NON-SPECIFIC PAIN IN THE LUMBAR SPINE AND THE MOBILITY OF THE HIP JOINT IN JUDOKAS
NEŠPECIFIKOVÁ BOLESŤ V LUMBÁLNEJ CHRBTICI A MOBILTA BEDROVÉHO KĹBU DŽUDISTOV

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ABSTRACT
Background: The hip joint is very often stressed and heavily loaded in the performance of diverse techniques in martial arts performance.
Objective: The aim of our work was to verify the effect of chronic non-specific pain in the lumbar spine on the level of active and passive rotation of the hip joint in the group of high-level judokas.
Sample and methods: A total of 17 judokas, including 9 males and 8 females, an average age of 18.65 ± 2.83 years, a body height of 171.18 ± 8.02 cm and a body weight of 64.06 ± 11.00 kg were divided into groups based on their anamnesis: group (n = 8) with lumbar spine pain for more than 6 months (nsLBP) and control group (n = 9) without pain (CG).
Results: Based on the results of the research we did not find statistically significant differences in the active and passive hip intra- and extra-rotation between nsLBP and CG groups. However, we found a moderate substantive significance between nsLBP and CG in the active and passive internal rotation of left lower limb, indicating a possible relationship between lumbar spine pain and reduced hip mobility. We also found a lower value for hip joint mobility in judo players compared to reference values.
Conclusion: The probands in both our groups showed a lower range of motion in the hip joint compared to the general population, therefore judo coaches need to pay more attention to the development of hip mobility.

Key words: Mobility. Judo. Hip joint. Pain. Lumbar spine

ABSTRAKT
Východiská: Bedrový kĺb je v športovom výkone bojových športov veľmi často exponovaný a značne zaťažovaný pri vykonávaní rôznorodých techník.
Cieľ: Cieľom práce bolo overiť vplyv chronickej nešpecifikovanej bolesti v lumbálnej časti chrbtice na úroveň aktívnej a pasívnej rotácie bedrového kĺbu v skupine výkonnostných džudistov.
Súbor a metódy: Výskumný súbor tvorilo spolu 17 džudistov, z toho 9 mužov a 8 žien, priemerného veku 18,65 ± 2,83 rokov, telesnej výšky 171,18 ± 8,02 cm a telesnej hmotnosti 64,06 ± 11,00 kg, ktorí boli rozdelení na základe anamnézy do skupiny (n = 8) s výskytom bolesti lumbálnej chrbtice viac ako 6 mesiacov (nsLBP) a kontrolnej skupiny (n = 9) bez bolesti (CG).
Výsledky: Na základe získaných výsledkov z výskumu sme nezistili štatisticky významné rozdiely v aktívnej a pasívnej intrarotácii a extrarotácii bedrového kĺbu medzi skupinami nsLBP a CG. Zistili sme však stredne veľkú vecnú významnosť medzi nsLBP a CG pri aktívnej a pasívnej vnútornej rotácii ľavej dolnej končatiny, čo naznačuje možný vzťah medzi bolesťou lumbálnej chrbtice a zníženou mobilitou bedrového kĺbu. Taktiež sme zistili u džudistov nižšie hodnoty mobility bedrového kĺbu v porovnaní s referenčnými hodnotami.
Záver: Probandi v oboch skupinách vykazovali nižší rozsah mobility bedrového kĺbu v porovnaní s bežnou populáciou a preto je dôležité, aby džudo tréneri venovali väčšiu pozornosť jej rozvoju.

Kľúčové slová: Mobilita. Džudo. Bedrový kĺb. Bolesť. Lumbálna chrbtica

INTRODUCTION

Studies in the field of medicine and sport point to the occurrence of lumbar pain in the athletes of various sports. Lumbar spine pain in athletes ranges from 30 % to 85 % incidence (Iwai et al. 2004; Lundin et al. 2001; Ganzit et al. 1998) and this status results from 10 to 15 % of all sports-related injuries (Almeida et al. 2012, Graw, Wiesel, 2008). According to Okada et al. (2007), lower back pain can be divided into a specific one and a non-specific one. Specific pain is relatively unknown and it may be the result of infection, tumours, inflammatory processes, or fractures. Non-specific lumbar spine pain is a relatively common phenomenon. In the case of lumbar spine injuries, the most common is the protrusion and the hernia of the intervertebral plate. From the disc, the gelatinous core is extruded or has already arched beyond its boundaries, where a break or prolapse occurs, causing the plate to press on surrounding ligaments or nerves (Weller, 2010). Pressure on these structures is the cause of inflammation and pain. These problems often arise as the result of poor posture and improper motion mechanics in everyday practice or sport. The prolonged overloading of soft tissue without adequate compensation leads to tension in the kinetic structures, resulting in back pain in both static positions and movement. This type of tension has been observed in athletes in tennis, contact sports, wrestling and judo (Iwai et al., 2002).

The physiological range of movement in the hip slightly differs according to various authors. The freedom of movement varies according to the type of activity being performed. Anatomically, the hip joint allows bipedal locomotion. It is therefore understandable that the greatest demands on the range of motion are put in the anterior-posterior direction. Kapandji (2008), in his publication, lists the possible range of lumbar motion to 140° flexion and 30° extension. The range of motion in this direction is also affected by the knee adjustment. With the knee flexed, the range of motion can rise to 150°. With the knee extended, the range of motion in the hip decreases, however it depends on the muscle shortening on the back of the thigh. Abduction and adduction reach approximately 45°, internal rotation 35–40° and outer 40–50° (Véle, 2006). Gúth (2016) reports the physiological range for intra-rotation and extra-rotation up to 45°.

Athletes often transfer relatively large force across the back to the limbs in repetitive specific motion patterns; this fact being one important aspect of the increase in painful back cases in this population (Almeida et al., 2012; Ong et al., 2003; Lundin et al., 2001). Okada et al. (2007) report about 35.4 % incidence of non-specific lumbar spinal pain (nsLBP) and up to 81.7 % lumbar radiolo-gical abnormality (LRA) in elite judokas. The incidence of LRA was lower in the lightweight category when compared to the middleweight and the heavyweight categories. By comparison, nsLBP is detected in wrestling with and without LRA occurrence at the 40 or 44 % (Iwai et al., 2004). In non-combative sports such as golf and tennis, where rotation movements in the hip are very common, the incidence of nsLBP is very similar to judo and wrestling (Harris-Hayes et al., 2009; Murray et al., 2009; Scholtes et al., 2009; Van Dillen et al., 2008; Vad et al., 2004; Vad et al., 2003). Harris-Hayes et al. (2009) and Vad et al. (2004) report that athletes who use repeated lumbar rotations with varying motion amplitudes are more prone to back pain. The limited range of motion in the hip joint can be compensated for by the lumbar hypermobility of the spine, resulting in overloading (Štefanovský et al., 2012; Van Dillen et al., 2008, 2007). Given the findings, we assumed that judokas with unspecified pain in the lumbar spine would present smaller range of motion in the hip joint compared to the control group.

SAMPLE

Research group was composed of 17 judokas, including 9 males and 8 females (average age 18.65 ± 2.83 years, average body height 171.18 ± 8.02 cm and average body weight 64.06 ± 11.00 kg) were divided into groups based on their anamnesis: group (n = 8) with lumbar spine pain for more than 6 months (nsLBP) and control group (n = 9) without pain (CG).

METHODS

All probands were informed about the research and voluntarily signed a consent to participate. The criteria for inclusion in the research were as follows: at least 5 years' experience in judo training, training at least 90 minutes per day and 5 times per week, participation in domestic and international competitions and either free of unspecified lumbar spine pain or experiencing pain for at least 6 months. The study design was approved by the local ethics committee.

Testing procedure: Mobility testing was performed by an experienced physiotherapist, a National Sports Centre employee, with more than ten years of experience, using a Baseline goniometer (Made in USA). At the beginning of the research, each proband was interviewed to determine the performance level, the incidence of unspecified pain in the lumbar spine, and afterwards their basic anthropocentric characteristics were measured. The probands were then divided into nsLBP and CG. We tested the active and passive extra- and intra-rotation in the lumbar joint in both limbs. The proband took up the position on the back on the massage table. The knee joint was bent 90° and overhanging the edge of the table so that the tested limb was relaxed. The examiner marked the center point on the right and left patella. The assistant fixed the proband´s pelvis in the correct position so that they touched the table with the lumbar portion of their back to avoid bending and turning the pelvis to the right or left.

Firstly, the measurement of the active extra-rotation of the right and left lower extremities took place. The physiotherapist put the midpoint of the goniometer to the indicated midpoint on the patella and determined the zero point of the overhanging limb of the proband while orienting themselves based on the horizontal position of the table so that the goniometer arms formed a 90° angle at the start of the measurement. The assistant fixed the pelvis to secure that the proband did not lift the limb or change the angle in the flexion of the knee joint at the extreme position of the movement. The proband moved the shank in an inward direction to the point where they were no longer able to continue the movement. The physiotherapist moved the end of the goniometer that follows the centreline of the tibia from the patella. The other end of the gauge remained in a horizontal position, parallel to the table. In the extreme, final position of the shank, the angle of the active extra-rotation was measured.

Secondly, we measured the active intra-rotation. Proband returned the shank to the starting position and then moved it to the outermost position when they were no longer able to continue the movement. In the final position, the examiner determined the angle of active intra-rotation.

Thirdly, the passive extra-rotation was measured. It was different compared to the active rotation, in that the desk-side assistant held the proband's ankle and pulled it towards themselves to the innermost position. In doing so, they made sure that they fixed the proband´s pelvis with their hand, and that the angle in the knee joint was always 90°.

Lastly, we measured passive intra-rotation. An assistant standing on the side of the table held the proband´s ankle and pulled it toward them to the outermost position. The angle in the knee joint had to be constantly 90° and the pelvis was constantly fixed.

Data analysis: The measured data were evaluated using a non-parametric Mann-Whitney U-test followed by a Cohen´s d calculation, with d < 0.2 being small, 0.2–0.8 medium, and > 0.8 large effect. The critical value for n = 8 and 9 for the U-test is 15 ($p \leq 0.05$). Calculations were made with SPSS 20.0 for Windows (Made in Chicago, Illinois, USA). Statistical significance was assessed at 5 % level.

RESULTS

In the active extra-rotation of right lower limb (table 1) there were no significant differences (U = 27.5, d = 0.130) between the lumbar spine pain group (nsLBP): 25.25 ± 4.71° and the control group (CG): 25.78 ± 3.38°. No significant differences between groups (table 1) were determined also with active extra-rotation of left lower limb (nsLBP 24.13 ± 4.09° vs. CG 23.78 ± 5.02°; U = 35.5; d = 0.076).

In active intra-rotation of the right lower limb (table 1), the nsLBP group achieved an average of 21.25 ± 9° and the control group achieved 22.44 ± 7.54°. The differences determined were not statistically and substantively significant (U = 33.0; d = 0.144). In the active intra-rotation of the left lower limb (table 1) we recorded an average value of 21.50 ± 6° in the nsLBP group, which is 3.61 degrees lower hip mobility compared to CG (25.11 ± 5.28°). The difference is not statistically significant (U = 20.5). Cohen´s *d* value indicates strong substantive significance (d = 0.626).

Differences in the passive right lower limb extra-rotation (table 2) between nsLBP (35.25 ± 5.28°) and CG (32.67 ± 7.53°) were shown to be statistically insignificant (U = 29) with moderate substantive significance (d = 0.403). In passive left lower limb extra-rotation (table 2), we recorded 33.75 ± 4.37° in the nsLBP group and 34.33 ± 5.20° in the control group. These differences are statistically and substantively insignificant (U = 31.5; d = 0.121).

Differences in passive intra-rotation of right lower limb (table 2) between nsLBP (32.25 ± 11.06°) and CG (33.11 ± 8.18°) were statistically and substantively insignificant (U = 35; d = 0.089). In passive left lower limb intra-rotation (table 2), we

Table 1 Active extra- and intra-rotation in the hip joint

Type of rotation	nsLBP	CG	U-test	Cohen´s *d*
Active extra-rotation right lower limb	25.25 ± 4.71	25.78 ± 3.38	27.5	0.130
Active extra-rotation left lower limb	24.13 ± 4.09	23.78 ± 5.02	35.5	0.076
Active intra-rotation right lower limb	21.25 ± 9	22.44 ± 7.54	33.0	0.144
Active intra-rotation left lower limb	21.50 ± 6	25.11 ± 5.28	20.5	**0.626**

Active extra- and intra-hip rotation; nsLBP – an experimental group with unspecified lumbar spine pain; CG – control group without pain, U-test – no statistical significance observed, Cohen´s d – substantive significance

Table 2 Passive extra- and intra-rotation in the hip joint

Type of rotation	nsLBP	CG	U-test	Cohen´s *d*
Passive extra-rotation right lower limb	35.25 ±5.28	32.67 ±7.53	29.0	**0.403**
Passive extra-rotation left lower limb	33.75 ±4.37	34.33 ±5.20	31.5	0.121
Passive intra-rotation right lower limb	32.25 ±11.06	33.11 ±8.18	35.0	0.089
Passive intra-rotation left lower limb	30.25 ±12.30	33.78 ±5.52	26.0	**0.395**

Passive extra- and intra-hip rotation; nsLBP – the experimental group with unspecified lumbar spine pain; CG – the control group without pain, U-test – no statistical significance, Cohen´s d – substantive significance

measured 30.25 ± 12.30° in the nsLBP group and 33.78 ± 5.52° in the control group. These differences are also statistically insignificant (U = 26) but with moderate substantive significance (d = 0.395). We can conclude that the measured values of passive intra-rotation of right and left lower limb in the nsLBP group were considerably dispersed, indicated by both standard deviations (11.06 and 12.30, respectively).

DISCUSSION

The aim of this study was to compare the active and passive extra and intra-rotation in the hip joint in the group of judokas with unspecified lumbar spine pain and in the group with no lumbar spine pain. Statistically, we did not confirm any differences between the groups and thus we did not confirm the reduced range of motion in the hip joint in the experimental group. Almedia et al. 2012 determined that judokas in the nsLBP group showed significantly reduced active and passive intra-rotation ($p \leq 0.001$) and total active and passive rotation ($p \leq 0.01$) of non-dominant lower limb, whilst there were no significant differences in the control group. The authors concluded that there was a relationship between the range of motion of the hip joint and the pain in the lumbar spine and that the experimental lumbar spine pain group showed greater asymmetry between the limbs. This is the only known study that has been done on a sample of judokas. Although we did not determine significant differences between groups, we can conclude that mainly in the case of active intra-rotation of the left lower limb (d = 0.626) and partly also the passive extra-rotation of the right lower limb (d = 0.403) and passive intra-rotation of the left lower limb (d = 0.395) there was observed moderate substantive significance, which suggests a possible association between lumbar pain and the limited range of motion in the hip joint in our probands. We can also conclude that the recorded values of extra-rotation and intra-rotation, either passive or active, are lower for both groups than those reported (Gúth, 2016; Véle, 2006) for the general population. Almeida et al. (2012) determined 27.5 ± 6.5° range of motion in judokas with back pain in the active intra-rotation of the non-dominant lower limb and 38.2 ± 6.5° in the control group. In our measurement, it was 21.5 ± 6° in the group with lower back pain and 25.11 ± 5.28° in the pain-free group. In passive intra-rotation, Almedia et al. (2002) determined 41.9 ± 6.1° in the dominant limb in the lower back pain group and 46.1 ± 8.4° in the control group. In passive intra-rotation of the dominant limb, we observed 32.25 ± 11.06° in the lower back pain group and 33.11 ± 8.18° in the pain-free group. These are significant differences, probably resulting from a different measurement methodology. Another study by Verall et al. (2007) showed that athletes with lower range of motion in the hip joint had a significantly higher predisposition to groin injuries, which can also lead to back pain, as a movement stereotype changes due to injuries and pain, which migth have a negative impact on the overall condition and condition of the spine. Likewise, Shum et al. (2005) noted reduced mobility in the hip joint in persons with lower back pain, and coordination between the spine and hip joints is generally impaired. Vad (2004) stated that there was a positive correlation between the reduced range of motion of the hip joint and the lumbar spine of professional golfers with a previous history of back pain. Back pain subjects exhibited a significant reduction in the spine range of motion in all directions. Wong et. al. (2004) reported the association of back pain with a decrease in hip flexion but not with hip movements in other directions. There was also a significant difference in the speed of movement in the lumbar spine between pain and pain-free groups. Another finding of this work was that back pain and reduced range of motion caused a significant increase in the time needed to complete torso movement. On the other hand, after a meta-analysis of 124 scientific articles from PubMed and EMBASE databases on the hip joint range of motion associated with lower back pain (LBP) Sadeghisani et.al. (2015) found that none of the studies explicitly mentioned a limited range of motion in the hip joint associated with lower spine pain, however there was recommended to include an examination of the range of motion in the hip joint in patients with lumbar spine pain.

The limitation of our work is that lumbar spine pain of our probands lasted for more than 6 months, but less than 1 year, while in other studies, similar research was performed on probands whose lumber pain persisted for at least 12 months, which in our case may have affected the fact that the hypothesis of the existence of a relationship between the reduced range of motion in the hip joint and the lumbar spine pain was not confirmed. Further research is required in sports with a similar performance structure, where rotation motion in the hip joint is often used, providing that lumbar spine pain in test subjects lasts for 12 months or more. Reduced hip mobility in both of our groups calls for further research that would compare hip mobility in a sporting and non-sporting population.

CONCLUSION

In our work we did not confirm the relationship between lumbar spine pain and the range of motion in the hip joint, as is the case with most similar researches. However, in view of some controversial results of the studies presented, further research with a more rigorous testing methodology is required. The probands in both our groups showed a lower range of motion in the hip joint compared to the general population, therefore judo coaches need to pay more attention to the development of hip mobility, which is a limiting factor to carrying out some techniques (eg Uchi-mata).

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