Article

Not peer-reviewed version

Sex Differences in Resistance Training Participation and Beliefs Among Adolescent Athletes: An Exploratory Cross-Sectional Study

Corey Marie Rovzar *, David Howell *, Aubrey Armento

Posted Date: 2 October 2025

doi: 10.20944/preprints202509.2342.v1

Keywords: strength training; resistance training; exercise; youth; athlete; adolescent; beliefs; injury prevention; sex differences

 doi:10.20944/preprints202509.2342.v1

Article

Sex Differences in Resistance Training Participation and Beliefs Among Adolescent Athletes: An Exploratory Cross-Sectional Study

Corey Marie Rovzar [1,*], David Howell [2] and Aubrey Armento [3]

[1] Department of Medicine, Stanford Prevention Research Center, Stanford University School of Medicine, Palo Alto, CA, USA

[2] Department of Orthopedics, University of Colorado School of Medicine, Aurora, CO, USA

[2] Sports Medicine Center, Children's Hospital Colorado, Aurora, CO, USA

* Correspondence: crovzar@stanford.edu

Abstract

Background: Resistance training (RT) is widely recommended for adolescent athletes to enhance performance and reduce injury risk. However, sex differences in RT participation and beliefs during adolescence remain underexplored. Methods: This exploratory cross-sectional study surveyed 108 adolescent athletes (62 females, 46 males; ages 13–18 years) recruited from sports medicine clinics and physical therapy facilities. Participants completed a 29-item questionnaire assessing demographics, sport involvement, and RT participation and beliefs. Items included RT frequency, duration, equipment use, age of initiation, and enjoyment. Statistical comparisons between sexes were conducted using chi-square tests for categorical variables and independent-samples t-tests for continuous variables, with significance set at $p < 0.05$. Results: Overall, 73% reported regular RT participation, with a higher but not statistically significant ($p < 0.05$) proportion of males compared to females (80% vs. 65%, $p = 0.07$). Females reported beginning RT at a younger age than males (12.1 vs. 13.4 years, $p = 0.005$). No significant sex differences were found in RT frequency (3.1 vs. 3.5 sessions/week, $p = 0.33$) or session duration (56.3 vs. 68.8 minutes, $p = 0.17$). Males more frequently reported use barbells (57% vs. 27%, $p = 0.002$), weight machines (70% vs. 37%, $p = 0.001$), and free weights (74% vs. 55%, $p = 0.04$). Females reported significantly lower enjoyment of RT compared to males (48% vs. 70%, $p = 0.02$). Conclusions: This study describes sex-based differences in RT participation and beliefs. Future research should prioritize developing and validating questionnaires to more accurately assess RT participation and beliefs and to guide efforts aimed at fostering positive, equitable training opportunities.

Keywords: strength training; resistance training; exercise; youth; athlete; adolescent; beliefs; injury prevention; sex differences

1. Introduction

Resistance training (RT) has gained widespread support as an essential component of youth athlete development, helping to reduce sports-related injuries and enhance overall physical well-being and sports performance [1–5]. The American Academy of Pediatrics and other sports medicine organizations support the inclusion of RT in youth sports, emphasizing its safety and efficacy when properly programmed, executed, and supervised [3,6]. Reflecting this consensus, the World Health Organization updated its 2020 physical activity guidelines to recommend muscle-strengthening activities at least three times per week for children and adolescents [7].

RT is a form of conditioning involving an individual working against resistive loads for the purposes of improved fitness, health, and/or performance [1,8]. The resistive loads can include one or a combination of body weight, weight machines, free weights, resistance bands, and medicine balls

 doi:10.20944/preprints202509.2342.v1

[9,10]. For adolescent athletes, RT has been documented as a method to improve overall strength, power, running and sport-specific speed, and motor control [4,11,12]. Furthermore, RT has been linked to improved cardiac function among obese youth, reduced body fat, improved insulin-sensitivity among overweight adolescents, and enhanced skeletal health [1,2,4,9,13].

Although once believed to be dangerous for youth due to the potential damage to growth plates, increasing evidence over the past two decades has mitigated this concern in favor of a link between supervised participation in RT with a reduction in sports-related injuries and greater enjoyment and confidence in engaging in physical activity [13]. Both the International Olympic Committee (IOC) and National Strength and Conditioning Associations (NSCA) have issued position statements supporting youth RT participation with the NSCA particularly highlighting its role in fostering lifelong positive exercise behaviors [9,13]. Injuries associated with RT typically result from improper handling of weights or poor exercise technique under excessive load—risks that are readily mitigated through professional supervision and instruction [1].

Despite broad support and documented benefits, regular RT participation among adolescents remains low worldwide [14]. Studies among adults populations have identified disparities in RT participation associated with educational attainment, health status, and sex, with those who are educated, healthy, or male more likely to engage in RT than those who are uneducated, unhealthy, or female [15,16]. Additionally, sex-based stigmas and misconceptions about RT have been shown to disproportionately limit participation among women [17]. While these factors have been examined in adults, little is known regarding participation in and beliefs about RT among youth athletes, and particularly, how these vary by sex. This is of particular importance as female youth have been identified as an at-risk population for increased injury rates relative to male youth [13]. To address this gap, we conducted a cross-sectional survey to identify differences in the beliefs about and participation in RT between male and female adolescent athletes.

 doi:10.20944/preprints202509.2342.v1

2. Materials and Methods

2.1. Study Design

We conducted a cross-sectional study using an electronic RedCap questionnaire (18) to measure participation in RT and beliefs about RT among youth athletes. The survey included a total of 29 questions: 8 questions on demographics (sex, age, race, ethnicity, school grade, zip code, and current injury status), 4 questions on sports participation and specialization, and 11 questions on participation in and beliefs about RT. To assess socioeconomic status, we used the Family Affluence Scale, a 6-item validated questionnaire scored from 0-13, designed to assess the socioeconomic status of the family based on an assets approach (19). Scores of 0–7 indicate low affluence, 8–11 moderate affluence, and 12–13 high affluence. We used a sports specialization scale (20) to assess the level of sports specialization from low, moderate, to highly specialized, with scores ranging from 0 to 6. Scores of 0–1 were classified as low specialization, scores of 2–4 as moderate specialization, and scores of 5–6 as high specialization. A custom questionnaire was developed specifically for this study to assess resistance training participation and beliefs among adolescent athletes (see Supplementary File 1), as no validated questionnaires existed at the time to measure the desired outcomes. RT questions included assessment of whether the athlete participated in RT, the frequency of RT per month, type of equipment used, seasonal frequency, access to weights, beliefs about RT (e.g. RT will make me better at my sport), family support of RT, and barriers to participation in RT.

2.2. Participants

This study received approval from the local Institutional Review Board (IRB) prior to participant recruitment and data collection. We included 13-18 year old male and female athletes who presented to a hospital-affiliated sports medicine center, outpatient physical therapy clinics, or who were active in local high school or club sport partnerships. Recruitment was conducted via distribution of a flyer with a QR code that the participant could scan and then complete the electronic questionnaires. Flyers were posted and/or provided in sports medicine clinics, physical therapy gyms, high school training rooms, and via email listservs to high school and club sport partnerships. Postcard consent was obtained from participants. Data was collected between April 2021 - December 2021.

2.3. Data Analysis

Data are presented as mean (standard deviation) for continuous variables and the number within group (corresponding percentage) for categorical variables. We compared demographic characteristics, resistance training volume/timing/beliefs, and types of equipment used between female and male participants using independent t-tests for continuous variables and chi-square analyses or Fisher's exact tests for categorical variables. Statistical significance was defined a priori as $p<0.05$, and all tests were 2-sided. Statistical analysis was performed using Stata Statistical Software: Version 18 (StataCorp, LLC, College Station, TX, USA).

3. Results

3.1. Demographics and Sports Participation

A total of 158 individuals completed the consent form. Of those, 108 (68%) completed the questionnaires: 62 female, mean age =15.0 ± 1.2 years; 46 male, mean age =14.9 ± 2.6 years, who were included in our analysis. There were no significant differences between female and male participants for demographic characteristics, family affluence, sport participation, or sport specialization level (Table 1).

 doi:10.20944/preprints202509.2342.v1

Table 1. Study sample demographic characteristics by sex.

Variable		Female (n=62)	Male (n=46)	P value
Age (years), mean (SD)		15.0 (1.2)	14.9 (2.6)	0.71
Race (n, %)	*American Indian or Alaska Native*	1 (2%)	0 (0%)	0.77
	Asian	2 (3%)	1 (2%)	
	Black Or African American	2 (3%)	0 (0%)	
	White	47 (76%)	40 (87%)	
	More Than One Race	7 (11%)	3 (7%)	
	Unknown Or Not Reported	3 (5%)	2 (4%)	
Ethnicity, n (%)	*Hispanic Or Latino*	10 (16%)	8 (17%)	0.59
	Not Hispanic or Latino	44 (71%)	35 (76%)	
	Unknown	8 (13%)	3 (7%)	
School Grade, n (%)	*8*	9 (15%)	4 (9%)	0.21
	9	17 (27%)	12 (26%)	
	10	23 (37%)	12 (26%)	
	11	7 (11%)	13 (28%)	
	12	6 (10%)	5 (11%)	
Currently Injured at Time of Assessment, n (%)		33 (54%)	30 (65%)	0.25

3.2. Sex Differences in Resistance Training Participation and Beliefs

The majority of the study sample (71% of all participants) engaged in RT with a non-significant, but greater proportion of male participants reporting regular participation in RT compared to female participants. However, female participants reported beginning RT at a significantly younger age compared to males. We did not observe any significant sex-related differences in the mean duration or frequency of RT between groups (Table 2). The majority of both the female and male participants engaged in RT both during the season and the off-season (Table 2).

Table 2. Resistance training participation, volume, timing, and beliefs by sex.

Variable		Female (n=62)	Male (n=46)	P value
Perform resistance training exercises (yes), n (%)		40 (65%)	37 (80%)	0.07
Age began resistance training (years), mean (SD)		12.1 (2.2)	13.4 (1.7)	**0.005**
Resistance training frequency (avg. times per week), mean (SD)		3.1 (1.6)	3.5 (1.3)	0.33
Resistance training duration (avg. mins per session), mean (SD)		56.3 (44.8)	68.8 (30.0)	0.17
	During season	2 (5%)	2 (6%)	>0.99
	During off-season	5 (13%)	5 (14%)	

 doi:10.20944/preprints202509.2342.v1

Seasonality of typical resistance training, n (%)	*Both*	32 (82%)	28 (80%)	
Believes resistance training will make me better at sport, n (%)		54 (87%)	42 (91%)	0.49
Believes resistance training will help me prevent injuries, n (%)		48 (77%)	33 (72%)	0.50
Believes resistance training will result in looking bulky or with muscles that are too big, n (%)		4 (6%)	4 (9%)	0.66
Believes resistance training will make me look good, n (%)		22 (35%)	23 (50%)	0.13
Believes resistance training will cause injuries, n (%)		1 (2%)	1 (2%)	>0.99
Enjoys resistance training, n (%)		30 (48%)	32 (70%)	**0.02**
Feels comfortable lifting weights, n (%)		37 (60%)	33 (72%)	0.19

Female participants reported enjoying RT significantly less than males (Table 2). No other significant differences regarding beliefs about RT were identified. Most female and male participants believed that RT would make them better at their sport, would help them prevent injuries, and felt comfortable lifting weights (Table 2). A small proportion of female and male participants believed that RT would result in looking bulky or with muscles that are too big (7%) or that RT will cause injuries, (2%) with a greater proportion believing that RT will make them look good (Table 2).

Male participants were significantly more likely than female participants to report using barbells, weight machines, and free weights (Table 3). There were no sex-differences observed in body weight or resistance band or cord utilization. For male participants, the highest proportion utilized free weights, followed by weight machines, body weight, resistance bands or cords, and lastly, barbell (Table 3). For female participants, the highest proportion used body weight and resistance bands or cords, followed by free weights, weight machines, and lastly, barbell (Table 3).

Table 3. Type of equipment used by females and males when performing resistance training.

Equipment Reported Using	Female	Male	P Value
Body weight	35 (56%)	31 (67%)	0.25
Resistance bands or cords	35 (56%)	27 (59%)	0.82
Barbell	17 (27%)	26 (57%)	**0.002**
Weight machines	23 (37%)	32 (70%)	**0.001**
Free weights (dumbbells, kettlebells)	34 (55%)	34 (74%)	**0.04**

4. Discussion

To our knowledge, this is the first study to examine sex differences in RT participation and beliefs among adolescent athletes. Overall participation in RT for both male and female athletes in our sample was higher than a previously reported estimate of high school students achieving the recommended US guidelines of muscle-strengthening activities three times per week (52%) [21–23]. The higher proportion of participation in RT observed in this study may reflect the sample consisting of recreational and competitive athletes rather than a general adolescent population. Furthermore,

 doi:10.20944/preprints202509.2342.v1

participants were recruited from outpatient sports medicine and physical therapy clinics, possibly increasing their exposure to RT as part of injury rehabilitation. Lastly, our measure of RT participation did not limit the analysis to those engaging in fewer than three days per week, although the mean frequency for both sexes was approximately three days weekly.

The majority of female and male participants reported believing that RT would make them better at their sport, help prevent injury, and were comfortable performing RT. However, female participants reported lower enjoyment of RT than the male participants. This may be due to a lack of social support, social stigma, the gym environment, a lack of confidence in skills, or different goals and motivation [17,24]. The lower reported enjoyment of RT among the female participants may be associated with the lower proportion participating in RT compared to their male peers. Future research should explore barriers to RT enjoyment among female adolescent athletes and provide a tailored approach to encourage positive RT experiences and ultimately sustain lifelong RT practices.

Although no significant sex differences were found in RT participation frequency or duration, there were significant differences in equipment usage, with male athletes more frequently utilizing barbells, weight machines, and free weights. These findings align with existing literature highlighting sex and/or gender differences in equipment preferences, potentially influenced by perceived gender roles, access, and exposure to specific types of equipment [17,24–26]. These findings suggest that incorporating the use of free weights, barbells, and weight machines into strength programming among young female athletes, with adequate instruction and supervision to promote comfort and confidence in using this equipment for RT may be valuable.

Interestingly, the female participants reported initiating RT at a younger age than the male participants. Because male individuals engage in RT at higher rates than female individuals related to societal norms and encouragement in strength-based activities, [27,28] we would expect them to also initiate RT earlier. Our findings may indicate differences in motivations or entry points into RT, possibly linked to injury prevention or earlier participation in structured sports programs for young female athletes. This aligns with evidence suggesting that coaches of girls' teams were more likely to be aware of and to adopt injury prevention programs than coaches of boys' teams potentially due to greater public awareness of higher injury risk among girls for non-contact ACL injuries [29]. Importantly, these findings reinforce evidence that supervised, age-appropriate RT is safe and beneficial for youth, including when initiated before adolescence [2]. Introducing RT in early adolescence (10-13 years old) can promote both injury prevention and positive engagement with physical activity.

This study has several limitations. The survey-based method employed is subject to bias and more limited in assessing the nuances of participants' attitudes and beliefs about RT. Second, the generalizability of our findings may be limited as the sample was from a single geographic region, many presenting for sports medicine care or rehabilitation, potentially limiting broader applicability. Finally, we are unable to report the response rate as we don't have the total number of people with access to the flyer/survey link. Despite these limitations, this is the first study to examine sex differences in participation in and beliefs/attitudes about RT among youth athletes. The findings provide relevant information for coaches and sports medicine professionals to inform their approach to implementing RT among adolescent athletes, while taking into consideration sex differences. Future studies should investigate psychosocial factors, such as perceived competence, social support, and motivational climate, to better understand these sex-specific disparities in RT attitudes and behaviors in a larger and more geographically diverse sample.

Resistance training (RT) is a critical component of youth athletic development, linked to improved sport performance and reduced injury risk. This study provides important insights for coaches, athletic trainers, and strength professionals working with adolescent athletes. While overall RT participation was relatively high among both male and female athletes, key sex differences should inform program design. Males were more likely to use traditional RT equipment (barbells, machines, and free weights) and to report enjoying RT. In contrast, females reported significantly less enjoyment and were more likely to use bodyweight and resistance bands. These differences may stem from

 doi:10.20944/preprints202509.2342.v1

varied access, confidence, social influences, or past exposure to training environments. Practitioners should consider these preferences when designing programs for female athletes. Creating supportive, inclusive training environments that emphasize competence and enjoyment may encourage greater engagement. Coaches might start with bodyweight and resistance band exercises, gradually introducing free weights and machines as confidence builds. Female athletes may also benefit from female role models, individualized instruction, and small-group formats that reduce intimidation. Importantly, most athletes regardless of sex believed that RT improves sport performance and helps prevent injury. These shared beliefs can be leveraged to motivate participation. Tailoring communication strategies to reinforce these benefits may be especially effective for less experienced or reluctant participants. In sum, practitioners can promote RT participation among youth by recognizing sex-specific preferences, enhancing enjoyment, and fostering confidence through progressive, supportive programming. These efforts may encourage long-term adherence to RT and contribute to improved athletic development and injury prevention for all youth athletes.

5. Conclusions

This study is the first to explore sex differences in both participation and beliefs around resistance training among adolescent athletes. Despite similar training frequency, female athletes reported lower enjoyment and less use of traditional equipment compared to males. These insights highlight the need to address sex-specific preferences and perceptions to promote equitable, engaging resistance training experiences for all youth athletes.

Supplementary Materials: The following supporting information can be downloaded at the website of this paper posted on Preprints.org, Table S1: Full questionnaire.

Author Contributions: Conceptualization, C.M.R.; methodology, C.M.R., D.R.H., and A.A.; formal analysis, D.R.H.; investigation, C.M.R.; data curation, C.M.R.; writing—original draft preparation, C.M.R.; writing—review and editing, D.R.H. and A.A.; supervision, A.A.; project administration, C.M.R. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding. Dr. Rovzar was supported by a training grant from the National Heart, Lung, and Blood Institute, National Institutes of Health (T32 HL161270). Dr. Howell has received research support from the Eunice Kennedy Shriver National Institute of Child Health and Human Development (R01HD108133, R21HD117284, R03HD094560), the National Institute of Neurological Disorders and Stroke (R01NS100952, R43NS108823), the National Institute of Arthritis and Musculoskeletal and Skin Diseases (R13AR080451), the 59th Medical Wing, Department of the Air Force, MINDSOURCE Brain Injury Network, the Tai Foundation, the Colorado Clinical and Translational Sciences Institute (UL1TR002535), and the Denver Broncos Foundation. Dr. Armento has received funding from the National Center for Advancing Translational Sciences through the Clinical and Translational Science Awards Program/Colorado Clinical and Translational Sciences Institute (K12TR004412, UM1TR004399).

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Colorado Multiple Institutional Review Board (COMIRB) at the University of Colorado Anschutz Medical Campus. Written informed consent was obtained from all participants prior to their inclusion in the study. For participants under the age of 16, written informed consent was obtained from a parent or legal guardian. Clinical trial registration: Not applicable.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Acknowledgments: We thank Casey Little for assistance with data collection.

Conflicts of Interest: The authors declare no conflicts of interest

 doi:10.20944/preprints202509.2342.v1

Abbreviations

The following abbreviations are used in this manuscript:

RT	Resistance training
IOC	International Olympic Committee (IOC)
NSCA	National Strength and Conditioning Associations (NSCA)

References

1. Faigenbaum AD, Kraemer WJ, Blimkie CJ, et al. Youth resistance training: updated position statement paper from the national strength and conditioning association. J Strength Cond Res. 2009;23:S60-S79.
2. Faigenbaum AD, Myer GD. Resistance training among young athletes: safety, efficacy and injury prevention effects. Br J Sports Med. 2010;44(1):56-63.
3. Lloyd RS, Cronin JB, Faigenbaum AD, et al. National Strength and Conditioning Association Position Statement on Long-Term Athletic Development. J Strength Cond Res. 2016;30(6). https://journals.lww.com/nsca-jscr/Fulltext/2016/06000/National_Strength_and_Conditioning_Association.1.aspx
4. Lloyd RS, Faigenbaum AD, Stone MH, et al. Position statement on youth resistance training: the 2014 International Consensus. Br J Sports Med. 2014;48(7):498-505.
5. Lehance C, Binet J, Bury T, Croisier JL. Muscular strength, functional performances and injury risk in professional and junior elite soccer players. Scand J Med Sci Sports. 2009;19(2):243-251.
6. Behm DG, Young JD, Whitten JH, et al. Effectiveness of traditional strength vs. power training on muscle strength, power and speed with youth: a systematic review and meta-analysis. Front Physiol. 2017;8:423.
7. Activity MP, WHO Team. WHO guidelines on physical activity and sedentary behaviour. World Health Organ. Published online 2020.
8. Kraemer WJ, Ratamess NA. Fundamentals of resistance training: progression and exercise prescription. Med Sci Sports Exerc. 2004;36(4):674-688.
9. Stricker PR, Faigenbaum AD, McCambridge TM, et al. Resistance training for children and adolescents. Pediatrics. 2020;145(6).
10. Ratamess NA, Alvar BA, Evetoch TK, et al. Progression models in resistance training for healthy adults. Med Sci Sports Exerc Off J Am Coll Sports Med. 2009;41(3):687-708.
11. García-Hermoso A, Ramírez-Campillo R, Izquierdo M. Is muscular fitness associated with future health benefits in children and adolescents? A systematic review and meta-analysis of longitudinal studies. Sports Med. 2019;49:1079-1094.
12. Lesinski M, Herz M, Schmelcher A, Granacher U. Effects of resistance training on physical fitness in healthy children and adolescents: an umbrella review. Sports Med. 2020;50:1901-1928.
13. Zwolski C, Quatman-Yates C, Paterno MV. Resistance Training in Youth: Laying the Foundation for Injury Prevention and Physical Literacy. Sports Health Multidiscip Approach. 2017;9(5):436-443. doi:10.1177/1941738117704153
14. Hulteen RM, Smith JJ, Morgan PJ, et al. Global participation in sport and leisure-time physical activities: A systematic review and meta-analysis. Prev Med. 2017;95:14-25. doi:10.1016/j.ypmed.2016.11.027
15. Rhodes RE, Lubans DR, Karunamuni N, Kennedy S, Plotnikoff R. Factors associated with participation in resistance training: a systematic review. Br J Sports Med. 2017;51(20):1466-1472.
16. Strain T, Fitzsimons C, Kelly P, Mutrie N. The forgotten guidelines: cross-sectional analysis of participation in muscle strengthening and balance & co-ordination activities by adults and older adults in Scotland. BMC Public Health. 2016;16(1):1108.
17. Vasudevan A, Ford E. Motivational factors and barriers towards initiating and maintaining strength training in women: a systematic review and meta-synthesis. Prev Sci. 2022;23(4):674-695.
18. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform. 2009;42(2):377-381.

 doi:10.20944/preprints202509.2342.v1

19. Torsheim T, Cavallo F, Levin KA, et al. Psychometric validation of the revised family affluence scale: a latent variable approach. Child Indic Res. 2016;9:771-784.
20. Jayanthi NA, LaBella CR, Fischer D, Pasulka J, Dugas LR. Sports-specialized intensive training and the risk of injury in young athletes: a clinical case-control study. Am J Sports Med. 2015;43(4):794-801.
21. Centers for Disease Control and Prevention. Youth risk behavior surveillance system. Published online 2011.
22. García-Hermoso A, Izquierdo M, López-Gil JF. Combined aerobic and muscle-strengthening activity guidelines and their association with obesity in US adolescents. Scand J Med Sci Sports. 2024;34(1):e14504.
23. US Department of Health and Human Services. 2018 Physical Activity Guidelines Advisory Committee Scientific Report. US Department of Health and Human Services; 2018.
24. Guess N. A qualitative investigation of attitudes towards aerobic and resistance exercise amongst overweight and obese individuals. BMC Res Notes. 2012;5:1-12.
25. Coen SE, Rosenberg MW, Davidson J. "It's gym, like gym not Jim": Exploring the role of place in the gendering of physical activity. Soc Sci Med. 2018;196:29-36.
26. Bopp M, Wilcox S, Oberrecht L, Kammermann S, McElmurray CT. Correlates of strength training in older rural African American and Caucasian women. Women Health. 2004;40(1):1-20.
27. García-Hermoso A, Muñoz-Pardeza J, Hormazábal-Aguayo I, Ezzatvar Y. Global Prevalence of Compliance with Muscle-Strengthening Activity Recommendations in Children and Adolescents: A Systematic Review and Meta-Analysis. Available SSRN 5151077.
28. Roberts BM, Nuckols G, Krieger JW. Sex differences in resistance training: a systematic review and meta-analysis. J Strength Cond Res. 2020;34(5):1448-1460.
29. Norcross MF, Johnson ST, Bovbjerg VE, Koester MC, Hoffman MA. Factors influencing high school coaches' adoption of injury prevention programs. J Sci Med Sport. 2016;19(4):299-304.: