



## RESEARCH ARTICLE

# The Identification of Commonly Used Pharmacological Ergogenic Aids and an Investigation of their Relationship with Gastrointestinal Symptoms

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ARTICLE INFO	ABSTRACT
Received: Apr 24, 2024 Accepted: Jun 15, 2024	The use of ergogenic aids by athletes is becoming increasingly common. Although ergogenic aids have positive contributions to the process of increasing performance, they can sometimes have negative effects on the gastrointestinal system. This study aimed to identify the types of commonly used pharmacological ergogenic aids and investigate the relationship between these aids and gastrointestinal symptoms. Our analysis included a total of 100 subject who exercised regularly and used at least one pharmacological ergogenic aid. For each subject, we determined a score on The Gastrointestinal Symptom Rating Scale which consists of 15 questions. To determine the ergogenic aids used by each subject, we used a questionnaire relating to the use of ergogenic aids and featuring five questions. Data were analyzed by one-factor analysis of variance (ANOVA) and independent T-tests. Analysis demonstrated that the most commonly used pharmacological ergogenic aid was protein powder and that l-carnitine was used the least. In terms of the incidence of gastrointestinal symptoms, analysis showed that caffeine, creatine, l-carnitine, arginine, protein powder and glutamine were the most frequently used pharmacological ergogenic aids. There was no significant difference in the incidence of gastrointestinal symptoms when compared between the different types of pharmacological ergogenic aids investigated ( $p>0.05$ ). However, the total gastrointestinal symptom score of subjects using more than one ergogenic auxiliary was significantly lower than that of subjects using only one ergogenic auxiliary ( $p<0.05$ ). In terms of the relative effects on the gastrointestinal system, we found that all of the pharmacological ergogenic aids tested caused similar levels of discomfort, and that individuals who used more than one pharmacological ergogenic aid experienced fewer gastrointestinal symptoms. In the light of our evaluations, we suggest that consumers of pharmacological ergogenic aids should be develop greater awareness of these products and consume these products more consciously.
<b>Keywords</b> Exercise Pharmacological ergogenic aid Gastrointestinal symptom Performance Health	
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## INTRODUCTION

Research has shown that use of pharmacological ergogenic aids is increasing (consciously or unconsciously) in individuals who exercise [1]. Individuals use such aids to increase performance, prevent injuries, improve physical appearance, overcome nutritional deficiencies, strengthen the immune system and accelerate post-exercise recovery [2].

Previous studies have tended to focus on the knowledge level of athletes with regards to the use of pharmacologic ergogenic aids. For example, Vento and Wardenaar, (2020) reported that 16% of students who exercised regularly stated that were knowledgeable with regards to such supplements and the good and bad consequences that these supplements may exhibit. All participants reported that they had used a sports food or nutritional supplement at least once over the previous twelve months and 77% reported consuming at least one ergogenic supplement. These authors reported that the subjects analyzed had significant knowledge in terms of the use of ergogenic supplements [3]. However, previous research carried out in Turkey reported findings that opposed research performed internationally. For example, Çetin et al. (2008) reported that the knowledge level of students at the Gazi University School of Physical Education and Sports with regards to doping and ergogenic supplements was extremely insufficient and that ergogenic supplements were only used on rare occasions. Based these findings, the authors determined that the majority of the participants on this study did not pay attention to their nutrition. Given the clear lack of knowledge relating to nutrition and ergogenic supplements, and the lack of regular health check-ups, Çetin et al. (2008) indicated that these students may face important health problems in the future [4].

In another study, Jagim and Kerksick (2021) investigated an adolescent populations and demonstrated that the popularity of nutritional aids had gradually increased over the last fifteen years, and suggested that this could have arisen consciously or unconsciously. These researchers suggested that this increased level of interest may allow a predictive ability that will allow for better learning in younger individuals [5].

The increasing and widespread use of ergogenic aids is driving a large economic sector. The easy accessibility of these pharmacological ergogenic aids, and the gradual and continuous increase in their consumption over recent years, have made this sector attractive and manufacturers have begun to view athletes as a potentially lucrative market. Another study used questionnaires to ascertain were individuals accessed dietary supplements and determined that websites, social media, gyms, trainers, friends, and pharmacies were the main sources of information [6]. However, is evident that many of these finds do not have proven value or a solid scientific basis. Furthermore, researchers have suggested that the claimed effects of these products are mostly the words of marketers or hearsay beliefs [7]. Bozkurt (2022) investigated whether ergogenic aids are beneficial or not and found that the participants were undecided when asked whether they would prefer natural nutrition or supplementation products [8]. On the other hand, little is known about the potential side effects and ethics associated with the use of these dietary aids. This situation indicates that individuals are uninformed about the use and benefits of natural nutrition and ergogenic support products, that they are unaware of the potential side effects, and do not have an opinion with regards to ethical values. Similar concerns were reported by Ercen (2016) [9].

Efficient marketing strategies have resulted in the use of nutritional supplements by millions of amateur and elite athletes [10]. The most popular pharmacological ergogenic aids include caffeine, calcium, creatine, l-carnitine, vitamins, arginine, steroids, protein powder, and glutamine. Miller et al. (2005) investigated these products and reported a range of potential side effects, including short-term psychological side effects (paranoia, aggression, sleep disorders, and depression), and physiological side effects (high blood pressure and heart attack). In particular, women have been reported to suffer from thickening of voice tone and increased hair growth on the body and face[11]. Serbest (2015) further reported a range of gastrointestinal symptoms, including diarrhea, vomiting, abdominal pain, heartburn, hunger pain, nausea, bloating and constipation [12].

Karakuş & Kılıç, (2006) reported concern in that although it is widely accepted that gastrointestinal symptoms can negatively affect performance, the factors that cause these symptoms have yet to be elucidated in detail [13,28]. In the present study, we aimed to determine the most commonly used pharmacological ergogenic aids and investigate their relationship with gastrointestinal symptoms.

## MATERIALS AND METHODS

### Study design

In this study, we used a quantitative and relational survey design. This type of experimental design aim to determine the existence and/or degree of change between two or more variables [14,29]. In addition, we used the criterion sampling method; purposive sampling is a sampling method that is suitable for individuals with specific, limiting and hard-to-reach individual characteristics [15]. *In this study*, we aimed to identify the most commonly used pharmacological ergogenic aids and identify their relationship with gastrointestinal symptoms. For this reason, we adopted a quantitative correlational survey design.

### Study participants

A total of 100 individuals, 70 males and 30 females, who were members of Wellness Sports Center, participated in the study. The mean exercise age of the individuals participating in the study was  $6.48 \pm 5.74$  years; on average, the participants attended a gym  $4.69 \pm 1.27$  days a week.

**Table 1. Demographic information.**

Demographic Information	N	Mean	S
Age	100	24.12	6.43
Height	100	176.81	10.59
Weight	100	79.04	15.45
BMI	100	22.71	3.97
Exercise Age	100	6.48	5.74
Weekly Gym Visits	100	4.69	1.27

### Data Collection Tools

The Gastrointestinal Symptom Rating Scale, consisting of 15 questions, was used to survey the participants. This scale was developed by Revicki et al. (1998) to investigate the common symptoms of gastrointestinal [16]. The Turkish validity and reliability of the scale was reported by Turan et al. (2017) [17]. The Gastrointestinal Symptom Rating Scale is a seven-point Likert scale ranging from no discomfort to very severe discomfort and the 15 items of this scale are collected in five sub-dimensions: reflux, indigestion, diarrhea, constipation and abdominal pain. The total score of the Gastrointestinal Symptom Rating Scale ranges from 15 to 105; higher total scores indicate a higher severity of symptoms [16] [17]. In order to determine the ergogenic aids preferred by the subjects, we used a bespoke questionnaire, designed in-house, related to the use of ergogenic aids that consisted of five questions. This survey consisted of questions about which ergogenic aids they used, how many ergogenic aids they used, and how many times a week they used them.

### Data Collection

The Gastrointestinal Symptom Rating Scale and the Ergogenic Auxiliary Detection Questionnaire were administered to selected members of the Wellness Sports Center. Participation in the study was voluntary. Participants signed a voluntary consent form and were informed about all details of the study. The starting date of this research recruitment is 11/09/2023 and the ending date is 24/11/2023.

## Data Analysis

Data analysis included descriptive statistics, single-factor analysis of variance (ANOVA) and an independent T-Test. All analyses were performed in SPSS program (26.0; IBM Corp., Armonk, NY).

## Publication Ethics

The study was conducted in accordance with the Declaration of Helsinki and approved by Gazi University Ethics Committee (Approval code: 2023-582).

## RESULTS

Table 2 shows that the most commonly used pharmacological ergogenic aid was protein powder and the least commonly used was l-carnitine. In terms of the frequency of gastrointestinal symptoms, caffeine, creatine, l-carnitine, arginine, protein powder and glutamine were the most frequently used pharmacological ergogenic aids. There was no significant difference between the types of pharmacological ergogenic aids examined in terms of the frequency of gastrointestinal symptoms ( $p>0.05$ ).

**Table 2. Incidence of gastrointestinal symptoms by type of pharmacological ergogenic aid used.**

Types of Pharmacological Ergogenic Auxiliaries	N	Mean	S	f	p
Protein Powder	31	20.76	8.52	.326	.923
Creatine	24	21.98	9.57		
Caffeine	19	22.02	7.74		
Arginine	9	21.26	9.17		
Glutamine	9	19.40	4.95		
L-Carnitine	8	21.76	8.62		
Total	100	21.37	8.80		

Next we compared data according to the method of ergogenic auxiliary use and found that the total gastrointestinal symptom score of individuals using more than one ergogenic auxiliary was significantly lower than individuals using only one ergogenic auxiliary ( $p<0.05$ ) (Table 3). In this context, it was determined that the effects of pharmacological ergogenic auxiliaries on the gastrointestinal system were similar to each other, and that individuals using more than one pharmacological ergogenic auxiliary experienced fewer gastrointestinal symptoms.

**Table 3. Comparison of the incidence of gastrointestinal symptoms by method of use.**

Method of Use	N	Mean	S	t	p
Those Using Only One Pharmacological Ergogenic Auxiliary	37	25.89	16.79	1.972	<b>.049*</b>

Those Using More Than One Pharmacological Ergogenic Auxiliary	63	21.21	6.66		
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## DISCUSSION

In this study, we analyzed 100 participants who exercised regularly. Our analysis demonstrated that protein powder was the most commonly used pharmacological ergogenic aid. In support of our findings, previous studies, involving bodybuilders [18], elite athletes [19] and amateur football players [20] also showed that protein powder was the most commonly used ergogenic aid. This significant increase in the usage of ergogenic aids can be interpreted in line with the findings of a study previously conducted on university students (Terzi, 2021): as body perception increased, attitudes towards negative eating decreased. Furthermore, the use of social media and the associated increase in visual communication can influence the attitudes of young individuals. These authors also stated that as positive attitude increases, eating attitudes become healthier [21]. Another study, involving high school students, found that the use of pharmacological ergogenic aids, energy drink consumption, and harmful substance habits were influenced by parents, friends and peers, as determined by the relational analysis of items in the diagnosis of depression as a result of increasing body perception and visual bullying during adolescence [22]. Another study, involving professional female football players, found that the highest risk of body perception and eating behavior disorder in female football players, when analyzed across different leagues, was detected in the third league of female football players (74.70%), followed by players in the second league (72.30%) and then the first league (61.20%) [23]. Furthermore, these authors identified a serious risk situation in terms of body dissatisfaction that increases with popularity. Furthermore, a significant difference was detected between the consumption of energy drinks and mass enhancers in female soccer players on training days. Early diagnosis and treatment were identified as important factors in terms of the risk of eating behavior disorders and the deterioration of body perception in female football players, thus indicating that it was important to reduce future risks [23]. This data suggests that the members of this particular study cohort (Wellness Sports Center) predominantly attend the gym to increase muscle mass and improve their appearance, thus generating significant interest in the use of protein powder.

The use of pharmacological ergogenic aids without awareness or in inappropriate doses can be associated with many side effects. The most prominent of these side effects is gastrointestinal symptoms [12]. In the present study, we determined that the pharmacological ergogenic aids with the highest incidence of gastrointestinal symptoms were caffeine, creatine, l-carnitine, arginine, protein powder and glutamine. However, when these aids were compared with each other, we found no statistically significant difference in terms of the incidence of gastrointestinal symptoms. When analyzing all ergogenic aids, we observed that one-fifth of all participants were uncomfortable with the product they used and experienced symptoms; in terms of percentiles, caffeine was the product that was most associated with gastrointestinal symptoms. Our review of the literature relating to pharmacological ergogenic aids revealed a multitude of studies that have investigated the effects of caffeine on gastrointestinal symptoms [24][25]. In particular, one previous study suggested that the time of caffeine consumption, the mood and shape during intake, and being accustomed to caffeine, all led to an increase in the effects on performance and gastrointestinal symptoms [26].

Another factor evaluated in our present study was whether gastrointestinal symptoms were associated with the use of a single pharmacological ergogenic aid or the use of more than one product. Our analysis revealed that the total gastrointestinal symptom score of individuals using more than one ergogenic aid was lower than individuals using only one ergogenic aid. Our review of the literature identified a rare study that had investigated the specific effects of pharmacological

ergogenic aids on gastrointestinal symptoms based on sodium bicarbonate dosing and fewer symptoms [27]. In the present study, we investigated several products provide findings that provide a different perspective to the existing literature.

## CONCLUSIONS

Based on the findings presented herein, we can conclude that the use of pharmacological ergogenic aids has increased over recent years. Analysis showed that protein powder was the most commonly used pharmacological ergogenic aid. Next, we investigated the effect of these aids on gastrointestinal discomfort. Caffeine was identified as the aid that cause the largest incidence of gastrointestinal symptoms. Furthermore, one-fifth of the participants experienced gastrointestinal symptoms, regardless of the aid used. Finally, we investigated the use of one or more aids and found that there was no significant difference between these two strategies. In the light of our evaluations, we suggest that consumers of pharmacological ergogenic aids should be develop greater awareness of these products and consume these products more consciously.

## Conflict of interest

None of the authors have any conflicts of interest to declare.

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