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Effects of Pinus pinaster and Yohimbine Supplementation on Kinanthropometric and Cardiovascular Parameters in Physically Active Men: a Randomized, Double-Blind, Placebo-Controlled Study

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Abstract

Introduction: The use of ergogenic aids to improve body composition and performance is widespread, yet comprehensive studies evaluating their effects on a wide range of kinanthropometric and physiological parameters are scarce. *Pinus pinaster* and yohimbine are two supplements with purported benefits, but their combined and isolated effects require further investigation. This study aimed to comprehensively evaluate the effects of 14-day supplementation with *Pinus pinaster*, yohimbine, or their combination on kinanthropometric profiles and cardiovascular responses to maximal exercise in physically active men. **Methods:** Forty physically active men (age 18-45 years) were randomized into four groups (n=9 each): placebo (PLA), *Pinus pinaster* 150 mg/day (PIN), yohimbine 5 mg/day (YOH), and Pinus+yohimbine 150mg/day + 5mg/day (PIN+YOH). A comprehensive battery of tests was conducted pre- and post-intervention, including: (1) Kinanthropometry (body composition, somatotype, skinfolds); (2) Cardiovascular responses (blood pressure, heart rate) at rest, exercise onset, peak exercise, and recovery. One-way ANOVA and Kruskal-Wallis tests were used to compare groups. **Results:** After 14 days, no statistically significant differences were observed between the four groups for any kinanthropometric and cardiovascular variables (all $p > 0.05$). All groups demonstrated expected physiological responses to maximal exercise, with significant increases in heart rate and blood pressure, followed by appropriate recovery. No adverse cardiovascular events were noted. **Conclusion:** Short-term supplementation with *Pinus pinaster*, yohimbine, or their combination did not significantly alter kinanthropometric, or cardiovascular parameters compared to placebo in this cohort of physically active men. The supplements were well-tolerated and appeared safe from a cardiovascular standpoint during maximal exercise. The trial was prospectively registered with the World Health Organization International Clinical Trials Registry Platform (ICTRP), registration number RBR-3rxr4bj.

Keywords: Kinanthropometry, Body Composition, Pinus pinaster, Yohimbine, Ergogenic Aids, Cardiovascular Safety.

Resumen

Introducción: El uso de ayudas ergogénicas para mejorar la composición corporal y el rendimiento es generalizado; sin embargo, son escasos los estudios exhaustivos que evalúen sus efectos en una amplia gama de parámetros cineantropométricos y fisiológicos. Pinus pinaster y yohimbina son dos suplementos con supuestos beneficios, pero sus efectos combinados e individuales requieren mayor investigación. Este estudio tuvo como objetivo evaluar de forma integral los efectos de la suplementación durante 14 días con Pinus pinaster, yohimbina o su combinación sobre los perfiles cineantropométricos y las respuestas cardiovasculares al ejercicio máximo en hombres físicamente activos. Métodos: Cuarenta hombres físicamente activos (de 18 a 45 años) fueron asignados aleatoriamente a cuatro grupos (n=9 cada uno): placebo (PLA), Pinus pinaster 150 mg/día (PIN), yohimbina 5

mg/día (YOH) y Pinus pinaster + yohimbina 150 mg/día + 5 mg/día (PIN+YOH). Se realizó una batería completa de pruebas antes y después de la intervención, que incluyó: (1) Cineantropometría (composición corporal, somatotipo, pliegues cutáneos); (2) Respuestas cardiovasculares (presión arterial, frecuencia cardíaca) en reposo, al inicio del ejercicio, en el pico del ejercicio y durante la recuperación. Se utilizaron pruebas ANOVA unidireccional y Kruskal-Wallis para comparar los grupos. Resultados: Después de 14 días, no se observaron diferencias estadísticamente significativas entre los cuatro grupos para ninguna de las variables cineantropométricas y cardiovasculares ($p > 0,05$ en todos los casos). Todos los grupos mostraron las respuestas fisiológicas esperadas al ejercicio máximo, con aumentos significativos en la frecuencia cardíaca y la presión arterial, seguidos de una recuperación adecuada. No se registraron eventos cardiovasculares adversos. Conclusión: La suplementación a corto plazo con Pinus pinaster, yohimbina o su combinación no alteró significativamente los parámetros cineantropométricos ni cardiovasculares en comparación con el placebo en esta cohorte de hombres físicamente activos. Los suplementos fueron bien tolerados y parecieron seguros desde el punto de vista cardiovascular durante el ejercicio máximo. El ensayo se registró prospectivamente en la Plataforma Internacional de Registros de Ensayos Clínicos de la Organización Mundial de la Salud (ICTRP), con el número de registro RBR-3rxr4bj.

Palabras Clave: Cineantropometría, Composición Corporal, Pinus Pinaster, Yohimbina, Ayudas Ergogénicas, Seguridad Cardiovascular.

Introduction

Kinanthropometry, the study of human size, shape, proportion, composition, maturation, and gross function, provides a critical framework for evaluating the effects of nutritional interventions on the human body (Marfell-jones *et al.,* 2006). In the realm of sports nutrition, athletes and physically active individuals frequently turn to ergogenic supplements with the goal of optimizing body composition by reducing fat mass and increasing lean mass and enhancing physical performance (Maughan *et al.,* 2018). Among the vast array of available supplements, plant-derived compounds such as *Pinus pinaster* (maritime pine bark extract) and yohimbine have garnered interest for their potential physiological effects.

Pinus pinaster extract, rich in proanthocyanidins, is known for its potent antioxidant and anti-inflammatory properties, which may aid in recovery and improve endothelial function, potentially benefiting nutrient delivery and cardiovascular health (Nishioka *et al.,* 2007; Rohdewald, 2002). Yohimbine, an alkaloid from the *Pausinystalia yohimbe* tree, is an α-2 adrenergic antagonist that can increase sympathetic nervous system activity, promoting lipolysis and potentially enhancing exercise performance (Ostojic, 2006). However, its sympathomimetic nature also raises concerns about cardiovascular safety, particularly during high-intensity exercise where cardiac demand is already elevated (Kearney *et al.,* 2010).

The combined use of supplements is a common practice, yet the synergistic or antagonistic effects are often not well understood. A comprehensive investigation is warranted to assess not only the efficacy of these supplements in isolation and combination but also their safety profile across a wide spectrum of physiological measures. This includes detailed kinanthropometric changes and cardiovascular responses during maximal stress. Therefore, the purpose of this robust, randomized, double-blind, placebo-controlled study was to conduct a comprehensive evaluation of the effects of 14-day supplementation with *Pinus pinaster*, yohimbine, and their combination on a wide range of kinanthropometric and cardiovascular variables in physically active men.

Material and Methods

Study Design and Ethical Aspects

This study employed a randomized, double-blind, placebo-controlled parallel-group design. Forty healthy, physically active men were recruited and randomly assigned to one of four groups (n=10 per group): Placebo (PLA), *Pinus pinaster* (150 mg/day; PIN), Yohimbine (5 mg/day; YOH), or a combination of *Pinus pinaster* and Yohimbine (150 mg + 5mg/day; PIN+YOH). The intervention period lasted 14 days, with comprehensive testing performed at baseline (Pre) and after the intervention (Post). The study was conducted in accordance with the Declaration of Helsinki and was approved by the Institutional Research Ethics Committee (CAAE: 86133025.6.0000.5336) and registered in International Clinical Trials Registry Platform (ICTRP) under identifier RBR-3rxr4bj (Stefani, 2025). All participants provided written informed consent before participation.

Participants

Participants were physically active men aged between 18 and 45 years, with a body mass index (BMI) between 20 and 30 kg/m², and engaged in regular strength exercise (at least 3 times per week for the last 6 months). Exclusion criteria included any known cardiovascular, metabolic, or musculoskeletal disorders; use of any medication or supplements known to affect the study variables; and allergies to the supplement ingredients.

Supplementation Protocol

Participants received capsules of identical appearance containing either the active supplements or a placebo (200mg per day of cornstarch). The *Pinus pinaster* extract (150mg/per day) was standardized to 94.1% of total proanthocyanidins and yohimbine (5,0mg per day) had a 98.0% degree of purity. The selected dosages were based on previous human studies reporting beneficial effects of *Pinus pinaster* on pro-inflammatory markers and of yohimbine on significantly increasing epinephrine concentrations (Bayer & Högger, 2024; Le Corre *et al.,* 2004). Capsule counts monitored adherence to the supplementation protocol upon their return at the end of the study.

Kinanthropometric Assessment

A full kinanthropometric profile was assessed at baseline and post-intervention, including: Body mass and height: Measured using a calibrated scale and stadiometer (Welmy®, Brazil). Body composition: body density was determined via the 8-site skinfold technique according to ISAK (triceps, subscapular, biceps, suprailiac, supraspinale, abdominal, thigh and calf) using a calibrated skinfold caliper (Cescorf®, Brazil). The Siri equation was used to estimate body fat percentage. Fat mass and lean mass were subsequently calculated (Petroski & Pires Neto, 2012). Skeletal muscle mass was calculated with Lee equation (Lee *et al.,* 2000). Somatotype: the Heath-Carter anthropometric somatotyping method was used to determine ratings for endomorphy, mesomorphy, and ectomorphy (Heath & Carter, 1967). All body composition assessments were conducted by two level 1 ISAK-certified anthropometrists.

Cardiovascular Assessment

Cardiovascular responses were measured during a maximal incremental treadmill test (Bruce protocol) (Bruce *et al.,* 1973). Heart rate (HR) was continuously monitored using a wrist photoplethysmography (Apple Watch®, USA). Systolic (SBP) and diastolic (DBP) blood pressure were measured using an automated sphygmomanometer at four key time points: at rest, at the onset of exercise (Time 0), at peak exercise, and after a 5-minute seated recovery period. Mean arterial pressure (MAP) and the rate-pressure product (double product) were calculated.

Statistical Analysis

Data are presented as mean ± standard deviation (SD). The Shapiro-Wilk test was used to assess the normality of data distribution. To compare baseline characteristics and post-intervention outcomes between the four groups, one-way analysis of variance (ANOVA) was used for normally distributed data. The level of statistical significance was set at $p < 0.05$. All statistical analyses were performed using GraphPad Prism (version 8.0).

Results

Baseline Characteristics

At baseline, there were no statistically significant differences between the four groups in any of the measured kinanthropometric or cardiovascular variables, indicating successful randomization (all $p > 0.05$).

Kinanthropometric Changes

After the 14-day intervention, no significant differences were observed between the groups for any kinanthropometric variable. Changes in body mass, BMI, body fat, lean body mass, skeletal muscle mass, muscle-to-bone index, somatotype components, and sum of skinfolds were minimal and statistically similar across all four groups ($p > 0.05$ for all). Detailed pre- and post-intervention data are presented in Table 1 and Figure 1.

Table 1. Kinanthropometric characteristics pre- and post-intervention.

Variable	Group	Pre-Intervention	Post-Intervention	P-Value (ANOVA)
Body Mass (Kg)	PLA	79.8 ± 11.1	81.5 ± 11.4	0.98
	PIN	82.2 ± 7.9	82.0 ± 9.1	
	YOH	80.4 ± 15.7	81.0 ± 17.1	
	PIN+YOH	80.5 ± 12.6	82.2 ± 14.2	
Height (Cm)	PLA	177.0 ± 7.6	177.0 ± 7.6	0.13
	PIN	178.1 ± 5.5	178.1 ± 5.5	
	YOH	176.6 ± 11.0	176.6 ± 11.0	
	PIN+YOH	176.0 ± 5.9	176.0 ± 5.9	
Body Mass Index (Kg/M^2)	PLA	25.44 ± 2.82	25.81 ± 2.90	0.27
	PIN	26.01 ± 3.31	25.78 ± 3.68	
	YOH	25.60 ± 3.17	25.63 ± 3.57	
	PIN+YOH	25.98 ± 3.73	26.70 ± 3.99	
Body Fat Mass (Kg)	PLA	11.81 ± 4.93	12.54 ± 3.83	0.76
	PIN	13.92 ± 4.67	14.48 ± 5.33	
	YOH	12.82 ± 7.54	12.50 ± 8.52	
	PIN+YOH	13.40 ± 7.05	13.51 ± 6.92	
Body Fat (%)	PLA	14.4 ± 4.5	15.1 ± 2.8	0.81
	PIN	16.7 ± 4.1	17.3 ± 4.7	
	YOH	15.0 ± 6.3	14.1 ± 7.1	
	PIN+YOH	16.2 ± 5.7	16.0 ± 5.5	
Lean Body Mass (Kg)	PLA	68.0 ± 7.1	69.0 ± 8.0	0.99
	PIN	68.2 ± 4.5	67.6 ± 5.0	
	YOH	67.6 ± 9.5	68.5 ± 11.0	
	PIN+YOH	67.1 ± 7.9	68.6 ± 9.5	
Skeletal Muscle Mass (Kg)	PLA	34.5 ± 4.5	35.0 ± 4.8	0.99
	PIN	35.1 ± 3.2	34.7 ± 3.5	
	YOH	34.2 ± 5.5	34.8 ± 6.5	
	PIN+YOH	33.9 ± 4.8	34.9 ± 5.7	
Muscle-To-Bone Index (Kg/Kg)	PLA	4.81 ± 0.45	4.84 ± 0.43	0.97
	PIN	4.74 ± 0.88	4.80 ± 0.71	
	YOH	4.79 ± 0.51	4.78 ± 0.45	
	PIN+YOH	4.88 ± 0.73	5.02 ± 0.59	
$\sum_8$ Of Skinfolds (Mm)	PLA	70.5 ± 23.1	70.7 ± 14.0	0.88
	PIN	80.9 ± 22.7	88.3 ± 24.7	
	YOH	74.0 ± 39.3	75.5 ± 44.9	
	PIN+YOH	81.0 ± 38.7	78.1 ± 37.3	

Data are in mean±SD. PLA = Placebo; PIN = *Pinus pinaster*; YOH = Yohimbine; PIN+YOH = *Pinus pinaster* associated with yohimbine.

Cardiovascular Responses

There were no significant differences between groups in cardiovascular responses at any time point (rest, exercise onset, peak, and recovery) post-intervention ($p > 0.05$ for all). All groups exhibited the expected physiological increase in heart rate and blood pressure during the maximal test, with values returning towards baseline during recovery. Figure 2 summarizes the peak exercise and recovery data.

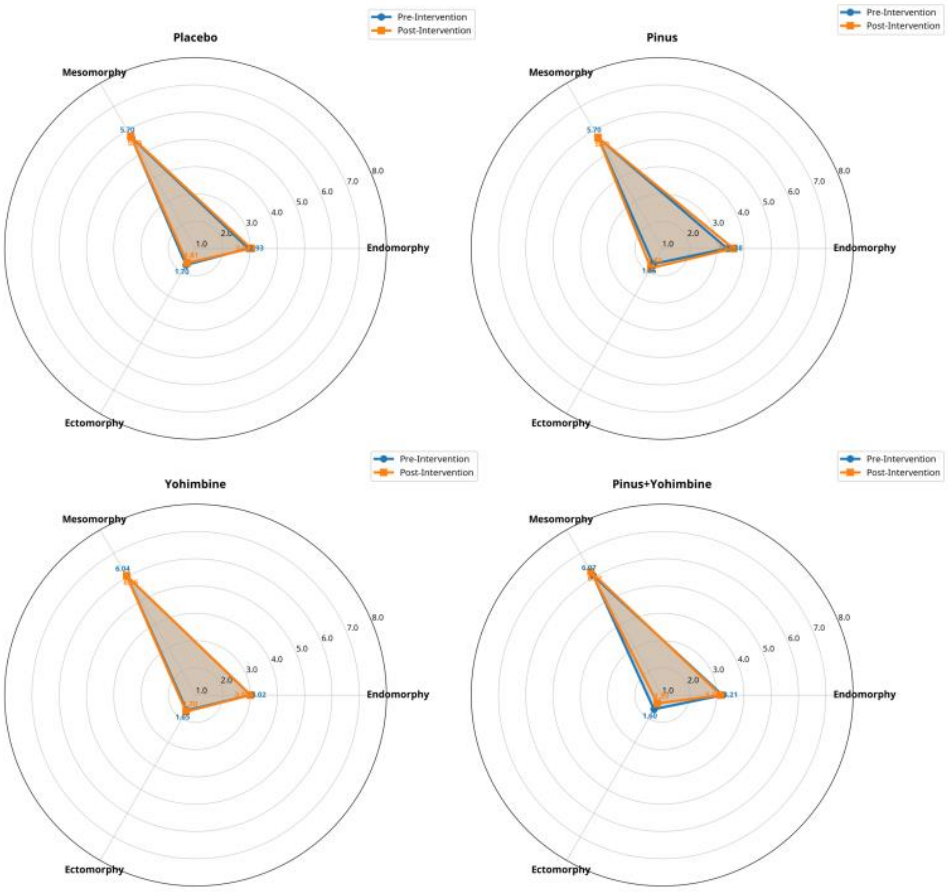

Figure 1. Somatotype of each group after 14 days of supplementation.

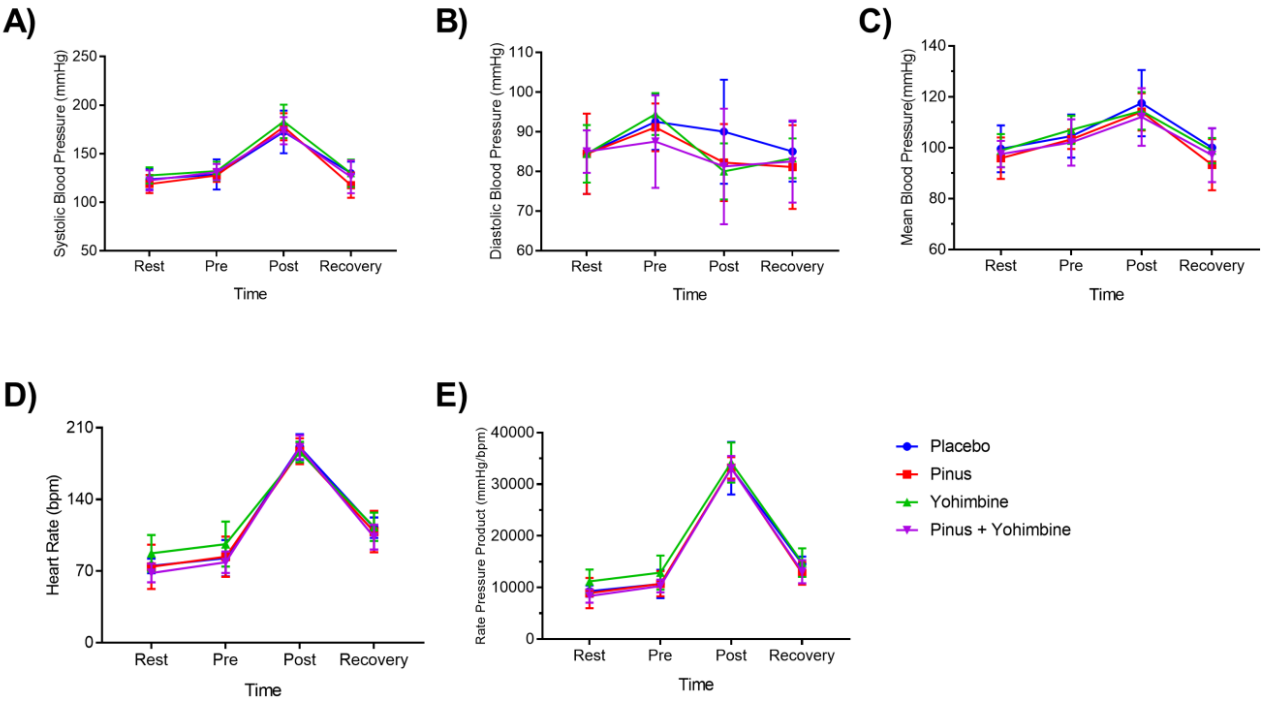

Figure 2. Cardiovascular responses of each group after 14 days of supplementation.

Discussion

This comprehensive study found that 14 days of supplementation with *Pinus pinaster*, yohimbine, or their combination did not result in statistically significant changes in kinanthropometric or cardiovascular parameters compared to placebo in physically active men. The overall lack of significant findings suggests that at the dosages and duration used, these supplements had a negligible effect on the wide array of variables measured.

The primary outcome of this study is the absence of significant effects on body composition. Despite the theoretical mechanisms of yohimbine promoting lipolysis and *Pinus pinaster* potentially improving nutrient partitioning, no significant changes in body fat percentage or lean mass were observed between groups. This may be due to the short duration of the intervention (14 days), which may be insufficient to induce measurable changes in body composition. Moreover, beyond the short duration of the intervention, it is possible that the yohimbine dosage used in the present study was insufficient to elicit measurable effects on body composition outcomes. Previous research in soccer players has demonstrated significant changes in body fat after 21 days of supplementation with 20mg/day of yohimbine, a dose approximately four times higher than that used in the current study (Ostojic, 2006).

From a cardiovascular safety perspective, the results are reassuring. The sympathomimetic properties of yohimbine did not lead to an exaggerated or dangerous cardiovascular response during maximal exercise. The blood pressure and heart rate responses in the YOH and PIN+YOH groups were statistically indistinguishable from the PLA and PIN groups at all measurement points. This indicates that a 5 mg/day dose of yohimbine is well-tolerated and does not appear to pose an acute cardiovascular risk during high-intensity exercise in this population (Jagim *et al.,* 2023). These safety findings are particularly relevant when compared to other multi-ingredient pre-workout studies, such as (Cameron *et al.,* 2018), which observed acute increases in diastolic blood pressure and resting energy expenditure in active females. In contrast, our protocol demonstrated a stable hemodynamic profile, reinforcing the tolerability of the specific dosage used.

Similarly, the performance measures of strength, power, and aerobic capacity were not significantly affected by any of the supplementation protocols. The small improvements seen across all groups are likely due to test familiarization (Maden-Wilkinson *et al.,* 2020). The gains in lean mass and bench press strength are an expected physiological finding, confirming the internal validity of our measurements, but this relationship was not influenced by any specific supplement.

The study's strength lies in its comprehensive and robust design, utilizing a randomized, double-blind, placebo-controlled protocol and a wide battery of kinanthropometric and physiological tests. However, the primary limitation is the short 14-day intervention period. It is plausible that a longer duration of supplementation would be required to elicit significant changes, particularly in body composition and performance. Furthermore, the study was conducted on a specific cohort of young, healthy, and physically active men, and the results may not be generalizable to other populations.

Conclusion

In conclusion, 14 days of supplementation with *Pinus pinaster* (150 mg/day), yohimbine (5 mg/day), or their combination did not significantly alter kinanthropometric profiles, cardiovascular responses to maximal exercise compared to placebo in physically active men. The supplements were well-tolerated and appeared to be safe from a cardiovascular standpoint. Future studies should investigate the effects of these supplements over a longer duration and in different populations to fully elucidate their potential ergogenic value and safety.

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Conflicts of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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Informed Consent Statement

All the athletes included in the study provided written informed consent.

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