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Strength and Conditioning for Judo

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summary

For elite judo athletes and recreational judo athletes alike, sport-specific strength and conditioning is essential in the prevention of injuries and for enhancing performance. This article offers suggestions for judo athletes and coaches for the development of strength and conditioning programs specific to the requirements of their sport.

Judo, one of the most popular sports in the world, is an exciting grappling sport similar to wrestling, but unlike wrestling, the competitors wear thick jackets called *judogis* or *gis*. The *gi* allows for different tactical approaches for the judo athlete when compared to wrestling, and some say judo is more technically oriented as a result of this difference. Nonetheless, judo athletes rely heavily on strength and conditioning to ensure success. Every judo coach

should be aware of this, and should work closely with strength and conditioning coaches to develop an appropriate strength and conditioning program for their athletes.

This article will discuss the literature published on injuries most common to grappling athletes and will make recommendations regarding strength and conditioning approaches to prevent injury and improve performance. We encourage the athletes and coaches to keep an active mind in analyzing what works best for them. The methods described in this article are what have worked for our athletes, but may not be best for others. Combining the effects of a properly designed and executed strength and conditioning program with quality coaching on the technical aspects of judo will improve performance and help to prevent injury.

Rules of the Game

Judo matches may last anywhere from 3 to 10 minutes depending on a variety of factors, but the regulation time for national and international matches is one 5-minute period. A judo competitor can win a match by scoring an *ippon* (“full point”). If an *ippon* is scored, then the match is over. This is an important distinction to the judo athlete who may

have to fight in up to 6 or 7 matches in 1 tournament. The score of *ippon* can be given to a judo competitor by one of the following 4 ways:

- Throwing an opponent onto his or her back with impetus.
- Holding an opponent down on his or her back for 25 seconds.
- Strangling an opponent into submission.
- Joint-locking an opponent into submission.

If a match is not won by *ippon* by the end of regulation time, then whomever has accumulated the most fractional points during the match is declared the winner.

Injuries

Preventing injury in sports by training specific joints identified as frequently injured is known as prehabilitation (4), and identifying injuries incurred in specific sports and developing programs to prevent them is a top priority of strength and conditioning coaches. It is also the judo coach’s responsibility to be knowledgeable about the most common injuries in judo and about how the strength and conditioning program will be of benefit to their athletes.

Common injury sites in wrestling occur at the knee, shoulder, ankle, head, elbow and neck (2, 6). Although neck injuries are most frequent in football and hockey (1), the neck injuries in grappling sports like wrestling and judo, although relatively rare, are no less catastrophic (2, 3). Previous studies reporting on the sport of wrestling have documented a wide range of injury rates, from 10 to 70%, depending on a variety of factors including how injury is defined, the population being studied, and whether a tournament or a season was evaluated (10).

Pasque and Hewett (10) performed a prospective study to evaluate injury patterns in a large population of 458 high-school wrestlers during one season. There were 219 injuries in 418 wrestlers followed throughout the season, for an overall injury incidence of 52 injuries per 100 wrestlers per season. The most common injury sites were the shoulder (24%) and the knee (17%). The researchers noted that the majority of injuries occurred in practice (63%), although the injury rate was higher in match competitions. Sixty-eight percent of practice injuries occurred during hard wrestling, 23% during drills, and 9% during conditioning. Sixty-seven percent of all practice injuries occurred during the last half of practice. Similar findings were seen in match competition, in which 42 and 36% of injuries occurred in the second and third periods, respectively, versus only 22% in the first period (10). Other researchers noted higher injury rates during competition (2).

It is logical to think the injuries in judo would be similar to those found in wrestling because judo is a jacketed form of wrestling. Finnish researchers (8) used national insurance records to analyze the types of injuries sustained by athletes participating in soccer, ice hockey, volleyball, basketball, judo, and karate over a 5-year period (1987–1991), and karate and judo had the highest rates of injury

reported. Approximately 70% of the injuries reported occurred during practice, and upper-limb injuries were more common in judo when compared with the other sports. The researchers also reported that dislocations were relatively more frequent in karate and judo (8).

Athletes in grappling sports may suffer injuries at many locations on the body. There is conflicting evidence regarding whether the rate of injury is higher in practice or competition, but the implications for coaches are clear:

- Create a strength-training program that is comprehensive and balanced in nature.
- Conduct hard *randori* (the technical term used to describe freestyle practice in judo) sessions in the first half of practice, or make sure the conditioning level of the athletes is high before conducting hard *randori* in the second half of practice.
- Focus on technical mastery in the areas of throwing, falling, hold-downs, and arm-locks.

Strength Training

Fleck and Kraemer (4) recommend performing a needs analysis before developing a strength and conditioning program for an athlete of a particular sport. The analysis should include a consideration of these questions:

- What muscle groups need to be trained?
- What are the basic energy sources that need to be trained?
- What type of muscle actions should be used in the sport?
- What are the primary sites of injury?

The primary sites of injury have already been discussed and are related to the first question; all major muscle groups should be included in the strength-training program for the judo athlete because of the diverse nature of injuries in grappling sports. A comprehensive literature review found numerous works offering guide-

lines for effective strength training programs for grappling athletes (5, 7, 9, 12, 13, 15). These programs commonly employ exercises that enhance the strength of all major muscle groups combined with lifts done in a ballistic manner. These lifts include the Olympic lifts and their supplements (power clean, power snatch, hang clean, hang snatch, and high pulls) and other lifts using an explosive phase, such as medicine ball throws, weighted squat jumps, and weighted split jumps.

Neck training should be a special consideration for all grappling athletes. Judo athletes are encouraged to throw their opponents onto their backs with high force. Because of the nature of grappling and combat sports, the judo athletes are sometimes at risk for cervical injury because body positions of the athletes can become quite contorted. Sometimes athletes being thrown risk cervical spine injuries to avoid landing on their backs and conceding the score of *ippon* (Figures 1 and 2).

Our strength-training program includes a balanced combination of neck exercises for our judo athletes that includes a 4-way neck machine (Nautilus, Vancouver, WA), manual resistance exercises, and free-weight exercises. The exercise movements target the cervical musculature, and include neck flexion, neck extension, and lateral flexion. Additionally, the upper trapezius and levator scapulae play a role in cervical stabilization and are targeted with a scapular-elevation movement. Table 1 shows combinations of neck exercises to improve overall neck strength. The athletes choose one of these cycles and can perform as few as 1 set of each exercise to efficiently train the neck musculature. The strength and conditioning coach must educate the athlete regarding the importance of strict form in and overall balance of the neck exercises. If 2 sets are performed for the anterior cervical musculature, then 2 sets should be done for the posterior musculature. In some cases, where muscular imbalances have



Figure 1. This throw, *teguruma* (“hand wheel”), is common in competitive judo. The defender has 2 options, to tuck the head and roll thus conceding a score or post on the head to prevent a score and risk injury. Photo by Bob Willingham.

been identified, however, athletes may be required to work a particular muscle group or plane of motion more than another.

Another special consideration for the judo athlete is grip strength. In judo, if an athlete dominates the grip fighting, that athlete is usually in control of the match and has a higher chance of winning. Although there are tactical and strategic approaches to dominating the grips, overall grip strength does play a role. There are numerous exercises that focus on the grip, and the following list is only a partial list of what the judo athlete can use to improve grip strength and endurance:

- Wrist curls.
- Reverse wrist curls.
- Barbell curls with pronated grip.
- Pronated or supinated barbell or dumbbell curls with a “thick” bar.
- Farmer’s walk: using dumbbells, walk with the dumbbells for as long as the dumbbells can be held. If walking with dumbbells is not a possibility, simply holding the dumbbells in a seated or standing position for a designated period of time is an effective grip strengthener.
- *Judogi* pull-ups: perform pull-ups using an old *gi* or a towel hanging from the pull-up bar, instead of the bar. Also, just hanging from the *gi* or towel in flexed-hang or straight-arm position.
- Wrist rollers.

What Energy Systems Need To Be Trained?

When considering the energy systems used for a particular activity, it is essential to analyze the intensity and the duration of that effort. Experts agree that most activities require energy from both the aerobic and anaerobic energy systems, but the percentage of adenosine triphosphate (ATP) production from aerobic and anaerobic sources will vary according to intensity and duration.

Table 1
Combinations of Neck Exercises

Cycle A	Cycle B	Cycle C
Shoulder shrugs db Neck flexion fw Neck extension nh Shoulder shrugs db	Harness neck ext. Lateral flexion mr (r) Lateral flexion mr (l) Neck flexion fw	Dead lifts Isometric (flexors), 60 s mr Isometric (extensors), 60 s mr Shoulder shrugs db

Choose one cycle to perform, 1–3 sets of each cycle, 10–20 repetitions/exercise

Note: db = dumbbell, fw = free weight, nh = neck harness, ext = extension, mr = manual resistance, r = right, l = left.

Time (seconds)	Anaerobic (%)	Aerobic (%)
0–30 s	80	20
0–60 s	70	30
0–120 s	60	40
0–240 s	40	60

Note: Data from Powers, S., and E. Howley. *Exercise Physiology: Theory and Application to Fitness and Performance*. New York: McGraw Hill, 2001.

According to the general guidelines in Table 2, energy system involvement is directly dependent on the duration of the activity. However, there are intermittent periods where intensity changes according to the demands of the particular match in dynamic sports like judo. For example, at certain times the athletes may be working at 100% of their maximum intensity, and at other times a submaximal percentage, and this is true for many sports. Most experts agree that during the 5 minutes of an average judo match, both aerobic and anaerobic energy systems are contributing varying percentages at various times.

Pulkinen (12) conducted a comprehensive review of the literature related to time–motion analysis of grappling sports and suggested a work to rest ratio of 2:1 to 3:1 for judo-specific interval training. Likewise, Tabata and his associates (14) found that 7 to 8 sets of interval training with the same work to rest ratio had a profound effect on both aerobic and anaerobic capacities. They used interval training for their national team speed skaters that involved 20 seconds of pedaling on a cycle ergometer at maximal levels followed by 10 seconds of submaximal work for 7 to 8 repetitions. Armed with this information, we use circuit weight training (CWT) combined with interval training (IT) as the main components of our metabolic conditioning program.



Figure 2. The athlete in white has countered an *uchimata* (“inner thigh sweep”) with a ride and roll maneuver. In defense, the athlete in blue is posting his head, attempting to prevent giving up a score. Photo by Bob Willingham.

1. One minute jumping rope	2. Leg extension	3. Leg curl
4. Bent-knee sit-ups	5. Neck cycle	6. Overhead press
7. Lat pull down	8. Dumbbell bench press	9. Barbell curl
10. Wrist curl	11. Farmer’s walk	12. Leg press

For this session, upper-body exercises should have a performance goal of 12–15 repetitions and lower-body exercises 12–20 repetitions. There should be little to no rest between the exercises.

There is no substitute for training in the actual sport. However, because of their metabolic costs, CWT and IT can be effective in creating a metabolic state similar to what develops in a judo match in a safe manner while maintaining strength (11, 14). This is especially important for those athletes who have to meticulously manage total body weight.

The CWT should be developed in accordance with the length of the bout. For example, the CWT session for an athlete preparing for an international event consisting of 5-minute matches

may be different than the session for a junior athlete preparing for a regional tournament with 3-minute matches. For an example of our basic CWT session, see Table 3. The frequency and overall volume with which the CWT should be used depends on a variety of factors, and the strength and conditioning coach should work closely with the judo coach to monitor overall training and competition volume in case acute program variables need to be modified. Also, we encourage the coaches (and athletes) to modify this program and to experiment with other variations to determine what best suits the needs of his or her athletes.

Table 4
Judo Specific Interval Training

Round 1	60 s shadowing 30 s push-ups 30 s pull-ups 60 s free squats 30 s heavy-bag lifts or double-leg lifts with partner 30 s <i>osotogari</i> attacks 30 s <i>ouchigari</i> attacks 30 s shrimping (with partner, in legs around-bottom) Maximum of 60 s break between rounds.
Round 2	60 s shadowing 30 s hold of the peak position of the pull-up 30 s half push-up (holding the midposition) 60 s half squats 60 s <i>ippon seoi nage</i> 60 s <i>ippon seoi nage</i> into <i>kouchi maki komi</i>

The intensity of the CWT session can be varied by several methods. We recommend varying the order of the exercise to increase or decrease the overall intensity. For example, for the first 2 to 3 weeks, the strength and conditioning coach may alternate upper-body and lower-body muscle groups with successive exercises to gradually prepare the athlete for more intense training as conditioning improves. As the season progresses, the intensity may be increased by working all lower-body and all upper-body muscle groups or by adding more multi-joint movements. To maximize efficiency of time, each circuit is separated by the interval-training method described above.

Another method that can be used to prepare the athlete for the metabolic environment specific to judo is judo-specific interval training (JSIT). By this, the authors are referring to a collection of movements that are specific to competition judo and can be performed with high intensity. For example, the athlete could begin with 1 minute of shadowing techniques (throws and takedowns), then proceed to timed segments of exercises totaling 5 minutes. This process can be continued for as many rounds as desired. See Table 4 for an example.

Metabolic conditioning is a part of grappling sports and is usually a natural component within the drilling and *randori* parts of the practice session. Pulkinnen (12) offers an example of the various components within a judo session:

- Warm-up: 10–15 minutes.
- Conditioning: 30 minutes.
- Technique instruction and review: 10–15 minutes.
- Technique- or situation-specific drills: 10–15 minutes
- *Randori*: 30–45 minutes

More intense supplemental metabolic conditioning, such as the CWT and JSIT, can be initiated to improve lactic acid tolerance, and Pulkinnen suggests 12 weeks to allow for this adaptation (12), which can be used on days off of the CWT program. There are many ways to manipulate this phase as the athlete's conditioning and ability to withstand lactic acid improves. For example, during the first week of JSIT, the athlete may require complete rest during the 60-second break between rounds. In successive weeks, the athlete may begin to shadow between rounds with increasing intensity. Also, the coach may decrease the break from 60 seconds to 50, then to 40 seconds. Again, the purpose

is to create the worst-case metabolic scenario.

What Types of Muscle Actions?

Concentric and eccentric muscle actions will be natural parts of all of the movements within the metabolic conditioning phase. Isometric muscle actions are a significant aspect of most grappling sports and should be implemented into the strength and conditioning program. For example, the strength and conditioning coach may implement specific isometric variations of exercises. Variations may include the half push-ups, v-ups, or holding of the peak contraction in the pull-up or bicep curl. See Table 4 (round 2) for an example.

Conclusion

Unlike wrestling, judo can take different forms for different people. Some train in judo to learn self-defense, and others train recreationally for fun or fitness. There are those who train for social reasons, and retired judo athletes who still enjoy coming to club workouts just to have fun *randori* sessions with some of the younger members—those sessions are enjoyed by the younger members as well. With wrestling, however, the average wrestling club member is young, male, and competition oriented. Our club encourages willing and able members to compete. We believe that competition judo offers an opportunity for personal growth unmatched by many other activities and sports. It is not a requirement, however. No professionally run club would make competition a requirement, but to the members that are competition oriented, strength and conditioning should be an important aspect of their overall training regimen.

We work individually with the club members involved in competition, developing strength and conditioning programs that work for them. Some of our members are students with light semester credit loads, and with these students,

we have more flexibility to vary the over all volume of work.

Others, however, work full time or are full-time students with heavy semester and course requirements and limited time to dedicate to judo or their strength and conditioning program. In these cases, the science of strength-training program development becomes more of an art. Nonetheless, all of our members use some variation of the CWT session described in Table 3 as part of their program to prepare for tournaments.

For the recreational judo athlete, we still recommend a supplemental strength and conditioning program. Staying in shape to play judo, rather than playing judo to stay in shape should be the general rule, and we make ourselves available to any of the recreational judo club members who request help in developing a personal program.

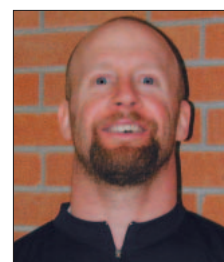
Judo is an excellent activity for children, and there is very little turnover of children in our club. For children, we try to incorporate strength and conditioning in a fun manner during practice sessions, and we encourage the kids to regularly perform at home the basic body-weight exercises that are done during practice. Supplemental strength and conditioning sessions outside of the judo practice sessions may be required for the more serious competition judo athletes, but exposing the children to some basic exercises that they may be using in the future, simply for health and fitness purposes, is desirable.

To enhance performance and, even more important, to prevent injury, expertise in the technical aspects of judo should be combined with an effective strength and conditioning program. There are many different programs that could be used. We recommend including neck and grip training as components especially helpful to the judo athlete. The

methods recommended within this article have proven efficient and effective for the athletes that we have worked with. ♦

References

1. Biasca, N., S. Wirth, and Y. Tegner. The Avoidability of head and neck injuries in ice hockey: An historical review. *Br. J. Sports Med.* 36:410–427. 2002.
2. Boden, B., W. Lin, M. Young, and F. Mueller. Catastrophic injuries in wrestlers. *Am. J. Sports Med.* 30:791–795. 2002.
3. Chesterman, B. *Judo*. Broomall, PA: Mason Crest Publishers, 2003. p. 33.
4. Fleck, S., and W. Kraemer. *Designing Resistance Training Programs*. Champaign, IL: Human Kinetics, 1997. pp. 88–91.
5. Grisaffi, D. Ballarmine Prep's strength training program for wrestling. *Strength Cond. J.* 18:54–58. 1996.
6. Jarret, G., J. Orwin, and R. Dick. Injuries in collegiate wrestling. *Am. J. Sports Med.* 26:674–680. 1998.
7. Kraemer, W., J. Vescovi, and P. Dixon. The physiological basis of wrestling: Implications for conditioning programs. *Strength Cond. J.* 26:10–15. 2004.
8. Kujala, U., S. Taimela, I. Antti-Poika, S. Orava, R. Tuominen, and P. Myllynen. Acute injuries in soccer, ice hockey, volleyball, basketball, judo, and karate: Analysis of national registry data. *Br. Med. J.* 311:1465–1469. 1995.
9. Lansky, R. Wrestling and Olympic style lifts: In-season maintenance of power and anaerobic endurance. *Strength Cond. J.* 21:21–27. 1999.
10. Pasque, C., T. Hewett. A prospective study of high school wrestling injuries. *Am. J. Sports Med.* 28:509–515. 2000.
11. Pichon, C., G. Hunter, M. Morris, R. Bond, and J. Metz. Blood pressure and heart rate response and metabolic cost of circuit versus traditional weight training. *J. Strength Cond. Res.* 10:153–156. 1996.
12. Pulkkinen, W. 2001. *The Sport Science of Elite Judo Athletes*. Guelph, Ontario, Canada: Pulkkinetics. pp. 19–31, 69.
13. Sanders, M. Strength and conditioning for submission fighting. *Strength Cond. J.* 21:42–45. 1999.
14. Tabata, I., K. Nishimura, M. Kouzaki, Y. Hirai, F. Ogita, M. Miyachi, and K. Yamamoto. Effects of moderate-intensity endurance and high intensity intermittent training on anaerobic capacity and VO_2max . *Med. Sci. Sports Exerc.* 28:1327–1330. 1996.
15. Takahashi, R. Power training for judo: Plyometric training with medicine balls. *Strength Cond. J.* 14:66–71. 1992.



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