supplement (DS) use ≥1 time/wk over the past 6 mo by supplement ingredients and amount spent per month on DSs with selected demographic and lifestyle characteristics based on the Dietary Supplement and Caffeine Intake Survey of US Army Active-Duty Personnel[1]

	DSs taken ≥1 time/wk					
Characteristic	Any DS[2]	≥5	Multivitamin or multimineral[3]	Protein and amino acid[4]	Herbal[5]	≥$50 spent on DSs/mo
Sex						
M	1.0	1.0	1.0	1.0[a]	1.0	1.0[a]
F	1.52 (0.99, 2.32)	0.51 (0.24, 1.06)	1.36 (0.89, 2.09)	0.43 (0.22, 0.87)*[b]	0.96 (0.44, 2.09)	0.47 (0.26, 0.85)**[b]
Age						
18–24 y	0.58 (0.34, 1.00)*[b]	2.53 (0.86, 7.43)	0.67 (0.39, 1.15)	1.14 (0.52, 2.46)[a]	0.61 (0.25, 1.47)	0.83 (0.44, 1.59)
25–29 y	1.00 (0.58, 1.71)[a]	2.59 (0.90, 7.42)	1.53 (0.90, 2.60)	1.86 (0.88, 3.91)[a]	0.86 (0.38, 1.98)	1.32 (0.71, 2.46)
30–39 y	1.09 (0.66, 1.80)[a]	2.32 (0.84, 6.42)	1.53 (0.94, 2.48)	2.66 (1.34, 5.26)**[b]	0.73 (0.34, 1.55)	1.24 (0.70, 2.20)
≥40 y	1.0[a]	1.0	1.0	1.0[a]	1.0	1.0
Education						
Some high school/high school	1.0[a]	1.0[a]	1.0[a]	1.0	1.0	1.0
Some college or associate degree	1.39 (1.00, 1.94)*[b]	0.83 (0.50, 1.40)[a]	1.63 (1.14, 2.31)**[b]	1.03 (0.67, 1.59)	1.44 (0.79, 2.63)	1.02 (0.69, 1.50)
Bachelor or graduate degree	1.91 (1.25, 2.93)**[b]	0.40 (0.20, 0.80)**[b]	2.14 (1.39, 3.30)***[b]	1.15 (0.68, 1.96)	1.04 (0.49, 2.23)	1.05 (0.65, 1.70)
Marital status						
Single or not married (widowed or divorced)	1.0	1.0	1.0	1.0	1.0	1.0
Married	0.84 (0.63, 1.13)	0.86 (0.54, 1.37)	0.96 (0.71, 1.31)	0.76 (0.53, 1.11)	1.10 (0.66, 1.83)	0.85 (0.61, 1.18)
BMI[6]						
18.5–24.9 kg/m^2	1.0[a]	1.0	1.0[a]	1.0[a]	1.0[a]	1.0
25–29.9 kg/m^2	1.38**[b] (1.02, 1.88)	0.69 (0.42, 1.16)	1.13*[b] (0.82, 1.57)	1.24*[b] (0.82, 1.87)	2.80**[b] (1.46, 5.37)	1.06 (0.74, 1.53)
≥30 kg/m^2	1.97**[b] (1.26, 3.08)	1.33 (0.69, 2.57)	1.60*[b] (1.02, 2.51)	1.77*[b] (1.02, 3.08)	3.27**[b] (1.47, 7.32)	1.40 (0.85, 2.30)
Tobacco use						
Not current	1.0	1.0	1.0[a]	1.0	1.0	1.0
Current	0.76 (0.57, 1.01)	0.86 (0.55, 1.36)	0.64 (0.48, 0.86)**[b]	1.01 (0.70, 1.44)	0.62 (0.37, 1.04)	1.18 (0.86, 1.63)
Aerobic exercise duration[7]						
Low	1.0	1.0[a]	1.0	1.0[a]	1.0[a]	1.0[a]
Medium	1.03 (0.74, 1.44)	1.77 (1.02, 3.07)*[b]	0.98 (0.69, 1.38)	1.36[a] (0.88, 2.10)	1.09[a] (0.59, 2.03)	1.04 (0.70, 1.54)[a]
High	1.29 (0.91, 1.83)	2.33 (1.36, 3.98)**[b]	1.33 (0.93, 1.89)	2.03 (1.33, 3.09)**[b]	2.30 (1.31, 4.03)**[b]	1.87 (1.28, 2.72)**[b]
Strength training[8]						
No	1.0[a]	1.0	1.0[a]	1.0[a]	1.0	1.0[a]
Yes	2.93 (2.14, 4.03)***[b]	0.87 (0.49, 1.56)	2.49 (1.76, 3.52)***[b]	8.25 (4.11, 16.58)***[b]	1.28 (0.71, 2.30)	2.91 (1.89, 4.48)***[b]

[1] All values are odds ratios; 95% CIs in parentheses. Values are presented on the basis of logistic regression modeling. The *n* of the sample surveyed was 990. Values not sharing a common superscript letter are significantly different. *$P < 0.05$, **$P < 0.01$, ***$P < 0.001$.

[2] Included all DSs defined by the Dietary Supplement Health and Education Act of 1994 (20) legislation that were reported as used ≥1 time/wk over the 6 mo before the survey. This category excluded any sports drinks, any sports bars or gels, and meal-replacement beverages.

[3] Included DSs that contained ≥2 minerals or vitamins and no additional supplement ingredients that were reported as used ≥1 time/wk over the 6 mo before the survey. This category did not include ingredients used in the manufacturing process as preservatives or colorants.

[4] Included, eg, amino acid mixes and protein powders for which the intention was to provide a single or complex protein source that was reported as used ≥1 time/wk over the 6 mo before the survey. These supplements did not include any additional supplement ingredients.

[5] Included ≥1 herbal DS ingredient with no nutrients or other supplement ingredients and were reported as used ≥1 time/wk over the 6 mo before the survey. This category also included plant-derived ingredients such as citric acid.

[6] Calculated from self-reported height and weight.

[7] Included the percentage of individuals who reported nonstop running, cycling, stair climbing, swimming, and road marching either within their army unit or on their own time each week.

[8] Defined as individuals who reported lifting weights or other forms of strength-condition exercise within their army unit or on their own time each week.

this category were caffeine tablets, glucosamine, fish oil, and melatonin.

There were significant differences in the types of DSs used on the basis of age, education, soldier rank, and Special Forces status (Table 3). Respondents aged 18–24 were less likely to report using multivitamin or multiminerals than were older respondents. Respondents aged ≥40 y were less likely to use protein and amino acid DSs than were respondents aged 25–39. Similarly, a higher prevalence of individuals who had more advanced educational attainment reported using multivitamin or multimineral products. Officers used more multivitamins or multiminerals andprotein and amino acid products than did enlisted soldiers. Members of the Special Forces reported greater use of multivitamins or multiminerals ($P < 0.05$) and protein and amino acid DSs ($P < 0.01$). Sex was also associated with the use of specific categories of DSs. Fewer women than men reported taking protein and amino acid supplements ($P < 0.01$) and combination products ($P < 0.01$).

After adjusting for the other covariates included in the model, logistic regression analysis showed a significant relation between age and several measures of DS use. These analyses indicated that 18–24-y-olds were significantly less likely than respondents age 40 and over to use any DS ($P < 0.05$), whereas 30–39 y olds ($P < 0.01$) and men ($P < 0.05$) were more likely to use protein and amino acid products (**Table 4**). Education was also a significant predictor of several types of DS use. Respondents with some college ($P < 0.05$) or a bachelor or graduate degree ($P < 0.01$) were more likely to use DSs than respondents with a high school education. Soldiers with a bachelor or graduate degree were also more likely to take multivitamins or multiminerals ($P < 0.001$) and less likely to take ≥5 DSs/wk ($P < 0.01$) than were other respondents. When all other factors were controlled, higher BMI was associated with several measures of DS use, including the use of any DS ($P < 0.01$), multivitamins or multiminerals ($P < 0.05$), protein and amino acids ($P < 0.05$), and herbal products ($P < 0.01$). Respondents who reported the current use of tobacco were less likely to report the use of multivitamins or multiminerals ($P < 0.01$) than were other respondents. There were significant relations between the duration of aerobic exercise and several measures of DS use, including the use of ≥5 DSs, the use of protein and amino acids, and the use of herbal supplements (all $P < 0.01$). Respondents who participated in strength training were more likely than nonparticipants to use multivitamins ($P < 0.001$) and protein and amino acid supplements ($P < 0.001$). Regression modeling indicated that predictors of high DS expenditures (>$50/mo) included being a man ($P < 0.01$), engagement in long weekly durations of aerobic exercise ($P < 0.01$), and participation in strength training ($P < 0.001$) (Table 4).

The survey included questions regarding reasons for DS use. Among supplement users, the most frequent reason selected for DS use was to promote general health (64.2%) followed by providing more energy (31.1%), greater muscle strength (24.9%), and enhancing performance (16.7%) (**Table 5**). For individual DS types, there were substantial differences in reasons reported for use.

TABLE 5
Reported reasons for using any dietary supplement (DS) and specific DS types ≥1 time/wk over the 6 mo before the survey among US Army personnel who use DSs based on the Dietary Supplement and Caffeine Intake Survey of US Army Active-Duty Personnel[1]

Reported reasons for DS use	Any DS[2]	Multivitamin or multimineral[3]	Protein and amino acids[4]	Individual vitamins or minerals[5]	Combination supplements[6]	Herbals[7]	Purported steroid analogs[8]	Other[9]
Promote general health	64.2 ± 2.07	76.1 ± 2.17	20.9 ± 2.84	55.2 ± 3.73	18.8 ± 4.01	34.5 ± 5.25	16.8 ± 6.94	35.7 ± 4.28
Give more energy	31.1 ± 2.00	8.9 ± 1.45	11.2 ± 2.21	4.4 ± 1.54	16.4 ± 3.80	15.6 ± 4.01	11.8 ± 6.00	22.7 ± 3.74
Greater muscle strength	24.9 ± 1.87	7.7 ± 1.36	59.0 ± 3.44	8.3 ± 2.07	37.9 ± 4.98	11.2 ± 3.48	49.3 ± 9.28	7.8 ± 2.40
Performance enhancer	16.7 ± 1.61	8.1 ± 1.39	30.4 ± 3.22	3.0 ± 1.28	31.1 ± 4.75	11.9 ± 3.58	48.1 ± 9.28	14.5 ± 3.15
Weight loss	12.4 ± 1.43	2.7 ± 0.83	9.2 ± 2.02	4.5 ± 1.55	39.9 ± 5.02	19.0 ± 4.34	0.0 ± 0.00	10.4 ± 2.74
Increased endurance	8.1 ± 1.18	2.9 ± 0.85	11.0 ± 2.19	1.2 ± 0.82	11.6 ± 3.28	8.3 ± 3.05	17.7 ± 7.08	3.4 ± 1.62
Not sure	6.9 ± 1.09	3.6 ± 0.95	2.1 ± 1.00	8.6 ± 2.10	1.5 ± 1.24	3.5 ± 2.04	0.0 ± 0.00	8.7 ± 2.52
Other	11.8 ± 1.40	3.7 ± 0.96	4.6 ± 1.46	9.8 ± 2.23	1.4 ± 1.20	9.3 ± 3.21	3.6 ± 3.44	16.4 ± 3.32

[1] All values are percentages ± SEs. The study sample was weighted by sex, age, and rank to represent the full army composition as of January 2007. The *n* of the sample surveyed was 990.

[2] Included all DSs defined by the Dietary Supplement Health and Education Act of 1994 (20) legislation that were reported as used ≥1 time/wk over the 6 mo before the survey. This category excluded any sports drinks, any sports bars or gels, and meal-replacement beverages.

[3] Included DSs that contained ≥2 minerals or vitamins and no additional supplement ingredients that were reported as used ≥1 time/wk over the 6 mo before the survey. This category did not include ingredients used in the manufacturing process as preservatives or colorants.

[4] Included, eg, amino acid mixes and protein powders for which the intention was to provide a single or complex protein source that was reported as used ≥1 time/wk over the 6 mo before the survey. These supplements did not include any additional supplement ingredients.

[5] Included DSs that were single-nutrient ingredient supplements, such as calcium or vitamin D, reported as used ≥1 time/wk over the 6 mo before the survey.

[6] Included DSs with mixtures of ingredients from the categories above that were reported as used ≥1 time/wk over the 6 mo before the survey. Combination supplements included ≥2 categories and multiple ingredients.

[7] Included ≥1 herbal DS ingredient with no nutrients or other supplement ingredients and were reported as used ≥1 time/wk over the 6 mo before the survey. This category also included plant-derived ingredients such as citric acid.

[8] Included steroidal hormones or herbal substitutes for hormones that were marketed as DSs and included the supplement facts panel on the label and were reported as used ≥1 time/wk over the 6 mo before the survey.

[9] Included those products marketed as DSs that included the supplement facts panel on the label that did not meet the definitions for the other 6 DS categories and were reported as used ≥1 time/wk over the 6 mo before the survey. Examples included melatonin, lycopene, caffeine, α-lipoic acid, coenzyme Q10, and General Nutrition Center fish body oils (Nutra Manufacturing Inc, Greenville, SC).

Protein and amino acids, combination products, and purported steroid analogs were frequently used to increase muscle strength and enhance performance. Combination supplements were also often used to promote weight loss consistent with some of the products that soldiers used in this category such as Hydroxycut and Xenadrine (Iovate Health Services Inc). Multivitamins and individual vitamins and minerals were typically used to promote general health.

DISCUSSION

In some respects, patterns of DS use in soldiers resemble those of the general population from which they were recruited. For example, 53.2% of soldiers report taking ≥1 DS/wk, and in a recent national civilian survey [ie, the National Health and Nutrition Examination Survey (1999–2000)], 52.0% of a representative sample of the US population reported taking ≥1 DS/mo (13). As with civilian adults, the most widely used DS type among soldiers was multivitamins (12, 23, 24). Also, like civilians, users of DSs in the army tended to be older and more highly educated (1, 25) than other users of DSs. Unlike civilians, army women did not significantly differ from men in their overall use of DSs. In the civilian US population, DS use is almost 10% higher for women (1). This may reflect the more homogeneous nature of the army population in terms of occupation and work requirements. Surprisingly, the reported use of DSs by general occupational assignment (combat arms, support, or service) did not differ significantly among army personnel, but persons assigned to an elite unit (Special Forces) reported a nearly 25% higher prevalence of use. This use may reflect the motivation related to greater physical expectations and demands placed on Special Forces soldiers (26).

All army soldiers are required to meet specific physical fitness and body composition standards, and regular aerobic exercise ≥3 times/wk is mandatory for most army occupations. Soldiers reported long mean durations of aerobic exercise that far exceeded national norms (27). In civilian adults, studies have shown that vigorous physical activity was associated with the use of any DS, multivitamin, multimineral supplements, and calcium (1). Because aerobic exercise is usually mandatory in the army, reports of high levels of exercise by survey respondents were not surprising, nor was the relation between high levels of exercise and DS use and expenditures.

In the army, strength training was also highly associated with the reported use of any supplements, multivitamins or multiminerals, protein and amino acid products, and spending >$50/mo on DSs. Soldiers who participated in strength training were almost twice as likely to use DSs as soldiers who did not participate in strength training (60.7% compared with 33.9%, respectively). This result is consistent with the civilian population because strength training is a major factor that predicts supplement use (13).

There are substantial differences in the use of certain categories of DSs when the data for soldiers are compared with available data from their civilian peers. Among soldiers, 20.2% of men and 9.0% of women were taking protein and amino acid supplements. In a survey of a representative sample of US men and women aged 18–44 y, the only protein or amino acid supplement that appeared in the top 10 nonvitamin herbal supplements was creatine, which was used by 4% of men aged 18–44 y but not by women or older men (24). Many soldiers also used combination products (9.1%) and miscellaneous other DSs (11.7%) that do not appear to be nearly as popular among civilians (24). Many of these products are marketed for their purported ability to enhance physical performance and reduce weight, and soldiers used them because they believed they would improve performance, muscle strength, and endurance.

Patterns of supplement use in young male soldiers varied substantially from a young male population surveyed at a commercial civilian gym (n = 222) (13). Participation in the survey was limited to individuals who exercised ≥4 h/wk and exercised at that level for ≥1 y. This level of exercise is comparable with that reported by male soldiers. Eighty-five percent of the gym sample regularly consumed DSs in contrast to 52.6% of male soldiers. Protein supplements were consumed by >59% of younger (aged 18–30 y) and middle-aged (aged 31–45 y) individuals at the gym (13). Creatine, which is marketed as being able to enhance physical performance, was also popular among younger individuals at the gym with 42% of younger individuals regularly consuming creatine. Fewer soldiers reported consuming these supplements. Many factors could account for these differences, including differences in socioeconomic status between soldiers and civilians at the gym or changes in patterns of supplement use over time.

The most common reason that soldiers who were regular DS users reported for taking DSs was to improve general health, which is consistent with the civilian population (24). However, 31.1% of soldiers took DSs to increase energy, 24.9% of soldiers took DSs to increase muscle strength, and 16.7% of soldiers took DSs to enhance performance. In the civilian population, few individuals reported taking DSs to increase muscle strength or enhance performance (24).

From a medical perspective, given the lack of data on the safety of many DSs, these findings raise a number of concerns. Over 12% of soldiers in all age groups, except the cohort aged ≥40 y, reported taking ≥5 different DSs/wk, and 9% of soldiers took combination products, often with other DSs. Given the lack of information regarding the possible adverse interactions of combinations of DSs and the evidence of interactions between DSs and common medications, this consumption of DSs may present health risks (3, 24). Weight loss was a fairly common (12.4%) reason soldiers used DSs (Table 5), and the FDA recently reported 69 brands of weight-loss DSs that contain drugs that could be harmful (28). Risks to soldiers, compared with risks to the general population, may be exacerbated by the various unique stressors to which soldiers are exposed, including environmental extremes, intense exercise, dehydration, and combat. There have been case reports of severe adverse events in military personnel taking DSs (18, 19). Almost 25% of army soldiers reported spending >$50/mo on DSs. For a lower-ranking soldier with minimal prior service, this could represent a significant proportion of discretionary income. Few civilian studies have addressed spending on DSs.

Educational interventions to limit the use of DSs may be warranted in the army and other at-risk populations who may use high levels of DSs and multiple DSs, such as adolescents and college-age populations (3, 29). The information provided by this survey regarding reasons soldiers use DSs may be helpful for formulating educational material broadly for this age cohort.

In conclusion, more than one-half of US Army soldiers use DSs regularly, and their selection of DSs reflects the unique occupational demands of their profession. The prevalence of DS use and frequent choice of multivitamin or multimineral products to improve health among active-duty army soldiers are similar to those of civilians, but many other aspects of DS use by soldiers differed from civilians. In the army, the prevalence of DS use did not differ between men and women; 22% of soldiers used multiple DSs types per week, and DSs used reflected the increased emphasis on fitness and performance, which are essential for success in the army. Reasons given by soldiers for using DSs included general health and increasing energy, strength, and physical performance. Concern about high levels of personal expenditure as well as potential health risk of the use of some products and combinations of multiple products among soldiers further underscores the recommendations of a recent report on the need for more careful monitoring of DS use among these personnel by army management (3).

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