The use of functional tests to assess risk of injuries in judokas

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Abstract

Background & Study Aim: High physical fitness requirements towards judokas, as well as the combat specificity may foster bodily injuries. The research objective was to identify the spinal joints, hip joints and shoulder joints mobility in relation to bodily injuries sustained by men practising judo (as professional or amateur sportsmen).

Material & Methods. Forty one men practising judo divided into two groups according to the level of sport advancement were considered for participation in this study. Group 1 (G1 – the study group) were 15 professional sportsmen. Group 2 (G2 – the control group) were recreational, amateur sportsmen (n = 26). The research tool consisted of a series of functional tests: (the Dega wall test, Thomas test, Thomayer test and Zipper – Back Scratch Test), as well as a custom survey on training methods, the number, type and circumstances of contracted injuries, as well as their treatment methods.

Results: Iliopsoas contracture was observed in 14 judokas (93%) in G1 and 15 judokas (58%) in G2. Thirteen practitioners in G1 and 11 in G2 scored negative in the Dega test, compared to 14 judokas in G1 and 7 judokas in G2 scored negative in the Back Scratch Test. Significant asymmetry was also observed in both groups: the discrepancy between the left and the right side amounted to p = 0.002 for G1 and p<0.001 for G2. A notably higher number of bodily injuries (p = 0.022) was noted among professional judo athletes.

Conclusions: The degree of functional limitations may be the effect, yet also the cause of bodily injuries. The majority of professional practitioners had limited joint flexibility (which may increase the risk of injury to this body part). This demonstrates an insufficient amount of stretching exercises during training.

Key words: Back Scratch Test • Dega test • Thomas test • Thomayer test

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**INTRODUCTION**

Bodily injuries are an undesirable effect of sports or health training, may be a result of immediate sports combat (e.g. blows and throws in combat sports), excessive bodily effort, improperly performed training or the lack of optimal post-exertional recovery [1-3]. Bodily injuries may therefore be due to excessive strain (with improperly led training), willingness to obtain the best results, mismatch between training intensity and age and health status of players or a too early return to training after a contracted injury. Bodily injury renewal is fostered by the use of steroid preparations with analgesic and anti-inflammatory functions. These substances improve the functioning of the loco-motor system, and as a result, the player seems healthy and ready to take on the training load. Another factors influencing bodily injuries include inaccurate warm-up (or the lack thereof), incorrect performance of exercises or their excessive difficulty, lack of protection, faulty sports equipment, facilities inaccurate to the exigencies of training performed, atmospheric conditions or behaviour of supporters [4-7].

In judo, as in other sport disciplines, bodily injuries are often a result of upper limb, lower limb and upper body overload, often related to the necessary adaptations of the musculoskeletal system. The repetitive block motions of uke (the opponent or fellow practitioner) cause overload in the same structures, creating muscular imbalance. It might cause a decrease in strength and flexibility and biochemical disorders in the locomotor system [8]. An early diagnosis of the asymmetry and muscular imbalance may be an effective means of bodily injury prevention.

The research objective was to identify the spinal joints, hip joints and shoulder joints mobility and to describe bodily injuries sustained by men practising judo (as professional or amateur sportsmen).

**MATERIAL AND METHODS**

**Participants**

The study included 41 persons practising judo, aged 18 to 30. Group 1 (G1) were 15 athletes training judo for at least ten years, who have obtained at least one kyu and won at least one medal in the Polish National Championships. Students training judo as amateurs (n = 26) for at least a year were qualified to Group 2 (G2). The biometric characteristics of the sample persons are listed in Table 1. Local bioethics committee has given consent to the study.

**Methods and protocols**

All sample subjects were subjected to a series of functional tests assessing the range of joint motion in the spine, hip joints and glenohumeral joints [9].

Dega test enables detection of muscle contractures within the glenohumeral joints. The tested person lifts arms in standing posture or sitting back to the wall. The angle between outstretched arms and the wall defines the degree of contracture.

Back Scratch Test (also referred to as Zipper Test or Shoulder Mobility Test) defines the functional mobility of the pectoral girdle during external rotation-abduction and internal rotation-adduction.

The Thomayer test (also referred to as finger tips-floor test) measures the spine and hip joints mobility. The tested person lifts arms in standing posture or sitting back to the wall. The angle between outstretched arms and the wall defines the degree of contracture.

The Thomas test detects flexion contractures within the hip joint. The patient lies supine, the non-examined limb flexed to the maximum in the knee joint and the examined limb straightened. The examiner

| Table 1. Characteristic of examined sportsmen |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| **Groups** | **N** | **Age (years)** | **Body mass (kg)** | **Body height (cm)** | **Training experience (years)** |
| G1 (professionals) | 15 | 23.1 ±3.1 | 81.9 ±11.9 | 177.3 ±5.9 | 10.1 ±3.8 |
| G2 (amateurs) | 26 | 20.2 ±0.4 | 73.7 ±10.6 | 179.6 ±6.4 | 1.8 ±1.9 |
presses the thigh of the non-examined limb to the patient’s chest. If a contracture is present, the tested limb rises off the floor. The angle between thigh axis and the surface on which the patient lies demonstrated the size of the contracture [9].

In tests for both sides, the general result was the score for the weaker side.

Furthermore, the researched persons filled in a custom survey which contained information concerning the contracted bodily injuries, their causes and treatment, as well as current health status.

**Statistical analysis**

Data were processed using standard methods of statistical analysis, arithmetical means and SD. The reliability of differences between particular groups was evaluated using Mann-Whitney U test, the differences between left and right side were compared by the Wilcoxon matched-pairs signed-ranks test. The minimal reliability level was adopted at $p \leq 0.05$.

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**Figure 1.** Results of Thomas and Dega tests ($G_1$ $n = 15$, $G_2$ $n = 26$).

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**Table 2.** Results of bilateral tests ($G_1$ $n = 15$, $G_2$ $n = 26$).

<table>
<thead>
<tr>
<th>Tests</th>
<th>Groups</th>
<th>Left</th>
<th>Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thomas Test</td>
<td>$G_1$</td>
<td>10.07 ± 6.66</td>
<td>0.67 ± 5.17</td>
</tr>
<tr>
<td></td>
<td>$G_2$</td>
<td>4.35 ± 4.71</td>
<td>4.81 ± 5.24</td>
</tr>
<tr>
<td>Dega’s Test</td>
<td>$G_1$</td>
<td>15.47 ± 12.82</td>
<td>1.00 ± 8.48</td>
</tr>
<tr>
<td></td>
<td>$G_2$</td>
<td>-12.40</td>
<td>-16.67</td>
</tr>
</tbody>
</table>

**Figure 2.** Results of Back Stretch and Thomayer’s tests ($G_1$ $n = 15$, $G_2$ $n = 26$).
The results were calculated in MS Excel 2013 and Statistica 10 computer packages.

**RESULTS**

Bilateral iliopsoas contracture was observed in 14 out of 15 judokas in G1 (negative score in Thomas test). In G2, bilateral contracture was detected in 11 subjects, with unilateral contracture detected in 4. Negative result of Dega test (limited mobility in glenohumeral joints) was scored by 13 athletes in G1 (bilateral in 10 athletes, unilateral in 3) and 11 athletes in G2 (bilateral in 6 athletes, unilateral in 5). No significant differences were noted between results for left and right side in either group, both for Thomas and Dega tests (Table 2). The difference between both results in Thomas and Dega tests for judokas in G1 and G2 was statistically significant at p = 0.002 (Figure 1).

The negative score in Back Scratch Test, demonstrating the limited mobility of the pectoral girdle (during external rotation-abduction and internal rotation-adduction), was observed in 14 judokas in G1 (bilateral in 11 athletes, unilateral in 3) and in 7 judokas in G2 (bilateral in 2 athletes, unilateral in 5). The differences between groups were significant, with p<0.001 (Figure 2). Significant asymmetry was also observed in both groups: the discrepancy between left and right side amounted to p = 0.002 in G1 and p<0.001 in G2 (Table 2).

Professional judo athletes earned better scores than amateurs in the Thomayer (spinal mobility) test (p = 0.042). Negative scores were observed for two subjects in G1 and eight in G2 (Figure 2).

A significantly higher number of bodily injuries (p = 0.022) was noted among professional practitioners. Taking account of the injury type, the one declared most often was contusion (2.4 cases per person in G1 and 0.12 in G2, p = 0.001), tendon or ligament strains and ruptures (1.13 in G1 and 0.12 in G2, p = 0.006) and joint sprains (1.07 in G1 and 0.58 in G2, p = 0.036). Joint dislocation and bone rupture were less common. Bodily injuries were most often related to upper extremities in G1 and lower extremities in G2. The quotient of bodily injuries and training experience (measured in years) amounted to, on average, to 0.56 in G1 and 0.91 in G2; the difference was not statistically significant (Table 3).

**DISCUSSION**

Most athletes practising combat sports on a professional basis have contracted a bodily injury at the time of training, and this is reported in the literature to occur to a degree of about 65%. The results of the present research show that about 70% of judo athletes experienced a bodily injury during the studied period, with the number of injuries per person measured at 0.75, which is consistent with the obtained results. The study uses the Thomayer test, which is considered a gold standard for determining spinal mobility. The obtained average scores for professionals and amateurs were 0.042 and 0.040, respectively. It was found that the group of professional judo practitioners obtained better scores than the group of amateur judokas (p = 0.042).

**Table 2.** Results of bilateral tests (G1 n = 15, G2 n = 26).

<table>
<thead>
<tr>
<th>Tests</th>
<th>Groups</th>
<th>Left</th>
<th>Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thomas Test</td>
<td>G1</td>
<td>-10.07** ±6.66</td>
<td>-10.67** ±5.17</td>
</tr>
<tr>
<td></td>
<td>G2</td>
<td>-4.35 ±4.71</td>
<td>-4.81 ±5.24</td>
</tr>
<tr>
<td>Dega’s Test</td>
<td>G1</td>
<td>-15.47** ±12.82</td>
<td>-11.00** ±8.48</td>
</tr>
<tr>
<td></td>
<td>G2</td>
<td>-3.62 ±5.45</td>
<td>-2.92 ±4.89</td>
</tr>
<tr>
<td>Back Scratch Test</td>
<td>G1</td>
<td>-11.97*** ±9.85</td>
<td>-6.40*** ±10.05</td>
</tr>
<tr>
<td></td>
<td>G2</td>
<td>1.00 ±7.69</td>
<td>5.85 ±6.31</td>
</tr>
</tbody>
</table>

**Table 3.** Characteristic of injuries in judokas G1 (n = 15) and G2 (n = 25).

<table>
<thead>
<tr>
<th>Number of injuries</th>
<th>Groups</th>
<th>Head and spine</th>
<th>Upper limb</th>
<th>Lower limb</th>
</tr>
</thead>
<tbody>
<tr>
<td>[n/person]</td>
<td>G1</td>
<td>0.80 ±1.08</td>
<td>3.60** ±5.03</td>
<td>2.47 ±3.11</td>
</tr>
<tr>
<td></td>
<td>G2</td>
<td>0.35 ±0.62</td>
<td>0.42 ±0.76</td>
<td>0.92 ±1.62</td>
</tr>
<tr>
<td>[n/person/training experience]</td>
<td>G1</td>
<td>0.04 ±0.07</td>
<td>0.30 ±0.44</td>
<td>0.20 ±0.29</td>
</tr>
<tr>
<td></td>
<td>G2</td>
<td>0.10 ±0.41</td>
<td>0.28 ±0.61</td>
<td>0.54 ±0.97</td>
</tr>
</tbody>
</table>

*p<0.05: differences between groups
The use of functional tests to assess risk of injuries in judokas

Boguszewski D et al.

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The age of the athlete has an impact on the appearance of overload injuries. For young athletes, where rapid bone growth in length was observed, muscles and tendons did not have enough time to gain length and flexibility. This may lead to the development of contractures in lower extremities. Their consequences include avulsion fractures, muscle tear and sprain, as well as growth cartilage overuse injury [24]. Incorrectly managed strength and endurance training, along with rapid growth in pubertal age, may lead to muscle-tendon imbalance. The imbalance between the volume and strength of antagonist muscles may lead to tendinitis and tunnel syndromes [25].

Judo practitioners sampled for the present paper were most likely to contract bodily injuries within upper extremities (professionals) and lower extremities (amateurs). Injuries of the lower extremities were also dominant among men training combat sports studied by Radziioch et al. [26]. Young judo adepts studied by Pieter, in turn, were prone to upper extremity injuries [27].

The injury risk assessment is done by various methods, including Flamingo Test, Rotational Test, Test of Susceptibility to Injuries During Falls (TSIDF), Double Leg Lowering Manuvre (DLLM), Core Muscle Strength and Stability Test (CMS&ST) or Functional Movement Screen (FMS) [28-34]. The aforementioned tests assess balance, range of motion of particular joints or the quality of movement: reconstructing the complex movement patterns. After all, bodily injuries may have different causes. However, they are most often due to a cumulation of micro injuries, locomotor system stress or incorrect warm-up [35-37].

Paterno et al. [38] have demonstrated that 30-50% of bodily injuries in children practising athletics are stress injuries. Acute injuries only constitute 15% of all cases and are most often the result of contact against the opponent. Among children training running, knee joint pathologies are the most common [38]. A higher risk of acute injury may appear in team sports and combat sports. It is due to more frequent physical contact between athletes. Hence, this group of sports puts an impact of muscular tissue, high balance level and postural muscle efficiency, as well as specific coordination skills, such as the ability to fall safely [38-43].

Currently, in professional sport, the role of physiotherapists is indisputable [44]. Future research should determine the suitability of functional physiotherapist tests with regards to the work of sport physiotherapists. Moreover, the use other standardised tests and trials could be useful to gain full information on a particular athlete. Functional studies of the locomotor system may be used in the pre-season preparations of the athletes. This might make it possible to identify pains experienced by athletes or their movement limitations, which may influence their preparation process and them achieving better sport results.

**Conclusions**

The degree of functional limitations may be the effect, yet also the cause of bodily injuries. The majority of professional practitioners had limited joint flexibility (which may increase the risk of injury to this body part). This demonstrates an insufficient amount of stretching exercises during training.

Overall, the results obtained call for a greater impact on supplementary exercises (compensatory exercises and stretching) in the training process for judokas.

**Conflict of Interest**

The author declares that has no conflict of interest.
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62 | VOLUME 12 | 2016 smaes.archbudo.com