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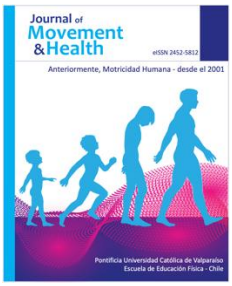

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Original article

Physical education undergraduates' knowledge regarding the benefits and risks of resistance training for adolescents: An exploratory analysis

Conocimientos de estudiantes de educación física sobre los beneficios y riesgos del entrenamiento de resistencia para adolescentes: un análisis exploratorio

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Abstract

Objective: This study investigated the knowledge and perceptions of Physical Education undergraduate students regarding the benefits, risks, and prescriptive parameters of resistance training (RT) for adolescents, evaluating their alignment with consolidated scientific evidence. **Method:** An exploratory, descriptive study using a quantitative approach was conducted with 84 undergraduate students. Data were collected via a structured digital questionnaire on Google Forms encompassing sociodemographic profile, personal training experience, risk/benefit perceptions, and a technical-prescriptive knowledge test. Data were analyzed using descriptive statistics (absolute and relative frequencies). **Results:** While over 90% of the undergraduates demonstrated updated perceptions by rejecting historical myths – such as growth impairment (91.5% disagreement) or general insecurity (92.8% disagreement) – significant technical gaps persist. Vulnerabilities were identified in neuroendocrine adaptations: 22.9% failed to recognize that a lack of testosterone does not preclude strength gains in youth, and 29.7% erroneously linked RT to flexibility impairment. Furthermore, commercial trends influenced perceptions, with 28.5% considering protein supplementation mandatory. Crucially, 86.7% of the respondents reported a complete absence of formal coursework or specific curricular units dedicated to youth strength prescription during their initial training. **Conclusion:** Although pre-service teachers possess a positive baseline perspective that refutes traditional taboos, they exhibit significant vulnerabilities regarding the physiological and prescriptive specificities of pediatric training. This gap appears to be associated with the reported lack of formal coursework, highlighting a valuable opportunity for evaluating curricular updates in higher education to substitute empirical common sense with evidence-based professional practice.

Keywords: resistance training; adolescents; academic perception; physical education

Resumen

Objetivo: Este estudio investigó el conocimiento y las percepciones de estudiantes de grado en Educación Física sobre los beneficios, riesgos y parámetros de prescripción del entrenamiento de fuerza (EF) en adolescentes, evaluando su alineación con la evidencia científica consolidada. **Métodos:** Se realizó un estudio exploratorio y descriptivo con enfoque cuantitativo en el que participaron 84 estudiantes. Los datos se recopilaron mediante un cuestionario digital abarcando el perfil sociodemográfico, la experiencia de práctica personal, la percepción de riesgos/beneficios y una prueba de conocimiento técnico-prescriptivo. Los datos se analizaron mediante estadística descriptiva. **Resultados:** Aunque más del 90% de los estudiantes demostró percepciones actualizadas, aún persisten brechas técnicas importantes. Se identificaron vulnerabilidades sobre las adaptaciones neuroendocrinas, donde el 22,9% no reconoció que la falta de testosterona no impide las ganancias de fuerza en jóvenes, y el 29,7% vinculó erróneamente el EF con el deterioro de la flexibilidad. Asimismo, las tendencias comerciales influyeron en las respuestas, pues el 28,5% consideró obligatoria la suplementación proteica. De manera crítica, el 86,7% de los encuestados manifestó una total ausencia de asignaturas formales o unidades curriculares específicas dedicadas a la prescripción de fuerza en jóvenes durante su formación inicial. **Conclusión:** A pesar de que los futuros profesionales poseen una perspectiva base positiva que refuta los tabúes tradicionales, exhiben debilidades conceptuales respecto a las especificidades fisiológicas y metodológicas del entrenamiento pediátrico. Esta deficiencia parece estar asociada con la falta reportada de asignaturas formales, lo que resalta la importancia de evaluar posibles actualizaciones en los planes de estudio universitarios para sustituir el sentido común empírico por una práctica profesional basada en la evidencia.

Palabras clave: entrenamiento de resistencia; adolescentes; percepción académica; educación física

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Key points

- Over 90% of undergraduates reject historical myths regarding growth impairment and general insecurity in adolescent resistance training.
- Significant vulnerabilities persist regarding physiological mechanisms (testosterone-related strength gains) and training prescriptive parameters.
- The results suggest a significant gap affecting initial training, with 86.7% of students reporting a lack of formal coursework on strength prescription for youth.
- The findings suggest a potential influence of commercial gym culture on academic perception, as seen in beliefs regarding mandatory protein supplementation.
- The findings highlight a need to consider curricular updates in higher education to substitute empirical common sense with evidence-based professional practice.

Introduction

Over the past few decades, resistance training (RT) has transcended its traditional boundaries as an activity restricted exclusively to adult populations and has increasingly become integrated into the physical activity repertoires of children and adolescents. This expanding demographic footprint is partially driven by the wider dissemination of scientific consensus regarding the multi-systemic benefits of early exercise engagement on global health indicators, physical fitness, and motor performance[1-4]. Furthermore, the contemporary rise in adolescent participation is also heavily modulated by sociological shifts, including the promotion of active lifestyles and the social valuation of corporality, identity, and body image in youth[5]. However, this growing adherence among developing individuals raises vital academic and professional inquiries regarding the pedagogical safety, methodological coherence, and overall efficacy of such programs, particularly when executed under unassisted conditions or without qualified technical guidance.

This theme acquires heightened relevance when examining the direct impacts that resistance exercises exert on biological, physical, and psychological domains during adolescence – a phase intrinsically marked by profound neuroendocrine, somatic maturation, and emotional transformations[6]. Far from being a practice limited strictly to muscle strengthening or superficial aesthetics, RT prompts a highly complex cascade of neuromuscular adaptations, metabolic regulation, and behavioral adjustments that demand systematic planning and rigorous supervision by certified professionals[7]. Low levels of muscular fitness during youth are positively associated with poor motor competence, decreased performance in daily play and games, and an increased risk of shifting toward tracking sedentary behaviors into adulthood[8]. Yet, despite substantial scientific advancements directed at dismantling historic taboos – such as the deeply entrenched fallacy that lifting weights prematurely damages growth plates and stunts skeletal development – misconceptions, conflicting lay data, and distorted perceptions remain ubiquitous in the public and non-formal training environments[1,9].

Consequently, investigating how Physical Education undergraduates comprehend RT for adolescents is not merely pertinent but strategically essential for public health and educational planning. These pre-service teachers and future professionals will be directly responsible for prescribing, monitoring, and evaluating exercise protocols across diverse age brackets. Therefore, their current academic perceptions, technical beliefs, and scientific knowledge will directly shape their forthcoming professional interventions, fundamentally influencing the safety, musculoskeletal health, and physical development of school-aged youth[10].

The choice of this research scope is justified by multiple academic and public health demands. First, there is an urgent necessity to align initial teacher training curricula with updated, evidence-based

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scientific guidelines, ensuring that university graduates are fully prepared to safe-proof and tailor exercise prescription for pediatric populations[11,12]. Second, it aligns with the critical social role that Physical Education teachers perform in combating pediatric obesity, anxiety, and physical inactivity[11,13]. This is particularly urgent given the rising prevalence of sedentary behaviors and sub-optimal health-related fitness tracking among youth, which poses severe public health challenges in developing countries like Brazil[14,15]. Lastly, this investigation addresses a notable gap in the literature, as empirical data focused specifically on the conceptual constraints and perceptions of undergraduate students regarding pediatric strength training remain scarce.

When appropriately structured, RT serves as a powerful pedagogical tool, significantly enhancing muscular strength, localized endurance, bone mineral content, and self-esteem during development[5,16,17]. Conversely, inappropriate implementation can result in joint overload, mechanical imbalances, acute musculoskeletal injuries, and negative psychological pressure[6,18]. By exploring the perceptions of Physical Education undergraduates, this exploratory analysis seeks to determine the extent to which these technical risks and biological benefits are understood, verifying if the students' knowledge stands in consonance with consolidated, evidence-based guidelines. Specifically, this study sought to answer the following research question: What is the level of alignment between Physical Education undergraduates' knowledge of youth resistance training and current scientific consensus? Given the exploratory nature of this investigation, we hypothesized that while pre-service teachers would demonstrate a positive baseline perspective by rejecting historical myths, significant technical and prescriptive gaps would persist due to a lack of specific, population-targeted curricular exposure. Thus, the object of study outlined herein provides a vital foundation for critical reflection regarding university curriculum designs, the limits of safe professional intervention, and the ethical-pedagogical responsibilities guiding Physical Education professionals in contemporary society.

Methods

Study Design and Ethical Considerations

This is an exploratory study with a quantitative approach, structured in accordance with the methodological frameworks proposed by Gaya et al[19]. The research project was formally registered and approved by the Institutional Review Board (Research Ethics Committee) of the Regional University of Cariri (CAAE: 933002525.4.0000.5055; Approval Opinion No. 7.998.117). In strict compliance with international and national ethical guidelines governing human subjects research (specifically CNS Resolutions 466/2012 and 510/2016), this study respected the participants' dignity and autonomy. Participation was strictly voluntary, and all respondents provided their explicit consent through a digital Free and Informed Consent Form (TCLE) before accessing the evaluation instruments. Privacy, data confidentiality, and anonymity were fully guaranteed, ensuring that the personal and academic information collected would be utilized solely for the stated academic purposes.

Participants

The target population consisted of undergraduate students enrolled in a Physical Education Degree program at a public education institution located in the “Cariri” region, situated in the south of the state of Ceará, Northeast Brazil. Socioeconomically, the student body is predominantly composed of young adults (over 58% aged 18–22 years) with a near-equal distribution between unemployed (50.6%) and employed (49.4%) individuals, highlighting a substantial profile of working students. Furthermore, official institutional public reports indicate a predominant low-income profile of public-school alumni, where approximately 87% of the undergraduates represent the first generation in their families to access higher education, with parents who did not complete a university degree. A non-probabilistic convenience

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sampling strategy was adopted based on student availability and voluntary adherence during data collection. The total student body of the program comprises approximately 300 students distributed across eight academic terms. During the classroom recruitment phase, a total of 160 undergraduates were invited to participate. Of these, 60 students declined to participate, and 16 digital questionnaires were excluded as posteriori due to incomplete data entry. Following these screening procedures, the final analysis sample was firmly established at 84 undergraduate students.

Data Collection Procedures and Instruments

The data collection instrument consisted of an *ad hoc* structured digital questionnaire containing 43 items, administered via the Google Forms platform. The questionnaire was specifically developed by the research team to investigate the multi-dimensional conceptual frameworks, perceptions, and technical knowledge of physical education undergraduates regarding RT for adolescents. The items were constructed based on an extensive analysis of current scientific literature, international clinical guidelines, and national educational frameworks. To ensure systemic tracking, the instrument was organized into five core thematic sections:

Section 1: Participant Characterization (8 items)

Formulated to map the sociodemographic, labor, and academic profile of the respondents. It gathered data on sex, age, current academic semester, employment status, personal active engagement in RT, length of regular practice, age of training onset, and previous contact with specific coursework covering pediatric RT. The formulation of these academic-exposure variables was theoretically supported by structural curriculum analyses regarding physical education and school health frameworks in developing regions[12,19,20].

Section 2: Perception of RT Benefits for Adolescents (5 items)

Measured participants' level of agreement concerning the multi-systemic positive outcomes of youth RT. Responses were captured using a 5-point Likert scale ranging from "Strongly agree" to "Strongly disagree". Items evaluated perceptions of strength gains, bone mineral density accrual, body composition optimization, improvements in self-esteem/confidence, and injury prevention in other physical activities[7,10,13,16,21].

Section 3: Perception of RT Risks for Adolescents (5 items)

Examined student beliefs and potential taboos regarding negative outcomes or barriers associated with youth RT. Measured via the same 5-point Likert scale, it included items assessing the risks of musculoskeletal injuries due to improper execution, skeletal growth plate impairment from excessive loading, dangers of unguided practice, psychological impacts of gym aesthetic pressures, and prescriptive errors stemming from a lack of biological development knowledge. The construction of these items was grounded in standard pediatric safety guidelines and psychosocial risk papers, specifically the American Academy of Pediatrics position statement[5,6,11,22].

Section 4: Technical-Prescriptive Knowledge Assessment (24 items)

Formulated as an objective True/False/Do Not Know cognitive test to control for guessing bias. This core section evaluated technical proficiency across six specialized thematic blocks (4 items each): (i) *Principles of Training and Security* (intensity limits and supervision); (ii) *Physiological Adaptations and Development* (neural vs. hormonal mechanisms); (iii) *Prescription and Progression* (multi-joint movements and non-linear loads); (iv) *Psychosocial and Behavioral Aspects* (body dysmorphia and social media pressures); (v) *Myths and Beliefs* (taboos regarding flexibility, gender, and epiphyseal closure); and (vi) *Specific Knowledge for the Professional* (developmental staging and parent communication). The scoring keys and scientific criteria were strictly anchored in international and national consensus statements[1,10,11,23-27].

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Section 5: General Perception and Self-Evaluation (3 items)

Explored the students' subjective self-rating of their technical expertise, the perceived importance of remaining scientifically updated on pediatric exercise science, and their perceived professional readiness to safely prescribe strength programs for youth immediately after graduation. These self-reflective metrics were contextualized considering critical teacher training paradigms and the professional autonomy models proposed by Nóvoa (1995)[28], as well as contemporary muscular fitness curriculum gaps discussed by Sortwell[20]. Prior to data collection, the questionnaire underwent content and face-validity scrutiny through an internal peer-review consensus panel among the expert authors to verify linguistic clarity, technical accuracy of the scoring keys, and thematic relevance. Although formal large-scale psychometric validation, factor analysis, or internal consistency reliability testing (e.g., Cronbach's alpha) were not performed due to the exploratory and descriptive design of the study, the factual precision of the knowledge matrices was strictly cross verified against the international sports science consensus guidelines. Consequently, the lack of a formal psychometric validation trial is explicitly acknowledged as a methodological limitation of this research.

Statistical Analysis

Data were exported from Google Forms to a digital spreadsheet and analyzed using descriptive statistics. Categorical variables, including sociodemographic characteristics, personal training background, and responses to both the Likert-scale perceptions (Sections 2 and 3) and the True or False knowledge test (Section 4), were expressed as absolute frequencies (n) and relative frequencies (percentages, %). Continuous variables, where applicable, were described using means and standard deviations. This descriptive approach allowed for the systematic distribution of academic responses, facilitating a direct contrast and alignment analysis between the undergraduates' conceptual frameworks and the parameters established by international sports science and Physical Education literature.

Results

The final sample comprised 84 undergraduate students enrolled in the Physical Education Degree program. Sociodemographic characteristics, alongside labor and academic enrollment status, are detailed in **Table 1**.

Table 1. Sociodemographic characteristics, labor status, and academic profile of the surveyed Physical Education undergraduate students (n = 84).

Variable	Category	n	%
Sex	Male	49	58.3%
	Female	35	41.7%
Age Range	18–22 years	49	58.3%
	23–30 years	25	29.8%
	Over 30 years	10	11.9%
Current Employment	Unemployed	43	51.2%
	Employed	41	48.8%
Academic Term (Semester)	1st Semester	22	26.2%
	2nd Semester	12	14.3%
	3rd Semester	7	8.3%
	4th Semester	3	3.6%
	5th Semester	6	7.1%
	6th Semester	14	16.7%
	7th Semester	9	10.7%
	8th Semester	11	13.1%

Note: Variations in sample sizes (n) across sub-variables are due to item-specific missing responses from participants.

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Personal Practice Profile and Curricular Contact with the Topic

Regarding personal RT experience, 72.6% (n = 61) of the total sample reported active gym-goers, whereas 27.4% (n = 23) reported no current engagement in RT. Due to the voluntary nature of the digital instrument and item-specific missing responses, the total number of valid answers fluctuated slightly across subsequent tracking questions. Among the undergraduates who provided data regarding their training history duration (n = 65), the length of regular engagement in RT varied, with 30.8% (n = 20) reporting a practice history of more than two years, followed by 27.7% (n = 18) who had been practicing for less than six months. Additionally, 23.1% (n = 15) of the undergraduates reported a training duration of between one and two years, while the remaining 18.5% (n = 12) had been engaged in the practice for a period ranging from six months to one year. Similarly, regarding the specific question evaluating the age of onset for regular RT (n = 66), the vast majority started during adolescence: 24.2% began at age 16, 15.2% at age 17, and 15.7% started prematurely between the ages of 13 and 15. Onset between 18 and 19 years old accounted for 21.0% of the undergraduates, while a minority of 6.1% initiated the practice after the age of 22.

Within the scope of initial teacher training, 86.7% (n = 72) of the 83 respondents stated they never had formal curricular contact with academic courses specifically addressing RT for adolescents. Only 13.3% (n = 11) reported having taken coursework with this specific focus. When breaking down which curricular contents offered related knowledge (n = 29), only 8 participants pointed out general courses from the biomedical matrix: Kinesiology, Biomechanics, Anatomy/Physiology, and Cine-anthropometry.

Perception of Risks and Biological/Social Barriers

The undergraduates' perceptions regarding historical myths and biological constraints associated with RT in adolescents are shown in **Table 2**. The data demonstrates a predominant trend toward the rejection of traditional misconceptions. Specifically, 91.5% of the participants strongly disagreed that RT impairs growth, and 51.8% strongly disagreed that it is unsafe for this demographic. Conversely, minor adherence to conservative views persisted regarding the appropriateness of weightlifting, which was considered inappropriate by a combined minority of 8.4%. Furthermore, a notable conceptual gap was identified regarding physiological adaptations: while the majority rejected the premise that a lack of testosterone prevents strength gains, a substantial 20.5% of the respondents reported not knowing how to answer this proposition. Lastly, the elitist framing that RT should be restricted exclusively to young athletes was almost universally refuted (98.8% of strong disagreement).

Table 2. Undergraduates' perceptions regarding historical myths, safety, and biological barriers associated with resistance training in adolescents (n = 84).

Statement	Strongly Agree	Partially Agree	Partially Disagree	Strongly Disagree	Do Not Know
Resistance training impairs the growth of adolescents.	-	6.0%	-	91.5%	2.4%
Resistance training is not safe for adolescents.	-	0.0%	41.0%	51.8%	7.2%
Weightlifting is inappropriate for adolescents.	6.0%	2.4%	-	91.6%	-
Adolescents cannot increase strength due to a lack of sufficient testosterone.	-	2.4%	22.9%	52.2%	20.5%
Resistance training is exclusively for young athletes.	-	-	-	98.8%	1.2%

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Technical-Prescriptive Knowledge and Training Myths

The academic performance of the undergraduates facing the True or False knowledge test concerning the methodological principles of prescription and fitness stigmas is presented in **Table 3.** The highest rates of correct answers were observed for the propositions regarding injury prevention potential (n = 79), the combined development of hypertrophy and adaptation (n = 70), and volume and recovery intervals (n = 69). Conversely, regarding the statement that training muscles in isolation is safer than performing functional exercises, 53 participants correctly identified it as false, while 16 marked it as true, and 14 did not know how to respond. For the propositions concerning training myths, 37 respondents correctly identified that RT does not impair flexibility, 63 correctly rejected the premise of female body masculinization, and 47 correctly identified that protein supplementation is not mandatory to yield training benefits during adolescence.

Table 3. Academic performance and frequency distribution facing the technical-prescriptive knowledge and training myths test (n = 84).

Evaluated Proposition	True	False	Do Not Know
Global Prescriptive Design: Exercises must include all major muscle groups, paying special attention to common imbalances (rotator cuff, hamstrings).	61	12	11
Repetition Zones: Training prescription for adolescents can utilize a range of 8 to 12 repetitions with moderate speed, emphasizing the concentric phase.	63	9	11
Isolated vs. Functional Training: Training muscles in isolation is safer for adolescents than performing functional exercises.	16	53	14
Volume and Recovery Interval: It is recommended to use 2 to 3 sets per exercise, with recovery intervals between 1 and 3 minutes.	69	8	7
Hypertrophy and Adaptation: The development of muscular hypertrophy in adolescents can occur along with neuromuscular adaptations, provided there is proper progression.	70	7	7
Training and Flexibility: Resistance training shortens the musculature and impairs flexibility in adolescents.	25	37	20
Female Training Concerns: Resistance training during adolescence causes masculinization of the female body due to testosterone production.	6	63	12
Preventive Perspective: With proper guidance, resistance training can be part of an injury prevention program for adolescents.	79	1	2
Requirement of Supplementation: Resistance training in adolescence only yields benefits if accompanied by protein supplementation.	24	47	12

Discussion

The heterogeneity identified in the sociodemographic and academic profiles of the undergraduates represents a rich element of analysis, allowing for the correlation of perceptual variations with academic maturity, life experiences, and the respondents' background. The near equivalence between working and non-working students suggests a scenario of shared time, which may exert a direct influence both on access to additional practical experiences and on the level of depth dedicated to theoretical contents regarding physical exercise prescription.

Concurrently, the high index of personal resistance training (RT) practitioners (72.3%), associated with the fact that the absolute majority initiated regular training during adolescence, indicates that RT is an empirical reality strongly consolidated in the routine of these students. This early practical experience may generate a trend toward the naturalization of the activity at younger ages. However, since simple practice does not ensure technical-scientific or conceptual mastery of prescriptive principles for specific populations, it is indispensable to interpret this experience critically, considering scientific evidence,

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thereby avoiding the reproduction of empirical conduct or mistaken generalizations unaligned with child and adolescent development.

While 72.6% of the participants engage in RT personally, 86.7% reported a lack of specific curricular contact regarding adolescent populations. This exploratory finding may reflect a historical trend in higher education, where RT disciplines have traditionally focused on adult fitness, athletic conditioning, or geriatric health, while often leaving pediatric prescriptive parameters unaddressed. Considering contemporary evidence on the necessity of embedding muscular fitness within modern educational frameworks[20] alongside recent insights demonstrating that health- and skill-related fitness components are inextricably intertwined during youth development[24], these results suggest an opportunity to discuss the evolution of university coursework. Gradual updates to legacy training curricula to include specific pedagogical and physiological guidelines for children and adolescents could support future professionals in meeting contemporary public health and fitness demands.

The centralization of responses from those who claimed indirect contact with the theme in courses of a structural and biological base, such as Kinesiology, Biomechanics, Anatomy, and Physiology, evidences a remaining biomedical and technicist bias in the curricular structure. This structural limitation aligns with contemporary international evidence highlighting that national health and physical education guidelines frequently fail to adequately address or prioritize muscular fitness and strength prescription within their formal core contents[20]. Rather than isolating functional biology from pedagogical and societal realities, initial teacher training must adopt critical and multi-dimensional frameworks that explicitly challenge the precarity of modern physical culture to effectively meet the complex demands of contemporary youth[29]. Consequently, the professional responsible for guiding adolescents must master human growth and maturation processes from an integral perspective, avoiding adult-centric and potentially harmful reproductions.

Prescription for youth requires tools that connect the body-as-function to the body-as-subject, establishing interfaces with public health sciences, movement pedagogy, and developmental psychology. Dependence on indirect correlations within fragmented and technicist courses, as criticized by[5], disregards the youth corporeality in construction and its inherent vulnerabilities. This perceived curricular insufficiency and the apparent distance from formal spaces of study and thematic deepening[28] could point toward a need for training models centered on the critical reconstruction of pedagogical practice. Without this institutionalized foundation, undergraduates remain vulnerable to decisions based on empiricism, common sense, and the acritical transposition of their own personal experiences.

Regarding risk perceptions, the 91.5% rejection of the growth impairment myth aligns undergraduates with the established consensus from the American Academy of Pediatrics[4], Canadian Society for Exercise Physiology[3], and National Strength And Conditioning Association[1], since reinforced by contemporary evidence[11,13]. However, recent paradigms[20,30] shift the academic debate from basic safety validation to a public health imperative, framing RT as an essential tool for neuromuscular enrichment and physical literacy. Thus, while this high myth-rejection rate is positive, it represents only a baseline conceptual victory. These exploratory findings suggest that the contemporary curricular challenge could beneficially transition from merely debunking historical taboos toward fostering greater proficiency in prescriptive parameters for safe, evidence-based professional intervention.

This perspective of safety is also consolidated in the disagreement exceeding 90% regarding the supposed intrinsic insecurity of the activity. Aligning with international guidelines from the National Strength and Conditioning Association and the American College of Sports Medicine, the risk does not reside in the practice of the modality itself, but rather in the intervening variables of its conduction, such as the absence of qualified supervision, improper progression of loads, and deficient execution techniques[1,9]. Nonetheless, the low residual rates of adherence to conservative concepts (such as

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considering weightlifting inappropriate or manifesting conceptual doubts about the mechanisms of strength gain) raise an alarm regarding the reflexes of a culture of fear and lay discourses diffused in non-formal environments, indicating that the lack of specific deepening generates points of epistemological insecurity in future teachers.

The expansion of this debate gains theoretical support from recent national methodological frameworks and interventions. The study protocol by Pedretti et al.[17] outlines the structure of the PROFIT-BR program within the school environment over 19 weeks, providing a standardized model for implementing adapted physical resistance, power, and agility exercises even in the face of limited infrastructure. Complementarily, the meta-analysis conducted by Mello et al.[16] corroborates that RT in the school setting significantly elevates bone mineral content and bone mineral density in critical areas such as the femoral neck and lumbar spine in both sexes, acting as a protective factor and primary prevention against chronic osteoarticular pathologies in adulthood. As highlighted by Labre [5], adolescence is marked by a corporeality in search of identity, autonomy, and self-esteem; thus, depriving youth of accessing the universe of RT based on unfounded fears configures a violation of their right to full bodily development.

Conceptual vulnerabilities reappear when analyzing the biological belief that the absence of high levels of testosterone would impede strength gains in adolescents, an assertion that generated doubt or lack of knowledge in more than 20% of the sample. Exercise physiology literature categorically demonstrates that initial adaptations and strength gains in the pre-pubertal and early pubertal phases occur predominantly via neuromuscular and neural mechanisms, such as improvement in inter- and intramuscular coordination, increased firing frequency, and more efficient recruitment of motor units[1]. Therefore, hormonal maturation acts as a late potentiating factor, but its absence at adult levels does not restrict neuromuscular adaptive responses. On the other hand, the expressive refutation of the idea that RT is intended exclusively for young athletes (98.8%) represents a positive milestone, indicating a deconstruction of excluder, elitist, meritocratic, and ableist logics that historically governed school sports in the 20th century. This understanding aligns with the legal frameworks of the National Common Curricular Base – BNCC[23], advocating for the democratization of access to bodily practices for the entire heterogeneity of students, especially those with low motor fitness, obesity, or a history of sedentary behavior, who express acute needs for guided intervention.

Finally, in the block focused on operational principles and daily gym myths, the high rate of correct answers regarding global prescriptive design[11], ideal repetition zones for beginners[1], volume and recovery intervals[31], and the simultaneous association between hypertrophy and neuromuscular responses.[16,17] signal a mostly positive technical scenario. In contrast, the remaining gaps regarding the safety of isolated exercises over functional ones indicate the persistence of empirical commercial practices not supported by authors like[10,26], who advocate the superiority of integrated exercises for developing postural control and refined motor coordination in youth under supervision.

In the same vein, the theoretical confusion regarding flexibility being impaired by strength gains contradicts the axioms of Dantas and Araújo[32] as well as international evidence[33], both of which demonstrate that resistance training protocols expand or maintain joint range of motion, provided that the exercises are executed throughout full arcs of movement. Sexist and essentialist views associated with the supposed masculinization of the female organism also demand urgent curricular confrontation, given that reduced basal levels of testosterone in women limit extreme hypertrophic responses, with gains being mediated by multifactorial and genetic interactions[22,34].

The significant perception that the benefits of training are conditioned on the adoption of protein supplementation suggests a possible internalization of market logic and the culture of high aesthetic performance embodied by contemporary society. Data presented by Alves and Lima[35] refutes this mandatory status, establishing that a balanced diet is fully capable of meeting the energy and protein needs

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of adolescents engaged in resistance exercise routines, reserving supplementation for specific clinical scenarios. Given that RT acts as a robust preventive strategy against injuries and for the promotion of musculoskeletal health[22,36], overcoming these gaps through a dialogic and updated academic formation is urgent to mitigate stigmas that may alienate and discourage the safe insertion of youth into this practice.

Strengths and limitations

Although this study provides valuable insights into the perceptions of pre-service Physical Education teachers regarding resistance training for adolescents, certain limitations must be acknowledged. First, a convenience, non-probabilistic sampling method was utilized within a single institutional setting, which restricts the generalizability of the findings to the broader population of Physical Education undergraduates. Second, data were collected using a self-reported digital questionnaire, which may introduce subjective or recall biases. Third, the survey instrument did not undergo formal psychometric validation or internal consistency reliability testing prior to administration. Finally, this investigation focused strictly on assessing student perceptions and beliefs rather than executing an objective, formal audit of the university's curricular plans or course programs. Consequently, these findings should be interpreted with caution and serve primarily as an exploratory baseline for future research. To advance this field of inquiry, future studies should consider expanding sample sizes, utilizing cross-institutional cohorts, and developing psychometrically validated instruments to objectively assess professional proficiency regarding youth strength prescription.

Conclusion

This study demonstrated that while Physical Education undergraduates possess a predominantly updated perception that aligns with international guidelines – successfully rejecting historical myths such as the restriction of RT due to growth impairment or general insecurity – significant conceptual and technical gaps persist. Vulnerabilities regarding physiological mechanisms (e.g., the role of testosterone in youth strength gains), prescribing parameters (isolated versus functional exercises), and fitness stigmas (flexibility impairment and mandatory protein supplementation) reveal that empirical common sense still influences professional training. Crucially, these misconceptions appear to be associated with the reported lack of formal coursework, as most students reported a complete lack of formal coursework specifically dedicated to RT for youth populations.

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Conflicts of Interest
The authors declare no conflicts of interest.

Author Contributions
Matos and Lima Silva conceived the study, designed the methodology, conducted the literature search, and drafted the initial manuscript. Pedretti provided overall supervision, project administration, led the manuscript rewriting and adaptation for journal publication, conducted the revisions and responses to peer reviewers, and performed the final editing and critical approval of the submitted version.

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

The authors declare that generative AI or AI-assisted technologies were not utilized during the writing process of this manuscript.