

Acute effects of taurine supplementation on visuomotor reaction time in physically active young adults

PEDRO PINHEIRO PAES¹; RUBEM CORDEIRO FEITOSA²; DENIS ALMEIDA VITAL³; MARLENE SALVINA FERNANDES DA COSTA⁴; JEAN HENRIQUE DERMARCO MARCOLINO DA SILVA⁵; SUELLEN KAROLLYNNE SOARES SILVA⁶; BEATRIZ CAVALCANTI DOS SANTOS⁷; WLALDEMIR ROBERTO DOS SANTOS⁸; FREDERICO CAMAROTTI JÚNIOR⁹.

^{1,2,3, 5,6,7} Department of Physical Education, Federal University of Pernambuco, Recife, BRAZIL

^{4,8} School of Physical Education, University of Pernambuco, Recife, BRAZIL

⁹ Department of Physical Education, Brazilian University Center, Recife, BRAZIL

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Abstract

Introduction: Physical performance in active individuals depends on the integration of motor abilities and cognitive processes. Taurine, an amino acid abundant in excitable tissues, contributes to central neuromodulation and calcium homeostasis and may therefore affect motor readiness. **Objective:** To evaluate the acute effects of taurine supplementation alone on visuomotor reaction time in physically active young adults. **Methods:** Methods: In this randomized, triple-blind, crossover, placebo-controlled trial, eleven physically active volunteers (22 ± 1.14 years) ingested 3 g of taurine, 3 g of starch (placebo), or 3 g of starch (in the condition induced effect placebo). Sessions were separated by a seven-day washout interval. Sessions were separated by a seven-day washout interval. Visuomotor reaction time and accuracy (hits/errors) were assessed using the ReactionX system before and after an incremental exercise protocol performed to exhaustion (Yo-Yo Endurance Test – Level 1). Data distribution was assessed using the Shapiro–Wilk test. Differences among the three experimental conditions were examined using the Friedman test, with paired comparisons performed using the Wilcoxon test. **Results:** No statistically significant differences were observed between the conditions (taurine, placebo, and induced placebo effect) in reaction time or accuracy, either before or after exercise exhaustion. Reaction time before showed a trend toward a difference among conditions ($p = 0.066$), while the post-exercise error-rate comparison between taurine and placebo yielded $p = 0.056$. Neither result met the statistical significance of $p < 0.05$. **Conclusion:** Under the conditions investigated, a single 3-g dose of taurine yielded no statistically significant differences in visuomotor reaction time or response accuracy in physically active young adults. These findings should be interpreted in light of the small sample size, the acute supplementation protocol, and the specific cognitive-motor task employed.

Keywords: taurine, reaction time, processing speed, placebo effect, psychomotor performance.

Introduction

Physical performance in physically active individuals depends in part on the integration of motor skills and cognitive processes (Lassiter et al., 2012; Moon et al., 2023; Delfa-de-la-Morena et al., 2025). Success in dynamic activities requires the nervous system to process information rapidly in order to organize precise neuromotor responses (Magill, 2000; Jothi et al., 2025). In this context, reaction time serves as a critical indicator of motor readiness, reflecting the efficiency of decision-making and movement execution (Polechoński et al., 2025; Brito et al., 2022). Thus, speed in central processing and the readiness of the motor response are fundamental to optimizing performance and movement efficiency (Janković et al., 2022).

In this regard, the speed and accuracy of the visuomotor response play an important functional role in sport context, enabling the integration of visual stimuli to guide decisions and motor actions in rapid tasks (Vesely et al., 2026). This ability to process visual information and respond promptly facilitates the execution of directed movements and reactive maneuvers (Cano et al., 2024). However, although a shorter reaction time reflects greater motor-cognitive efficiency, its isolated improvement does not necessarily guarantee an enhancement in overall athletic performance, given the multifactorial nature of physical performance (Zwierko et al., 2024).

Currently, nutritional ergogenic aids are widely utilized to enhance physical performance among both elite athletes and recreationally active individuals (Chtourou et al., 2019; Antonio et al., 2024). Among these strategies, energy drinks stand out due to their accessibility and the promise of improving performance, reducing perceived fatigue, and promoting alertness (Oliver et al., 2021; Mihaiescu et al., 2024). Although physical performance is related to aspects such as force-generating capacity, endurance, and exercise tolerance, perceptual-cognitive performance involves processes such as attention, concentration, information processing

speed, and decision-making, which contribute to the interpretation of environmental stimuli and the execution of appropriate motor responses (Vesely et al., 2026). Thus, the effects of substances present in energy drinks may extend beyond the physical dimension, influencing relevant cognitive functions (Seidl et al., 2000; Deng et al., 2025; Köse et al., 2026).

Among the compounds present in these formulations, taurine (TAU) has attracted interest due to its potential actions on the central nervous system (Kowsari et al., 2018). This amino acid is involved in regulating neural transmission and modulating neuronal excitability, mechanisms that may be related to cognitive processes such as attention and information processing (Rafiee et al., 2022; Mihaiescu et al., 2024). In this context, TAU has attracted increasing interest because of its potential influence on perceptual-cognitive performance, which may contribute to the speed and accuracy of motor responses (Lassiter et al., 2012; Cao et al., 2025).

TAU is a free, non-proteinogenic β -amino sulfonic acid notable for not being incorporated into proteins, standing out as one of the most abundant compounds in excitable tissues, with particularly high concentrations in the brain and skeletal muscle (Ripps & Shen, 2012; Rafiee et al., 2022; Rais et al., 2023). In these tissues, it represents a significant portion of the intracellular amino acid pool and performs essential functions related to modulating neural transmission, stabilizing cell membranes, and maintaining calcium homeostasis (Ozan et al., 2022; Rais et al., 2023; Júnior et al., 2024).

The mechanisms of action involve central neuromodulation through interaction with inhibitory receptors, regulating cortical excitability and neural transmission (Rafiee et al., 2022; Ozan et al., 2022; Moore et al., 2026). Peripherally, it acts on calcium homeostasis, potentially modulating calcium handling by the sarcoplasmic reticulum, thereby promoting excitation-contraction coupling and contractile readiness (Pereira et al., 2012; Kurtz et al., 2021). In addition to these mechanisms, TAU exhibits neuroprotective and antioxidant properties, helping to neutralize free radicals and preserve mitochondrial function, which may contribute to reducing oxidative stress resulting from physical activity (Pereira et al., 2012; Rais et al., 2023; Antonio et al., 2024; Júnior et al., 2026).

Reaction time can be defined as the interval between the presentation of a stimulus and the onset of the motor response (Magill, 2000; Polechoński et al., 2025). This variable can be classified as simple, when it involves only one stimulus and one response, or as a choice task, when it requires the identification of multiple stimuli and the selection of the appropriate response (Jothi et al., 2025). From a physiological perspective, reaction time can be divided into a premotor phase, related to central cognitive processing, and a motor phase, associated with peripheral neuromuscular activation (Polechoński et al., 2025; Blinch et al., 2024). Thus, it is a relevant variable for physical performance, as it directly influences the speed and effectiveness of decision-making in dynamic activities (Flôres et al., 2023; Janković et al., 2022; Delfa-de-la-Morena et al., 2025).

The evidence regarding the effects of TAU on reaction time remains mixed (Deng et al., 2025; Moore et al., 2026). Although some studies have not observed benefits on simple psychomotor reaction time, others have demonstrated that supplementation can reduce choice reaction time and mitigate the decline in cognitive performance under conditions of fatigue (Peacock et al., 2013; Kowsari et al., 2018; Ozan et al., 2022). These proposed effects have been attributed to possible changes in neural processing and the modulation of mechanisms associated with central fatigue through the neuromodulation of inhibitory receptors, suggesting that TAU may contribute to the efficiency of neural processing and to the readiness of motor responses during tasks with high cognitive and physical demands (Skopek & Hnizdil, 2010; Kowsari et al., 2018; Deng et al., 2025).

Despite interest in the neuromodulatory potential of TAU, scientific evidence regarding its effects on perceptual-cognitive variables and executive functions remains inconsistent (Moore et al., 2026). While some investigations have observed reductions in choice reaction time and gains in inhibitory control and working memory (Giles et al., 2012; Ozan et al., 2022), other studies have identified no isolated benefits in processing speed or accuracy (Peacock et al., 2013; Liu & Rong, 2025). These discrepancies are attributed to methodological differences, including variations in dosage, timing of post-ingestion evaluation, population profile, and task demand and complexity (Moore et al., 2026).

In addition to these factors, variables such as age, physical fitness, and biological sex can influence reaction time (Vesely et al., 2026). The level of physical activity appears to modulate responsiveness to ergogenic aids, since physically active individuals—but not elite athletes—may have greater potential for neuromotor improvements resulting from supplementation (Kurtz et al., 2021). In contrast, high-performance athletes may exhibit a potential ceiling effect due to prior physiological adaptations and higher muscle concentrations of TAU. Thus, physically active individuals constitute a more suitable population for investigating the potential effects of supplementation on reaction time and other neuromotor variables (Kurtz et al., 2021; Deng et al., 2025). Furthermore, this population profile has practical relevance, since neuromotor performance plays a significant role in physical and sports activities (Peacock et al., 2013).

In addition to the physiological aspects related to supplementation, cognitive factors may also influence performance on neuromotor tests (Paes & Júnior, 2025). In this context, a methodological tool that has yet to be fully explored in studies involving sports supplements is the induced placebo effect (IPE), which allows for the

assessment of how beliefs associated with the ingested substance can significantly impact performance, producing responses that do not stem exclusively from its physiological effects (Chtourou et al., 2019). Including an expectancy-induced effect placebo condition may help characterize the contribution of expectations to performance. (Meador et al., 2017).

Despite the widespread consumption of TAU through energy drinks, most studies investigate TAU in combination with other bioactive compounds, primarily caffeine (CAF), which are frequently present in energy drinks and pre-workout supplements, making it difficult to identify its isolated effects (Giles et al., 2012; Peacock et al., 2013; Moore et al., 2026). Consequently, experimental evidence examining the acute effects of isolated TAU supplementation on visuomotor reaction time remains limited (Giles et al., 2012; Liu & Rong, 2025). Given its role in modulating neural transmission, cortical excitability, and neuromuscular function, it is plausible to assume that TAU supplementation may influence performance on tasks that depend on the integration of visual perception, cognitive processing, and motor response. Thus, the objective of this study was to evaluate the acute effects of TAU supplementation alone on visuomotor reaction time in physically active young adults, using a randomized, triple-blind, placebo-controlled (PLA) clinical trial.

Materials and Methods

Study Design and Participants

This is an experimental study with a randomized, triple-blind, crossover, placebo-controlled trial (Thomas et al., 2009). The entire process was conducted using a triple-blind design, in which the participants, evaluators, and the researcher responsible for statistical analysis were unaware of the experimental condition applied in each session (Ghazzagh et al., 2024). The order of supplementation was randomly assigned using the website Randomizer.org (Urbaniak & Plous, 2013). The entire study was conducted at a multi-sport gym between August 2024 and September 2025. The study was approved by the Research Ethics Committee of the Federal University of Pernambuco, under approval number 7,679,667, and conducted in accordance with the ethical principles established in the Declaration of Helsinki. All volunteers were informed about the study's objectives, risks, and benefits and signed the Informed Consent Form (ICF) before the procedures began; they were guaranteed the right to withdraw from the study at any time.

Individuals of both sexes, aged 18 to 40 years, were included if they were classified as active or very active according to the International Physical Activity Questionnaire (IPAQ) (Matsudo et al., 2001) and deemed fit to undergo the experimental procedures using the Physical Activity Readiness Questionnaire (PAR-Q) (França et al., 2020). In addition, participants were excluded if they had a history of cardiovascular disease, musculoskeletal or joint injuries, or to be chronic users of stimulant ergogenic substances. Individuals taking medications belonging to the classes of beta-blockers, angiotensin-converting enzyme (ACE) inhibitors, angiotensin receptor blockers (ARBs), calcium channel blockers, or diuretics were also excluded (Silva et al., 2021). Finally, individuals with any degree of color blindness were not included due to the nature of the cognitive tests used. Participants who reported discomfort or malaise resulting from supplementation, as well as those who did not attend any of the assessment stages, were excluded from the analysis.

Initially, 31 volunteers met the eligibility criteria. Of these, 12 did not begin the experimental procedures, and 8 did not complete all stages of data collection. Thus, the final sample consisted of 11 participants, recruited through convenience sampling using posters displayed in high-traffic areas and promotion on social media.

Procedures

Each participant underwent four data collection phases. The first phase consisted of anthropometric assessment and familiarization with the Reaction X equipment and the incremental protocol. The second, third, and fourth phases corresponded to the experimental sessions, during which the different supplementation conditions were administered.

Following the familiarization session, the experimental phases were conducted with a seven-day interval between them, providing a 7-day washout interval intended to minimize potential carryover effects between sessions (Kurtz et al., 2021). All supplements were prepared and made available 24 hours in advance by a researcher not involved in the study, following the technical guidelines provided by the compounding pharmacy responsible for their supply.

In the experimental sessions, participants received 3 g of TAU or 3 g of starch, as used in the PLA and EPI, one hour before the incremental protocol was performed. The supplements were prepared by a specialized compounding pharmacy and packaged in identical sachets, with similar sensory characteristics across the experimental conditions. The contents of each sachet were diluted in 500 mL of water for consumption. In addition, participants were instructed to avoid strenuous physical exercise and the use of ergogenic aids in the 24 hours preceding each experimental session, in order to minimize potential interference with the variables under investigation (Miloni et al., 2016; Júnior et al., 2024).

The EPI condition involved inducing the expectation that participants would ingest TAU, even though they were actually receiving a placebo. To this end, immediately before taking the supplement, participants were given an envelope stating what they would be ingesting (Paes & Júnior, 2025). In the TAU and PLA sessions, the envelope contained the phrase: “You are taking a Randomized Supplement.” In the EPI session, the message presented was: “You are taking Taurine.” Participants were instructed not to reveal the content of the message to others involved in the study. This procedure was carried out by a pre-designated researcher who did not participate in the assessments nor have access to the collected data.

After ingesting the supplement corresponding to the experimental session, participants rested for one hour in an air-conditioned room with a controlled environment free from external stimuli. This period was adopted to allow for the absorption and metabolism of the ingested compound (Kammerer et al., 2014). At the end of this interval, reaction time was assessed using the Reaction X device.

Next, the participants performed upper- and lower-body stretches, followed by a standardized five-minute warm-up. The warm-up consisted of four minutes of walking at 4 km/h and one minute of light jogging at 6 km/h, performed on the course used for the incremental protocol, including the changes in direction marked by cones (Tan et al., 2025).

After completing the incremental protocol, the participants returned to the climate-controlled room and repeated the reaction time test using the Reaction X device, under the same conditions as the initial assessment. The purpose of this procedure was to compare performance before and after the incremental protocol, as well as to examine possible changes in reaction time and response accuracy as a function of the different experimental conditions, as shown in figure 1 (Ozan et al., 2022).

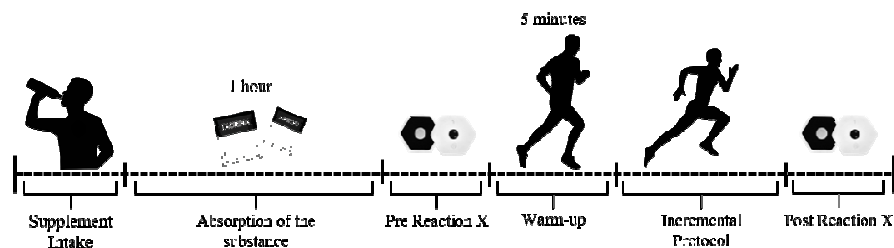


Figure 1. Data collection procedure

Incremental Protocol – Yo-Yo Endurance Test – Level 1

The incremental protocol used was the Yo-Yo Endurance Test – Level 1, developed by Bangsbo in 1994. The test consists of continuous back-and-forth runs on a 20-meter course marked by cones. Participants were required to cover the distance between the ends of the track at a pace dictated by pre-recorded audio cues played through a cell phone connected to a speaker, in accordance with the test’s original guidelines.

Upon hearing the first beep, the participant began running and was required to reach the marked line before the next beep sounded. If the participant did not reach the line by the specified time, the evaluator recorded a warning. The test was terminated after two consecutive warnings or when the participant reached voluntary exhaustion (Castagna et al., 2006).

The intensity of the test increased progressively throughout the stages by shortening the interval between the audible signals, requiring gradual increases in running speed (Tan et al., 2025). At level 1, the test began at a speed of 8 km/h, and at the start of each stage, participants were verbally informed of the corresponding stage and the required running speed.

To minimize the influence of environmental factors and ensure standardization of procedures, all assessments were conducted in the same multisport gym and at times similar to those of the other experimental sessions. Test conditions were kept constant throughout the data collection period.

Instruments

To characterize the sample, body weight and height were measured for all participants using a mechanical anthropometric scale with an attached stadiometer (110CH, Welmy®, Brazil). Body weight was recorded in kilograms (kg) and height in centimeters (cm). Subsequently, body mass index (BMI) was calculated as the ratio of body weight to the square of height (kg/m^2) (Peterson et al., 2016).

Eligibility for study participation was assessed using the PAR-Q, a tool used to identify potential restrictions on physical exercise and evaluate participants’ overall health status (França et al., 2020). The questionnaire consists of seven questions; if a participant answered “yes” to any of them, a medical evaluation was required, followed by approval for inclusion in the study.

Physical activity level was assessed using the short version of the IPAQ, validated for the Portuguese language (Matsudo et al., 2001). The instrument allows for estimating the frequency, duration, and intensity of physical activities performed during the week prior to its administration. Based on the responses obtained, participants are classified as sedentary, irregularly active (A or B), active, or very active. To be eligible for the study, participants had to be classified as active or very active.

To assess visuomotor reaction time, the ReactionX sports training light system (Queling-Sport®, Shenzhen, China) was used, consisting of four LED (light-emitting diode) light sensors. The device features technology similar to that used by the BlazePod™ system, which is widely employed in sports assessments and training involving rapid neuromotor responses (De-Oliveira et al., 2021).

The selected protocol was the “Find Difference” test, in which the four sensors emit light stimuli simultaneously, with three of the same color (red) and one of a different color (green). The participant was required to identify and touch the sensor of the distinct color using their dominant hand. After each touch, the stimuli were automatically turned off and presented again in a new configuration, successively, for 60 seconds (Hoffman, 2020). The variables recorded by the system included the total number of touches, the number of correct and incorrect responses, and the latency between the presentation of the light stimulus and the participant’s response, which was used to quantify choice visuomotor reaction time. The reaction time was determined by the average of the latency intervals recorded over the 60-second test period (Janković et al., 2022). In addition, an accuracy index was calculated using the ratio of the number of correct responses to the total number of attempts made. This indicator was used to quantify task-specific response accuracy. (Huzarska-Rynasiewicz et al., 2025).

All data generated by the system were stored on a smartphone using the official ReactionX app and subsequently exported for analysis, following the manufacturer’s recommendations.

Statistical Analysis

Statistical analyses were conducted using IBM SPSS Statistics for Windows, Version 20.0 (IBM Corp., Armonk, NY, USA). Given the non-normal distribution of the variables analyzed and the repeated-measures design, non-parametric procedures were employed. Sample characteristics for anthropometric variables were expressed using descriptive statistics as median (standard error) along with minimum and maximum values. Continuous and count data were summarized using medians and interquartile ranges (IQRs), as appropriate. Differences across the three experimental conditions (TAU, PLA, and EPI) were evaluated using the Friedman test. For pairwise comparisons, the Wilcoxon signed-rank test was applied. Within-condition comparisons between pre- and post-exercise measurements were also performed using the Wilcoxon signed-rank test. The level of significance was set at $p < 0.05$.

Results

The sample consisted of 11 participants (6 men and 5 women). The median age was 22 years, ranging from 19 to 32 years. Body weight had a median of 65.5 kg (54.6–92.0 kg), while height had a median of 1.67 m (1.57–1.78 m). The median BMI was 23.7 kg/m², with values ranging from 22.0 to 30.3 kg/m² (Table 1).

Table 1. Sample characteristics.

	Women(n Median ± SE	=5)	Men (n =6) Median ± SE	Total (n =11) Median ± SE	Min - Max
Age (years)	20.00±2.48		22.50±0.68	22.00±1.14	19 - 32
Body mass (kg)	60.50±1.57		74.50±3.74	65.50±3.46	54.60 – 92.00
Height (m)	1.61±1.80		1.75±2.04	1.67±2.30	1.57 – 1.78
BMI (kg/m ²)	22.7±0.49		24.9±1.14	23.70±0.72	22.00 – 30.30

Note: BMI: Body Mass Index; SE: Standard error

Table 2 presents the reaction time and accuracy values obtained under the different experimental conditions (TAU, PLA, and EPI). No statistically significant differences were observed between the conditions for any of the variables analyzed.

At rest, reaction time showed similar values among TAU (0.620 s [0.585–0.720]), PLA (0.640 s [0.535–0.740]), and EPI (0.640 s [0.585–0.780]), with no significant difference between the conditions ($\chi^2 = 5.44$; $p = 0.066$). After exhaustion, the values remained similar among TAU (0.590 s [0.585–0.705]), PLA (0.660 s [0.545–0.795]), and EPI (0.590 s [0.575–0.685]), with no significant differences ($\chi^2 = 0.571$; $p = 0.761$).

Regarding response accuracy, the number of errors at rest was similar among TAU (0 [0.00–1.50]), PLA (1 [0.00–2.50]), and EPI (1 [1.00–2.00]), with no significant differences between conditions ($\chi^2 = 2.74$; $p =$

0.255). After exhaustion, the observed values were 0 [0.00–1.00] for TAU, 1 [0.00–3.00] for PLA, and 1 [0.00–2.00] for EPI, again with no significant differences ($\chi^2 = 3.80$; $p = 0.150$).

The number of correct responses remained similar across the experimental conditions both at rest (TAU: 51 [46.00–52.00]; PLA: 50 [46.00–53.00]; EPI: 49 [47.50–51.00]) and after exhaustion (TAU: 50 [46.00–52.00]; PLA: 49 [47.00–53.00]; EPI: 51 [46.50–52.00]), with no statistically significant differences between the conditions ($p > 0.05$).

Table 2. Comparison of the effects of supplementation on reaction times and accuracy at rest and after exhaustion.

	TAU Median [IIQ]	PLA Median [IIQ]	EPI Median [IIQ]	X ²	df	p	Paired comparisons (W)	z	p
RT-Pre (s)	0.620 [0.585– 0.720]	0.640 [0.535– 0.740]	0.640 [0.585– 0.780]	5.44	2	0.066	TAU×PLA (32.50) TAU×EPI (18.50) PLA×EPI (17.00)	0.510 -1.289 -1.423	0.646 0.213 0.168
RT-Post (s)	0.590 [0.585– 0.705]	0.660 [0.545– 0.795]	0.590 [0.575– 0.685]	0.571	2	0.761	TAU×PLA (20.00) TAU×EPI (25.50) PLA×EPI (45.00)	-1.156 0.000 1.067	0.278 1.000 0.306
INC- Pre	0 [0.00-1.50]	1 [0.00-2.50]	1 [1.00-2.00]	2.74	2	0.255	TAU×PLA (12.50) TAU×EPI (17.00) PLA×EPI (30.50)	0.254 0.652 0.222	0.860 0.549 0.855
INC- Post	0 [0.00-1.00]	1 [0.00-3.00]	1 [0.00-1.50]	3.80	2	0.150	TAU×PLA (1.00) TAU×EPI (3.00) PLA×EPI (34.50)	1.992 1.572 1.422	0.056 0.120 0.159
COR-Pre	51 [46.00- 52.00]	50 [46.00- 53.00]	49 [47.50- 51.00]	0.571	2	0.751	TAU×PLA (23.00) TAU×EPI (39.00) PLA×EPI (40.00)	0.059 0.533 0.622	1.000 0.622 0.559
COR- Post	50 [46.00- 52.00]	49 [47.00- 53.00]	51 [46.50- 52.00]	0.143	2	0.931	TAU×PLA (28.50) TAU×EPI (17.50) PLA×EPI (27.50)	0.102 1.019 0.489	0.959 0.330 0.656

Note: TAU: Taurine. PLA: Placebo; EPI: Induced Placebo Effect; RT: Reaction time; Pre: Pre-exercise rest; Post: Post-exercise exhaustion; INC: Incorrect answers; COR: Correct answers; IIQ: interquartile range; X²: Friedman test statistic; df: degrees of freedom; p: Probability of obtaining that value if the null hypothesis is true; W: Wilcoxon signed-rank statistic; z: standardized test statistic.

Table 3 presents a comparison of response accuracy between the resting (pre) and exhaustion (post) conditions under the TAU, PLA, and EPI conditions. No statistically significant differences were observed between the conditions for any of the variables analyzed.

Regarding incorrect responses, the TAU condition showed a median of 0 errors both at rest and after exhaustion ($\chi^2 = 0.200$; $p = 0.655$; $W = 10.5$; $p = 0.498$). In the PLA condition, the median was 1 error at both time points ($\chi^2 = 0.500$; $p = 0.480$; $W = 11.5$; $p = 0.398$). Similarly, the EPI condition showed a median of 1 error at rest and after exhaustion ($\chi^2 = 0.500$; $p = 0.480$; $W = 24.0$; $p = 0.407$).

Table 3. Comparison of incorrect and correct responses before and after exercise.

	Pre (Rest) Median [IIQ]	Post (Exhaustion) Median [IIQ]	χ^2	df	p vaule	W	p vaule
INC-TAU	0 [0.00–1.50]	0 [0.00–1.00]	0.200	1	0.655	10.50	0.498
INC- PLA	1 [0.00–2.50]	1 [0.00–3.00]	0.500	1	0.480	11.50	0.398
INC-EPI	1 [1.00–2.00]	1 [0.00–1.50]	0.500	1	0.480	24.00	0.407
COR-TAU	51 [46.00–52.00]	50 [46.00–52.00]	0.00	1	1.000	30.50	0.797
COR-PLA	50 [46.00–53.00]	49 [47.00–53.00]	0.090	1	0.763	35.00	0.893
COR-EPI	49 [47.50–51.00]	51 [46.50–52.00]	1.60	1	0.206	17.00	0.300

As for correct responses, the TAU condition had a median of 51 correct answers at rest and 50 after exhaustion ($\chi^2 = 0.000$; $p = 1.000$; $W = 30.5$; $p = 0.797$). In the PLA condition, the median was 50 correct answers at rest and 49 after exhaustion ($\chi^2 = 0.090$; $p = 0.763$; $W = 35.0$; $p = 0.893$). In turn, the EPI condition showed a median of 49 correct responses at rest and 51 after exhaustion ($\chi^2 = 1.600$; $p = 0.206$; $W = 17.0$; $p = 0.300$).

Note: TAU: Taurine. PLA: Placebo; EPI: Induced Placebo Effect; RT: Reaction time; Pre: Pre-exercise rest; Post: Post-exercise exhaustion; INC: Incorrect; COR: Correct; IIQ: interquartile range; X²: Friedman test statistic; df: degrees of freedom; *p* value: Probability of obtaining that value if the null hypothesis is true; W: Wilcoxon signed-rank statistic.

Discussion

The present study evaluated the acute effect of ingesting 3 g of TAU on visuomotor reaction time in physically active young adults. The results showed that supplementation did not produce significant changes in reaction time or response accuracy when compared to the PLA and EPI conditions. Furthermore, no differences were observed between the rest and exhaustion conditions for any of the variables analyzed. No statistically significant differences in perceptual-cognitive performance were detected between the TAU and expectancy-induced placebo conditions. Although placebo effects have been observed in other physical performance variables following the induction of the belief that TAU was ingested (Paes & Júnior, 2025), such effects were not evident in visuomotor reaction time. These findings suggest that acute, isolated intake of TAU, under the conditions used in this study, was not capable of altering the participants' perceptual-cognitive performance or neuromotor readiness.

The comparison of pre-exercise reaction time across conditions did not reach statistical significance ($p = 0.066$). One possible explanation for the absence of significant effects may be related to the timing of the tests in relation to the pharmacokinetics of TAU. The one hour interval adopted in this study was based on protocols previously used in the literature; however, evidence indicates that peak plasma concentrations of TAU may occur between one and 2.5 hours after ingestion (Pereira et al., 2012; Kurtz et al., 2021). Thus, the possibility that different time windows produce distinct responses in tasks dependent on the integration of cognitive processing and motor response cannot be ruled out (Giles et al., 2012; Kammerer et al., 2014).

Physiologically, TAU may help maintain sustained attention and mitigate central fatigue under metabolic stress (Kowsari et al., 2018). However, the present study did not detect a statistically significant difference in postexercise error rates between the TAU and PLA conditions ($p = 0.056$). This effect is attributed to its neuromodulatory action on inhibitory receptors, which stabilize cortical excitability (Moore et al., 2026). Thus, TAU could preserve decision-making efficiency and cognitive readiness, preventing declines in psychomotor performance on highly demanding tasks (Ozan et al., 2022).

The absence of statistically significant pre- to postexercise changes indicates that no differences were detected in the measured reaction-time and accuracy outcomes. These findings do not establish whether central fatigue occurred. Although the protocol induced physical exhaustion, the findings regarding accuracy and reaction time suggest that the central fatigue threshold required to impair psychomotor performance was not reached (Rafiee et al., 2022). TAU may influence this stability through its neuromodulatory action on receptors that stabilize cortical excitability and help mitigate central fatigue (Moore et al., 2026). This preservation of neuromotor readiness suggests that the protocol's demands were insufficient to compromise central processing, keeping motor efficiency stable regardless of physical fatigue or nutritional intervention (Deng et al., 2025).

Although Júnior et al. (2024) observed favorable effects of acute TAU supplementation on aerobic performance variables in active young adults, the results of the present study suggest that such benefits do not appear to extend to visuomotor reaction time performance. The absence of an ergogenic effect from TAU alone corroborates previous evidence from similar studies, such as that by Skopek and Hnízdil (2010), who did not observe improvements in visual reaction time with 0.5 grams of TAU. Similarly, Giles et al. (2012) and Peacock et al. (2013) did not report any significant benefits from the use of 2 grams of isolated TAU on simple reaction time or decision-making reaction time under the conditions they investigated in physically active young adults. Kammerer et al. (2014) also confirmed the ineffectiveness of 1 gram on cognitive performance in military personnel. These findings reinforce that, at acute doses and in active subjects, TAU alone does not optimize neuromotor variables (Moore et al., 2026).

Divergent results, such as those reported by Seidl et al. (2000) and Ozan et al. (2022), often stem from the coadministration of TAU with CAF, which may promote synergistic effects in central processing. Meta-analysis evidence indicates that the CAF+TAU combination surpasses the isolated efficacy of the substances on reaction time, balancing CAF's central stimulation with TAU's neuromodulatory support (Deng et al., 2025). This interaction optimizes cortical excitability and neuromotor readiness, resulting in more robust cognitive benefits; however, the observed acute ineffectiveness when used in isolation highlights the role of methodological confounders and the need to isolate components to validate independent ergogenic effects (Moore et al., 2026).

From another perspective, unlike acute, isolated administration, chronic use (>7 days) appears to yield more consistent results in improving choice reaction time and mitigating neuromuscular fatigue (Kurtz et al., 2021). While acute doses target immediate neuromodulation of GABAergic and glycinergic receptors, prolonged intake may act via slower mechanisms of homeostatic restoration and antioxidant protection against metabolic

stress (Moore et al., 2026). Therefore, the absence of acute significance does not rule out TAU's ergogenic potential in chronic loading protocols. Further research is needed to determine whether longer-term TAU supplementation affects visuomotor performance.

Furthermore, test complexity modulates neuromotor responsiveness, such that simple reaction-time tasks are generally less sensitive to nutritional interventions than tasks with high cognitive or memory demands (Janković et al., 2022; Moore et al., 2026). Increasing the number of components in a response raises the demands on movement preparation, thereby prolonging pre-motor time and neural latency (Blinch et al., 2024). Tasks requiring sustained attention or decision-making are more sensitive to TAU-mediated neuromodulation, particularly under physical stress (Moore et al., 2026). Thus, the observed stability may reflect a lower sensitivity to the choice reaction time test used to detect improvements in central processing efficiency (Moon et al., 2023).

The present findings contribute to a more differentiated understanding of TAU supplementation by indicating that potential effects on physical performance should not be assumed to extend to all cognitive-motor outcomes. Although previous studies have investigated TAU in relation to aerobic performance and other physiological outcomes, the present study did not identify statistically significant benefits for the specific visuomotor task assessed. This distinction is relevant because performance on a brief, device-based choice reaction-time task represents only one component of the cognitive-motor demands encountered in sport. Accordingly, the findings should not be interpreted as evidence that TAU is ineffective across all aspects of physical or cognitive performance, but rather as a lack of detectable benefit for the outcomes evaluated under the conditions tested.

Several methodological considerations should be taken into account when interpreting these findings, particularly the small sample size, the use of a single acute dose, the assessment conducted 1 hour after ingestion, and the characteristics of the visuomotor task. The comparisons that yielded p values close to, but above, the prespecified significance threshold ($p = 0.066$ for pre-exercise reaction time and $p = 0.056$ for postexercise errors) do not establish an intervention effect and should not be interpreted as evidence of efficacy.

Future studies with adequate statistical power should examine different post-ingestion assessment intervals, supplementation protocols, and levels of cognitive-motor task complexity. The use of validated outcome measures and procedures that adequately control for supplementation-related expectations may also help clarify whether the effects of TAU vary according to task demands, assessment timing, or individual characteristics.

Conclusion

This randomized, triple-blind, placebo-controlled crossover study investigated the acute effects of isolated TAU supplementation on visuomotor reaction time and response accuracy in physically active young adults. Under the conditions tested, a single 3-g dose of TAU did not produce statistically significant differences in reaction time or in the numbers of correct and incorrect responses compared with the placebo and induced effect placebo conditions, either before or after the incremental exercise protocol. These findings indicate that acute TAU supplementation did not yield detectable improvements in the specific cognitive-motor outcomes assessed in this sample.

The main contribution of this study is to provide task-specific evidence concerning the acute effects of TAU alone on visuomotor performance while distinguishing the supplementation condition from a placebo condition involving induced expectations. From a practical perspective, the findings do not support recommending a single 3-g dose of TAU specifically to improve visuomotor reaction time or response accuracy in physically active young adults under comparable testing conditions. However, this conclusion should remain restricted to the dose, timing, population, and task investigated. The results neither establish equivalence between the experimental conditions nor exclude the possibility of different responses under other supplementation protocols or cognitive-motor demands.

However, the interpretation of these findings must account for important methodological limitations. The present study relied on a small sample size of 11 physically active university students, which restricts the generalizability of the data to other populations or competitive athletes.

Furthermore, notable limitations include the absence of a non-supplemented control condition and the lack of specific dietary control regarding baseline habitual TAU intake, factors that circumscribe the scope of the results and the statistical power achieved.

Finally, future research should investigate larger and more diverse cohorts, encompassing individuals with varying fitness levels and athletic disciplines. Evaluating multiple post-ingestion time windows and employing tasks with higher cognitive-motor demand and complexity are also recommended. Additionally, investigating chronic supplementation protocols may offer new insights into the potential neuromodulatory adaptations of TAU on reaction time, provided they are supported by a solid theoretical rationale.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used Gemini (Google) to assist in the creation of images and to help refine the formal translations into English, when appropriate. After using this tool, the authors reviewed and edited the content as needed and takes full responsibility for the content of the publication.

Conflicts of interest The authors declare that they have no conflicts of interest.

Limitations

Several methodological and sample-related limitations must be considered when interpreting the findings of this study. The primary limitation concerns the absence of a baseline control condition (without any supplemented intervention), which hindered the assessment of performance in an unsupplemented control condition and precluded a more precise differentiation between the specific physiological effects of TAU and responses stemming from the induced placebo effect. Furthermore, baseline dietary intake was not controlled, specifically due to the absence of a Food Frequency Questionnaire targeted at habitual TAU consumption. This omission may have introduced uncontrolled inter-individual variability in tissue stores of the amino acid, as participants with high prior dietary intake might have exhibited a ceiling effect, thereby dampening responsiveness to acute supplementation.

Another relevant limitation pertains to the sample characteristics, which consisted strictly of physically active university students. This homogeneous sample limits the external validity and generalizability of the findings to populations with varying fitness levels, such as sedentary individuals, who might possess greater scope for perceptual-motor optimization or elite athletes with consolidated neuromuscular adaptations. Finally, the small sample size ($n = 11$) limited the statistical power of the analysis, making it difficult to detect subtle improvements or small-to-moderate effect sizes. This constraint is highlighted by the statistical trends observed for resting reaction time ($p = 0.066$) and post-exhaustion error rate ($p = 0.056$), which might have reached statistical significance in larger, adequately powered cohorts.

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