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Abstract. The rapid expansion of Brazilian jiu-jitsu (BJJ), against the backdrop of territorially heterogeneous access to highly qualified coaches, makes the task of developing a scientifically verified methodology for autonomous training particularly significant. Within the present study, a comprehensive, validated system of independent training for a BJJ athlete is formed, aimed at the targeted optimization of specific physiological characteristics and the development of key psychological competencies under conditions of limited external supervision. The methodological basis includes a systematic review of academic literature, a comparison of block periodization protocols, and a content analysis of practices for the use of wearable technologies to objectify training load. The obtained results made it possible to construct an integrated model based on the logic of block periodization (accumulation, transmutation, and realization blocks) with an emphasis on the development of strength endurance and power; in particular, in the transmutation block it is advisable to use intensities on the order of 85–90%. It is demonstrated that psychological predictors of sports performance, including Perseverance (r=0.179) and Self-efficacy, are statistically associated with the athlete's level of experience and require purposeful formation through self-reflection protocols. A self-monitoring system combining field testing (jump tests) and the use of inertial sensors is considered a critically important component for timely load adjustment and reduction of the pronounced risk of injury, estimated at 5.5 injuries per 1000 hours of training. Practical implementation of the proposed methodology provides the athlete with tools sufficient to achieve competitive readiness under conditions of self-training, compensating for the absence of continuous coaching supervision, and the presented materials are of interest to competitive BJJ athletes focused on systematizing the process and maximizing performance.

Keywords: Brazilian jiu-jitsu, Independent training, Periodization, Sports physiology, Athlete self-monitoring, Psychological resilience, Injury prevention.

Contents

Introduction

The relevance of developing a methodology for independent training of athletes in Brazilian jiu-jitsu (BJJ) is determined by a combination of two key circumstances: the accelerating global expansion of the discipline and the need to adapt training strategies to situations of limited access to personal highly qualified coaching support. As a grappling sport characterized by pronounced technical complexity, BJJ in recent years has demonstrated sustained international dissemination, in which competitiveness increasingly depends not only on the level of physical conditioning but also on the formation of psychological resilience [1].

Additional justification of the topic's significance is based on data reflecting the simultaneous territorial and technological expansion of the BJJ industry. Forecast estimates indicate that the global BJJ market, valued in 2025 at 500 million USD, may reach 1.2 billion USD by 2032, demonstrating a compound annual growth rate (CAGR) of approximately 15% in the period 2025–2033 [2]. Such dynamics indirectly indicate growth in the number of practitioners and an increase in demand for alternative and hybrid learning formats, including online instruction and specialized technological applications designed to support autonomous progress. With a high frequency of training activity, when 85.7% of adult practitioners attend classes 3–5 times per week [3], the task of precise regulation of volume and intensity becomes fundamental, especially under conditions of independent load management. In parallel, the role of technological trends is increasing, including the dissemination of AI applications, premium online content, and wearable devices for performance monitoring, which emphasizes the necessity of integrating digital tools into the framework of autonomous self-improvement and increases the significance of developing self-monitoring procedures.

A substantial scientific and practical deficit is manifested in the fact that,

despite a sufficiently detailed description of the physiological demands of BJJ (in particular, the need to develop power, strength endurance, and anaerobic capacity), there is no holistic, scientifically grounded model specifically adapted to independent management of the training process [4]. A significant portion of existing research and solutions in the field of periodization is oriented toward elite athletes operating under conditions of constant direct supervision by a coaching staff and sport physiologists [1]. The insufficiency of approaches that integrate the principles of specific block periodization, technologized objective self-monitoring, and targeted development of psychological characteristics increases the vulnerability of autonomously training athletes to overtraining and exacerbates the problem of injury, the mean level of which is estimated at 5.5 injuries per 1000 training hours.

The aim of the study is to construct a scientifically grounded methodology and an applied system for independent preparation of a BJJ athlete, oriented toward optimizing physiological parameters and forming key psychological competencies during training without a permanent coach.

Scientific novelty is determined by the proposal of an integrated model of autonomous preparation of a BJJ athlete that combines the principles of specific block periodization, technologically supported self-monitoring based on wearable sensors, and the purposeful development of psychological resilience through self-reflection and monitoring.

The research hypothesis is that the systematic application of a scientifically grounded and technologically supported methodology of periodization and self-monitoring enables athletes training without a permanent coach to effectively optimize conditioning readiness and maintain a high level of psychological resilience.

Materials and Methods

The methodological construct of the study is based on the classical provisions of sport and physical education theory, modified with consideration of the applied specifics of combat martial arts; theoretical analysis and generalization of practical experience were used as the supporting methods. The central principle is the maximal objectification of conclusions through reliance on data extracted from highly ranked peer-reviewed publications indexed in Scopus and Web of Science (WoS).

Within the framework of the systematic review, a targeted search and critical analysis of scientific works published in recent years was conducted, with priority inclusion of sources from Scopus and WoS. Search strategies focused on blocks describing the physiological determinants of BJJ, periodization models and protocols, epidemiological characteristics of injury, as well as psychological predictors of sporting success. The application of this approach ensured the selection of a current and methodologically reliable body of information that is fundamentally necessary for constructing an autonomous training methodology, in which errors in load programming are associated with a high cost in the form of a reduced adaptive response and an increased risk of adverse outcomes.

The comparative analysis of training protocols was oriented toward comparing load regimes characteristic of BJJ and of combat sports similar in the structure of competitive activity (in particular, judo), followed by identifying rational work-to-rest ratios as well as intensity levels expressed through indicators such as the percentage of one-repetition maximum in strength and conditioning preparation. The analytical focus shifted to the transferability of the identified regimes into a self-regulated process format, for which the absence of continuous external control is typical, which increases the significance of a clearly formalized logic of block periodization.

The content analysis of technical documentation was aimed at assessing the applicability of modern digital solutions for quantitative recording of load and

the quality of motor execution. In particular, the capabilities of inertial sensors and accelerometry were analyzed for tasks of objective registration of performance indicators in combat sports. This method made it possible to substantiate an instrumentation set capable of partially compensating for the deficit of coaching observation by providing measurable feedback on speed and power parameters, as well as through algorithmic classification of movements, which is significant for improving technical effectiveness under conditions of autonomous preparation.

The source base was formed in accordance with academic criteria for selection and verification. The priority corpus comprised peer-reviewed publications from highly ranked scientific journals, covering studies of the relationships between psychological predictors and training experience, analysis of specific tests of physical readiness, and the epidemiology of injury in BJJ, which provided a theoretical foundation for designing periodization and self-monitoring models, as well as for formulating risk management protocols. An additional corpus is represented by analytical materials of leading consulting organizations, used to incorporate statistical estimates of market dynamics and technological trends through 2033.

CHAPTER 1. COMPREHENSIVE METHODOLOGY FOR AUTONOMOUS TRAINING

The research results are structured into four interconnected blocks that form a comprehensive, step-by-step methodology for independent training of a BJJ athlete: requirements analysis, cycle planning, objective self-monitoring, and risk management.

1.1 Analysis of Specific Requirements and Psychological Predictors of Autonomous Preparation in BJJ

Success in Brazilian jiu-jitsu is formed at the intersection of specific physiological capacities and relatively stable psychological characteristics; the correct identification of these requirements serves as the methodological foundation for designing an autonomous training program.

From the standpoint of physiology, competitive activity in BJJ is characterized by high metabolic variability and imposes increased demands on the ability to repeatedly reproduce high-intensity efforts. A typical bout lasting 5–10 minutes is organized as a sequence of short explosive high-intensity intervals (approximately 2–4 seconds), alternating with more prolonged low-intensity phases or pauses in the range of 27–44 seconds [4]. Such a temporal architecture of load implies pronounced anaerobic alactic power, ensuring the execution of throwing actions and rapid positional transitions, with a simultaneous need for high aerobic capacity, critical for accelerated phosphocreatine resynthesis and for maintaining performance throughout the entire match [5, 7].

Empirical data also indicate that performance in BJJ is statistically associated with indicators of maximal dynamic and isometric strength, as well as with the level of strength endurance. Consequently, an autonomously constructed preparation system should go beyond the development of general strength and

hypertrophy, shifting the emphasis toward functionally significant strength endurance of muscle groups that determine the effectiveness of grips (including grip strength), positional stabilization, and the execution of choking actions.

In the absence of constant coaching control, the role of psychological mechanisms increases to the level of a system-forming factor, because it is precisely these mechanisms that compensate for the functions of external monitoring, maintenance of motivation, and operational decision-making regarding plan adjustment. Research data demonstrate positive relationships between accumulated training experience (mediated, among other things, by belt level) and a number of psychological characteristics significant for sustainable progress [8, 10].

One of the most informative predictors of autonomous performance is Grit, interpreted as a combination of sustained interest and perseverance in achieving long-term goals. For BJJ, it demonstrates one of the most pronounced correlations with experience ($r=0.179$, $p=0.000$) [10]. In the practical context of independent preparation, this characteristic functionally supports adherence to long, often monotonous cycles of periodization and reduces the likelihood of abandoning the program after setbacks or competitive defeats. Additional significance is emphasized by the presence of positive relationships both for the component Consistency of Interests ($r=0.123$) and for the component Perseverance of Effort ($r=0.193$), which reflects the multicomponent structure of this construct [10].

Self-efficacy and Self-control also retain substantial significance, demonstrating correlations of $r=0.123$ and $r=0.090$, respectively [10]. Self-efficacy serves as a cognitive-motivational basis for confidence in the ability to master technically complex elements and to make decisions about load dosing in the absence of immediate external expert evaluation. Self-control, in turn, ensures regulation of the volume and intensity of training work under conditions of fatigue and uncertainty, reducing the likelihood of erroneous decisions that can lead to the accumulation of incomplete recovery and the development of

overtraining.

Considering that the indicated psychological characteristics, according to analytical data, are not fully fixed and demonstrate concomitant development as experience accumulates, it is advisable to include targeted psychoregulatory practices in the autonomous program. The most applicable within this framework are protocols of structured self-reflection, the maintenance of training diaries, and systematic revision of goals, which creates conditions for strengthening Grit and increasing psychological resilience in the long term.

Below, Table 1 demonstrates the influence of training experience (belt) on key psychological variables of BJJ athletes.

Table 1. Influence of training experience (belt) on key psychological variables of BJJ athletes (compiled by the author based on [10]).

Psychological Variable	Correlation with Experience (r)	Significance Level (p)	Interpretation for Self-Preparation
Perseverance	0.179	0.000	Fundamental for long-term autonomous learning and adherence to periodization
Resilience	0.144	0.002	Critical for recovery and maintaining focus after defeats/failures
Self-efficacy	0.123	0.006	Confidence in the ability to independently master new technical elements
Mental toughness	0.113	0.010	A positive predictor of resistance to the stress of competitions and the training routine
Self-control	0.090	0.033	Necessary for the objective management of training volume and intensity

Thus, it can be stated that autonomous performance in Brazilian jiu-jitsu is determined not by general physical fitness, but by a precise match between the preparation profile and the structure of the bout, as well as by the athlete's capacity to independently maintain the quality and continuity of the process: the intermittent load of the match (series of explosive efforts of 2–4 s against the background of longer phases of 27–44 s within 5–10 minutes) requires the

simultaneous development of anaerobic alactic power (for throws, abrupt positional transitions, and attacking bursts) and high aerobic capacity (as a metabolic recovery module that accelerates phosphocreatine resynthesis and enables repeated high-intensity episodes without degradation of technique). Consequently, the design of an independent program should rely on prioritizing strength qualities that are directly convertible into grappling effectiveness: maximal dynamic and isometric strength and, especially, functional strength endurance of muscle groups that ensure holds, positional stabilization, force production by the trunk and limbs, and grip productivity (including grip strength), rather than isolated increases in mass or abstract strength training. In the absence of constant coaching control, the key limiter of progress becomes not so much physiology as psychological self-regulation: grit serves as the leading predictor of adherence to long cycles and resilience to regressions after defeats, whereas self-efficacy and self-control ensure correct decisions regarding the dosing and adjustment of load, reducing the risk of accumulating incomplete recovery and overtraining; at the same time, the association of these characteristics with experience indicates the possibility of their targeted strengthening. Practical implication: an effective autonomous preparation system in BJJ should be constructed as an integration of the bout's energy specificity, applied strength endurance, and embedded self-monitoring mechanisms (diary, regular self-reflection, goal revision), because it is precisely this triad that simultaneously ensures physical readiness to repeat efforts and psychological readiness to maintain course throughout long-term periodization.

1.2 Principles for Constructing and Planning an Independent Periodization Cycle in BJJ

The deficit of constant coaching support increases the importance of strict adherence to a pre-structured plan, since process stability is largely determined

by discipline and the predictability of managerial decisions. Under these conditions, the most functional organizational framework for the independent preparation of a BJJ athlete is block periodization: it makes it possible to sequentially concentrate on developing a limited set of physical qualities within a given time segment, reduces the cognitive costs of planning, and provides the possibility of objective recording of progress [1]. An additional advantage is the ability of this approach to ensure the effective integration of physiologically compatible training modalities [9, 11].

In the classical variant, a macrocycle, as a rule designed for 16–24 weeks with a peak for the target competition, is structured into three basic blocks. The accumulation phase is defined by a high overall volume at moderate intensity; its purpose is to form a supporting base of general physical preparedness, to establish prerequisites for strength endurance, and to stimulate muscle hypertrophy. In this period, the use of additional high-volume sets with moderate loads is permissible, including a drop set of 10 repetitions at 75% 1RM, which is considered a practical tool for maintaining and increasing muscle mass that is critically important for grappling specificity [6]. As the strength core, basic exercises are used, including back squats, deadlifts, and the bench press, as well as variants more specific to gripping tasks, such as weighted pull-ups and the bent-over barbell row [6]. In parallel, specific BJJ preparation in the accumulation block, as a rule, has a more sparing intensity and is oriented toward expanding the technical repertoire, mastering new positional solutions, and increasing the overall volume of grappling.

The transformation phase is built on a controlled reduction of overall volume with a pronounced increase in intensity. The vector of preparation shifts from basic work capacity to specific power, explosive effort, and speed manifestations, which reflects the requirements of competitive episodes where decisive actions are often executed within a short time window. Plyometric and ballistic means are integrated into this block, as well as specialized training

complexes with work-to-rest modes that model the metabolic structure of the bout. For emphasized development of maximal power, the expediency of using loads in the range of 85–90% 1RM is indicated.

The realization, or competition-tapering, phase is characterized by a substantial reduction in training volume while maintaining high specific intensity corresponding to competitive requirements. Its task is reduced to optimizing neuromuscular efficiency and creating conditions for full supercompensation before the start. Within this block, the technical-tactical component of BJJ becomes dominant: training content is concentrated on as specific as specific scenarios, practicing tactics, controlling tempo, and managing risks.

The practical value of the block model is manifested in the need for strict adherence to scientifically grounded regimes of load and recovery. Thus, when developing power in the transformation phase, the recommended intensity of 85–90% 1RM requires sufficient rest intervals; a ratio of approximately 1:5 is considered a condition that supports recovery of the central nervous system and makes it possible to maintain the high quality of each repetition [6]. Such an organization of training work directly corresponds to the task of effective integration of physiologically compatible training modalities, ensuring the manageability of the adaptive response in an autonomous preparation format [1].

Below, Table 2 structures recommendations on strength load depending on the phase of the mesocycle for a BJJ athlete.

Table 2. Recommendations on strength load depending on the phase of the mesocycle for a BJJ athlete (compiled by the author based on [6]).

Training Goal	Mesocycle Phase	Intensity (% 1RM)	Volume (Sets/Repetitions)	Work-to-Rest Ratio
Power development	Transmutation	85–90%	3–4 sets, 4–5 repetitions	1:5 (for maximal recovery)
Hypertrophy maintenance	Accumulation/Transmutation	75%	1 additional set, 10 repetitions	Varies

Special endurance	Transmutation/Competitive	Moderate (70% 1RM)	3–4 sets, 5 repetitions	1:3 (emphasis on metabolic stress)

Continuous periodization as a dynamic system implies regular monitoring of the current state and timely modification of preparation parameters. Under conditions of autonomous organization of the training process, this work should be maximally regulated: self-monitoring procedures should be formalized as formalized criteria and recorded indicators, so that the feedback obtained functions not as episodic observation but as a stable element of subsequent planning and rapid adjustment of loads. Next, in Figure 1, the structure of the macrocycle of autonomous BJJ preparation will be described with a focus on self-correction.

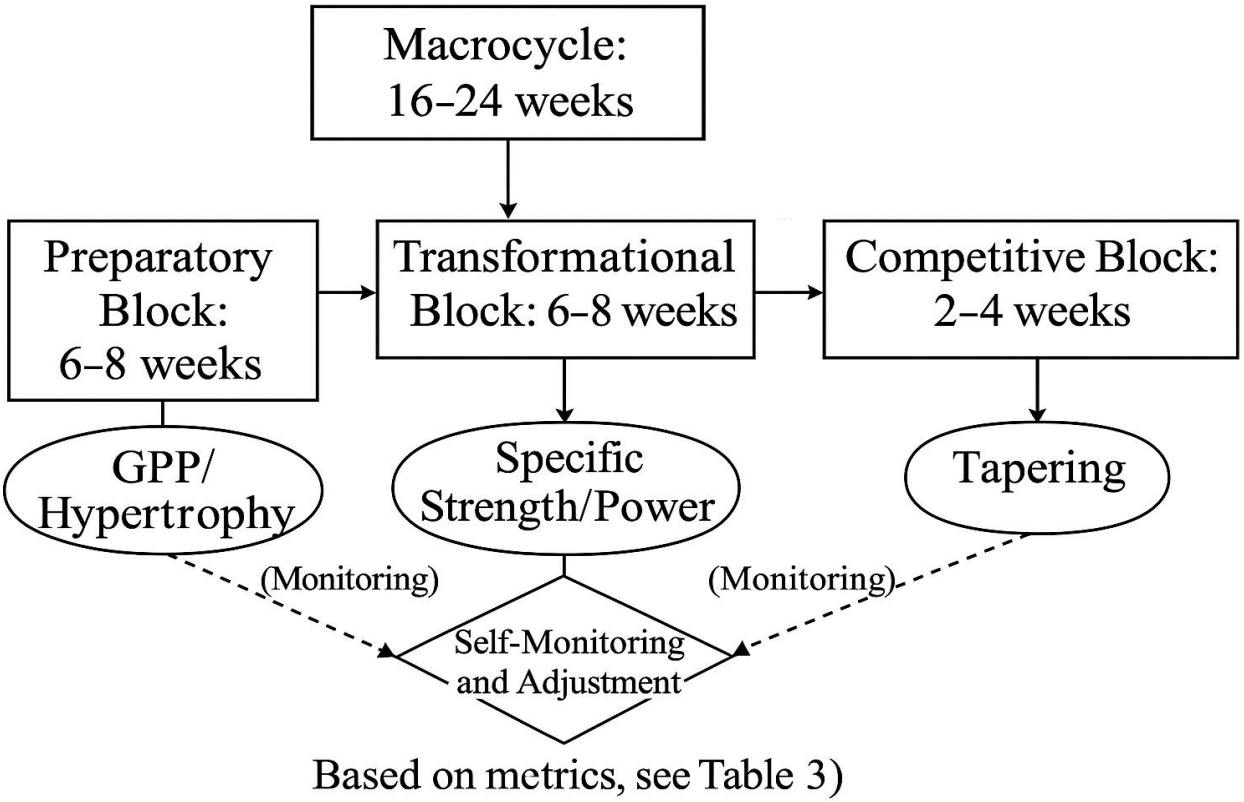

Fig. 1. Structure of the macrocycle of autonomous BJJ preparation (focus on self-correction) (compiled by the author based on [1,6, 19, 20]).

The principles for constructing an independent BJJ periodization cycle under conditions of a deficit of coaching support are reduced to the fact that the plan must be structured in advance, limited in the number of qualities developed simultaneously, and verifiable through formalized metrics; otherwise, autonomous preparation rapidly disintegrates into a chaotic set of sessions. The most functional framework here is block periodization, because it reduces the cognitive costs of planning, facilitates the recording of progress, and makes it possible to purposefully integrate physiologically compatible modalities within each block. A 16–24 week macrocycle is advisable to construct as a sequence of three phases: an accumulation phase (6–8 weeks) with high volume and moderate intensity to form a basic general physical preparedness base, prerequisites for strength endurance, and maintenance/increase of muscle mass (including moderate loads and additional volume sets such as 10 repetitions at ~75% 1RM against the background of basic multi-joint movements and pulling exercises relevant to gripping work), a transformation phase (6–8 weeks) with a controlled reduction in volume and an increase in intensity, where the emphasis shifts to specific strength, power, and explosive manifestations, including plyometrics/ballistics and complexes modeling the metabolic structure of the bout; when developing power, the 85–90% 1RM range is justified with a small number of repetitions and mandatory preservation of execution quality, and a realization/tapering phase (2–4 weeks), in which volume is substantially reduced while maintaining high specific intensity to optimize neuromuscular efficiency and ensure supercompensation before the start, and the technical-tactical component becomes dominant. It is critically important that within blocks, load parameters must be subordinated to recovery rules: for example, power work at 85–90% 1RM requires long pauses (guideline Work:Rest ≈ 1:5) to restore the CNS and maintain consistently high power output, whereas for tasks of special endurance a denser regime is permissible (for example, about 1:3) with an emphasis on metabolic stress. Finally, since periodization is a dynamic system,

the autonomous model must include a regulated loop of self-monitoring and correction: pre-specified indicators (load, well-being/recovery, execution quality, key strength/endurance markers) must be recorded regularly and trigger adjustment of volume/intensity according to rules, so that feedback is not a subjective feeling but a stable managerial mechanism that closes the planning cycle for the next iteration of the macrocycle.

1.3 System of Self-Monitoring and Objective Evaluation of Training Process Effectiveness

The self-control system serves as a basic tool that allows for partial compensation for absence of prompt expert interpretation by a coach. In the autonomous construction of the training process, it becomes fundamentally important to translate subjective sensations into objective, quantitatively recorded metrics, which ensures early detection of unfavorable trends, reduces the risk of overtraining, and contributes to more accurate optimization of the supercompensation phase. For regular monitoring of the degree of recovery and the level of work capacity, field tests are used that can be performed without complex laboratory equipment [12]. Jump tests are used as an informative indicator of neuromuscular power, including the countermovement jump and the squat jump, which are regarded as reliable markers of central nervous system fatigue and overall power [12, 21]. Recording jump height using simple applications or wearable devices enables a BJJ athlete to conduct daily or weekly tracking of recovery status; even a moderate decrease in the indicator should be interpreted as an objective signal of the need to reduce training volume. To assess specific endurance and anaerobic–aerobic capacity, it is advisable to adapt protocols borrowed from related combat sports, including the Special Judo Fitness Test (SJFT) and its modifications, as well as schemes close in logic to the

Wingate test, implemented on a rowing ergometer or cycle ergometer [12]. Such procedures allow one to quantitatively characterize the ability for repeated high-intensity efforts and to calculate a fatigue index, for example through the difference between peak and mean power [13].

Within Table 3, metrics of objective evaluation of physical readiness for self-monitoring are described.

Table 3. Metrics of objective evaluation of physical readiness for self-monitoring (compiled by the author based on [12, 13]).

Physical Capacity	Assessment Method (Field/Technological)	Primary Measured Indicator	Goal in Autonomous Monitoring
Power	Vertical and squat jumps	Height and force generation	Monitoring recovery and peak condition
Anaerobic capacity	30-second continuous jump	Number of jumps, fatigue index	Assessment of the ability to perform repeated high-intensity efforts
Specific endurance	Modified SJFT (Index)	Index (heart rate and number of repetitions)	Measurement of the ability to sustain continuous effort
Technical quality	Inertial sensors/Video analysis	Speed, acceleration, classification	Objective assessment of the effectiveness of techniques and movement patterns

Technological support and the coupling of feedback loops have, in recent years, become of fundamental importance for increasing the objectivity of training analysis. Wearable inertial sensors (inertial sensors) constitute an instrumental basis that enables quantitative registration of parameters that previously were largely captured via expert assessment: speed, acceleration, level of effort, as well as automated classification of strikes and technical actions [13, 16]. Within the preparation of a BJJ athlete, this creates conditions for obtaining reproducible evidence of progress, including an increase in power or improved rapidity of transitions between positions, which supports self-efficacy and ensures a more substantiated selection of corrective decisions during planning.

Technically, such sensors are applicable for recording characteristics associated with the quality of striking actions, for automated identification of techniques, assessment of endurance and power, as well as for instrumental analysis of grappling components [15, 17].

The most effective self-monitoring model is based on integrating objective and subjective sources of information into a unified interpretive system. Verification of the current functional status is achieved by comparing the results of field tests (e.g., changes in jump height) and physiological metrics (e.g., heart rate variability, HRV) with subjective indicators, including the rating of perceived exertion scale (RPE) and standardized well-being questionnaires. Substantial discrepancies between pronounced subjective signs of fatigue and simultaneously objectively reduced performance should be regarded as a clinically meaningful marker of unfavorable recovery; such a constellation should serve as an immediate trigger for adjusting the plan and reducing the total training load volume.

For clarity, Figure 2 will present an integrative model of self-monitoring for a BJJ athlete.

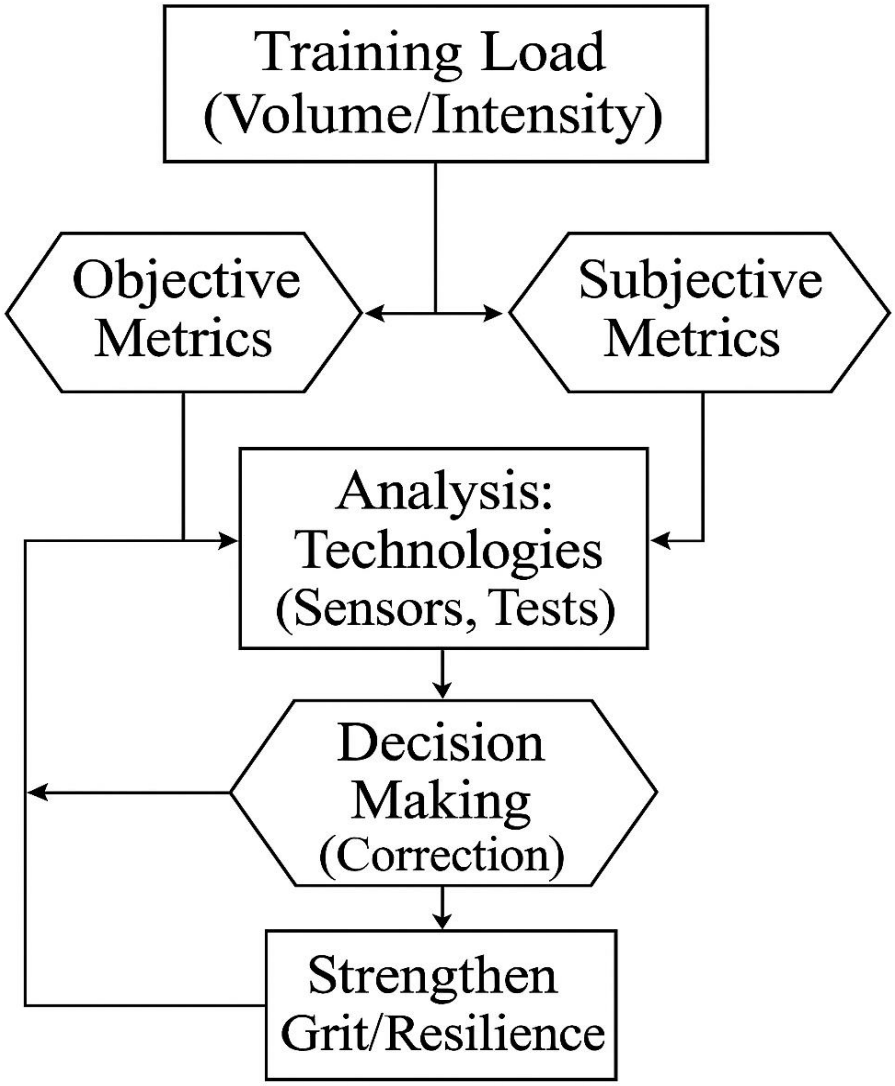

Fig. 2. Integrative self-monitoring model of a BJJ athlete (compiled by the author based on [12, 13, 21, 22]).

The model presented in Figure 2 reflects an iterative, cyclically organized process in which self-monitoring results form a direct feedback loop that simultaneously affects the parameters of physical load and the athlete's psychological foundation, thereby supporting and strengthening the development of self-monitoring.

Thus, an integrative system of self-monitoring for a BJJ athlete is substantiated as a key mechanism of autonomous management of the training process, converting subjective sensations into objectively recorded metrics and thereby ensuring early detection of unfavorable recovery, reducing the risk of

overtraining, and enabling more precise optimization of supercompensation: as accessible field markers, jump tests (CMJ/SJ) and a 30-second continuous jump are proposed for monitoring neuromuscular power and anaerobic capacity, as well as a modified SJFT and protocols logically close to Wingate for quantitative assessment of the ability to perform repeated high-intensity efforts and calculation of the fatigue index; additionally, the role of technological support (inertial sensors/video analysis) is demonstrated for objectification of technical parameters (speed, acceleration, classification of actions) and for increasing the reproducibility of progress assessment; the final model is based on comparing objective tests and physiological indicators (including HRV) with subjective indicators (RPE, well-being questionnaires), where the discrepancy high subjective fatigue + objective decline in performance is interpreted as a clinically meaningful signal requiring immediate load adjustment within a cyclic feedback loop.

1.4 Injury prevention and risk minimization under conditions of training without a coach

Brazilian jiu-jitsu is characterized by a pronounced injury risk: according to available data, the incidence of injuries reaches 5.5 per 1000 hours of training practice and 55.9 per 1000 competitive matches. In the absence of continuous coaching supervision ensuring monitoring of the quality of technique execution, the level of fatigue, and the behavior of sparring partners, independent adherence to strict risk-management protocols is required. Epidemiological data indicate that approximately 89% of all injuries occur within the training process, while the predominant proportion, about 79% is associated with free sparring (free sparring); consequently, the key threat is localized not so much in competition as in potentially uncontrolled training interactions. Most injuries are described as acute and arising as a result of direct contact with an opponent. The most

vulnerable anatomical regions are the knee joint (about 25% of all injuries) and the shoulder joint (approximately 13%), and lesions in these areas often have an acute nature and are associated with a contact mechanism [9]. This injury structure substantiates the need to prioritize strengthening measures aimed at specific stabilization and prevention of injuries to the indicated joints.

Below, Figure 3 demonstrates the distribution of injury frequency by body regions in BJJ.

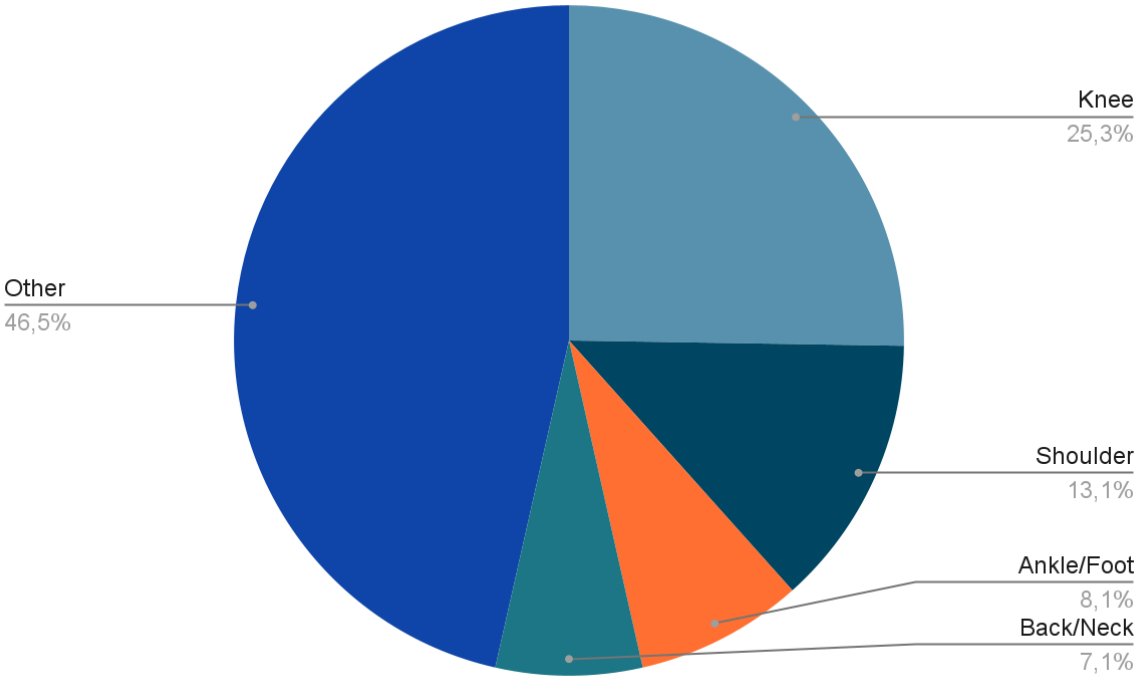

Fig. 3. Distribution of injury frequency by body regions in BJJ (Top 4) (compiled by the author based on [14]).

Effective independent risk management in BJJ implies regulation of the most injury-prone components of preparation and reliance on measurable recovery criteria. Since free sparring is considered the leading source of injuries, within an autonomous model it is advisable to introduce strict limitations on its intensity and dosing. In accumulative and transforming blocks, partial replacement of free sparring with positional and technical formats, as well as

specialized drills, is justified, allowing high specificity to be maintained and endurance to be developed with a lower probability of injury. When signs of incomplete recovery appear according to self-monitoring data (e.g., a decrease in jump height or unfavorable HRV dynamics), the volume and proportion of maximal sparring should be reduced without delay, because the combination of fatigue and uncontrolled contact substantially increases the likelihood of acute injury [23-25].

Given the increased vulnerability of the knee and shoulder joints, warm-up and general physical preparation programs should include targeted means of dynamic stabilization. For the knee joint, priority is given to exercises that develop balance and neuromuscular control in single-leg support positions, including variations of Bulgarian split squats, which contribute to improved stability and controllability of the lower-limb axis. For the shoulder joint, activation of the rotator cuff and work across the full physiological range of motion are of fundamental importance; practical value is provided by exercises with elastic bands aimed at increasing joint stability prior to high loads and contact impacts [14, 18].

Management of cumulative stress also requires special attention, since autonomous preparation increases the risk of imperceptible accumulation of fatigue. With objective signs of decreased work capacity or an increase in the fatigue index, an immediate reduction of the total volume of BJJ-specific load by 20–30% for 2–3 days is justified, which makes it possible to restore functional reserves without disrupting the logic of the macrocycle. The ability for timely self-correction under such conditions directly correlates with the development of self-monitoring (Table 1).

That is, under autonomous training in BJJ, the key source of injuries is not associated with competitions but with the training process (up to ~89% of all injuries), primarily with free sparring (~79%), against the background of predominantly acute contact injuries with the greatest vulnerability of the knee

(~25%) and shoulder (~13%) joints; in this regard, prevention should be structured as a risk-management system that includes regulation of the dosing and intensity of free sparring (with partial replacement by positional/technical formats and drills in accumulative/transforming blocks), mandatory linkage of admission to maximal sparring to objective recovery criteria (dynamics of jump tests, HRV) and immediate reduction of contact load when signs of incomplete recovery are present, as well as targeted dynamic stabilization of the knee (single-leg control, variations of Bulgarian split squats) and the shoulder (rotator cuff activation, work across the full range, band exercises); additionally, the need to control cumulative stress and implement prompt deloading when performance declines is substantiated—reducing BJJ volume by 20–30% for 2–3 days—as a practical mechanism for risk minimization without violating the logic of the macrocycle.

Conclusion

The study was aimed at developing a scientifically substantiated methodology for the independent preparation of an athlete in Brazilian jiu-jitsu in a situation of the absence of continuous coaching supervision. The obtained results indicate that the effectiveness of autonomous preparation is ensured not by individual methods of training organization, but by the systemic integration of physiological planning, psychological preparation, and technologically supported self-monitoring. Within the physiological block, block periodization constitutes the priority approach, enabling the sequential development of basic strength endurance in the accumulative block and the enhancement of specific power in the transforming block, which corresponds to the intermittent–interval work regime characteristic of a BJJ match.

The psychological component of the autonomous model is based on developed personal predictors of sustainable progress: perseverance, resilience, and self-efficacy. These qualities are regarded as amenable to development and

demonstrate an association with training experience (correlation up to r=0.179). Consequently, protocols of self-reflection and goal setting should be interpreted not as optional practices, but as an obligatory component of the methodology, ensuring the stability of plan adherence and the timeliness of corrective decisions.

A key condition for the reproducibility of autonomous preparation is the objectification of the training process. The implementation of accessible field testing, including jump protocols, as well as the use of wearable technologies, in particular inertial sensors, provides quantitative feedback that functionally compensates for the absence of continuous coaching observation. Such feedback increases the precision of load regulation and makes it possible to record the dynamics of target performance parameters at a level sufficient for making substantiated management decisions.

Injury prevention in an autonomous environment requires strict control of the most risky elements of practice. Given that free sparring is the dominant source of injuries (up to 79% of injuries), risk minimization presupposes strict regulation of its intensity and share within the structure of the microcycle. At the same time, systematic, targeted work on stabilizing the knee and shoulder joints as the most vulnerable zones is required, which functionally corresponds to the logic of secondary prevention and reduces the likelihood of acute injuries under conditions of contact load.

The stated objective of developing a scientifically substantiated methodology and a practical system for independent preparation of a BJJ athlete has been achieved. A methodological framework has been formed, grounded in data from leading scientific sources and defining applied guidelines for load planning, instrumental self-monitoring, and risk management. The hypothesis that the systematic application of a technologically supported methodology enables autonomous BJJ athletes to effectively optimize readiness is consistent with the synthesis of data on periodization, psychological predictors, and monitoring tools.

The practical significance of the work is determined by the possibility of using the proposed model as a methodological instrument for competitive BJJ athletes and experienced practitioners. The methodology provides structuring of the training process and reduces dependence on continuous external supervision, enabling independent scientifically substantiated decisions regarding adjustment of volume, intensity, and recovery interventions. Its application contributes to a reduction in the risk of overtraining and injury, which increases long-term effectiveness and supports athletic longevity.

Promising directions for further research are associated with a prospective longitudinal evaluation of the effectiveness of the proposed autonomous methodology in comparison with traditional preparation models under continuous coaching control. Additional research interest is represented by the development of more specific and simultaneously accessible field tests for assessing anaerobic power and strength endurance of the upper and lower limbs in BJJ athletes, as well as analysis of the influence of hybrid training formats (online instruction in combination with technologically supported self-monitoring) on the dynamics of athletic performance.

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