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An examination of performance enhancement attitudes and belief levels regarding sports supplements among students receiving education on ergogenic aids and anti-doping practices

Umut Can Karakaya¹ and Mehmet Ali Ceyhan^{2*}

Abstract

Background This study examines the changes in performance enhancement attitudes and sports supplement belief levels among sports sciences faculty students after education on ergogenic aids and anti-doping practices. In the highly competitive environment of modern sports, nutrition and ergogenic aids are crucial in enhancing athletic performance and preventing injuries. However, research in this area is limited, and existing literature emphasizes the need to explore the relationship between education and these topics.

Methods The study employed an experimental design using a one-group pre-test and post-test method. The research group comprised 61 students (24 female and 37 male) from the Faculty of Sport Sciences at Bayburt University. Data collection tools included the “Personal Information Form,” the “Performance Enhancement Attitude Scale (PEAS),” and the “Sports Supplement Belief Scale (SSBS).” Data were collected via Google Forms and analyzed using SPSS 26.0 software. The skewness and kurtosis values were calculated to assess the data distribution, and parametric tests, including t-tests and ANOVA, were applied.

Results The findings revealed that education on ergogenic aids and anti-doping practices significantly improved students’ performance-enhancement attitudes. For example, PEAS scores increased from a pre-test mean of 38.74 to a post-test mean of 44.13 ($p < 0.05$), representing a change of approximately 13.91%. However, no significant changes were observed in SSBS scores. This suggests that students’ beliefs regarding sports supplements may be shaped by prior knowledge and experiences, making them less influenced by the educational intervention.

Conclusions This study demonstrates that education on ergogenic aids and anti-doping practices can positively influence students’ performance-enhancement attitudes. However, more in-depth educational programs may be required to impact beliefs about sports supplements. These findings can guide the development of more effective educational programs to enhance athletic performance and safeguard athlete health. By providing evidence-based

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insights, this study significantly contributes to the existing literature and supports the development of policies and educational initiatives in anti-doping and athlete education.

Keywords Doping, Education, Student, Anti-doping, Ergogenic aid, Supplement, Sports supplement

Introduction

Successful performance in sports is determined by an athlete's capacity to produce work or expend energy. Training facilitates a series of physiological adaptations that enable the athlete to generate greater output and delay the onset of fatigue. However, athletes must prepare for competition by understanding the factors that limit their performance in a specific activity and taking additional steps to mitigate these effects [1]. Adaptation to the competitive demands of modern sports is achieved through a balanced and adequate diet. Proper nutrition is a fundamental factor in minimizing injuries and optimizing athletic performance, maintaining health, supporting growth, and ensuring maturation [2].

Studies conducted over the past two decades have highlighted the benefits of nutrition on exercise performance [3]. An athlete aiming to maximize exercise gains and peak competition performance must focus on proper nutrition and nutrient intake specific to their sport [4].

Achieving high performance in sports requires more than prolonged and consistent training [5]. Additionally, methods that can expedite or facilitate the body's recovery must be implemented [6]. Among these methods, nutrition and dietary supplementation play a pivotal role. Nutrition in sports is a critical factor influencing an athlete's performance during the competition process. Supportive products include a balanced diet and supplementary foods designed to help athletes achieve their desired performance levels in a shorter period. Athletes of all ages and abilities commonly use sports supplements to enhance performance, accelerate recovery, or minimize the risk of injury [7].

These supplements contain non-doping compounds [8]. They are commonly referred to as ergogenic aids. Sports dietary supplements are substances or strategies that enhance athletic performance by boosting energy production [9]. Specifically, ergogenic aids are mechanical, nutritional, pharmacological, physiological, or psychological tools athletes use to improve energy levels, performance, and recovery.

Frequently used ergogenic aids include amino acids, bee pollen, caffeine, carnitine, chromium, creatine, ginseng, glucosamine, and protein powders. However, excessive consumption of these substances can lead to adverse effects such as allergic reactions, central nervous system disturbances, gastrointestinal issues, and kidney damage [10]. Therefore, proper usage within recommended limits is critical to balancing performance optimization and health in sports [11]. In addition, more information

about supplements is needed due to their increasing consumption. Unfortunately, athletes rarely seek information from expert sources such as dietitians. Furthermore, educational programs on the subject are not available in every country, especially in developing countries. This leaves athletes vulnerable to misinformation, which can harm their health and lead to misunderstandings about their sport [12].

Examining attitudes toward performance enhancement and beliefs about sports supplementation among students receiving education on ergogenic aids and anti-doping measures is essential for understanding their knowledge and awareness of these topics. Ergogenics and anti-doping practices also have an important aspect regarding the health of injured athletes, as athletes who have been injured and are trying to return to sports are thought to be in a much weaker state psychologically and are more likely to overuse ergogenics or doping. Therefore, it is of great importance to educate healthy athletes and athletes returning to sports after injury about ergogenics and anti-doping [13]. Moreover, such research plays a crucial role in addressing critical factors like the development, widespread adoption, and quality of education in this field. Exploring these dimensions contributes to better-informed practices and enhances the effectiveness of preventive measures against doping in sports. By fostering a more comprehensive understanding of these issues, educators and policymakers can implement strategies to promote ethical behaviour, improve educational content, and encourage responsible use of performance-enhancing methods within the framework of sports ethics.

Building on these findings, the primary aim of this study is to examine the attitudes toward performance enhancement and the belief levels regarding sports supplements among students who have received education on ergogenic aids and anti-doping practices.

Materials and methods

This section of the study provides detailed information on the research model, the population and sample, data collection tools, and the methods used for data analysis, focusing on examining the attitudes toward performance enhancement and the belief levels regarding sports supplements among students who have received education on ergogenic aids and anti-doping practices.

Research design

In line with the purpose of the study, an experimental research design using a one-group pre-test post-test method was employed to examine the performance enhancement attitudes and beliefs regarding sports supplements among students who received education on ergogenic aids and anti-doping practices. This method also aimed to determine how students' attitudes and beliefs changed following the training. Experimental research models are "studies aimed at determining the effect of differences created by the researcher on the dependent variable. The primary goal of experimental designs is to establish a cause-and-effect relationship between variables" [14]. The one-group pre-test post-test method involves applying an independent variable to a randomly selected group, followed by measurements taken before and after the intervention [15]. This design was specifically chosen to explore the changes in students' attitudes and beliefs within the education they received, aligning with the study's objectives.

Table 1 shows the weekly course content. The course was given continuously for 2 h per week for 14 weeks. The courses were conducted by an expert academic in the field. Participants were asked to attend all courses completely. Of the 72 students who took the course, 61 met this condition and were included in the study, while 11 students were excluded from the study.

Research aim

The primary objective of this study is to examine the performance enhancement attitudes and sports supplement belief levels of students who have received education on ergogenic aids and anti-doping practices. The research focuses on two main areas of investigation:

Performance enhancement attitudes

The following sub-questions were addressed regarding the performance enhancement attitudes of students who have received ergogenic aid and anti-doping education:

- Does education on ergogenic aids and anti-doping practices affect students' performance-enhancement attitudes?
- Is there a significant difference between performance enhancement attitudes and the gender variable?

- Is there a significant difference between performance-enhancement attitudes and active sports participation?
- Is there a significant difference between performance enhancement attitudes and the place of residence variable?
- Is there a significant difference between performance enhancement attitudes and the achieved sporting success variable?
- Is there a significant difference between performance enhancement attitudes and the age variable?
- Is there a significant difference between performance enhancement attitudes and the sports age variable?
- Is there a significant difference between performance enhancement attitudes and the income variable?

Sports supplement belief levels

- The following sub-questions were addressed regarding the sports supplement belief levels of students who have received ergogenic aid and anti-doping education:
- Is there a significant difference between sports supplement beliefs and the gender variable?
- Is there a significant difference between sports supplement beliefs and active sports participation?
- Is there a significant difference between sports supplement beliefs and the place of residence variable?
- Is there a significant difference between sports supplement beliefs and the achieved sporting success variable?
- Is there a significant difference between sports supplement beliefs and the age variable?
- Is there a significant difference between sports supplement beliefs and the sports age variable?
- Is there a significant difference between sports supplement beliefs and the income variable?

This study aims to understand the impact of ergogenic aid and anti-doping education on students' attitudes and beliefs, thereby contributing to the development of more effective educational programs in this field.

Table 1 Education program

Week	Course Content
1–3	The concept of ergogen and the classification of ergogenics
4–5	The concept of doping and its historical development
6–7	Institutions and organizations fighting against doping
8–10	Prohibited substances according to the list updated by WADA on a yearly basis
11–12	Prohibited substances and doping control according to sports branches
13–14	Anti-doping processes

Participants

The research used a random sampling method. The research group consisted of 61 students (24 females and 37 males) enrolled in the Ergogenic Aids and Anti-Doping course in the spring semester of the 2022–2023 academic year. These students were third-year undergraduate students at the Department of Coach Education, Faculty of Sports Sciences, Bayburt University.

Data collection

The data for the study were collected using the Google Forms platform, allowing participants to be reached electronically. The data collection tools included the “Personal Information Form,” the “Performance Enhancement Attitude Scale (PEAS)” (Yıldız & Toros, 2016), and the “Sports Supplement Belief Scale (SSBS)” [16].

Personal information form

The researcher designed a Personal Information Form consisting of seven items to gather demographic information about the sample group. These items include gender, active sports participation, place of residence, achieved sporting success, age, sports age, and monthly income variables.

Performance enhancement attitude scale

The Performance Enhancement Attitude Scale (PEAS), initially developed with 97 items in a 4-point Likert format, was refined by Petroczi (2002) into a 17-item, 6-point Likert scale and subsequently introduced into the literature [17]. The PEAS consists of 17 items rated on six levels of agreement, encompassing a single dimension. Responses are scored using a 6-point Likert scale ranging from “Strongly Disagree” to “Strongly Agree.” The scale’s total score ranges from 17 to 102, with higher scores indicating a positive attitude toward performance enhancement, while lower scores signify a negative attitude [17].

Previous international validity and reliability studies of the scale reported a Cronbach’s Alpha value between 0.71 and 0.91 [17]. The scale has been adapted into Turkish, with findings presented at various conferences in Mısır, Gaziantep, and Elazığ [18, 19]. During the adaptation process, no new items were added, and none of the original items were removed, ensuring full fidelity to the original scale [19].

The sports supplement belief scale

The Sports Supplement Belief Scale (SSBS) was developed by Hurst, Foad, Coleman, and Beedie (2017) and later translated into Turkish as the Spor Besin Takviyeleri İnanç Ölçeği (STİÖ) by Karafil, Atay, and Ulaş (2019) [16]. The scale consists of six items and is structured as a 6-point Likert-type instrument [16, 20]. The

response options range from (1) “Strongly Disagree” to (6) “Strongly Agree.”

The scale is designed to assess athletes’ beliefs regarding using sports supplements, specifically in the context of training and competition. The minimum possible score, 6, is obtained when participants select “Strongly Disagree” for all six items, while the maximum possible score, 36, is achieved by selecting “Strongly Agree” for all items. Higher scores on the scale suggest a greater propensity for the use of supplements, including potentially doping-related or prohibited substances.

The validity study with athletes reported factor loadings for scale items ranging from 0.463 to 0.966. The reliability coefficient for the scale was determined to be 0.891, indicating high internal consistency [20].

Statistical analyses

The raw data collected through the research instruments were initially transferred to Microsoft Excel for organization. The data were categorized within Excel based on demographic variables to prepare them for analysis. Subsequently, the data were imported into the SPSS software package (version 26). The skewness and kurtosis values of the data were calculated to assess their distribution, and based on the results, it was determined that parametric tests would be applied.

For comparisons between two groups, an independent samples t-test was employed, while for variables with three or more groups, a One-Way ANOVA was utilized. A Pearson correlation analysis was conducted to examine relationships between parameters. Additionally, to calculate the differences between the pre-test and post-test scores of the research group, a paired samples t-test was applied.

For all statistical tests, a significance level of $p < 0.05$ was considered the threshold for meaningful differences.

Results

This section of the study focuses on presenting and interpreting findings derived from data analysis, which are presented in tables.

Table 2 provides demographic information about the study group. Of the participants, 37 (60.7%) are male, and 24 (39.3%) are female students. A total of 35 students (57.4%) actively participate in sports, while 26 (42.6%) do not engage in sports actively. Regarding the place of residence, 32 students (52.5%) live in villages, towns, or districts, while 29 (47.5%) reside in cities or metropolitan areas. In terms of achieved sporting success, 26 students (42.6%) reported no significant achievements, 33 (54.1%) have achieved success at the national level, and 2 (3.3%) have accomplishments at the international level.

The When examining Table 3, it was determined that the participants’ average age was 21.86 ± 1.41981 , their

Table 2 Percentages and frequencies of participants' demographic variables

Variables	Groups	f	%
Gender	Female	24	39.3
	Male	37	60.7
Active Participation in Sports	Yes	35	57.4
	No	26	42.6
Place of Residence	Village/Town/District	32	52.5
	City/Metropolitan Area	29	47.5
Achieved Sporting Success	None	26	42.6
	National	33	54.1
	International	2	3.3

Table 3 Descriptive statistics for age, sports age, and monthly income variables

	Mean	Medyan	ss.	Min.	Max.	Skewness	Kurtosis
Age (Years)	21.86	21.00	1.41981	20.00	27.00	1.251	1.859
Sports Age (Years)	3.11	2.00	2.60831	0.00	8.00	0.902	-0.678
Monthly Income (TRY)	1643.44	1250	783.23450	1000.00	4500	1.236	1.866
Pre-Test (PEAS*)	38.74	38.23	9.94094	17.06	70.29	0.555	1.273
Post-Test (PEAS*)	44.13	47.17	15.86932	16.06	74.29	-0.058	-0.827
Pre-Test (SSBS**)	22.20	22.83	5.54781	5.33	31.00	-0.670	0.617
Post-Test (SSBS**)	21.01	20.66	5.78517	8.17	31.00	-0.464	-0.207

* $p < 0.05$; *Performance Enhancement Attitude Scale

**Sports Supplement Belief Scale

Table 4 t-Test results for PEAS scores based on the gender variable of participants

	Gender	N	X	ss.	t	p
Pre-Test (PEAS*)	Female	24	40.53	9.77	1.137	0.260
	Male	37	37.58	10.00		
Post-Test (PEAS*)	Female	24	44.13	14.73	0.001	0.259
	Male	37	44.13	16.76		

average years of sports participation (sports age) was 3.11 ± 2.60831 , and their average monthly income was 1643.44 ± 783.23 . The participants' pre-test mean score on the Performance Enhancement Attitude Scale (PEAS) was 38.74. Given that the arithmetic mean of the scale is 59.5, a group mean below this value indicates a negative attitude. The participants' post-test mean score on the PEAS was 44.13, which falls below the scale's arithmetic mean, indicating a continued negative attitude.

For the Sports Supplement Belief Scale (SSBS), the participants' pre-test mean score was 22.20. With an arithmetic mean of 21.0, a higher score suggests stronger belief in sports supplements and a potential inclination toward doping or using prohibited substances. Thus, the study group was identified as having scores above the average, indicating a stronger belief in supplements.

In the post-test, the participants' mean score on the SSBS was 21.01, which aligns closely with the scale's arithmetic mean. This indicates that the study group had moderate scores, suggesting a balanced belief in sports supplements, without a pronounced inclination toward their use. According to Tabachnick and Fidell [21] it is assumed that the data are normally distributed when the

skewness and kurtosis coefficients are between -1.5 and $+1.5$. However, it is also accepted that the data with a kurtosis and skewness value between $+2$ and -2 are normally distributed [22; 23; 24]. According to Kline [25] in order to accept that the normality assumption is met, the skewness and kurtosis values must be less than 3. In this study, it is assumed that the quantitative data are normally distributed.

Table 4 indicates that no significant difference was found in the PEAS pre-test and post-test scores based on the gender variable of the participating students ($p > 0.05$).

Table 5 shows that no significant difference was found in the SSBS pre-test and post-test scores based on the gender variable of the participating students ($p > 0.05$).

Table 6 reveals that no significant difference was observed in the PEAS pre-test and post-test scores based on the active sports participation status of the students ($p > 0.05$).

Table 7 indicates that no significant difference was found in the SSBS pre-test and post-test scores based on the active sports participation status of the students ($p > 0.05$).

Table 5 t-Test results for SSBS scores based on the gender variable of participants

	Gender	N	X	ss.	t	p
Pre-Test (SSBS**)	Female	24	22.21	4.55	0.012	0.991
	Male	37	22.19	6.16		
Post-Test (SSBS**)	Female	24	20.30	5.47	-0.770	.444
	Male	37	21.47	6.00		

Table 6 t-Test results for PEAS scores based on the variable of active sports participation

	Activity	N	X	ss	t	p
Pre-Test (PEAS)	Yes	35	38.0756	10.41900	-0.606	0.547
	No	26	39.6448	9.38450		
Post-Test (PEAS)	Yes	35	41.0807	15.55295	-1.776	0.081
	No	26	48.2489	15.64504		

Table 7 t-Test results for SSBS scores based on the variable of active sports participation

	Activity	n	X	ss	t	p
Pre-Test (SSBS)	Yes	35	21.6905	6,24933	-0.838	0.405
	No	26	22.8974	4.45922		
Post-Test (SSBS)	Yes	35	22.0333	5.08969	1.614	0.112
	No	26	19.6474	6.45727		

Table 8 t-Test results for PEAS scores based on the variable of place of residence

	Residence	N	X	ss.	t	p
Pre-Test (PEAS)	Village/Town/District	32	40,1618	8,01125	1,173	,245
	City/Metropolitan Area	29	37,1805	11,65661		
Post-Test (PEAS)	Village/Town/District	32	42,5147	18,16411	-,836	,406
	City/Metropolitan Area	29	45,9249	12,96316		

Table 9 t-Test results for SSBS scores based on the variable of place of residence

	Residence	N	X	ss	t	p
Pre-Test (SSBS)	Village/Town/District	32	21.9740	4.87167	-0.339	0.736
	City/Metropolitan Area	29	22.4598	6.28879		
Post-Test (SSBS)	Village/Town/District	32	19.4479	6.49033	-2.303	0.025*
	City/Metropolitan Area	29	22,7471	4.37789		

* $p < 0,05$ **Table 10** ANOVA test results for PEAS scores based on the variable of achieved sporting success

		Sum of Squares	sd.	Mean Square	F	p	Difference
Pre-Test (PEAS)	Between Groups	763.410	2	381.705	4.286	0.018*	3 > 2 > 1
	Within Groups	5165.932	58	89.068			
	Total	5929.342	60				
Post-Test (PEAS)	Between Groups	316.277	2	158.139	0.620	0.541	-
	Within Groups	14793.844	58	255.066			
	Total	15110.121	60				

* $p < 0,05$

According to Table 8, no significant difference was observed in the PEAS pre-test and post-test scores based on the variable of place of residence among the participating students ($p > 0.05$).

According to Table 9, a significant difference was found in the SSBS post-test scores based on the variable of place of residence ($p < 0.05$). In contrast, no significant difference was observed in the SSBS pre-test scores ($p > 0.05$).

Table 10 presents the ANOVA test results for PEAS scores based on the variable of achieved sporting success. The analysis reveals a significant difference in PEAS pre-test scores concerning the participants' levels of achievement ($p < 0.05$). Upon examining the source of this difference, it was found that participants with international achievements (3) and national achievements (2) scored significantly higher compared to those with no

Table 11 ANOVA test results for SSBS scores based on the variable of achieved sporting success

		Sum of Squares	sd.	Mean Square	F	p	Difference
Pre-Test (SSBS)	Between Groups	48.068	2	24.034	0.775	0.465	-
	Within Groups	1798.621	58	31.011			
	Total	1846.689	60				
Post-Test (SSBS)	Between Groups	17.263	2	8.631	0.251	0.779	-
	Within Groups	1990.832	58	34.325			
	Total	2008.095	60				

Table 12 Pearson correlation analysis results for age, sports age, and monthly income variables

		Age	Sports Age	Economic Income
Pre-Test (PEAS)	r	-0.140*	0.196*	0.180*
	p	0.284	0.031	0.039
	n	61	61	61
Post-Test (PEAS)	r	0.142*	-0.201	0.138
	p	0.046	0.120	0.288
	n	61	61	61
Pre-Test (SSBS)	r	0.001	0.046	-0.139
	p	0.996	0.724	0.285
	N	61	61	61
Post-Test (SSBS)	r	0.73*	-0.019	0.128
	p	0.033	0.883	0.327
	n	61	61	61

* $p < 0.05$ **Table 13** Paired samples t-Test results for identifying differences between the Pre-Test and Post-Test scores of the study group

Variables	Groups	X	n	ss.	t	p	Difference
PEAS	Pre-Test	38.74	61	9.94	-2.192	0.032*	5.39
	Post-Test	44.13	61	15.86			
SSBS	Pre-Test	22.20	61	5.54	1.066	0.291	-1.18
	Post-Test	21.01	61	5.78			

* $p < 0.05$

achievements (1), with the results favouring those with international and national achievements.

Table 11 presents the ANOVA test results for SSBS scores based on the variable of achieved sporting success. The analysis indicates that there is no significant difference in SSBS pre-test and post-test scores with respect to the participants' levels of achievement ($p > 0.05$).

Table 12 identified a low negative correlation between participants' age and PEAS pre-test scores ($p < 0.05$). In contrast, a low positive correlation was observed between age and both PEAS post-test scores ($p < 0.05$) and SSBS post-test scores ($p < 0.05$). However, no significant relationship was found between age and SSBS pre-test scores ($p > 0.05$).

A low positive correlation was found with PEAS pre-test scores ($p < 0.05$) for the sports age variable. However, no significant relationships were identified between sports age and PEAS post-test scores, SSBS pre-test scores, or SSBS post-test scores ($p > 0.05$).

A low positive correlation was detected with PEAS pre-test scores ($p < 0.05$) regarding the income variable. In

contrast, no significant relationships were found between income and PEAS post-test scores, SSBS pre-test scores, or SSBS post-test scores ($p > 0.05$).

According to Table 13, a significant difference was observed between the pre-test and post-test scores of the study group for the PEAS variable ($p < 0.05$). On the other hand, no significant difference was found between the pre-test and post-test scores for the SSBS variable ($p > 0.05$).

Discussion

This study examined the performance enhancement attitudes and sports supplement belief levels of students who received education on ergogenic aids and anti-doping practices. The findings obtained are in line with the research aim and are discussed in this section within the context of the existing literature.

No significant differences were found in the PEAS pre-test and post-test scores or the participating students' SSBS pre-test and post-test scores based on the gender variable. Supporting this result, Yıldız (2017) found no

significant difference in attitudes toward prohibited substances among the research group based on gender [18]. Similarly, Şapçı (2010), in a study with students participating in inter-university sports competitions, reported no variation in performance enhancement attitudes by gender [26]. Morente, Femia, and Zabala (2014) also reached similar conclusions, noting no differences in performance enhancement attitudes based on participants' gender [27].

Ayaş (2020) observed no significant difference in the belief levels regarding sports supplements among participants based on gender [28]. Sirico et al. (2018) also found no gender-based differences in habits and beliefs regarding dietary supplements [29].

Conversely, Backhouse, Whitaker, and Petroczi (2013) identified gender-based differences in performance enhancement attitudes among their study group [30]. Similarly, Aydın and Soyer (2023) found variations in performance enhancement attitude levels based on gender [31]. Göbel (2023) observed that karate practitioners' sports supplement belief levels varied by gender, while Duran and Aykora (2021) noted similar differences in sports supplement beliefs among participants based on gender [31, 32].

Considering the universal nature of all nuances within sports, it can be suggested that performance enhancement attitudes and sports supplement belief levels may not vary significantly based on gender among students.

No significant differences were found in the PEAS pre-test and post-test scores or the participating students' SSBS pre-test and post-test scores based on their active sports participation status. Similarly, Aydemir (2019) reported that performance enhancement attitudes did not vary with active sports participation among the research group [33].

In a study by Karataş, Karataş, and Çevrim (2012), physical education and sports school (PESS) students were asked why they did not use doping, with 49.42% responding that it would harm their health [34]. Aladağ (2014) found no differences in the knowledge levels regarding performance-enhancing products among PESS students based on their respective sports disciplines [35].

However, the literature also includes findings indicating different outcomes [31]. Based on these findings, it can be suggested that regardless of whether sports science faculty students actively participate in sports, their knowledge gained from prior sports experiences is similar, and their attitudes developed during this process do not show significant differences.

A significant difference was observed in the participating students' SSBS post-test scores based on their residence. In contrast, no significant differences were found in the PEAS pre-test or post-test scores, nor the SSBS pre-test scores.

In ancient societies, participants who achieved high rankings in competitions gained a prestigious status within their civilization and were often celebrated as heroes. This process of glorification sometimes extends to deification [36]. Similarly, in modern times, successful athletes are often viewed as prominent figures within their communities. As a result of this appeal and the pursuit of such special recognition, athletes may continue to resort to doping despite its prohibition. According to the 2015 data published by the World Anti-Doping Agency (WADA), approximately 2% of the analyzed samples revealed "abnormal findings" [37]. Similarly, a study by the German Federal Institute of Sport Science found that 53.4% of athletes reported never having used doping substances, implying that about 47% might have used doping at least once in their lifetime [38].

These findings demonstrate that doping remains a contemporary issue among athletes. One of the contributing factors is the ease of access to doping substances in today's globalized world. This increased accessibility has also led to greater awareness of performance-enhancing products.

In this context, findings from WADA and the broader literature suggest that individuals living in metropolitan areas have easier access to various performance-enhancing and ergogenic aids compared to those in smaller, less populated regions. This difference in accessibility may account for the observed variations in the study results related to place of residence.

A significant difference was identified in the PEAS pre-test scores based on the variable of achieved sporting success among participants. Upon examining the source of this difference, it was observed that participants with international and national achievements scored higher than those without, with results favouring international and national success. Additionally, no significant differences were found in the PEAS post-test, SSBS pre-test, or SSBS post-test scores based on the same variable.

Supporting these findings, Yalçinkaya (2016) reported that attitudes toward doping substances varied among elite athletes depending on their level of national success and national team membership [39]. Similarly, Şapçı (2010) found that attitudes toward doping substances differed among university athletes based on whether they underwent doping testing after achieving success [26].

In another study, Morente-Sanchez et al. (2013) examined a group of 72 Spanish national cyclists and reported a mean performance enhancement attitude score of $X = 36.12 \pm 9.39$ [27]. This value is below the scale's average score of 59.5, indicating that the cyclists had negative attitudes toward performance enhancement.

In light of these findings, attitudes toward performance enhancement may vary based on the variable of achieved

success. However, this variability can be mitigated through targeted educational programs.

A low negative correlation was identified between the participants' age and PEAS pre-test scores, while a low positive correlation was found between age and PEAS post-test and SSBS post-test scores. On the other hand, no significant relationship was observed between age and the SSBS pre-test scores.

A low negative correlation was identified between the participants' age and PEAS pre-test scores, while a low positive correlation was found between age and PEAS post-test and SSBS post-test scores. On the other hand, no significant relationship was observed between age and the SSBS pre-test scores.

A low positive correlation was detected between the participants' sports age and PEAS pre-test scores. However, no significant relationships were found between sports age and the PEAS post-test, SSBS pre-test, or SSBS post-test scores. Similarly, a low positive correlation was observed between income and the PEAS pre-test scores. At the same time, no significant relationships were identified between income and the PEAS post-test, SSBS pre-test, or SSBS post-test scores.

Supporting these findings, Yalçinkaya (2016) reported that attitudes toward doping substances varied depending on participants' age [39]. Şapcı (2010) found that attitudes toward doping substance use differed based on sports age and income levels [39].

In a study conducted by Öztürk (2009) to assess handball players' knowledge levels about doping substances, 35.8% of athletes aged 20–24 believed that using doping substances to enhance performance or for other reasons was unacceptable [40]. Furthermore, a significant difference was identified when comparing the attitudes toward doping between athletes under 20 and those over 20.

Yücel et al. (2016) also found that handball players' knowledge of doping varied according to income levels [41]. These findings suggest that demographic variables such as age, sports experience, and income may influence attitudes and knowledge regarding doping and performance-enhancing substances.

Athletes' desire for fame and recognition, high transfer fees, and the drive to succeed in competitions create an environment conducive to doping. Additionally, athletes often face financial pressures related to housing, nutrition, and sports equipment. Sponsorship agreements, which arise to address these financial needs, demand successful results from athletes and use them as marketing tools. This environment of reward and performance expectations can significantly drive athletes toward doping [42].

In summary, as the financial gains associated with sporting success increase, so does the importance of winning. This growing emphasis has made sports

increasingly competitive and high-stakes over time. This heightened competitiveness provides a critical context for understanding the rising prevalence of doping in the sports domain [35].

In this context, with proper education, students' performance-enhancement attitudes and beliefs in sports supplements may increase with age. Similarly, attitudes toward performance enhancement will likely improve with increased sports experience and income.

A significant difference was observed between the pre-test and post-test scores of the PEAS variable among participants. The average pre-test score was 38.74, while the post-test average increased to 44.13. Given that the arithmetic mean of the scale is 59.5, scores below this threshold indicate a negative attitude. In this context, it can be suggested that students who received education on ergogenic aids and anti-doping practices significantly improved their performance-enhancement attitudes.

Conversely, no significant difference was found between the pre-test and post-test scores of the SSBS variable. The average pre-test score for SSBS was 22.20, while the post-test score was slightly lower at 21.01. With an arithmetic mean of 21.0, higher scores on the scale indicate stronger beliefs in sports supplements and a greater inclination toward doping and prohibited substances.

Considering that the study group consisted of sports sciences faculty students with athletic backgrounds, it can be inferred that their beliefs about sports supplements remained consistent and did not vary significantly despite the education they received on ergogenic aids and anti-doping practices.

Limitations of the study and recommendations for future research

This study was limited to students from the Faculty of Sport Sciences at Bayburt University, with results drawn from a specific population of 61 participants. The selection of the research group from a single institution restricts the generalizability of the findings. Additionally, participants' performance enhancement attitudes and beliefs regarding sports supplements were evaluated solely through specific scales. Incorporating qualitative methods could provide a deeper understanding of participants' perspectives on these topics.

Recommendations for future research include

- We are conducting studies with more extensive and diverse participant groups across different universities and various sports disciplines to enhance the generalizability of the findings.
- Qualitative research methods, such as focus group discussions or in-depth interviews, should be

employed to analyze students' attitudes toward doping and sports supplements comprehensively.

- Implementing longitudinal studies to investigate the long-term effects of educational programs on performance enhancement attitudes and beliefs.
- In subsequent studies, a control group can be added to strengthen the study. Additionally, qualitative components can be added.
- We are exploring similar research in different cultural contexts to identify cultural variations in athletes' attitudes and beliefs regarding doping and the use of ergogenic aids.

These steps can contribute to a more comprehensive understanding of the factors influencing attitudes and beliefs about doping and performance enhancement, ultimately aiding the development of more effective educational and policy interventions.

Conclusion

This study aimed to evaluate the performance enhancement attitudes and sports supplement belief levels of sports sciences faculty students who received education on ergogenic aids and anti-doping practices. The findings revealed a significant improvement in the performance enhancement attitudes of students following the education, while their sports supplement belief levels showed no substantial change. This outcome may be attributed to the students' prior athletic backgrounds and pre-existing knowledge and experiences regarding ergogenic aids, which might have shaped their beliefs independently of the educational intervention.

The results demonstrate that education on doping and ergogenic aids can positively impact student attitudes toward performance enhancement. Such educational programs are precious in raising awareness and enhancing understanding of ergogenic aids and anti-doping efforts. However, altering beliefs about sports supplements may require more in-depth educational initiatives and awareness campaigns to address misconceptions and behavioural patterns related to supplement use.

Moreover, educational programs' content, delivery, and duration should be considered, as these aspects can influence participants' attitudes and beliefs. To ensure the long-term effectiveness of these programs, it is essential to regularly update the content and tailor it to the specific needs of the participants.

Lastly, preventing doping and performance-enhancing substances in sports and fostering a more ethical sports culture requires a comprehensive approach. This approach should integrate individual educational initiatives, societal awareness projects, institutional policies, and regulatory mechanisms. In this context, the findings of this study provide a foundation for developing more

comprehensive policies and educational programs in the future.

Abbreviations

SPSS	Statistical Package for the Social Sciences
%	Percentage
IAAF	International Association of Athletics Federations
IOC	International Olympic Committee
N	Number of Participants
P	Significance Level
PEAS	Performance Enhancement Attitude Scale
R	Correlation Coefficient
S	Page Number
Df	Degrees of Freedom
SD	Standard Deviation
SSBS	Sports Supplement Belief Scale
T	t-Test Value
TDK	Turkish Language Association
TADC	Turkish Anti-Doping Commission
TWF	Turkish Weightlifting Federation
NOC of Turkey	National Olympic Committee of Turkey
WADA	World Anti-Doping Agency
$\bar{x}$	Mean

Supplementary Information

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Supplementary Material 1

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Author contributions

Study Conception and Design: U.C.K., M.A.C.; Data Acquisition, Analysis, or Interpretation of Data: U.C.K., M.A.C.; Drafting the Manuscript: U.C.K., M.A.C. All authors critically reviewed the manuscript for significant intellectual content. Senior Authorship: M.A.C. All authors approved the final version of the manuscript.

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Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request. The dataset will be accessible only for academic purposes, and any use of the data will recognize the original study and maintain the confidentiality of the participants.

Declarations

Ethics approval and consent to participate

The research was conducted with the knowledge and approval of the school administration. The study was carried out in accordance with the Declaration of Helsinki and applicable local guidelines and regulations. Ethical approval was obtained from the Faculty Ethics Committee of the Bayburt University Rectorate, Bayburt University, with the decision number 26.11.2022–104520, dated 25.11.2022 documented in the 2022/249 Bayburt University Rectorate Ethics Committee Decisions. The participants in this study voluntarily participated of their own accord. Informed consent was obtained from all participants. All methods were carried out in accordance with the relevant guidelines and regulations.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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