STM JOURNALS

Recent Trends in
Sports

Volume 3, Issue 1, 2026
January–June
DOI (Journal): 10.37591/RTS

https://journals.stmjournals.com/rts

Research RTS

Developmental Responses to Structured Training Loads in Competitive Youth Judo

Vansh Julka[1,*], Anulekha Dey[2]

Abstract

This study investigates the influence of a planned and regulated training-load structure on the physical and technical growth of elite youth judoka aged 10–16. A four-week training program progressively modified the key variables of training intensity, frequency, and volume to support performance development while avoiding overfatigue and injury. Ten athletes participated, with performance assessed before and after training using tests for muscular endurance, core stability, lower-body explosive power, uchikomi execution speed, grip strength, and qualitative ratings of tachi-waza and ne-waza skills. The post-training data showed improvement across every measured indicator, confirming positive adaptations in strength, power, movement efficiency, and technical execution. Athletes at all experience levels, from those with higher baseline scores to those with lower initial values, showed meaningful enhancement, demonstrating the benefit of systematic load control. The results emphasize that well-designed, age-appropriate training-load management promotes safe, sustainable development while boosting performance in youth judo athletes. Athletes who entered the program with higher baseline scores, such as participants B and H, continued to display improvement, indicating that the training plan was sufficiently challenging to stimulate adaptation even among more experienced judoka. At the same time, athletes who started with comparatively lower baseline values, such as D and I, also showed marked enhancements in performance.

Keywords: Age-appropriate training, elite judoka, movement efficiency, ne-waza, physical development, progressive overload, psychomotor development, randori, skill acquisition, technical development

INTRODUCTION

Judo, founded by Jigoro Kano in 1882 [1–10], is a modern martial art, Olympic discipline, and educational philosophy that emphasizes the efficient use of both physical and mental energy. Derived from the Japanese term meaning "the gentle way," judo integrates technique, timing, and strategic thinking with self-discipline. Beyond its competitive dimension, judo contributes to the holistic development of practitioners by promoting physical fitness, motor coordination, emotional regulation, discipline, and resilience—characteristics that are particularly influential during childhood and adolescence.

The competitive pathway of judo typically begins in youth, where foundational training shapes long-term performance trajectories. The 10–16 age range is especially critical, as athletes undergo substantial physical growth, neuromuscular development, and technical acquisition. At this level, training must be structured to optimize performance gains without compromising health, recovery, or safety. Therefore, managing the physical demands placed on young athletes is essential, especially in elite training environments where performance expectations are high.

***Author for Correspondence**
Vansh Julka
E-mail: julkavansh822@gmail.com

[1]Student, Department of Physical Education, Amity School Physical Education and Sports Science, Noida, Uttar Pradesh, India
[2]Assistant Professor, Department of Physical Education, Amity School Physical Education and Sports Science, Noida, Uttar Pradesh, India

Received Date: February 11, 2026
Accepted Date: February 13, 2026
Published Date: February 19, 2026

Citation: Vansh Julka, Anulekha Dey. Developmental Responses to Structured Training Loads in Competitive Youth Judo. Recent Trends in Sports. 2026; 3(1): 7–14p.

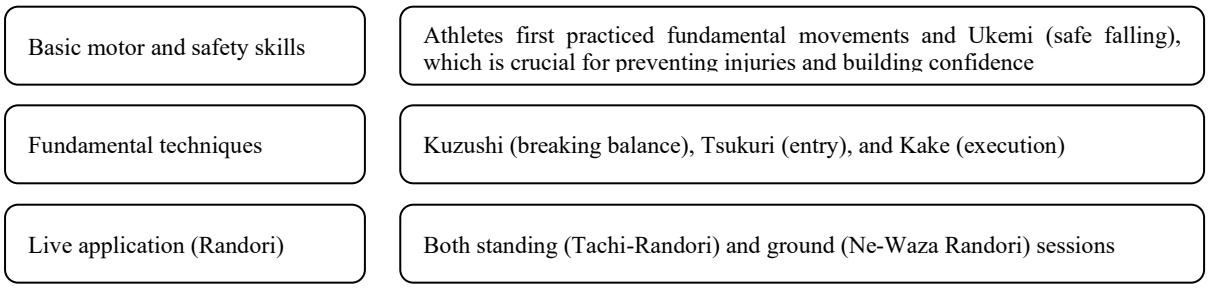

Figure 1. Overview of the structured judo training program showing the progression from basic motor and safety skills to fundamental techniques and live practice (randori) used during the training period.

Study Focus

The present study examined training-load management in elite youth judo athletes aged 10–16 years. Training-load is understood as the cumulative physiological and psychological stress imposed through athletic activity, typically quantified across three primary dimensions:

- *Intensity:* How hard an athlete trains
- *Volume:* Total training completed (duration or number of repetitions)
- *Frequency:* how often training sessions occur

Training-load management refers to the systematic planning, monitoring, and adjustment of these variables to:

- Enhance athletic performance
- Support physical and technical development
- Prevent excessive fatigue, overtraining, and injury

Given that elite youth Judokas engage in structured, competitive training with high physical and technical demands, understanding optimal load distribution is vital for long-term athletic success and well-being [11–13].

Context of Training in Youth Judo

Skill acquisition in judo during the early and developmental elite stages prioritizes both technical proficiency and psychomotor development. This sport requires sustained concentration, timing, and precision. Posture, grip strategies, balance control, and coordinated movement flow require continual mental engagement. These cognitive skills translate into enhanced agility, decision-making, and emotional self-regulation beyond the sporting environment (Figure 1).

Before transitioning to complex competitive strategies, young athletes must achieve mastery of:

- Falling and rolling safely (Ukemi)
- Gripping and grip-breaking strategies
- Stance and posture transitions
- Fundamental offensive and defensive tactical responses

Core Training Components

Youth judo training involves multiple modalities aimed at progressive development:

Randori (free practice) functions as a semi-competitive scenario in which athletes apply techniques against resisting partners. Two primary modalities are used.

- *Tachi-randori:* standing practice focused on throws, kuzushi (unbalancing), and timing
- *Ne-waza randori:* Ground practice, including pins, joint locks, transitions, and chokes

Randori strengthens tactical adaptability, reflex responsiveness, technical fluency, and mutual respect among practitioners. Kata (formal techniques) are structured pair sequences used to internalize judo principles through precision and controlled execution. The most relevant to youth training are:

- *Nage-no-kata:* throwing principles and biomechanical efficiency
- *Katame-no-kata:* principles of ground control
- *Kime-no-kata:* self-defense concepts for armed and unarmed attacks

Katame-Waza (grappling techniques)—a cornerstone of competitive judo—includes:

- *Osaekomi:* Waza (pins), for example, Kesa-Gatame, Yoko-Shiho-Gatame
- *Shime:* Waza (Strangulations), for example, Juji-Jime and Okuri-Eri-Jime
- *Kansetsu:* Waza (Joint Locks), for example, Juji-gatame, Ude-garami

Biomechanical Foundations of Judo

Effective performance depends heavily on posture and movement mechanics (Tai-Sabaki):

- *Shizen:* Tai (natural posture) allows relaxed mobility and rapid reaction
- *Jigo:* Tai (defensive posture) enhances stability and minimizes vulnerability

Athletes must fluidly transition between postures to execute or defend against throws. Falling techniques (Ukemi) serve both safety and performance purposes by distributing impact forces during high-amplitude throws. Mastery of forward, backward, side, and rolling breakfalls enables athletes to engage confidently in practice and competition (Figure 2).

METHODOLOGY

Research Design

This study used a quantitative research design to examine how a structured training program influences the physical and technical development of youth Judokas. A planned four-week training cycle was implemented, allowing for the standardized measurement of changes in strength, endurance, coordination, and skill execution. This approach was chosen because it enables a clear comparison between baseline performance and post-training improvements, making it suitable for evaluating training effectiveness in young athletes (Figure 3).

Population and Sample

The sample consisted of 10 young judo athletes between the ages of 10 and 16 years who were already training in a competitive environment. A purposive sampling method was used to include only athletes who regularly participated in structured judo training. All participants completed the training intervention and participated in both the pre- and post-testing sessions (Figure 4).

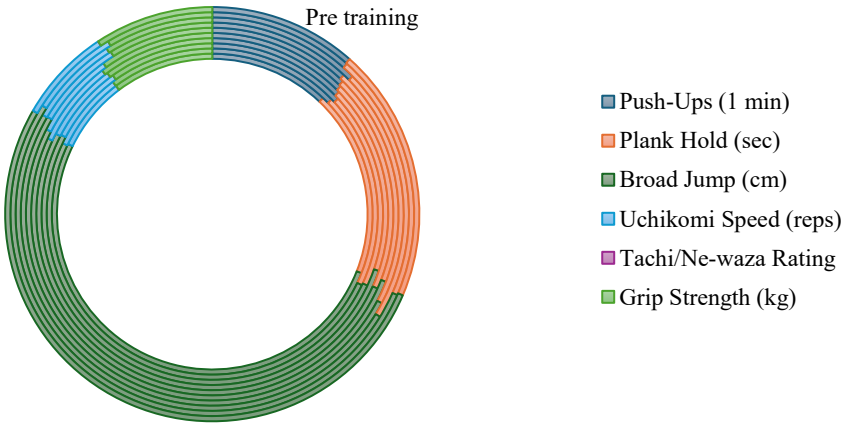

Figure 2. Progressive learning stages in training and performance development.

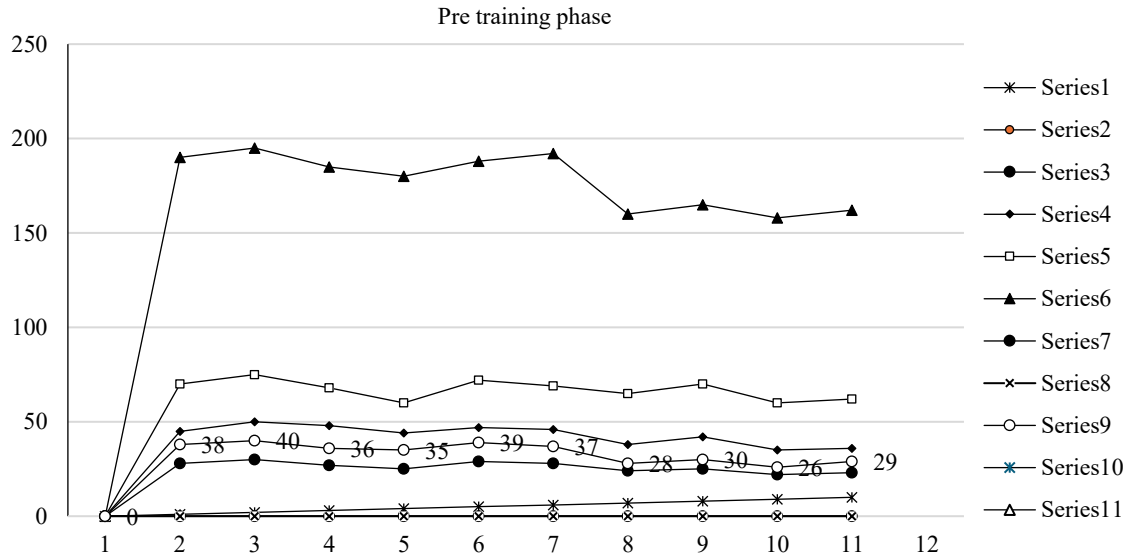

Figure 3. Skill evaluation and performance assessment.

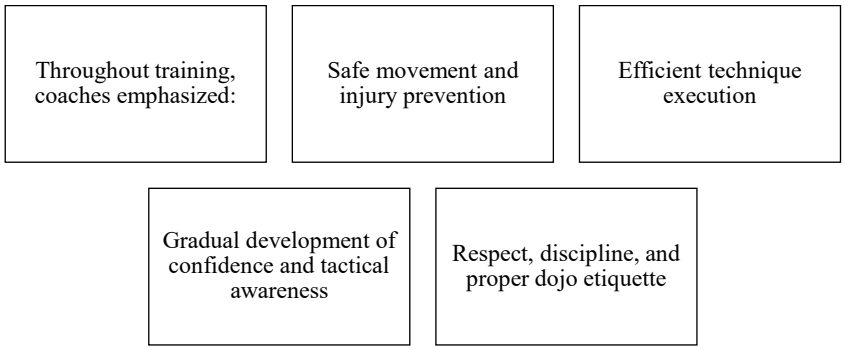

Figure 4. Training methodology and process of skill development in Judo.

Training methodology (process of skill development): The training program was designed around the natural progression of learning in judo, ensuring that each stage built on the skills learned previously. The development process followed four progress was observed through the belt-grading system, where athletes advance based on technical ability, discipline, and consistency in training (Figure 4).

Progress was observed through the *belt-grading system,* where athletes advanced based on their technical ability, discipline, and consistency in training.

Validity and Reliability

To ensure that the training and testing procedures accurately reflected skill development, judo experts reviewed all components of the program. The testing protocols for push-ups, plank hold, broad jump, grip strength, and technical ratings were identical during week 1 and week 4 assessments.

This consistency helped ensure that changes in performance were due to training and not due to differences in testing conditions.

Data Collection

Data was collected twice: once at the start of the training cycle and again after four weeks. Each athlete completed physical tests and technical evaluations that measured performance outcomes.

All tests were conducted in controlled conditions to ensure accuracy and fairness (Figure 5).

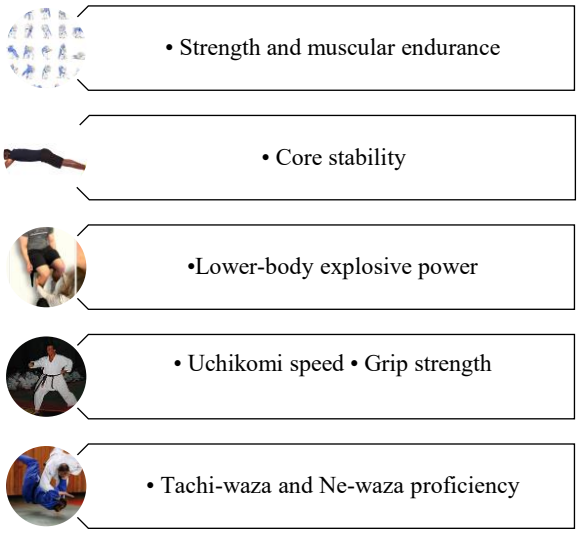

Figure 5. Step-by-Step Aims of the 3–7 weeks training program.

Administration of Data Collection

Qualified judo coaches and strength-and-conditioning staff supervised both testing sessions. Athletes completed a standardized warm-up before each assessment, and technique evaluations were performed using a descriptive rating scale (average, good, very good, excellent). The same evaluators were present in both sessions to maintain consistency.

Statistical Tool

The collected data were organized and analyzed using simple descriptive statistics to compare the performance before and after training. Changes in the athletes' physical abilities and technical ratings were examined to understand how effectively the training-load supported their development during the season.

RESULT

This section presents the outcomes of the four-week structured training-load program on the physical and technical performance of youth judoka. Baseline and post-training data were analyzed to identify changes in strength, endurance, power, grip ability, and skill execution in ten male and female athletes.

Baseline Performance Data (Before Training)

Athlete J's Grip Strength was recorded as 29 kg, based on the expected female range. Overall Performance: Athletes B (male) and H (female) demonstrated consistently high scores across all indicators.

- *Gender comparison:* The male group showed higher upper-body endurance (push-ups) and explosive leg power (broad jump), where the difference was most clearly observed.
- *Core stability:* The gap between male and female Plank Hold results was minimal, suggesting similar levels of core strength development across genders.
- *Skill correlation:* Athletes rated as average in skill (D and I) also recorded comparatively lower physical test values, suggesting a link between physical preparedness and technical mastery. A comparison of grip strength and skill ratings also indicated that stronger grips generally correlated with higher technical efficiency.

Performance After Training (Week 1 → Week 4)

Universal Improvement: All evaluated parameters demonstrated improvement, indicating positive adaptation to the structured training load (Table 1).

- *Gains by Metric:*
  - *Push-Ups:* Male gains of 4–7 repetitions (reps); female gains of 6–7 reps.

- *Plank hold:* Male gains of 7–10 seconds; female gains of 6–7 seconds.
- *Broad jump:* Male gains of 12–15 cm; female gains of 10–15 cm.
- *Uchikomi speed:* Both male and female judoka improved by 4–5 repetitions, reflecting advancements in technical speed and coordination.
- *Grip strength:* Male increases of 2–4 kg; female increases of 2–3 kg.

- *Skill progression:* All athlete ratings moved upward by one descriptive level (e.g., average to good; very good to excellent).

Improvements in skill ratings corresponded with improvements in physical variables, reinforcing the connection between physical conditioning and effective technical performance (Table 1).

DISCUSSION

The purpose of this study was to examine how a structured and progressively regulated training-load program influences the physical and technical development of youth judoka aged 10–16 years. The results clearly demonstrate that when training loads are planned according to developmental needs, young athletes respond with consistent and meaningful improvements in their performance. A major finding of this study was that all athletes showed progress across every measured parameter, regardless of their initial capabilities. Athletes who entered the program with higher baseline scores, such as participants B and H, continued to display improvement, indicating that the training plan was challenging enough to stimulate adaptation, even among more experienced judoka. At the same time, athletes who started with comparatively lower baseline values, such as D and I, also showed marked enhancements in performance. This suggests that the training structure was inclusive and appropriately scaled to support a wide range of developmental levels in the participants. Improvements in muscular endurance, core stability, lower-body power, and grip strength highlight the positive effects of systematic load progression. These adaptations are particularly relevant for judo, where explosive leg power contributes directly to effective throwing mechanics, and strong grips and a stable core enable better control during standing and ground exchanges. The increase in broad jump distances and improvements in plank times further reflect enhanced neuromuscular coordination and better overall physical preparedness of the players.

The gains observed in the uchikomi speed provided further insight into the connection between physical conditioning and technical efficiency. Faster repetitions indicate more precise timing, better rhythm, improved balance, and increased fluidity in technique execution. This supports the existing literature suggesting that technical skills in judo are strengthened when physical and neuromuscular capacities develop alongside technical training [14].

Table 1. Pre- and post-training performance data from weeks 1 to 4.

S.N.	Name	Gender	Push-ups (→)	Plank hold (→)	Broad jump (→)	Uchikomi (→)	Tachi/Ne-waza (→)	Grip strength (→)
			Pre→ post	Pre→ post	Pre→ post	Pre→ post	Pre→ post	Pre→ post
1.	A	M	45 → 52	70 → 80 sec	190→205 cm	28→33 reps	Good→very good	38 → 41 kg
2.	B	M	50 → 57	75 → 82 sec	195 → 210 cm	30→35 reps	Very good→excellent	40 → 43 kg
3.	C	M	48 → 53	68 → 75 sec	185 → 200 cm	27→31 reps	Good→very good	36 → 40 kg
4.	D	M	44 → 49	60 → 70 sec	180 → 193 cm	25→29 reps	Average→good	35 → 38 kg
5.	E	M	47 → 52	72 → 79 sec	188 → 202 cm	29→33 reps	Very good→excellent	39 → 42 kg
6.	F	M	46 → 51	69 → 77 sec	192 → 204 cm	28→32 reps	Good→very good	37 → 40 kg
7.	G	F	38 → 44	65 → 72 sec	160 → 172 cm	24→28 reps	Good→very good	28 → 31 kg
8.	H	F	42 → 47	70 → 76 sec	165 → 178 cm	25→30 reps	Very good→excellent	30 → 33 kg
9.	I	F	35 → 41	60 → 68 sec	158 → 170 cm	22→26 reps	Average→good	26 → 29 kg
10.	J	F	36 → 42	62 → 69 sec	162 → 175 cm	23→27 reps	Good→very good	29 → 31 kg

A strong relationship between physical improvement and technical progression was also evident. Athletes who developed greater grip strength and core stability received higher tachi-waza and ne-waza ratings after a four-week intervention [15–17]. These results reinforce the principle that physical conditioning is not separate from technical development in judo but is a key contributor to effective skill execution. The upward shift in skill ratings from "average" to "good," and from "very good" to "excellent" reflects not only physical growth but also improved confidence, sharper decision-making, and more efficient technique application during both standing and ground situations [18].

This study also highlights the importance of appropriate load management during adolescence. The 10–16 age range is a sensitive developmental period, characterized by rapid physical growth and an increased risk of overuse injuries. The structured progression used in this study—gradually increasing training volume, frequency, and intensity—appears to have supported healthy adaptation without signs of excessive fatigue or performance decline in the participants. This finding is consistent with recommendations from youth sports research, which emphasizes the need for careful monitoring and gradual increments in training demands [10]. Overall, the results of this study show that a well-designed, age-appropriate training-load program promotes safe, effective, and holistic development among young judo athletes. Improvements were observed not only in physical fitness but also in technical performance, illustrating the interconnected nature of conditioning, skill acquisition, and confidence. These findings highlight the value of structured training in youth judo programs and support the use of monitored load progressions to optimize performance. Future studies should examine longer training cycles, explore gender-specific trends, or incorporate technological tools, such as heart rate monitoring or digital load tracking, to further refine training-load management strategies for young judoka [10].

CONCLUSION

The four-week intervention clearly demonstrated that appropriate load planning, gradual progressions, and well-balanced training sessions produce measurable improvements across all performance domains in elite youth judoka aged 10–16. (a) Physical Adaptation: All participants showed advancements in physical conditioning, indicating positive adaptations in muscular endurance, core stability, neuromuscular coordination, and grappling-specific strength. (b) Technical Progress: Technical progress paralleled physical development, with all athletes improving their tachi-waza and ne-waza ratings, confirming that better conditioning supports smoother execution of techniques. (c) Systematic Benefits: The structured training benefited both experienced, high-baseline athletes and developing, lower baseline athletes. (d) Training Management: The findings reinforce that effective training-load management optimizes frequency, volume, and recovery to match the developmental needs of youth athletes, minimizing fatigue and injury risk. This study confirms that a carefully planned and progressively regulated training program significantly enhances both physical fitness and technical skills in youth judo athletes, supporting the use of monitored, age-appropriate structures for sustainable development.

REFERENCES

1. American Academy of Pediatrics Council on Sports Medicine and Fitness; McCambridge TM, Stricker PR. Strength training by children and adolescents. Pediatrics. 2008 Apr;121(4):835–840. doi:10.1542/peds.2007-3790. PMID:18381549.
2. Balyi I, Way R, Higgs C. Long-Term Athlete Development. Champaign (IL): Human Kinetics; 2013. doi:10.5040/9781492596318.
3. Buchheit M, Laursen PB. High-intensity interval training, solutions to the programming puzzle: Part I: cardiopulmonary emphasis. Sports Med. 2013;43:313–38. DOI: 10.1007/s40279-013-0029-x. PubMed: 23539308.
4. Engebretsen L, Soligard T, Steffen K, Alonso JM, Aubry M, Budgett R, et al. Sports injuries and illnesses during the London Summer Olympic Games 2012. Br J Sports Med. 2013 May;47(7):407–414. doi:10.1136/bjsports-2013-092380. PMID:23515712.
5. Foster C, Florhaug JA, Franklin J, Gottschall L, Hrovatin LA, Parker S, et al. A new approach to monitoring exercise training. J Strength Cond Res. 2001;15:109–15. DOI: 10.1519/00124278-200102000-00019. PubMed: 11708692.

6. Gabbett TJ. The training-injury prevention paradox: should athletes be training smarter and harder? Br J Sports Med. 2016;50:273–80. DOI: 10.1136/bjsports-2015-095788. PubMed: 26758673.
7. Ahmedov F. Judo combat: time-motion analysis and biomechanical approach. In: IJF Academy, editor. 1st ed. Lausanne (Switzerland): IJF Academy; 2021. p. 1–150.
8. Jones L. Judo Kata: Practice, Competition, Purpose. Santa Clara (CA): Via Media Publishing; 2016.
9. Bergeron MF, Mountjoy M, Armstrong N, Chia M, Côté J, Emery CA, et al. International Olympic Committee consensus statement on youth athletic development. Br J Sports Med. 2015 Jul;49(13):843–851. doi:10.1136/bjsports-2015-094962. PMID:26084524.
10. Kano J. Jigoro Kano: the father of judo – historical biography, pedagogical philosophy, and institutional legacy of Kodokan Judo. In: Japan Judo Education Association, editor. 1st ed. Tokyo (Japan): Kodokan Archives Press; 1986. p. 1–300.
11. Young D. Mind over muscle: writings from the founder of Judo. Rev Artes Marciales Asiát. 2012;1(3):88–89. doi:10.18002/rama.v1i3.262.
12. Warner D. Skill Acquisition for Judo: Principles into Practice. New York (NY): Routledge; 2025. doi:10.4324/9781003051343.
13. Kraemer WJ, Ratamess NA. Fundamentals of resistance training: progression and exercise prescription. Med Sci Sports Exerc. 2004;36:674–88. DOI: 10.1249/01.MSS.0000121945.36635.61. PubMed: 15064596.
14. Ebell SB. Competition versus tradition in Kodokan judo. Rev Artes Marciales Asiát. 2008;3(2):28–37. doi:10.18002/rama.v3i2.359.
15. Jones LC. The canon of judo: classic teachings on principles and techniques. Rev Artes Marciales Asiát. 2012;1(1):90. doi:10.18002/rama.v1i1.169.
16. Faigenbaum AD, Kraemer WJ, Blimkie CJ, Jeffreys I, Micheli LJ, Nitka M, Rowland TW. Youth resistance training: updated position statement paper from the National Strength and Conditioning Association. J Strength Cond Res. 2009 Aug;23(5 Suppl):S60–79.doi:10.1519/JSC.0b013e3181 9df407. PMID:19620931.
17. Verhoshansky Y, Siff M. Supertraining. 6th ed. Rome (Italy): Ultimate Athlete Concepts; 2009.
18. Mazzola D. The gentle way: maximizing efficacy and minimizing violence in Judo. Philos J Conflict Violence. 2018;2(2):282–304. doi:10.22618/TP.PJCV.20182.2.437005.

