

Squat Winnowing: Cause of Meniscus Injuries in Non-Athletic Females

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Abstract

Background: Sports activities were thought to be the major cause of meniscus injury in both men and woman, but our observations of non-athletic females show that the cause of meniscus injury was unrelated to any type of sports activity.

Objectives: This study revealed squat winnowing to be a major cause of meniscus injury in non-athletic females.

Patients and Methods: This retrospective study was conducted in a tertiary care orthopaedic hospital which caters to a population of 10 million people. We assessed 120 non-athletic females who had received treatment in our hospital over a period of 2 years. The most probable cause of knee injury, per initial patient history, was recorded for all non-athletic females who presented clinical signs and symptoms of meniscus injury. The diagnoses were confirmed by relevant MRI and arthroscopy of patients' knees. All females who engaged in athletic activity and other females with unrelated, non-traumatic knee pathologies were excluded from the study.

Results: Through our study, we found that 42% (n = 50) of females suffered an injury during squat winnowing of rice, either at home or at work. Another 29% (n = 35) of females cited a history of slipping and spraining their knee as a cause of knee injury, while 19% (n = 16) of females suffered a knee injury during complex accidents such as a traffic accident. Finally, 13% (n = 16) of the females had no definite history of knee injury.

Conclusions: Our observations add to the knowledge base of the various causes of meniscus tears; this study also revealed that socio-cultural factors influence and contribute to the mechanism of various types of knee injury.

Keywords: Meniscus Injury, Squat Winnowing, Non-Athletic Females

1. Background

Agriculture ranks among the most hazardous industries. Farmers run a very high risk of fatal and non-fatal injuries alike; farming is one of the few industries in which family members (who often share the work and live on the premises) are also at risk for fatal and non-fatal injuries (NIOSH 2013) (1). A study by Ghosh investigated that the physical demand required for farm work ranges from moderate to heavy; it often includes standing, squatting, bending, reaching, carrying heavy loads, and working for long hours. Any of these may present certain hazards for the worker. Thus, the health of agricultural workers is always at risk. Women continue to use traditional tools for their work (1). Long work hours, continuous attention, precision, variety of work, extreme posture, and poor nutrition and health seem to indicate that farmers are under major physical stress.

Joints held in an awkward posture for a long hour is an unavoidable state of affairs in the agriculture industry, households, or in animal care jobs. This is a major reason for the increase in probable episodes of joint problems. According to Bridger the ability of the muscles to protect

the joints against external forces is degraded and the joint itself is more easily damaged when the limb is exposed to great force (2, 3).

The job of rice winnowing at home or at work, which has been the cause for many musculoskeletal and knee problems in these people, is much the same. Winnowing rice has existed as an occupation for ages and mankind has adopted many traditional ways to go about the task. Some perform it manually, while others take a partial manual and partial machinery approach. Different people in different parts of the globe winnow rice in their own traditional ways, such as those who do it with a squatting posture. Our females traditionally carry out the winnowing of rice and other agricultural products while squatting since olden times. These people often injure their knees during this process, and based on our observations, we have found rice winnowing to be the most common cause of knee pain and meniscus injury in these females. Patients presented a long history of knee pain, including the locking and recurrent effusions of the affected knee. In their prospective study,

Baker et al. (4) mentioned that hospital treated meniscus injuries indicated an association with prolonged kneeling or squatting at work, along with several other occupational activities. Because long-term results after major meniscectomy were generally disappointing, a more conservative clinical approach to the management of meniscus tears has developed over the past two decades (2, 5, 6).

2. Objectives

We aimed to study various causes of meniscus injuries in nonathletic females in Kashmir.

3. Patients and Methods

This retrospective study was conducted in a tertiary orthopaedic center. The data of all meniscus injury patients received or operated on in this hospital over the last two years were collected for analysis. All patients with a history of sports-related injuries, and all male patients, were excluded from the study. All non-athletic females with a diagnosis of either medial or lateral meniscus injury were included in this study. The pre-existing detailed histories and physical examinations were analyzed. The diagnosis of meniscus injury was confirmed by MRI and subsequent arthroscopy of the knee. Meniscus signals shown by MRI have four grades: 0, uniformly low-signal

intensity (normal meniscus); 1, irregular increases in intrameniscal signal; 2, linear increased signal patterns not extending to the superior or inferior meniscal surface (the clinical importance of this type of change in the meniscal structure, as seen via MRI, is not well understood even today); 3, the abnormal signal extends to the articular surface. While grades 0 - 2 have no surgical significance, grade 3 is visible by arthroscopy and represents a meniscal tear (7). We included only those patients with a grade 3 meniscus tear, which were confirmed later by arthroscopy.

4. Results

We studied 120 non-athletic female patients with meniscus injuries presenting over the past 2 years in our hospital. Our results found that 42% (n = 50) of females suffered an injury while in a squatting position during rice winnowing, either at home or at work. Also, 29% (n = 35) of the females mentioned a history of slipping and spraining the knee as a cause of knee injury, while another 19% (n = 16) injured their knees from a complex knee injury, such as one sustained from a vehicular accident. Finally, 13% (n = 16) of the females presented no definite history of knee injury (Table 1). The right knee was involved more often (n = 35) than the left knee (n = 15). The number and distribution of meniscus injuries are shown in Table 2.

Table 1. Causes of Meniscus Injury^a

Activity	No. of Patients	Percentage	Age Group	BMI
Squat Winnowing	50	42	34 ± 8.2	21.3 ± 4.2
Knee Sprain	35	29	28 ± 6.4	19.2 ± 2.7
Complex knee Trauma	19	16	37 ± 15.3	20.3 ± 1.9
No Definite Trauma	16	13	35 ± 7.2	25 ± 3.7
Total	120	100		

^aData are presented as mean ± SD.

Table 2. Distribution of Meniscus Injury^a

Activity	No. of Patients	Medial Meniscus Injury	Lateral Meniscus Injury
Squat Winnowing	50	42	8
Knee Sprain	35	32	3
Complex Knee Trauma	19	13	6
No Definite Trauma	16	12	4
Total	120	99 (84)	21 (16)

^aData are presented as No.(%).

5. Discussion

Kashmir is regarded as the state of farmers. Approximately 74% of the population is involved directly or indirectly with farming. Meniscus injuries are common worldwide and are on the rise due to the increased involvement of people in sports activities. While the incidence of meniscus injuries is well known in athletes, its incidence in the non-athletic female population is high in this part of world owing to cultural and traditional habits.

5.1. Mechanism of Injury

Menisci can be torn during innocuous activities, such as walking or squatting. The traumatic action is most often a twisting movement at the knee while the leg is bent. This is the typical posture our females adopt during rice winnowing in a squatting position. They squat (hyperflexion of knee), hold the winnower with both hands full of rice, and then throw the rice up into the air, allowing the air to separate the husk from the rice during its fall. In this process, the weight of the rice and the force used to throw it into the air generates lot of stress to the knees. While winnowing, these female workers often twist their knees. Patients first present with recurring pain, locking and effusions of the knee when they start seeking medical advice. The medial meniscus is torn more often than the lateral meniscus, since the medial meniscus is less mobile. Sometimes, when going from a squatting position to standing, the menisci gets caught between the femoral and tibial condyles, developing a tear in the medial meniscus.

In this study, the mean BMI of patients was higher in the meniscus injury group where squatting or no definite trauma was cited as the cause of injury. The right knee was involved more ($n = 35$) than the left knee ($n = 15$). We presume this is due to traditional habits. The age group of patients had little observable effect on the mechanism as most were in a single range; however, the mean age group among those with sprains was lower. The age group of the female population used for this study when compared to other studies is lower. We presume that most of our females are involved in traditional and cultural habits that predispose them to knee stress, whereas in other studies, either athletic, degenerative, or generalized trauma had all been studied. Also, women in this part of world are less exposed to athletic activities because of religious restrictions. The RTA is also less frequent and women are usually not using two-wheelers for transportation. A high percentage (42%) of people in our study experienced a meniscus injury due to winnowing, as women farmers suffer from multiple musculoskeletal problems that are caused by overuse or misuse of muscles that significantly impair their activities for daily living (8). The knee injuries in non-athletic household females is primarily due to extreme postures such as kneeling and squatting for long hours at home and on

the farm (4). Other postures, like bending and twisting while squatting also affect the knees. The adult meniscus is avascular in the inner two-thirds (9). Meniscal injury may be the most common knee problem that women farmers are bound to be exposed to as a result of extreme postures (10), lifting loads, and long hours of winnowing rice at fields or at home. According to the United States National Library of Medicine (11), isolated medial meniscus tears occur more frequently than any other tear. Traumatic lesions of the menisci are commonly produced via rotation while the flexed knee moves toward an extended position. The most common location for injury is the posterior horn of the meniscus, where longitudinal tears are the most common type of injury. A meniscus is usually torn due to a rotational force incurred while the joint is partially flexed, which is the posture these female farmers adopt while squatting and winnowing. During vigorous internal rotation of the femur on the tibia with the knee in a squatting posture while throwing rice up and down in the winnower, the femur tends to force the medial meniscus posteriorly and towards the center of the joint. If the peripheral attachment of the menisci are torn or stretched, the posterior part of the meniscus is forced toward the center of the joint and is caught between the femur and tibia. This results in a longitudinal tear when the knee is suddenly extended.

The prevalence of meniscus tears is the same in both knees. In a few different studies, the BMI of a person was shown to have a greater effect on the frequency of meniscus tears. This is because having a higher BMI results in more weight on the joints, which can cause misalignment of the knee that, in turn, causes more weight on the muscles and results in an easier tear. The same was observed in our study. In 2008, the U.S. Department of Health and Human Services reported a combined total of 2,295 discharges with a principal diagnosis being a tear in the lateral cartilage/meniscus (836.0), a tear in the medial cartilage/meniscus (836.1), and a tear in the cartilage/meniscus (836.2). Females comprised a total of 53.49% of discharges, while males made up 45.72%. Individuals between the ages of 45 - 68 comprised approximately 31.73% of discharges, followed by the 65 - 84 age group with 28.82% of discharges (12). In 1948, Fairbank (13) described radiographic changes following total meniscectomies.

Suthar et al. (8) noted that 56.67% of female farmers had pain in their thighs, and a large segment (63.33%) reported pain in their calf muscles due to various household and farm chores.

Preventing these injuries is a big challenge for policy makers, as it is difficult to convince uninformed individuals about preventative measures and teach them alternative ways to winnow. However, a mass campaign targeting farmers could be held to educate them. The proverb, "When a king sits on his throne to judge, he winnows out all evil with his eyes," rings true, but is practically impossible to follow. Winnowing rice with the wind's help, or using winnowing fans on farms are both possible alterna-

tives. At home, women should be advised to sit on a support placed under the buttocks and keep their knees extended while doing so. Also, they should be discouraged from keeping their right knee fully flexed and upright when holding the winnowing basket and while removing the husk. Thorough examination of the knee joint is of utmost importance and a high index of suspicion is required while dealing with the farmer population, as the actual prevalence of such a condition may be high.

It is an unfortunate reality that working rural women suffer from multiple musculoskeletal problems that significantly impair their daily life activities. In the home and farm, women perform tasks while sitting, standing, squatting, bending, twisting, and engaging in awkward postures during prolonged working hours and with inadequate rest. These facts are associated with the occurrence of serious musculoskeletal disorders. We have found that winnowing in a squatting position for repeated and extended periods has been a major cause of chronic knee pain in our female population. The symptom complex comprises a typical working non-athletic female with chronic, low-grade knee pain and a history of recurrent knee swellings and locking following an acute injury to the knee from winnowing rice in a squatting position. Further studies with proper randomization should be conducted in the countries where farming is prominent in order to draw definitive conclusions.

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Footnote

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tation of data: Dr. Younis Kamal, Dr. Munir Farooq, and Naseemul Gani; drafting of the manuscript: Dr. Naseemul Gani, Dr. Younis Kamal, Dr. Hayat Ahmad Khan, Dr. Snobar Gul, and Dr. Irfan Ahmad Latoo; critical revision of the manuscript for important intellectual content: Dr. Munir Farooq; statistical analysis: Dr. Snobar Gul, Dr. Younis Kamal, and Dr. Hayat Ahmad Khan.

References

1. Ghosh J. *Uncovering Women's Work*. 2007. Available from: <http://infochangeindia.org/agenda/women-a-work/uncoverinfochangeindia.org/agenda/women-a-work/uncover>.
2. Bridger RS. *Introduction to Ergonomics*. London: Taylor and Francis; 2008.
3. Clark CR, Ogden JA. Development of the menisci of the human knee joint. Morphological changes and their potential role in childhood meniscal injury. *J Bone Joint Surg Am*. 1983;**65**(4):538-47. [PubMed: 6833331]
4. Baker P, Coggon D, Reading I, Barrett D, McLaren M, Cooper C. Sports injury, occupational physical activity, joint laxity, and meniscal damage. *J Rheumatol*. 2002;**29**(3):557-63. [PubMed: 11908573]
5. NIOSH. *Agricultural Safety. Official Home Page of Centre for Disease Control and Prevention*. 2013. Available from: <http://www.cdc.gov/niosh/topics/aginjury/>.
6. Krause WR, Pope MH, Johnson RJ, Wilder DG. Mechanical changes in the knee after meniscectomy. *J Bone Joint Surg Am*. 1976;**58**(5):599-604. [PubMed: 946970]
7. Barronian AD, Zoltan JD, Bucon KA. Magnetic resonance imaging of the knee: Correlation with arthroscopy. *Arthroscopy*. 5(3):187-91. doi:10.1016/0749-8063(89)90169-2. [PubMed: 2775391]
8. Suthar N, Kaushik V. Musculoskeletal problems among agricultural female workers. *Stud Home Com Sci*. 2013;**7**(3):145-149.
9. Arnoczky SP, Warren RF. Microvasculature of the human meniscus. *Am J Sports Med*. 1982;**10**(2):90-5. [PubMed: 7081532]
10. Duncan JB, Hunter R, Purnell M, Freeman J. Meniscal injuries associated with acute anterior cruciate ligament tears in alpine skiers. *Am J Sports Med*. 1995;**23**(2):170-2. [PubMed: 7778701]
11. NAS. *Musculoskeletal Disorders and the Workplace: Low Back and Upper Extremities*. Official Home Page of National Academy of Science, Washington DC: National Research Council. 2001.
12. *Knee Problems*. [May 2014]; Official Home Page of National Institute of Arthritis and Musculoskeletal and Skin Disease.
13. Fairbank TJ. Knee joint changes after meniscectomy. *J Bone Joint Surg Am*. 1948;**30**(4):664-70.