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Annals of Biological Research, 2011, 2 (6):79-83
(http://scholarsresearchlibrary.com/archive.html)

Annals of Biological Research
Scholars Research Library
ISSN 0976-1233
CODEN (USA): ABRNBW

Comparison of Flexibility of Pelvic and Femoral Muscles in Futsal, Weightlifting and Swimming

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ABSTRACT

Flexibility of muscles is considered as a factor preventing sport injuries. The purpose of this research was to examine the effect of three sports, namely futsal, weightlifting, and swimming, on flexibility of pelvic and hip muscles in order to determine the relationship between the types of sports and flexibility of muscles under evaluation. 75 male athletes, 25 subjects for each sport with average 23.18 years old were evaluated. The data were collected by means of filling out questionnaires and by measuring the flexibility of 12 muscles on both sides of pelvic and femoral area. Data were analyzed by student's t-test. The results revealed a significant difference of iliopsoas and abductor longus muscles flexibility in swimmers, while a significant difference of quadriceps and hamstring muscles flexibility in weightlifters and a significant difference of tensor fasciae latae and piriformis muscles flexibility in futsal players. In each sport, a group of muscles, selectively, gain more flexibility than other muscles; thus, in order to prevent sport injuries, we must pay attention to all muscles and separately, stretch them in sport exercises.

Key words: Flexibility, pelvic, femoral, muscles.

INTODUCTION

Most sport activities require degrees of relative flexibility. Some sports like gymnastics, ballet diving, and karate need more flexibility for better performance. An athlete with limited range of motion, performance capabilities will decline [4]. For instance, an athlete with tight and inelastic hamstring will experience reduction of speed, since hamstring restrains the hip joint's ability to bend and subsequently, the length of steps decreases. Lack of flexibility can lead to uncoordinated and inharmonious movements [16]. Proper flexibility and stretching movements can prevent delayed onset muscle soreness after a strenuous sport activity [15]. Moreover,

shortness of pelvic and femoral muscles can affect the skeletal system and damage it. The hamstring muscles are important contributors to the control of human movement and are involved in a wide range of activities from running and jumping to forward bending during sitting or standing and a range of postural control actions. Hamstring muscle strains are the most common muscle injuries in athletes [4]. The proposed etiology includes insufficient flexibility, strength (force-generating capacity) impairment or imbalance, and dyssynergic contraction that can place excessive strain on the hamstring muscles [1]. Static stretching of the hamstring muscles, to maintain flexibility and improve performance, [1, 6] has been proposed as a proactive and preventive strategy and is now in common use. Studies with collegiate football players [8] and military basic trainees [7, 16] document the success of this strategy in reducing the rates of lower-extremity injuries. Reduced hamstring muscle flexibility has been implicate in lumbar spine dysfunction, with a number of studies [2, 5] showing a strong positive correlation between decreased hamstring flexibility and low back pain. Other researchers [5, 14] have suggested that hamstring muscle function in a variety of movements is part of a coordinated motor program and thus the appropriate periods of lengthening and shortening and perhaps even the degree of lengthening itself may be a learned part of the motor control process. According to Li, hamstring shortness reduces lumbar lordosis in standing posture [18]. Howell (1984), in his study on 17 female rowers, observed that by instructing muscle stretching exercises, the possibility of back pain decreases [9]. In the research of Stevenson et al. (2001) which was carried out on factory workers, it was proven that flexibility of muscles generally influential on chronic back pain [17]. Moreover, according to the research of Medeiros, muscle stretching techniques increase hip range of motion which can be effective in performing sport activities [15]. Considering the importance of muscle flexibility in prevention of sport injuries, the objective of this research is to examine the flexibility of certain muscle groups in pelvis and lower limbs in futsal, weightlifting, and swimming; all these sports are followed by the activity of lower limbs in various forms. By examining these muscles, it is revealed which sport has the ability to affect the flexibility of each muscle. Furthermore, by identifying the muscles that have less flexibility in each of these sports, we can include the improvement of their flexibility in athletes' program in order to prevent possible sport injuries. In this case, considering the biomechanical properties of muscles in each type of sport, we can provide background knowledge for the athletes.

MATERIALS AND METHODS

This research was an analytical study that examines flexibility of certain pelvic and femoral muscles in futsal, weightlifting, and swimming. Sampling was random and sample size was specified based on consultation with statistics specialists. After referring to physical education organization of the province and identifying specific futsal, weightlifting and swimming sport clubs, we selected and evaluated 25 athletes who had been for two years active in those sports. Athletes were all male, their age were more than 20 (with average 23.18 years), and performed at least three exercise sessions a week, each session lasting for an hour or more. Using goniometer, flexibility of 6 muscles on left and right side was measured. The muscles that were evaluated were quadriceps, piriformis, tensor fasciae latae, abductor longus, iliopsoas, and hamstring. The reason behind choosing these muscles was based on their significance in performing hip joint movements and their effect on lumbosacral area. The method of measuring the flexibility of

these muscles is based on Janda approach and is as follows [13]; it has been repeated three times for each muscle and their average has been recorded:

1. Piriformis muscle (Pyramidalis)
Measuring flexibility: Subject lies on his stomach and bends his knee up to 90°. The center of the goniometer is positioned on the tuberosity of tibia. One arm of the goniometer is set along the vertical and the other is set along the shin. Then, while holding the thigh fixed with one hand, we ask the subject to move his shin outward; in this state, we read the angle between the vertical and the shin. The more the angle is, the more is flexibility.

2. Tensor Fasciae Latae Muscle
Measuring flexibility: Subject lies in a supine position on the bed in a way that his pelvis is near the end of the bed and with both legs hanging from the bed. Then the subject pulls his opposite leg toward his stomach as much as possible. In this position, the center of the goniometer is positioned on subject's anterior superior iliac spine (ASIS), an arm of the goniometer is set along the horizontal and the other arm is set along the femur and there will be an angle between the two arms. The more the angle is, the more is flexibility.

3. Iliopsoas Muscle (Iliacus Muscle)
Measuring flexibility: Subject lies in a supine position on the bed in a way that his pelvis is on the verge of the bed and with both legs hanging from it. Then the subject pulls his opposite leg toward his stomach as much as possible. In this position, the center of the goniometer is positioned on subject's greater trochanter; one arm of the goniometer is set along the femur and the other arm along trunk level. The more the angle is, the more is flexibility.

4. Hamstring
Measuring flexibility: Subject lies in a supine position on the bed. He is then asked to lift his leg with straight knee to the point of significant stretching pain. In this state, the center of the goniometer is set on subject's greater trochanter; one arm of the goniometer is set along the femur and the other arm along trunk level. The more the angle is, the more is flexibility.

RESULTS

Considering the data, average flexibility of the examined muscles in the three athletic fields, that is futsal, weightlifting, and swimming, was obtained.

Table 1. Flexibility of pelvic and femoral muscles in futsal

Direction	Right (Degrees)	Left (Degrees)
Muscle Flexibility	**Average±Standard Deviation**	**Average±Standard Deviation**
Quadriceps	23.14±3.16	22.56±2.22
Piriformis	50.11±5.85	51.66±6.51
Tensor Fasciae Latae	19.78±2.36	20.75±2.89
Abductor Longus	78.39±6.93	81.02±5.06
Iliopsoas	51.23±4.55	50.29±3.94
Hamstring	48.85±4.11	48.30±4.26

Table 2. Flexibility of pelvic and femoral muscles in weightlifting

Direction	Right (Degrees)	Left (Degrees)
Muscle Flexibility	**Average±Standard Deviation**	**Average±Standard Deviation**
Quadriceps	25.41±2.71	24.71±2.54
Piriformis	47.62±5.92	48.02±5.12
Tensor Fasciae Latae	17.17±1.98	16.82±2.01
Abductor Longus	82.52±6.88	81.70±5.17
Iliopsoas	50.05±4.21	49.11±3.55
Hamstring	50.71±4.46	49.71±4.77

Table 3. Flexibility of pelvic and femoral muscles in swimming

Direction	Right (Degrees)	Left (Degrees)
Muscle Flexibility	**Average±Standard Deviation**	**Average±Standard Deviation**
Quadriceps	20.39±1.97	23.21±3.05
Piriformis	49.15±5.67	46.39±6.38
Tensor Fasciae Latae	17.19±2.16	17.56±3.24
Abductor Longus	76.43±6.09	79.77±4.85
Iliopsoas	53.67±3.90	52.28±3.41
Hamstring	52.87±3.68	52.25±5.26

The average flexibility of iliopsoas and abductor longus muscles is significantly more in swimmers than in the other two sports, while the average flexibility of quadriceps and hamstring is more in weightlifters and the average flexibility of tensor fasciae latae and piriformis muscles is more in futsal players with a significant difference in both right and left legs.

DSCUSSION

By examining the results, we found that muscles which are responsible for rotation movements in hip joint are more flexible in futsal players (tensor fasciae latae and piriformis), while the quadriceps and abductor longus muscles are more flexible in weightlifters. Moreover, iliopsoas and hamstring are more flexible in swimmers. In a similar research that Harvey carried out on four types of sports, namely track and field, basketball, yachting, and tennis, he concluded that flexibility of iliopsoas in track and field and basketball is more in comparison with yachting and tennis, where the flexibility of the non-preferred leg was revealed to be more than that of the preferred leg.

CONCLUSION

In the present research, the preferred leg that is the right leg in futsal and swimming has shown less flexibility than the left leg. But in weightlifters, flexibility of the left leg is less and not similar to other sports. The reason for such a difference may be the techniques performed by the athletes of this sport. Although the flexibility of iliopsoas is more in swimmers than in the athletes of the other two sports, generally the flexibility of iliopsoas in all of these three sports is more in comparison with sports studied by Harvey [7]. The average flexibility of quadriceps in weightlifters was consistent with Harvey's results, but in futsal players and swimmers was less than the sports studied by Harvey. Flexibility of tensor fasciae latae too was more in futsal than in other sports; yet in Harvey's research, in all the fields studied, its flexibility was identical and

the flexibility of iliopsoas muscle in all these three sports is more than that of Harvey's research. We compared this research with Harvey's just because it reveals that different sports have different effects on biomechanical conditions of muscles and this notion must be taken into consideration in sport exercises and in each type of sport, considering shortness or tension of muscles, there must be preparatory and flexibility exercise plans for athletes not only to improve their performance, but also to prevent possible sport injuries [7].

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