Where is sport science? Self-reported training methods of mixed martial arts athletes and coaches during fight camp.

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Mixed martial art | Opinion paper

Headline

In recent years mixed martial arts (MMA) has experienced unprecedented growth reflected by its rise in professionalism, making it a highly popular global sport (1, 2). Alongside there is increased interest and demand for knowledge on evidence – based practices in MMA and the best examples are the new UFC Performance Institutes built in Las Vegas (2017) and Shanghai (2019) ($14 and $13 million investments, respectively) focusing on research and on developing new standards for optimum athletic performance in combat sport athletes. Despite the popularity of MMA it is unknown what training methods are utilized by MMA coaches and athletes and to what extent they use scientific data (evidence-based approach) to enhance performance on a daily basis (3). This is a limiting factor for professionals engaged in the physical preparation of MMA athletes and for sport scientists whose goal should be publishing applied and relevant research (4,5). Based on anecdotal evidence and author experience in combat sports environment it is known that head coach is often perceived as “all knowing” about every facet of their discipline when, in fact, they typically are not formally educated or well-trained in current methods of enhancing sport performance. Particularly in those martial arts which are not severed from their historical roots such as judo, taekwondo, karate where grade designates the hierarchy, and in turn, "master" has always the right to the last word. It should be considered that while the head coach has some training and experience in the concepts and subtleties of the sport (particularly as it relates to technique and tactics) holistically they are typically untrained or poorly trained in evidence-based strength and conditioning methods (6). Therefore the purpose of this study is to reveal that evidence-based strength and conditioning (S&C) and sport – science is poorly understood and implemented by MMA athletes1 and coaches.

Aim

The aim of this survey was to gather information regarding training methods and sport science employed by MMA athletes and coaches. We hypothesized that sport science is poorly understood and implemented in MMA environment.

Methods

49 MMA athletes and coaches completed surveys that questioned about their strength and conditioning (S&C) and monitoring practices. The questionnaire consist of 40 multiple - choice and open – ended questions. The survey consisted of 2 sections, and took about 15 minutes to complete. The first section surveyed the athletes regarding overall MMA training and strength training volume during fight - camp. The second section using open – ended question surveyed what type of resistance training and monitoring tools they used on a daily basis.

Results

87% athletes and 13% coaches responded to questionnaire. The frequency (days per week) of training sessions ranged from 5 to 12 per week. More than 60% of the responders dedicate 2 – 4 weight training sessions per week. 70% of athletes said that MMA training typically lasts 60 – 90 minutes and 50% responders trains twice per day. 12.5% of athletes dedicate less than 2 weight sessions per week while 13% do not perform any weight training. 24% of subjects do not do any exercise that focuses solely on the neck musculature. 39% do not utilize weightlifting exercises such as clean, snatches or their derivatives in their training program. 86% use resistance circuit – based training twice per week or more and 51% subjects argue that this is better method of preparations than traditional resistance training. 66% of fighters utilize shadow boxing with dumbbells exercise on a daily basis. 46% responders reported that resistance – based training make them slower athlete. During resistance training 48% of athletes often trains to failure. Only 24% of athletes carries out any performance assessment regularly. 60% subjects do not use heart-rate monitors while 89% do not use wellness questionnaires. More than 50% do not report rate of perceived exertion to quantify training load.

Discussion

Modern training and optimal preparation of future coaches and athletes require combining knowledge that comes from practical experience and scientific achievements. In accordance to our assumption, MMA coaches and athletes do not utilize scientific data to enhance training process. The training frequency and volume represented by MMA fighters is similar to those found by Amtmann et al.(7) . Because of the fact that MMA is a mixture of different sport disciplines there is a concern over excessive volumes of work which may lead to overtraining and injury risk (7,8,9). Therefore adequate periodization strategies and time efficient training programs should be employed to manage the training loads with caution (10). In the other hand, some athletes are convinced to systematic resistance training which may improve athletic performance. Alarming is fact than 24% of athletes do not perform any neck strengthening exercises. Streider et al. (11) identifies neck strength, size and posture as potential factors that reduce risk by lessening the magnitude of force upon impact. Thus, increasing neck strength and possibly size could substantially reduce risk or severity of brain injury or outcomes. Secondly, more than one-third of athletes do not use olympic weightlifting (OL) exercise in their strength and conditioning program. It has been reported that maximal strength and power often distinguish superior competitors in combat sports (12) and lower - body power is significantly enhanced in high - level MMA athletes compared to low - level competitors (13). Thus exercises such as olympic lifts and their variants should
be taken into consideration when it comes to program design. Moreover, 8% of responders said that these exercises are not beneficial for MMA performance and 9% claims that OL involves too much risk of injury. Sport scientists and strength and conditioning coaches should dispel these myths and misconceptions. For example, Tricoli et al. (14) demonstrated that the inclusion of weightlifting movements resulted in greater improvements in markers of speed, agility, and power than traditional jumping exercises. In regards to injury risk, Aasa et al. (15) in systematic review reported that injury incidence in weightlifting is similar to other non-contact sports and low compared to contact sports. Third, the most common training method among MMA athletes is resistance-based circuit which in combination with MMA specific training volume may lead to greater overuse and overtraining. It must be acknowledged that subjects during this type of training often reaches state of muscle failure (or near failure). Muscle failure delays the recovery time (16) and is not superior to non-failure training regarding strength and hypertrophy adaptation (17). Carrol et al. (18) and Painter et al. (19) studies shown that incorporation of explosive and negative tools that accurately provide values within rather than repetition-maximum zones for load prescription may provide superior results in magnitude of strength/power gains. It should be also noted that principle of dynamic correspondence is not applied properly. 66% of athletes use dumbbell shadow boxing in their training program and the purpose of this exercise employment is: “hands speed development” “enhancing explosive power of hands”, “increasing punching force “. Just because movement resembles a boxing act it does not necessarily mean it transfers positively to punching performance.

The S&C coach may be required to acknowledge more nuanced factors of sport specificity beyond the potentially superficial metabolic and mechanical aspects (20). Verkoshansky’s dynamic correspondence attempts to logically piece aspects of training specificity into more quantifiable, directed components. These include the 1) amplitude and direction of movements, 2) accentuated regions of force production, 3) dynamics of effort, 4) rate and time of maximum force production, and 5) regime of muscular work (21). We believe that these components may not be emphasized appropriately, especially with higher loads by altering kinematic punching pattern. Finally we found that most athletes do not use wellness questionnaires and RPE’s. Monitoring athletes’ training load is essential for determining whether they are adapting to their training program, understanding individual responses to training, assessing fatigue and the associated need for recovery, and minimizing the risk of nonfunctional overreaching, injury, and illness (21). James (10) proposes that MMA fighters should record fatigue level, sleep quality, resting morning heart rate, and rate of perceived exertion using questionnaires such as RESTQ-Sport, profile of mood states, and total quality recovery. Simple wellness questionnaires have demonstrated the ability to detect changes in various perceptions of muscle soreness, fatigue and overall well-being scores in high-performance team sports - athletes (23,24). Moreover, Slimani et al. (25) review provide evidence that RPE value and session RPE are of how and effective tool that accurately put a similar quantification of combat and internal training loads, as assessed by lactate and HR-based methods during simulated and official competitions and training in novice and elite combat sport athletes. The development of any field relies on research, training programs and innovations in practice. There is a clear need of education in MMA environment about importance and role of sport science in athletic performance enhancement. It might be suggested that sport – science research is poorly translated and/or disseminated in MMA.

### Practical applications
- High training volume of MMA athletes requires properly designed and periodized strength and conditioning program
- Implementation of olympic lifts (full or derivatives) may be beneficial for improving athletic performance
- Implementation of neck strength training may reduce the risk of injuries related to brain damage
- Implementation of simple monitoring tools such as wellness questionnaires and RPE’s may help in tracking athlete training response
- There is a need of better education and communication between sport scientists and MMA environment

### Limitations
- Survey was conducted only in Poland therefore results should not be extrapolated to other countries
- Out of 49 subjects only 13% were coaches. Athletes may not be educated well as coaches regards sport science this fact could falsify the true results of the survey.

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### References
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