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THE IMPORTANCE OF RECOVERY IN FORMER RUGBY PLAYERS

Victor MATEI[1]

[1] National University of Physical Education and Sport, Faculty of Physical Education and Sport, Bucharest, Romania

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Abstract. *The category of large-sized athletes is one of interest from the perspective of the evolution of their physical characteristics both during their careers and in the post-activity period. This study evaluates the impact that the integration of biomechanical elements can have on the sports careers of rugby players, this being a positive prognostic factor for the improvement of their performance, the efficiency of their recovery from injury and the preservation of a satisfactory health status allowing them to engage in physical activity in the post-performance stage. Four former rugby players participated in the study. The research was conducted at the Techirghiol Spa and Recovery Sanatorium with the help of a multidisciplinary team. The study provides the following conclusions: after evaluation, former rugby athletes show certain sequelae from the practice of contact sports (rugby), particularly in the joint and spine areas, which causes changes in their biomechanical parameters; the pain threshold felt by former elite athletes is higher. Post-performance, these athletes require careful monitoring to maintain the functionality of their joints, live normal lives and carry out regular activities; recovery treatment, physical therapy and balneotherapy positively influence the general health of former rugby players.*

Keywords: *biomechanics, post-performance, rugby.*

Introduction

Throughout the history of sport, it has been revealed that some sports disciplines require the existence of specific characteristics such as strength, impulse, contact and impact. In these cases, young aspirants to play a sport must first pass a selection test that takes into account the compatibility of their native physical, motor and somatic qualities with the chosen sport for achieving optimal performance in their future sports careers.

By definition, large-sized athletes are those whose height, weight, arm span, muscle mass and other somatic qualities exceed the usual standards, and once highlighted, these characteristics offer an advantage to the training and competitive expression of an athlete or team. Nowadays, "the quest for 'super sizes' is confirmed by the fact that this trend is not only apparent in the elite adult division, but also in juniors" (Sedeaud et al., 2013, p. 191). From a biomechanical point of view, researchers discuss about a specific relationship between forces (weight, pushing force, pulling force, etc.) - levers represented by body segments as they are anatomically defined, kinetic energy, potential energy, impulses, etc. (Knudson, 2007). Among these characteristics, the most relevant are definitely the torque-weight (force) and the centre of gravity (point of application of the force) as well as the components of this force in the process of producing movement (Floyd, 2020).

The positioning of the centre of gravity on the Y-axis that defines an athlete's stature, together with the vector dimension of the weight $G = mg$, are elements that define a certain biomechanical characteristic of that athlete.

Therefore, in the case of rugby players (and not only) we are talking about the accumulation of physical and mechanical elements that define, on the one hand, the positioning of the centre of gravity, and on the other hand, the vector dimension of weight on three planes - XYZ.

In the present study, the focus will be on rugby as a heavy-contact sport (Pringle, 2009) but more as a sport where large-sized athletes play together with normal stature athletes (Chiwaridzo et al., 2020). “Rugby league is a team sport in which players engage in repeated high-intensity exercise involving frequent collisions” (Johnston et al., 2014, p. 1087), so the risk of injury and medical condition is very high for the athletes. The risk of injury is increased in athletes with higher scores for foul play - an aggression factor involving unethical, “dirty” play (Makarowski et al., 2021a), but also in athletes with high values for the stimulating risk, in which case, irrespective of the result (losing or winning the competition is not so important), athletes focus on sensation seeking, their activity being directed towards the generation of a pleasant state of excitement (Makarowski et al., 2021b).

In their research, Sedeaud et al. (2013) reach the following conclusion: “Rugby players have become taller and heavier. Their current morphology is the product of a long process of competition and selection. This study demonstrates that this selection is already present at a young age” (p. 185). Nowadays, the trend in practical applications is “to select bigger, stronger, and faster players in higher-level rugby teams, as these characteristics have been associated with superior performance” (Lombard et al., 2015, p. 986), the benefits of anthropometric qualities being essential for anticipating performance potential (Gabett et al., 2008). However, in elite sports activity, it is also essential to foster effective behaviours in athletes and remove undesirable ones (Pelin et al., 2018). In top-level athletes, one can talk about a combination of physical, anthropometric qualities and mental states - the athletes’ self-monitoring process in competition enabling future self-adjustments (Pelin et al., 2020).

Biomechanics is defined as “the study of the structure and function of biological systems by means of the methods of mechanics” (Hatze, 1974, p. 189), and its main applications to sport are related to performance improvement as well as injury prevention and treatment.

In the game of rugby, the accumulation of injuries is up to three times higher than in soccer or American football, as this collective game has many contact, tackling, ruck, maul and scrum phases (Brooks & Kemp, 2008; Mellalieu et al., 2008) and involves intense efforts interspersed with short periods of lower intensity (Duthie et al., 2003). The props and 2nd line players are the most prone to injury because these positions have the most frequent contacts with the opponent (Kaplan et al., 2008). Also, these positions are associated with most large-sized athletes.

In this regard, the ideal approach for athletes with special size is the “optimised” individualised training (Bartlett, 2007) that differs from the one planned for normal stature players, is adapted to their needs and aims at injury prevention, given that “any injury to, or lesion in any of the individual elements of the musculoskeletal system will change the mechanical interaction and cause degradation, instability and disability of movement” (Tung-Wu & Chang, 2012, p. S13).

It is obvious that, in the case of rugby players, mostly in the post-performance stage, the accumulation of injuries and elements that have affected the athlete’s constitution requires professional management. Therefore, these problems need to be identified and treated in such a way that professional physical ability and insertion into non-sporting life remain unaffected, and the skills acquired during the practice of sport can be further exploited until old age so that the level of somatic functions of the body remains optimal.

Current research in the field focuses on the maladaptive, dysfunctional potential of contact sports, in this case, rugby. High performance is sometimes associated with the vulnerability of the athlete's physical and neurological health and general well-being. Unlike the flow state - where athletes are task-oriented, focused on the present and fully "immersed in the game" (Predoiu et al., 2019, p. 30), sports performance also involves competitive stress, namely situations that could generate worry, anxiety (for example, anxiety in physically dangerous conditions, in new circumstances during the competition, etc.) or even boredom. The stress felt by athletes could affect both their sleep patterns and well-being; in this context, a distinction should be made between "healthy stress" and "unhealthy stress", the latter leading to distress and diminishing the athlete's well-being (Kanji & Chopra, 2009; Piotrowski et al., 2021).

All humans, but especially athletes, are constantly subjected to the universal force of gravity and thus to internal forces surrounding the body and to external forces and collisions. Through the interaction of these forces and their effects, the body shape, function and movement can be examined, and the resulting knowledge can be applied to promote the quality of life (Tung-Wu & Chang, 2012) of rugby players during both their athletic careers and post-performance.

The *aim* of this research is to investigate the impact of playing elite rugby on athletes in order to increase knowledge with means specific to biomechanics, by analysing the possibility to increase their quality of life.

Objectives

- Highlighting the impact of playing elite rugby on retired athletes;
- Identifying the possibility to maintain an unaltered biomechanical structure, within the age limits.

Research questions

1) What are the changes in biomechanical parameters and pain threshold in former elite rugby players?

2) Can the lifestyle and diet, corroborated with appropriate medical and maintenance treatments, ensure convenient functional parameters for the rugby players over longer periods?

3) Do the spa treatment, physiotherapy and gymnastics performed according to specialised medical indications have a beneficial influence on maintaining the athlete's fitness and increasing their quality of life?

Methodology

Participants

The somatic models of rugby players reveal that the selection process places emphasis on certain mandatory constituents (weight and height). According to Badea (2012), a prop has a weight of 115.19 ± 5.6 kg and a height of 185 ± 5 cm, with a body composition of 87% muscle mass - 13% fat. A 2nd line player has a weight of 117.5 ± 5.35 kg and a height of 199 cm ± 2 cm, with a body composition of 88% muscle mass - 12% fat. Both props and 2nd line rugby players are athletes with special size and biomechanical characteristics.

Participants in the study were 4 former rugby players with the following characteristics (Table 1):

Table 1. *Participants in the study*

Rugby player	Position	Experience level	Height	Weight
C1	2nd line	10 years elite	197 cm	119 kg
C2	Prop	9 years elite	185 cm	121 kg
C3	2nd line	8 years elite	195 cm	131 kg
C4	Prop	6 years elite	188 cm	122 kg

Instruments

To evaluate the medical condition of athletes, the multidisciplinary team used the following standardised scales: Medical History Scale, Visual Analogue Scale for Pain (VAS Pain) and mobility scales for each joint. Joint mobility was objectively assessed by both classical goniometry and the Gonio Pro - iOS mobile application.

a. VAS Pain: former rugby players report various and persistent painful areas, especially in the shoulders, knees and spine. This is explained by the fact that, during their elite sports activity, valid rugby players got engaged in various roles involving force, percussion force, pushing force, shocks, etc., elements that commonly affect important parts of the musculoskeletal system.
b. Range-of-motion assessment: the most affected joints were assessed through both the active movement that the athlete was able to do and the maximum passive movement performed by the examining physician. Range of motion was assessed using the Gonio Pro - iOS mobile application but also the classical goniometer. The assessed joints were: knees - active and passive flexion movement; shoulder - active and passive flexion movement, active and passive abduction movement; hip - flexion, internal rotation, external rotation.
c. Schober’s test: used to assess lumbar spine range of motion. The examiner makes a sign next to the spine at the line that joins the two anteroposterior iliac spines, then measures 5 cm caudally and 10 cm cranially. The athlete is asked to lean forward until the toes are reached, if possible. The result of a Schober’s test is positive if the distance between the two measurements is less than 5 cm.

Procedure

The study was conducted at the Techirghiol Spa and Recovery Sanatorium with the help of a multidisciplinary team: physicians, physiotherapists, specialists in the field of sport science. The former rugby players (C1-C4) were assessed by specialised staff. The aim was to identify methods to reduce the existing disabilities of athletes.

Rehabilitation and recovery treatment included hydrotherapy in the saltwater pool of Techirghiol Lake, mud packs, physiotherapy, electrotherapy, laser therapy, magnetotherapy and mesotherapy for 14 days.

Athletes were monitored during the study by the attending physician in terms of both health status and associated comorbidities.

Results

In the study conducted at the Techirghiol Spa and Recovery Sanatorium, the rugby players recorded an overall health improvement in the post-treatment period.

At the beginning of treatment, the first examination of athlete C1 revealed swelling in the anteromedial area of the right knee and palpable oedema in the popliteal fossa of the left knee. All these conditions were remitted after physiotherapy treatment starting with the eighth day. In the case of athlete C4, epicondylitis was observed in the lateral area of the right elbow, but the inflammation remitted after approximately 6 days of recovery treatment. (Table 2)

Table 2. *General evaluation*

Rugby player	GENERAL EVALUATION BEFORE	GENERAL EVALUATION AFTER
C1	swelling of the right knee oedema of the left knee	0
C2	0	0
C3	0	0
C4	inflammation of the right elbow	0

Prior to treatment, athletes answered questions about joint pain but also about how violent the pain was. It is to be considered that rugby gives former practitioners a much higher pain threshold, in other words, these athletes have lower pain sensitivity, feel less and claim less painful areas when applying the stimulus in question (Thornton et al., 2017). This is due to the training conditions and the specific demands of the sport concerned. In rugby players, pain occurs because the muscular, articular and skeletal systems have long been overused, and the biomechanical characteristics that had recommended them for playing this sport focused the pain on certain well-defined areas of the body. A clear improvement in the perception of pain sensation can be observed in all athletes after recovery treatment. The first athlete shifted from VAS 6 to VAS 2, and the last athlete, from VAS 3 to VAS 1 (Table 3). Thus, the pain felt in different areas of the body was remitted to a large extent, which was evidenced by the Visual Analogue Scale (VAS Pain).

Table 3. *VAS Pain*

Rugby player	BEFORE	AFTER
C1	6	2
C2	4	2
C3	6	2
C4	3	1

The most affected joints of former rugby players were the knees, shoulders and hips, with a lower incidence in the lumbar spine.

At the end of the spa treatment, a 10-degree increase in knee joint mobility for the active flexion movement and a decrease in anteroposterior oedema and inflammation were recorded (Table 4).

Table 4. *Knee evaluation - active and passive flexion movement*

Rugby player	RIGHT KNEE FLEXION				LEFT KNEE FLEXION			
	Before		**After**		Before		**After**	
	Active	Passive	**Active**	**Passive**	Active	Passive	**Active**	**Passive**
C1	80°	85°	**95°**	**100°**	80°	85°	95°	100°
C2	85°	90°	**95°**	**100°**	85°	90°	95°	100°
C3	85°	90°	**90°**	**100°**	90°	90°	90°	100°
C4	90°	100°	**100°**	**100°**	95°	100°	95°	100°

The scapulohumeral joint mobility increased by 5-10 degrees of movement in the active flexion plane (Table 5) and about 5 degrees of movement in the abduction plane (Table 6). Moreover, the bicipital shoulder tendinitis recovered after the first physiotherapy sessions.

Table 5. *Shoulder evaluation - active and passive flexion movement*

Rugby player	RIGHT SHOULDER FLEXION				LEFT SHOULDER FLEXION			
	Before		**After**		Before		**After**	
	Active	Passive	**Active**	**Passive**	Active	Passive	**Active**	**Passive**
C1	100°	110°	**110°**	**110°**	105°	110°	110°	110°
C2	110°	130°	**110°**	**120°**	110°	130°	110°	120°
C3	115°	130°	**120°**	**120°**	110°	130°	115°	120°
C4	100°	120°	**110°**	**120°**	105°	120°	110°	120°

Table 6. *Shoulder evaluation - active and passive abduction*

Rugby player	RIGHT SHOULDER ABDUCTION				LEFT SHOULDER ABDUCTION			
	Before		**After**		Before		**After**	
	Active	Passive	**Active**	**Passive**	Active	Passive	**Active**	**Passive**
C1	80°	90°	**100°**	**110°**	85°	90°	90°	110°
C2	100°	100°	**100°**	**110°**	100°	100°	100°	110°
C3	90°	100°	**100°**	**100°**	90°	100°	90°	100°
C4	100°	110°	**110°**	**110°**	100°	110°	100°	110°

For the hip joint, no improvement was observed in terms of degrees of movement and mobility (either passively or actively) after recovery treatment but only a decrease in joint pain (Tables 7, 8 and 9).

Table 6. *Hip joint evaluation – flexion*

Rugby player	RIGHT HIP FLEXION				LEFT HIP FLEXION			
	Before		**After**		Before		**After**	
	Active	Passive	**Active**	**Passive**	Active	Passive	**Active**	**Passive**
C1	50°	60°	**55°**	**62°**	45°	60°	**45°**	**60°**
C2	60°	70°	**60°**	**65°**	55°	70°	**55°**	**65°**
C3	45°	50°	**45°**	**50°**	45°	50°	**45°**	**50°**
C4	50°	60°	**55°**	**60°**	50°	60°	**55°**	**60°**

Table 7. *Hip joint evaluation – internal rotation*

Rugby player	RIGHT HIP INTERNAL ROTATION				LEFT HIP INTERNAL ROTATION			
	Before		**After**		Before		**After**	
	Active	Passive	**Active**	**Passive**	Active	Passive	**Active**	**Passive**
C1	25°	30°	**30°**	**30°**	25°	30°	**30°**	**30°**
C2	30°	30°	**30°**	**30°**	35°	35°	**35°**	**35°**
C3	30°	30°	**30°**	**30°**	35°	35°	**35°**	**35°**
C4	20°	35°	**30°**	**35°**	20°	35°	**30°**	**35°**

Table 8. *Hip joint evaluation – external rotation*

Rugby player	RIGHT HIP EXTERNAL ROTATION				LEFT HIP EXTERNAL ROTATION			
	Before		**After**		Before		**After**	
	Active	Passive	**Active**	**Passive**	Active	Passive	**Active**	**Passive**
C1	30°	30°	**32°**	**35°**	30°	30°	**32°**	**35°**
C2	25°	30°	**25°**	**30°**	25°	30°	**25°**	**30°**
C3	25°	30°	**27°**	**30°**	25°	30°	**25°**	**30°**
C4	30°	30°	**33°**	**35°**	30°	30°	**30°**	**35°**

As regards lumbar spine, the results could not be analysed quantitatively because Schober's test remained unchanged during treatment, only mechanical lumbar pain decreased considerably. During clinical examination, an improvement in lumbar spine mobility can be observed after recovery treatment. (Table 10)

Table 9. *Schober's test*

Rugby player	BEFORE	AFTER
C1	POSITIVE	POSITIVE
C2	POSITIVE	NEGATIVE
C3	POSITIVE	NEGATIVE
C4	POSITIVE	POSITIVE

The complex balneo-physio-kinetic treatment plan included salt baths with water from Techirghiol Lake, mud packs, physiotherapy but also specific kinetic exercises.

The effects of treatment on former rugby players have shown an improvement in their quality of life by reducing joint pain and increasing mobility. These recovery programmes should be attended by as many athletes as possible. Treatments should be performed biannually for a more beneficial effect on health due to improved quality of life by maintaining the optimal parameters of former athletes.

Discussion

The tasks to be performed by a large-sized athlete during the competitive activity are likely to involve the use of this size in impact sports, for example, rugby. It is about the overuse of the skeletal and muscular systems, which is reflected, at the end of the sports career, in biomechanical dysfunctions of the levers and joints. Given their specific configuration, rugby players tend to have more severe sequelae after giving up sport due to overusing their joints (especially the shoulder, knee, hip and spine), which is caused by the specific demands of their position in the team. These changes are usually irreversible and greatly affect an individual's life and post-performance activity. In this sense, it is necessary for their health to be carefully and constantly monitored in order to keep certain parameters under control.

The importance of properly managing the injuries suffered by elite rugby players offers the premises for proper health management after retirement. Through careful monitoring and proper recovery, the athlete's condition can be improved. Former players may experience changes in the adipose tissue/muscle mass ratio in the post-performance stage.

At the same time, athletes from rugby, American football, martial arts, recognise the painful sensation with more difficulty than other athletes (and compared to non-participating athletes) due to their hard training regime, experience or possibly as a result of learning to cope with pain (Thornton et al., 2017). Thus, it can be assumed that, during top-level sports activity, the athlete endures the pain better than an ordinary individual. Further studies need to be conducted in this regard.

Biomechanics in sports aims at correcting technical elements (Pavan et al., 2020) and preventing injuries (Tierney & Simms, 2017; Trewartha et al., 2015), but addresses only a few issues related to large-sized athletes. These athletes are a particular category that requires special attention, considering that they have to deal with another type of load due to their somatic characteristics.

Particular attention should be paid to improving the general condition of rugby players during their sports careers but also after their retirement from sporting life.

Conclusion

The rugby players' height, weight, muscle mass (prop and 2nd line player) are a burden in itself for the skeletal system. Therefore, athletes these characteristics must follow a certain line of sports training to maintain their muscle mass so that their extra weight does not represent an additional burden for their already overused joints during the practice of elite sport.

It is very useful for rugby players to maintain as long as possible and at an adequate level the indices of their muscle mass and adipose tissue in the post-performance period to successfully cope with physical and biomechanical demands during leisure activities. It is also advisable to periodically monitor their health, especially with regard to joints, through specific methods of therapy and treatment, in order to maintain the optimal functioning of their bodies as a whole.

An improvement in the general condition of athletes participating in this study has been noticed following the application of specific recovery treatments.

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