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Brazilian jiu jitsu (BJJ) is a grappling sport that was derived from judo in the early 20th century. Long-time judo practitioner Mitsuhiro Maeda spent significant time traveling around the world spreading knowledge and teaching judo techniques to students in various countries. Eventually, he crossed paths with Brazilian natives Carlos and Helio Gracie, who took the techniques they learned from Maeda and adapted them to fit their physical capabilities more appropriately, which did not include size or strength (8). This is widely considered the birth of BJJ, which allows the smaller or less physically gifted individual to defeat a larger opponent with technique. Since its inception, it has grown in popularity, primarily due to its successful use in mixed martial arts (MMA) fights and self-defense situations (5,15). As BJJ has grown in popularity, so too has the research behind the physiological makeup of the BJJ athlete and effective training methods to develop strength, power, and endurance for grappling. Sound technical and tactical strategies will always remain the backbone of success in jiu jitsu; however, developing strength, power, and endurance are now a critical piece to the puzzle for the hobbyists to elite level practitioners who wish to maximize their potential. In order to improve said physiological qualities, one must first understand the demands of BJJ on the athlete, as well as appropriate training strategies to improve performance potential.

THE BREAKDOWN OF BJJ

As previously mentioned, BJJ plays a major role in the overall arsenal of many MMA fighters, however it is a competitive sport in its own right too. BJJ matches are classified as “gi” or “no-gi,” where the athletes are either wearing a thick kimono (known as a “gi”) or tight compression apparel, respectively. Both styles of BJJ have their own technical nuances but the overarching goal of both styles remains the same.

Every match begins with both athletes standing and attempting to either take their opponent down or pull-guard (attacking from the bottom position). The objective is to win by securing a chokehold or joint lock, which ultimately forces the opponent to submit or “tap” to avoid being strangled unconscious or suffering injury from the joint manipulation. If neither grappler can submit the other, the grappler who accumulated the most points for dominant positions is awarded the win for the match.

Match length varies depending on one’s skill level and rank with the following times being most common:

- White belt: 5 min
- Blue belt: 6 min
- Purple belt: 7 min
- Brown belt: 8 min
- Black belt: 10 min

Elite or professional jiu jitsu athletes may have only one match against a predetermined opponent like MMA; however, the overwhelming majority of BJJ matches occur in tournament-style brackets where an athlete may have 4 – 5+ matches in one day. This style of competition and the training itself places a huge demand on the athletes, requiring them to prepare with sound strength and conditioning methods for optimal performance outcomes.

STRENGTH

While BJJ relies heavily on technical ability to defeat an opponent, strength underpins the ability of the athlete to express said abilities against another skilled opponent, making it an important attribution to the overall makeup of a BJJ athlete (12). Research by Andreato et al. has demonstrated that BJJ athletes possess excellent abdominal/upper body strength and endurance, as well as high levels of isometric low back strength (4). More specifically, grip strength, pulling motions (dynamic strength), resisting positional advances against an opponent (static strength), and holding an advantageous position all require high levels of strength from the BJJ athlete (8). The degree to which strength ultimately determines success in a BJJ match is difficult to quantify due to the collective variables at play including technique, experience, weight division, fatigue, etc. Regardless, inferring the findings of this research along with a biomechanical analysis of the sport, it could be argued that developing an adequate level of maximal strength and subsequent strength endurance, particularly through the upper body and trunk areas, can aid BJJ performance positively (4).

POWER

BJJ requires slow/static movements to control one’s opponent and apply force during submissions; however, several instances occur where these movements need to be executed in a rapid fashion. A match can end in a matter of seconds or continue for 10 or more minutes (black belts); however, research demonstrates that during the average competitive BJJ bout each 117-s block of work contains four 3 – 5 s expressions of high-intensity effort followed by 25 s of lower-intensity work bringing the “high:low” work to rest ratio (HI:LO) to around 1:5 for every 117 s (1,3,7). This indicates that the adenosine triphosphate phosphocreatine system (ATP-PC) is in fact an important part of the BJJ athlete’s performance make up as it is the primary fuel source for these high force expressions (7).

The high force expressions include things such as takedowns, throws, positional/submission escapes, and certain submission applications. A high level of technical mastery is required to apply high force with a technique at a particular time to induce a successful outcome. It is particularly advantageous for a BJJ athlete to possess adequate rate of force development (RFD) ability relative to their body weight, as they more often than not compete against those of the same size as they are (18).

ENDURANCE

A BJJ athlete requires both anaerobic endurance and aerobic capacity to be well suited for competition (2,9). The ability to withstand the acidosis produced from buffering hydrogen ions during a bout is key for the athlete's ability to maintain grip controls, frame against their opponent, apply submission techniques, escape, and nearly all other continuous activities involved in the sport itself (4). Traditional methods of preparation for grappling sports such as wrestling and judo, however, have led to confusion in this sport of BJJ by direct comparison. Judo, for example, typically only contains 30 – 37 s of work followed by 10 – 15 s of rest or a 3:1 work to rest (W:R) ratio, whereas BJJ contains around 117 s of work with a 20 s pause or 6:1 – 10:1 W:R ratio (2,16). It is inaccurate to equate the conditioning needs of a BJJ athlete to that of other grappling sports, when in fact there are considerable differences (2).

Aerobic capacity contributes to recovery both within and between matches for the BJJ athlete. As matches get longer and closer to the 10-min mark seen at the black belt level, aerobic capacity becomes even more pertinent (7,8,9).

INJURIES AND MOBILITY

One of the known dangers with competing and training in a grappling sport is the inherent risk of injury. BJJ athletes attempt to manipulate one another's joints to the point of damage prior to forced submission. Combined with chaotic scrambles for dominant positions or unpredictable countermovements from the opponent, this can lead to acute and chronic injury over time. Scoggin et al. examined the prevalence of injury during BJJ competition and found an injury rate of 9.2 per 1,000 exposures, 78% of which were orthopedic (14). The elbow joint was most injured due to the "arm bar" joint lock submission, occurring twice as often as knee injuries, and three times as often as ankle/foot, hand, and shoulder injuries, respectively.

Considering whether these types of injuries are preventable or not is an interesting concept; however, competition is chaotic and unpredictable. Interestingly, a vast majority of injuries appear to occur during training, which is far more controllable, suggesting that strength and conditioning coaches and athletes could more closely monitor training scenarios so that the risk for injury is reduced (13). In addition, BJJ athletes can certainly make themselves more robust and resistant to injury by obtaining adequate mobility through the shoulders, hips, lumbar spine, and posterior chain so that they are more easily able to maintain position, recover guard, execute sweeps, and escape unfavorable positions (6). A major opportunity for further research would be to analyze common BJJ injury data and compare the training regimen, nutrition, medical history, recovery tactics, and lifestyle of the given athletes to better understand potential mechanisms of injury.

TRAINING

Devising a training plan that meets the demands of a BJJ athlete is a delicate blend of volume, intensity, frequency, and exercise selection. Performance training that detracts from or negatively impacts BJJ specific training should be avoided. This becomes difficult from a recovery standpoint when a BJJ athlete trains 5 – 6 times a week for 1.5 – 2 hr at a time and perhaps competes dozens of times per year. Outside of enhancing performance, several key considerations to a BJJ training program include the following:

- Most BJJ athletes compete in a specific weight class, therefore excessive muscular hypertrophy should be avoided in most cases, unless the athlete wishes to compete at a higher weight class.
- High-volume, high-intensity BJJ skill sessions can put major stress on the joints and compression/torque on the neck/mid-low back. Therefore, exercises must be selected carefully as not to further stress these areas.
- Scheduling of workouts throughout the week must be chosen carefully to allow for enough recovery between sessions.
- Less can often be more. The overarching goal of strength and conditioning for BJJ is to provide the minimum effective dose for the desired adaptations and ultimately allow for more time to train BJJ, recover, or possibly cut weight if necessary.

PRACTICAL APPLICATION

There is no "one-size-fits-all" programming style for the BJJ athlete due to factors such as skill level (elite versus non-elite), age, training availability, experience, injury history, and more. While no two BJJ athletes' schedules are alike, most serious competitors have their competition schedule laid out far in advance to allow for proper training camps and potential weight cutting. The example provided in this article demonstrates an eight-week periodized training cycle which begins with strength endurance and ends with a focus on maximal strength and power. This would be ideal if a BJJ athlete has a break in their competition schedule, or very few competitions of importance during the training period. The traditional annual plan where an athlete goes through an extended offseason, preseason, and in season training period does not apply to the BJJ athlete due to the fact that competitions can occur year-round and there are almost never extended periods of time where one stops training BJJ. Below is the first block of training focusing on strength endurance.

This block is intended to build the athlete's ability to withstand stress and workload accumulation for higher-intensity training to come in later weeks through several methods including cluster sets, which are a popular resistance training strategy using short periods of rest between single repetitions or groups of repetitions within a set (10). Cluster sets are used for key primary exercises, such as the Zercher squat and trap bar deadlift, to allow for both improved technical execution and the potential for greater load to be used.

DEVELOPING STRENGTH, POWER, AND ENDURANCE IN THE BRAZILIAN JIU JITSU ATHLETE

TABLE 1. EXAMPLE WEEK OF PROGRAMMING FOCUSED ON IMPROVING STRENGTH ENDURANCE

WEEK 1 STRENGTH ENDURANCE		
Monday	A1	Deadbugs 3 x 8 each at 60%
	A2	KB swing 3 x 10
	A3	Plyometric push-up 3 x 5
	B1	Zercher squat 3 x 10 (5:2) at 60%
	B2	Single-arm DB farmer's carry 3 x 30 m/each
	B3	Half-kneeling landmine press 3 x 8 each at 60%
	C1	Split stance RDL 3 x 8 each at 60%
	C2	Bear crawls 3 x 20 m
	C3	Gi chin-ups 3 x 8
Tuesday	A1	Run 45 s at 100% MAS 3 x 4
	A2	Run 45 s at 75% MAS 3 x 4
	Each set will be 6 min long, rest 3 – 5 min between sets	
Wednesday	A1	Snapdowns 3 x 5
	A2	Single-arm KB snatch 3 x 5
	A3	Band pull aparts 3 x 10
	B1	Trap bar deadlift 3 x 10 (5:2) at 60%
	B2	Half-kneeling cable lift 3 x 10 each
	B3	Bird dog row 3 x 8 each
	C1	Single-arm KB press 3 x 8 each
	C2	Slider hamstring curls 3 x 10
	C3	Paloff press 3 x 8 each
Thursday	OFF	
Friday	A1	Face pulls 3 x 10
	A2	Bent-over MB slam 3 x 6
	A3	Turkish get-ups 3 x 2 each
	B1	Incline bench press 3 x 10 (5:2) at 60%
	B2	Barbell hip thrust 3 x 8 at 60%
	B3	Lateral bear crawls 3 x 20 m
	C1	Gi landmine rows 3 x 10
	C2	Pause push-ups 3 x 8 (3 s/each)
	C3	Reverse hyperextensions 3 x 8
Saturday	A1	Cycle 45 s at 100% MAS 3 x 4
	A2	Cycle 45 s at 75% MAS 3 x 4
	Each set will be 6 min long, rest 3 – 5 min between sets	
Sunday	OFF	

*(5:2) = Indicates cluster set; complete 5 repetitions, rest 10 s, and repeat until all 15 are done

*MAS = Maximum aerobic speed

*KB = Kettlebell

*DB = Dumbbell

*MB = Medicine ball

TABLE 2. EXAMPLE WEEK OF PROGRAMMING FOCUSED ON IMPROVING STRENGTH AND POWER

WEEK 1 STRENGTH ENDURANCE			
Monday	A1	Plank shoulder taps	3 x 8 each
	A2	Single-arm KB swing	3 x 10
	B1	Barbell back squat	4 x 5 at 80%
	B2	Half-kneeling ankle dorsiflexion	4 x 20 s/each
	B3	Half-kneeling landmine press	4 x 5 each at 75%
	C1	Inverted row	3 x 10
	C2	Barbell RDL	3 x 5 each at 80%
	C3	Ab rollouts	3 x 8
Tuesday	A1	Run 25 s at 80% MAS	5 x 6
	A2	Run 5 s at maximal effort	5 x 6
	Each set will be 6 min long, rest 3 – 5 min between sets		
Wednesday	A1	Split stance snapdowns	3 x 3 each
	A2	Box jumps	3 x 5
	B1	Hang power cleans	4 x 3 at 70%
	B2	Chest supported row	4 x 6
	B3	Stability ball plank circles	4 x 10
	C1	Rack pulls	4 x 5 at 80%
	C2	Single-leg squat	3 x 6 each
	C3	Bench side plank	3 x 20 s/each
Thursday	OFF		
Friday	A1	MB rotational toss	3 x 5 each
	A2	Depth plyometric push-up	3 x 4
	B1	Clean pulls	4 x 3 at 70%
	B2	DB bench press	4 x 6
	B3	Ab hollow hold	3 x 20 s
	C1	Weighted chin-ups	4 x 5
	C2	KB goblet squat	3 x 6
	C3	Reverse Nordic curls	3 x 8
Saturday	A1	Cycle 25 s at 80% MAS	5 x 6
	A2	Cycle 5 s at maximal effort	5 x 6
	Each set will be 3 min long, rest 3 – 5 min between sets		
Sunday	OFF		

*MAS = Maximum aerobic speed

*KB = Kettlebell

*DB = Dumbbell

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Various exercises targeting the low back and posterior chain (e.g., reverse hyperextensions, split stance Romanian deadlifts [RDLs]) and upper body (e.g., single-arm kettlebell press, half-kneeling landmine press, gi chin-ups) are used to address the specific needs of BJJ athletes as discussed earlier. Each session is considered a “full body session” so that volume is dispersed throughout the week to help reduce the likelihood of soreness and fatigue accumulation compared to an upper or lower body split routine.

For example, on Tuesdays and Saturdays, the conditioning is general and aimed at improving the athlete’s aerobic power through maximum aerobic speed (MAS) training (11,18). In this example, running is used as the primary method on Tuesdays and rowing on Saturdays. While this W:R ratio is simply 1:1, it can be later adapted to meet the demands of BJJ more closely as discussed previously in the endurance section.

The next block highlighted in Table 2 is from week 6 of the program, where the primary emphasis has shifted towards developing strength and power. In this block, the athlete’s volume has dropped significantly; however, the intensity has also increased significantly. The barbell back squat and rack pull are used to initiate high force production from the athlete, as well as being paired with contrasting high velocity movements, such as box jumps, and power cleans. Key areas of the body (e.g., low back, posterior chain, back, shoulders) are all still addressed as well; however, volume for these movements is at a maintenance level as to not overload the athlete and create undue fatigue.

The conditioning in this portion of the program is targeted at short bouts of high-intensity exertions paired with intermediate bouts of moderate-intensity exertion as seen by the MAS workout on Tuesday. Saturday’s MAS workout is optional and can be replaced with a low-intensity steady state session if BJJ sport training is becoming more pertinent and higher in intensity.

CONCLUSION

BJJ is a rapidly evolving sport that requires an array of physical and technical competencies. A delicate balance exists between performance training for BJJ and actual BJJ training, in that the former should enhance the latter. Keeping the BJJ athlete healthy and ready to compete are two of the most important aspects of a BJJ training program, followed by specific endurance, strength, and power development. Research analyzing the specific physiological profile of elite BJJ athletes and mechanisms of injury is continuously evolving with several informative pieces of literature being published in the past five years alone (4,12,16,17,18).

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