

Jacobs Journal of Sports Medicine

Research article

Use of Appearance and Performance-enhancing Drugs and Supplements among University Students in Kuwait

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Received: 12-30-2015

Accepted: 01-21-2016

Published: 02-18-2016

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Abstract

Objectives:

Use of appearance and performance-enhancing drugs and supplements (APEDS) has increased among young persons. We surveyed undergraduates in Kuwait to determine prevalence and factors associated with use.

Methods:

We surveyed 2002 students from private and public campuses. A pre-tested self-administered questionnaire assessed use of anabolic androgenic steroids (AAS), growth hormone, protein powders, amino acids, fat burners, and laxatives/diuretics. We evaluated associations between APEDS use and sociodemographic, health, and health behavioral variables.

Results:

Response rate was 98% (n = 1962). Lifetime prevalence of use was 26.6%; current prevalence was 10.9%. Males and females predominantly used protein powder (27.7%), and laxatives/diuretics (13.9%), respectively. Mood disturbances, the predominant symptom, were significantly associated with use of AAS (p = 0.004), growth hormone (p = 0.038), fat burners (p < .001), and laxatives/diuretics (p = .001). In multivariate analyses, APED use was significantly associated with athletic club membership (OR = 2.32; 95% CI = 1.70-3.16); dieting (OR = 2.22; 95% CI = 1.76-2.82); vigorous exercise (OR = 1.78; 95% CI = 1.40-2.26); smoking shisha (OR = 1.75; 95% CI = 1.23-2.48); negative body image (OR = 5.38; 95% CI = 3.48-8.28); and Kuwaiti nationality (OR = 1.94; 95% CI = 1.17-3.22).

Conclusions:

More than 26% of undergraduates reported use of APEDS, and use was significantly associated with relevant symptoms and risky behaviors. Prospective studies should assess causality and trends.

Keywords: Performance-Enhancing Drugs; Androgenic Steroids; Growth Hormone; Supplements; Kuwait; Middle East

Abbreviations

APEDS: Appearance and Performance-Enhancing Drugs and Supplements;

AAS: Anabolic Androgenic Steroids;

HGH: Human Growth Hormone

Introduction

Appearance and performance-enhancing drugs and supplements (APEDS) include anabolic androgenic steroids (AAS); human growth hormone (HGH); stimulants; diuretics; protein, amino acid, and creatine supplements; and other agents that potentially improve athletic performance, promote muscle growth, and enhance weight loss [1,2]. These substances can potentially enhance athletic performance, muscle gain, and fat loss, but they also are associated with serious adverse effects such as increased aggression, anxiety, mood disorders, kidney stones, hypertension, cardiac arrhythmias, hepatitis, and infertility [3-10].

Use of APEDS has emerged as a worldwide public health concern, particularly among adolescents and young adults [11-13]. In the United States, APEDS (protein powder or shakes, creatine, amino acids, or steroids) were used at least weekly by 4.7% of adolescent males and 1.6% of females in 1999 [4]. In 2011, an estimated 2-6% of US high school students had used steroids without a doctor's prescription [14]. Among Australia adolescents, lifetime prevalence of AAS has been estimated at 2.4% [15]. In Western European countries, 0.6-3.6% of adolescents have used AAS and about 17% have used protein supplements [16,17]. These findings are particularly concerning because up to 25% of dietary supplements have been found to be contaminated with steroids or stimulants [18,19].

Less is known, however, about the use of APEDS in the Middle East. A study from Jordan found that about 4% of university students had used AAS in the prior four weeks. [10]. In Iran, 22-27% of male college athletes and fitness participants surveyed reported using creatine, and more than 20% had used protein or amino acid powders [20,21]. We surveyed university students in Kuwait to assess prevalence of and attitudes related to APEDS use, and sociodemographic, health, health behavioral, and psychological factors associated with use.

Methods

Sample and Study Design

We conducted a cross-sectional survey of male and female undergraduate students in Kuwait enrolled in one public and three private universities in 2010. We randomly selected three of six private university campuses in Kuwait, and five of the 14 campuses of Kuwait University, the only public university in the country. The Kuwait University campuses included schools of engineering, administration, social and allied health sciences, and education. Questionnaires in Arabic or English (based on respondent preference) were distributed to all students in every undergraduate class at these campuses during a single academic week. All participants provided informed consent and the study was approved by the institutional review board of every university.

Sample size was estimated at 1906 respondents with 95% confidence intervals (type I error $\alpha = 0.05$); 6 % prevalence; 3% precision; and 80% power (type II error = 0.2). Additional students were enrolled to allow for the possibility of missing data.

Qualitative Data

To inform choice of topics and wording of survey questions, we conducted four structured, face-to-face interviews regarding knowledge, attitudes, and behaviors related to use of APEDS in Kuwait. Respondents were male users of APEDS and included an athletic club owner; an athletic club member; an athletic trainer who reported using AAS; and another student who reported using AAS and HGH. We were unable to identify a female informant who would admit use in a face-to-face interview. Interview questions addressed types of APEDS used by young men in Kuwait; knowledge about APEDS, route of administration, and health effects; reasons for use; sources of supply; opinions about regulation of these substances; and primary aspects of body image of interest to men in this demographic. Teams of two researchers, one of whom primarily observed and took notes, conducted interviews. Qualitative data was assessed to identify categories of phrases and relationships between sub-groups of data.

Survey Tool and Pilot Study

Qualitative data were used to design a self-administered, 42-question survey that assessed sociodemographic variables and health behaviors (13 questions); current and former use of APEDS and associated mental and physical symptoms (10 questions); knowledge and attitudes regarding APEDS (10 questions); and body image (6-9 questions depending on gender of respondent). We tested the survey tool by conducting a pilot study of students at the Allied Health Sciences campus of Kuwait University. Ninety-seven students completed questionnaires in Arabic or English (based on student's preference). Based on results, we underlined and bolded significant wording for clarification but made no other changes to the survey tool. Therefore, pilot data were included in analyses.

Statistical Analysis

Data entry and analysis were performed by using Statistical Package for Social Sciences (SPSS) version 16 for Windows (SPSS Inc., Chicago, IL, USA). Age, the only continuous variable, was categorized into three groups based on frequency distribution. P values were obtained by using the chi-square test. Prevalence of current and former use was estimated for each APED assessed. Univariate and multivariate logistic regression models were used to evaluate associations between use of APEDS and sociodemographic, health, and health behavioral variables.

Results

A total of 1962 (98%) students answered the questionnaire, among which 1112 (56.7%) were female, 1063 (61.1%) were aged 19-21 years, and 1923 (88.7%) were of Kuwaiti origin (Table 1).

In all, 26.6% (n= 522) of respondents reported having "ever" used APEDS (95% confidence interval = 24.7-28.6; Table 2). Prevalence of current use of APEDS was 10.9% (95% CI= 9.5-12.3). Current users most commonly reported using protein powder (6.0%; n = 117) or amino acid supplements (4.8%; n = 94), and most had used APEDS for less than six months.

Table 1. Associations between demographic factors and use of appearance and performance-enhancing drugs and supplements by undergraduates in Kuwait (N=1962)

Characteristic	Users	Non-users	Unadjusted	P value	Adjusted	P value
	n (%)	n (%)	OR (95% CI)		OR (95% CI)	
Gender						
Female	218 (41.9)	894 (62.3)	1.00		1.00	
Male	302 (58.1)	542 (37.7)	2.36 (1.91-2.90)	<0.001	0.81 (0.59-1.11)	0.181
University						
Public	330 (63.2)	108 (70)	1.00		1.00	
Private	192 (36.8)	82 (30)	1.38 (1.11-1.71)	0.004	1.09 (0.80-1.48)	0.601
Nationality						
Non-Kuwaiti	43 (8.4)	174 (12.3)	1.00			
Kuwaiti	471 (91.6)	1235 (87.7)	1.61 (1.13-2.30)	0.015	1.94 (1.17-3.23)	0.010
Marital status						
Never married	452 (87.1)	1283 (89.7)	1.00		1.00	
Ever married	67 (12.9)	148 (10.3)	1.34 (0.97-1.84)	0.075	1.48 (0.96-2.28)	0.075
Age (years)						
<18	46 (10)	287 (22.4)	1.00		1.00	
19-21	284 (61.7)	779 (60.8)	2.19(1.55-3.09)	<0.001	2.36 (1.91-2.90)	
≥22	130 (28.3)	215 (16.8)	3.60(2.45-5.30)	<0.001	2.36 (1.91-2.90)	
Governorate						
Mubarak- Alkabeer	80 (15.6)	185 (13.1)	1.00		1.00	
Capital	157 (30.6)	416 (29.4)	0.92 (0.66-1.28)	0.632	0.96 (0.63-1.46)	0.857
Hawali	136 (26.5)	336 (23.8)	0.91 (0.65-1.28)	0.586	0.99 (0.64-1.52)	0.961
Al-Farwaniya	68 (13.3)	209 (14.8)	0.74 (0.50-1.09)	0.131	0.82 (0.50-1.34)	0.430
Al-Ahmadi	52 (10.1)	163 (11.5)	0.74 (0.49-1.12)	0.155	0.76 (0.45-1.28)	0.304
Al-Jahra	20 (3.9)	105 (7.4)	0.45 (0.26-0.78)	0.005	0.85 (0.43-1.68)	0.637

Family income (KD/month)							
<1000	55 (11)	222 (15.9)	1.00		1.00		
1001-2000	328 (65.3)	874 (62.5)	0.62 (0.43-0.90)	0.012	1.32 (0.86-2.03)		0.208
2001-3000	99 (11.7)	249 (17.8)	0.93 (0.71-1.21)	0.590	1.34 (0.81-2.21)		0.260
>3000	119 (23.7)	301 (21.5)	0.92 (0.67-1.27)	0.609	0.93 (0.55-1.57)		0.774
Monthly allowance (KD/month)							
<100	51 (10.1)	254 (18.3)	1.00		1.00		
101-200	255 (50.4)	805 (58)	0.29 (0.20-0.44)	<0.001	0.98 (0.63-1.55)		0.943
201-300	95 (18.8)	180 (13)	0.46 (0.34-0.62)	<0.001	1.30 (0.76-2.27)		0.347
>300	105 (20.8)	149 (10.7)	0.81 (0.56-1.16)	0.245	1.22 (0.68-2.19)		0.503
Father's educational level							
<High school	73 (14.3)	240 (17)	1.00		1.00		
≥High school	128 (25.1)	359 (25.5)	1.18 (0.84-1.65)	0.345	1.04 (0.66-1.63)		0.868
University and above	309 (60.6)	811 (57.5)	1.26 (0.93-1.69)	0.137	0.91 (0.58-1.42)		0.668
Mother's educational level							
<High school	84 (16.2)	252 (17.7)	1.00		1.00		
≥High school	123 (23.7)	366 (25.7)	0.98 (0.70-1.35)	0.885	0.93 (0.59-1.47)		0.755
University and above	312 (60.1)	808 (56.7)	1.18 (0.89-1.57)	0.262	0.96 (0.60-1.53)		0.860

Former users most commonly reported having used fat burners (9%; n = 172). Among all current and former users, 52.1% reported using only one substance, 25.4% had used two substances, and 22.8% had used three or more substances. A total of 222 (11.3%) respondents reported never having heard of APEDS.

Among the demographic variables assessed, male gender (OR = 2.36; 95% CI = 1.91-2.90); being of Kuwaiti versus non-Kuwaiti nationality (OR = 1.61; 95% CI = 1.13-2.30); and enrollment in a private versus public university (OR = 1.38; 95% CI = 1.11-1.71) were significantly associated with APEDS use. In multivariate analyses, only being of Kuwaiti nationality remained statistically significant (OR = 1.94; 94% CI = 1.17-3.22).

Characteristics of APED use differed by gender. Males most commonly reported current (13.8%) or former (13.9%) use of protein powders, and females most frequently reported current (3.7%) or former (10.1%) use of laxatives/diuretics. In addition, males more frequently had used amino acids, fat burners, AAS, and HGH than had females (Tables 3a, 3b). Males primarily reported using HGH to attract the opposite sex;

laxatives/diuretics and fat burners to improve shape; and AAS and protein and amino acid supplements to improve athletic performance (Table 3a). Females primarily used APEDS of any type to improve physical appearance (Table 3b). Males cited health clubs or gyms as their primary source of APEDS, while females cited sources such as physicians, pharmacies, and online stores (Tables 3a and 3b). Notably, 50% of males who used AAS and HGH reported injecting these substances. About half of male users and a majority of female users reported that they had succeeded in stopping use of APEDS. For each substance assessed, majorities of male and female users reported satisfaction with outcome. However, both male and female users were significantly more likely to report dissatisfaction with physical appearance compared with non-users ($p < .001$; Table 4).

Mood disturbances were significantly associated with use of AAS ($p = 0.004$), HGH ($p = 0.038$), fat burners ($p < .001$), and laxatives ($p = .001$; Table 5). Other symptoms significantly associated with APED use included seizures, insomnia, anxiety, irregular heartbeat, dry mouth, impotence, and growth of excess facial and body hair. In particular, use of AAS was signifi

Table 2. Use of appearance and performance-enhancing drugs and supplements by undergraduates in Kuwait (N=522).

Substance	Current user			Former user			TOTAL (Ever used)		
	n	%	95 % CI	n	%	95% CI	n	%	95% CI
Protein powders	117	6.0	5.0-7.1	123	6.7	5.6-7.9	240	12.2	(10.8-13.8)
Amino acids	94	4.8	3.4-5.9	85	4.6	3.7-5.6	179	9.1	(7.9-10.5)
Fat burners	56	2.4	2.2-3.7	172	9.0	7.6-10.4	238	12.1	(10.7-13.7)
Laxatives, diuretics	46	2.3	1.7-3.1	132	6.9	5.8-8.1	178	9.1	(7.9-10.5)
Anabolic steroids	24	1.2	0.8-1.8	35	1.8	1.1-2.3	59	3.0	(2.3-3.9)
Human growth hormone	22	1.1	0.7-1.7	31	1.6	1.1-2.3	53	2.7	(2.1-3.6)
TOTAL	213	10.9	9.5-12.3	309	15.7	14.2-17.5	522	26.6	(24.7-28.6)

CI = confidence interval. *Sum of individual rows exceeds the totals because some users reported having used more than one substance.

Table 3a. Use of appearance and performance-enhancing drugs and supplements among male university students in Kuwait

	Growth hormone n=53	Anabolic steroids n=59	Protein powder n=240	Amino acids n=179	Fat burners n=238	Laxatives, diuretics n=178
	(%)	(%)	(%)	(%)	(%)	(%)
Ever used	(6.0)	(7.0)	(27.7)	(2.0)	(16.7)	(5.8)
Current user	(2.3)	(3.1)	(13.8)	(11.8)	(4.3)	(1.3)
Ex-user	(3.8)	(3.9)	(13.9)	(10.2)	(12.4)	(4.4)
Route						
Oral	(43.8)	(36.1)	(100)	(99)	(97.6)	(95.0)
Injection	(50.0)	(50.0)	0	(1.0)	0	(5.0)
Combination*	(6.3)	(13.9)	0	0	(2.4)	0
Duration						
<6 months	(80.6)	(90.3)	(69.5)	(73.0)	(82.0)	(75.0)
6 months-1 year	(9.7)	(9.7)	(22.9)	(22.5)	(16.9)	(25.0)
> 1 year	(9.7)	0	(7.6)	(4.5)	(1.2)	0
Reason for use						
Improve sports performance	(42.2)	(56)	(45.1)	(44.1)	(34.2)	(43.9)
Improve shape	(71.1)	(68.6)	(77.6)	(76.7)	(83.6)	(41.5)
Improve health	(22.2)	(21.6)	(21.5)	(21.5)	(21.3)	(24.4)
Attract opposite sex	(24.4)	(17.6)	(10.8)	(11.1)	(11.6)	(7.3)
Peer pressure	(4.4)	(2.0)	(2.0)	(1.9)	(5.0)	(4.5)
Other	(6.7)	(7.8)	(5.4)	(5.6)	(4.1)	(9.8)
Source						
Health club/gym	(64.4)	(70.6)	(62.6)	(64.0)	(55.1)	(43.6)
Family/friend	(28.9)	(31.4)	(19.7)	(21.1)	(24.6)	(17.9)
Others**	(26.0)	(23.2)	(37.2)	(37.9)	(42.4)	(34.0)

Satisfaction with use						
Poor	(11.6)	(7.8)	(10.5)	(9.4)	(8.7)	(19.4)
Good	(34.9)	(39.2)	(48.5)	(46.3)	(47)	(41.7)
Very good	(34.9)	(27.5)	(24.5)	(26.3)	(28.7)	(25.0)
Excellent	(18.6)	(25.5)	(16.5)	(18.1)	(15.7)	(13.9)
Thought of stopping						
Yes, and did	(43.2)	(41.2)	(48.5)	(41.9)	(50.0)	(63.2)
Yes, but did not	(22.7)	(33.3)	(27.2)	(31.3)	(29.3)	(26.3)
No	(34.1)	(25.5)	(24.3)	(26.9)	(20.7)	(10.5)

* injection + others ** including physicians, stores, and internet

Table 3b. Use of appearance and performance-enhancing drugs and supplements among female university students in Kuwait.

	Growth hormone n=53	Anabolic steroids n=59	Protein powder n=240	Amino acids n=179	Fat burners n=238	Laxatives diuretics n=178
	(%)	(%)	(%)	(%)	(%)	(%)
Ever used	(0.8)	(0.7)	(3.3)	(1.6)	(10.7)	(13.9)
Current user	(0.5)	(0.1)	(1.3)	(0.6)	(2.5)	(3.7)
Ex-user	(0.3)	(0.6)	(2.0)	(0.9)	(8.3)	(10.1)
Route						
Oral	(6.00)	(100)	(100)	(100)	(100)	(98.0)
Injection	(20.0)	0	0	0	0	(1.0)
Combination *	(20.0)	0	0	0	0	(1.0)
Duration						
<6 months	(66.6)	(100)	(93.3)	(66.6)	(91.0)	(73.0)
6 months-1 year	(33.3)	0	(6.7)	(33.3)	(7.6)	(10.4)
> 1 year	0	0	0	0	(1.5)	(16.4)
Reasons for use						
Improve sport performance	(12.5)	(14.3)	(13.8)	(6.7)	(5.0)	(3.0)
Improve shape	(50.0)	(85.7)	(62.1)	(46.7)	(78.4)	(55.2)
Improve health	(37.5)	(14.3)	(43.5)	(40.0)	(24.5)	(44.0)
Attract opposite sex	0	(14.3)	(3.4)	(6.7)	(6.9)	(3.0)
Peer pressure	0	0	0	0	(8.8)	(5.2)
Other	0	0	0	1 (6.7)	(7.8)	(7.5)
Source						
Health club/gym	0	0	(13.8)	(6.7)	(5.1)	(2.3)
Family/friend	(37.5)	(14.3)	(31.0)	(13.3)	(38.8)	(28.6)
Others **	(46.1)	(75.0)	(46.3)	(48)	(51.8)	(54.2)
Satisfaction with use						
Poor	(14.3)	(14.3)	(30.8)	(35.7)	(21.1)	(23.3)
Good	(57.1)	(14.3)	(50.0)	(28.6)	(38.9)	(46.5)
Very good	(14.3)	(28.6)	(11.5)	(21.4)	(29.5)	(21.7)
Excellent	(14.3)	(42.9)	(7.7)	(14.3)	(10.5)	(8.5)
Thought of stopping						
Yes, and did	(50.0)	(42.9)	(59.3)	(73.3)	(65.3)	(64.1)
Yes, and did not	(50.0)	(42.9)	(22.2)	(20.0)	(26.5)	(21.4)
No	0	(14.3)	(18.5)	(6.7)	(8.2)	(14.5)

*injection + others ** including physicians, stores, and the internet

cantly associated with mood disturbances ($p = .004$), excess growth of facial and body hair ($p < .001$), and impotence ($p < .001$).

In multivariate analyses, behaviors that were significantly associated with APEDS included membership in sports clubs (OR= 2.32; 95% CI = 1.70-3.16); dieting to lose or gain

Table 4. Gender, body image, and use of appearance and performance-enhancing drugs and supplements by university students in Kuwait (N=1724)

Gender	Perception of physical appearance	Users	Non-users	OR (95% CI)	<i>p</i> value
Female (n=1007)		(n= 298)	(n= 709)		
		<i>n</i> (%)	<i>n</i> (%)		
	Satisfied	19 (8.7)	199 (91.3)	1.0	<0.001
	Not satisfied	189 (27.0)	510 (73.0)	3.88(2.36-6.40)	
Male (n=717)		(n=296)	(n=421)		
		<i>n</i> (%)	<i>n</i> (%)		
	Satisfied	5 (11.1)	40 (88.9)	1.0	<0.001
	Not satisfied	291 (43.3)	381 (56.7)	6.11(2.38-15.68)	

Total response is <1962 due to missing data about perception of physical appearance.

Table 5. Associations between symptoms and use of appearance and performance-enhancing drug and supplements among undergraduates in Kuwait

Symptoms	Substance		<i>P</i> value
	Ever used	Never used	
	<i>n</i> (%)	<i>n</i> (%)	
Anabolic steroids	(n=59)	(n=1659)	
Mood disturbance	38(64.0)	167(38.0)	0.004
Excess body/facial hair	16(27.0)	56(13.0)	<0.001
Impotence	8(14.0)	10(2.0)	<0.001
Laxatives, diuretics	(n=178)	(n=1538)	
Mood disturbance	89(52.0)	116(36.0)	0.001
Insomnia	70(41.0)	104(32.0)	0.045
Anxiety	68(40.0)	70(22.0)	<0.001
Dry mouth	58(34.0)	76(23.0)	0.011
Irregular heart beat	54(32.0)	63(20.0)	0.004
Growth hormone	(n=53)	(n=1665)	
Mood disturbance	29(55.0)	176 (40.0)	0.038
Seizures	6(11.0)	15(3.0)	0.007
Amino acids	(n=179)	(n=1536)	
Impotence	11(6.0)	6(2.0)	0.022
Fat burners	(n=228)	(n=1489)	
Mood disturbance	113(52.0)	92 (33.0)	<0.001
Insomnia	102(47.0)	72(26.0)	<0.001
Anxiety	76(35.0)	62(22.0)	0.003
Irregular heart beat	70(32.0)	47(18.0)	<0.001
Hair loss	53(24.0)	44(16.0)	0.012
Seizures	15(7.0)	6(2.0)	0.010
Protein powders	(n=240)	(n=1479)	
Seizures	15(6.0)	6(2.0)	0.022
Impotence	13(6.0)	5(2.0)	0.029

weight (OR = 2.22; 95% CI = 1.76-2.82); habitual vigorous exercise (OR = 1.78; 95% CI = 1.40-2.26); and smoking water pipes or shisha (OR = 1.75; 95% CI = 1.23-2.48; Table 6). Smoking cigarettes was significantly associated with APEDS use in univariate analyses but not the multivariate model. In addition, APEDS users were significantly more likely than non-users to report having a family member or friend who used APEDS (OR = 4.63; 95% CI = 3.33-6.45). The four male informants had named all these variables during qualitative interviews.

In all, 47% of users and 23% of non-users responded that APEDS were less negative than using illicit drugs, such as heroin or cocaine ($p < 0.001$; Table 7). A majority of both users (59%) and non-users (73%) perceived the use of APEDS as a problem in Kuwait, and the difference between these proportions was highly significant ($p < .001$).

A substantial majority of respondents (87% of non-users and 79% of user; p value $< .001$) supported regulation of APEDS in Kuwait.

Table 6. Health behaviors associated with use of appearance and performance-enhancing drugs and supplements among university students in Kuwait.

Behavior	Users (n=508) n (%)	Non-users (n=1408) n (%)	Unadjusted OR (95% CI)	P value	Adjusted OR (95% CI)	P value
Smoke cigarettes						
Never	343 (67.5)	1182 (83.9)	1.00			
Past or current	165 (32.5)	226 (16.1)	2.50 (1.96-3.18)	<0.001	1.15(0.79-1.67)	0.473
Smoke water pipe (shisha)						
Never	314 (60.4)	1151 (80.2)	1.00		1.00	
Past or current	206 (39.6)	285 (19.8)	2.55 (2.04-3.19)	<0.001	1.75 (1.23-2.48)	<0.01
Vigorous exercise						
No	311 (61.0)	560 (39.7)	1.00		1.00	
Yes	199 (39.0)	851 (60.3)	2.38 (1.93-2.92)	<0.001	1.78 (1.40-2.26)	<0.001
Friend or relative uses APEDS						
No	52 (10.5)	448 (38.6)	1.00		1.00	
Yes	441 (89.5)	712 (61.4)	5.34 (3.91-7.28)	<0.001	4.63 (3.33-6.45)	<0.001
Diet						
Unmodified	267 (51.9)	420 (29.5)	1.00		1.00	
Weight gain/loss	247 (48.1)	1002 (70.5)	2.58 (2.10-3.17)	<0.001	2.22 (1.76-2.82)	<0.001
Member of sports club/gym						
No	286 (55.6)	1198 (83.7)	1.00			
Yes	228 (44.4)	234 (16.3)	4.06 (3.22-5.11)	<0.001	2.32 (1.70-3.16)	<0.001

Table 7. Association between use and perception of appearance and performance-enhancing drugs and supplements among undergraduates in Kuwait.

Attitude/Belief	Users (n=522)	Non-users (n=1218)	P value
	n (%)	n (%)	
Is use of APEDS as negative as using substances such as cocaine?			
Yes	172 (33.9)	567 (47.8)	<0.001
No	239 (47.0)	275 (23.2)	
Don't know	97 (19.1)	345 (29.1)	
Is use of APEDS problematic in Kuwait?			
Yes	294 (59.0)	785 (73.0)	<0.001
No	114 (22.9)	117 (10.9)	
Don't know	90 (18.1)	174 (16.2)	
How does the media affect APEDS use?			
Encourages use	174 (34.4)	442 (40.3)	0.057
Discourages use	79 (15.6)	171 (15.6)	
Plays no role	253 (50.0)	484 (44.1)	
Should Kuwait regulate APEDS use?			
Yes	400 (78.7)	962 (87.2)	<0.001
No	61 (12.0)	53 (4.8)	
Don't know	47 (9.3)	88 (8.0)	

Discussion

We identified a substantial prevalence of APEDS use among undergraduate students in Kuwait (26.7%). The current prevalence of laxatives/diuretics use (9.1%), AAS (3.0%), and HGH (2.7%), which can cause particularly serious physical, psychological, and behavioral effects. Notably, the lifetime prevalence of AAS use among males was 7%, and 3% of males were current users. We also found statistically significant associations between use of APEDS and adverse effects such as mood disturbances, anxiety, insomnia, irregular heartbeat, seizures, and impotence. These results reinforce previous reports; for example, use of AAS is associated with increased risk of anxiety, major depressive disorders, and suicidality [5,6]. Indeed, in one large, multi-year study of US high school students, steroid use was even more strongly associated with suicidal ideation (OR, 3.7-11.8) than was cocaine, ecstasy, hallucinogens, inhalants, marijuana, alcohol, or tobacco [6].

Despite these health risks, our data indicated that about 11% of participants in this study had not heard of APEDS, and almost half did not think using APEDS was as risky as using illicit drugs. Young adults in Kuwait might tend to underestimate or misunderstand the health risks of using APEDS if their information on these substances comes from friends, family members, product companies, or other non-medical sources.

Prior studies have indicated that companies that develop and distribute APEDS omit information on adverse effects. In one analysis, eight of 12 APEDS associated with severe cardiac effects lacked relevant warnings on their websites, product labels, or package inserts [22].

Users of APEDS were significantly more likely to report habitual vigorous exercise, but also were more likely to engage in risky behaviors, such as smoking cigarettes or water pipes (shisha) or dieting to lose or gain weight. These findings mirror data from other studies indicating that adolescent users of anabolic steroids are more likely to smoke cigarettes and use alcohol, narcotic drugs, marijuana, and cocaine [23-27]. In addition, neurologic research points to the addictive properties of some types of APEDS, including AAS [28,29]. In our study, 23-33% of males and 20-50% of females reported that they had considered stopping use of APEDS but had not, which could indicate struggles with addiction.

In all, 14.6% of respondents in Kuwait had taken multiple substances during the same time period. Polysubstance use involving APEDS has been reported in other countries [12, 30-32]. Furthermore, researchers have hypothesized that the legal use of fitness supplements can serve as a gateway for AAS use; in the United States, for example, undergraduates who used both fat-burning and muscle-building supplements were most likely to report using and believing in the safety and efficacy of AAS [32].

Respondents' primary motivations for using APEDS differed by gender. Females most often reported having taken APEDS to improve body shape, while males most commonly took them to enhance athletic performance. However, both males and female users of APEDS were significantly more likely than non-users to report dissatisfaction with their physical appearance. For example, male users reported dissatisfaction with muscularity of their arms, chest, and legs. Our findings reflect those from other studies indicating that APEDS often are used for cosmetic reasons and that use is associated with negative body image [33-35].

Membership in a health club or gym was significantly associated with use of APEDS in Kuwait. Notably, male users, including all four informants in the qualitative study, reported that health club personnel were their primary source of supply. However, female respondents identified other sources including supplement stores, physicians, and orders placed through the media and the Internet.

Several limitations merit mention. First, because this was a cross-sectional study, we could not evaluate trends in use of APEDS over time, or causal relationships between use and factors such as physical and psychological symptom. Prospective studies could overcome these shortcomings. In addition, because of the sensitivity of the topics assessed and the fact that data were entirely self-reported, with no independent verification of APEDS use, the true prevalence of APEDS use, adverse effects, and other outcomes might exceed our findings.

Conclusion

Our data indicate that at least one-quarter of undergraduates in Kuwait have used APEDS and almost 11% are current users. As has been reported in other countries and regions, use of APEDS among adolescents and young adults was significantly associated with numerous problematic physical, psychological, and behavioral factors. These findings are particularly relevant because approximately 82% of the population of Kuwait is aged less than 45 years (Public Authority for Civil Information, December 2013) [36]. We recommend prospective studies to further explore the effects of APEDS use in Kuwait. In addition, at-risk populations could benefit from prevention and education activities that target both legal supplements and the illicit use of drugs such as AAS. Further studies can be suggested to explore educational interventions for University students, clinical and counseling services for the large minority of students apparently not able to quit usage on their own, and other public health interventions such as education intervention for the public at large, changes in laws regarding these substances.

The authors thank Dr. Susan Jacob and Mrs. Ajitha Suresh for assistance with statistical analysis and Dr. Amy Karon for editorial assistance.

Conflicts of Interest and Source of Funding: The authors report no conflicts of interest and declare no funding sources for this project.

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