

# Knee function after a mean of 19 years Post-retirement in 65 Italian semi-professional rugby veterans.

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**Abstract.** *Background and aim:* sport activity has been largely correlated to the development of knee osteoarthritis, but only few papers have investigated the long-term impact of a rugby career on the knee joint. The aim of this retrospective study was to evaluate the incidence and epidemiology of knee osteoarthritis and general health in a population of 65 retired semi-professional rugby players. *Methods:* demographic and anamnestic analysis was recorded and Oxford Knee score, SF-12 and VAS were submitted to all veterans in order to assess current knee function, general health condition and level of pain. Parametric analysis of Spearman was used to evaluate the statistical significance on these results and the Kruskal-Wallis test was used to assess the significant differences between the questionnaire results and the demographic and anamnestic records. *Results:* we found that players who sustained a knee injury during their career have a current reduction of the knee function compared to veterans who did not suffer any injury and who showed values comparable with those of the health population. In terms of general and mental health, athletes who retired later have now a better condition than those who retired from the sport earlier. *Conclusions:* we concluded that knee injury prevention should be an unequivocal priority because although rugby is a high energy sport, it does not increase the risk of knee osteoarthritis in absence of serious knee injuries. ([www.actabiomedica.it](http://www.actabiomedica.it))

**Key words:** Osteoarthritis, sport injury, ACL, meniscus, rugby, age of retire, veterans, Oxford Knee Score, SF-12, VAS

## Introduction

Osteoarthritis is a degenerative joint disease that may cause anatomical alterations and decrease articular function (1). Generally, this pathology affects adults over the age of 60 years and its treatment could be challenging, especially in younger patients (1, 2, 3, 4).

Osteoarthritis can be a consequence of disproportion between the consistence of articular cartilage and

the pressure stresses to which it is subjected. For this reason, sport practice was largely associated to the development of osteoarthritis that is related to the type of sport practiced, level of activity, sustained injuries, joint conformation, muscle mass and body mass index (BMI) (5,6,7,8).

Joint injuries contribute to the occurrence of osteoarthritis with a particular incidence in the knee joint (5,9,10).

There are numerous epidemiological studies on the risk of developing osteoarthritis in many sports, particularly in soccer (11, 12, 13), while only few papers investigate how the rugby career affects the knee joint (14,15).

Rugby is a high energy contact sport (16) and because of lots of physical contacts, players of this sport suffer many musculoskeletal injuries particularly in the knee joint (17,18,19).

The aim of this study was to evaluate the incidence and epidemiology of knee osteoarthritis in a population of 65 retired semi-professional rugby players who played between the 1980s and 1990s and the early 2000s.

## Methods

This is a retrospective study investigating the general health and knee function of retired rugby players who played at least one season in a semi-professional Italian league (Serie A, Serie B) and/or at least one season in an European professional league (the Heineken cup) between years the 1980s and 1990s and the early 2000s. ([https://www.federugby.it/index.php?option=com\\_content&view=article&id=14739&Itemid=1096](https://www.federugby.it/index.php?option=com_content&view=article&id=14739&Itemid=1096)) (<https://epcrugby.it/>)

This study was performed in accordance with the ethical standards of the 1964 Declaration of Helsinki as revised in 2001 and an informed written consent was obtained from all veterans participating in the study.

All veterans were submitted to a demographic and anamnestic analysis of their career: age, weight, height, BMI, starting age of career, injuries suffered during the career, surgical procedures undergone during the career, retirement age, reason of retirement, educational level, any post retirement weight gain were recorded.

Oxford Knee Score was used for current knee functional assessment (OKS) (20), Short Form-12 (SF-12) divided into mental health (MENTALSF - 12) and physical health (PHYSICALSF - 12) was used to assess general health conditions (21), and the visual analogue scale (VAS) was used to evaluate the current level of physical pain (22).

A parametric analysis of Spearman was conducted to evaluate the statistical significance on these results and the analysis of Kruskal-Wallis was used to verify the significant differences between the mean value of each questionnaire according to the value of each recorded demographic and anamnestic variable. The statistical significance was set for  $p < 0.05$ .

All 65 veterans answered to the questionnaires at a mean time from retirement of  $18,77 \pm 10,65$  years; middle age at the time of investigation was  $51 \pm 8$  years with minimum of 32 years and maximum of 72 years.

## Results

The demographic characteristics of the interviewed rugby veterans are reported in the table below (Table 1).

The mean career starting age was 11 years (min 3 – max 21), the mean age of retirement was 32 years (min 20 – max 43), mean career length was 21 years (min 8 – max 35) and the mean post-retirement weight gain was 6.4 Kg (min 8 – max 30).

8 out of 65 veterans started to play in the 1970s, 30 in the 1980s and 27 in the 1990s.

At their highest level, 2 veterans played in the Heineken Cup, 52 participated in Serie A and 11 in Serie B.

39 veterans played in the scrum and 26 played in back roles.

**Table 1.** Demographic characteristics of 65 veterans participating in the study.

Variables	Mean	Standard deviation	Median	Minimum	Maximum
Age	51.8	8.9	51.0	32.0	72.0
Weight	96.1	16.2	95.0	69.0	140.0
Height	1.80	0.07	1.8	1.65	1.97
BMI	29.0	5.4	28.4	0.0	39.2

During their career, 26 veterans did not suffer any knee injuries, 6 reported MCL lesion, 1 LCL lesion, 7 ACL lesion, 8 ACL lesion associated with meniscal lesion, 2 quadriceps lesion, 5 injuries due to chronic knee instability, 7 isolated meniscal lesion, 3 PCL lesion.

There were 4 MCL injuries in the 1980s and 2 in 1990s, 1 LCL tear in 80's, 4 ACL injuries in the 1980s and 3 in the 1990s, 1 PCL injury in the 1970s and 2 in the 1990s, 5 meniscal lesion in the 1980s and 2 in the 1990s, 1 combined meniscal lesion and ACL rupture, 3 in the 1980s and 4 in the 1990s, 2 quadriceps injuries in the 1990s, 2 injuries due to knee overload, 1 in the 1980s and 2 in the 1990s.

12 former rugby players underwent a surgical procedure of ACL reconstruction, 5 had a meniscectomy and 28 did not undergo any surgical procedure.

Fourteen veterans retired from sport for personal reasons, 21 for injuries, 15 for other professional careers and 15 for age limit.

The current mean weight for the veterans who had suffered a MCL lesion, LCL lesion, ACL lesion, PCL lesion, meniscal injury, concomitant ACL and meniscal injury, quadriceps injury and multi-ligament

knee injuries were:  $95.3\text{Kg} \pm 13.1\text{Kg}$ ,  $72.0\text{Kg} \pm 0.0\text{Kg}$ ,  $104.7\text{Kg} \pm 16.1\text{Kg}$ ,  $96.7\text{Kg} \pm 15.3\text{Kg}$ ,  $91.0\text{Kg} \pm 20.1\text{Kg}$ ,  $101.0\text{Kg} \pm 11.7\text{Kg}$ ,  $76.0\text{Kg} \pm 1.4\text{Kg}$ ,  $111.2\text{Kg} \pm 17.5\text{Kg}$ , respectively.

The current mean weight for veterans who had not suffered any career-related injury was  $93.3\text{Kg}$

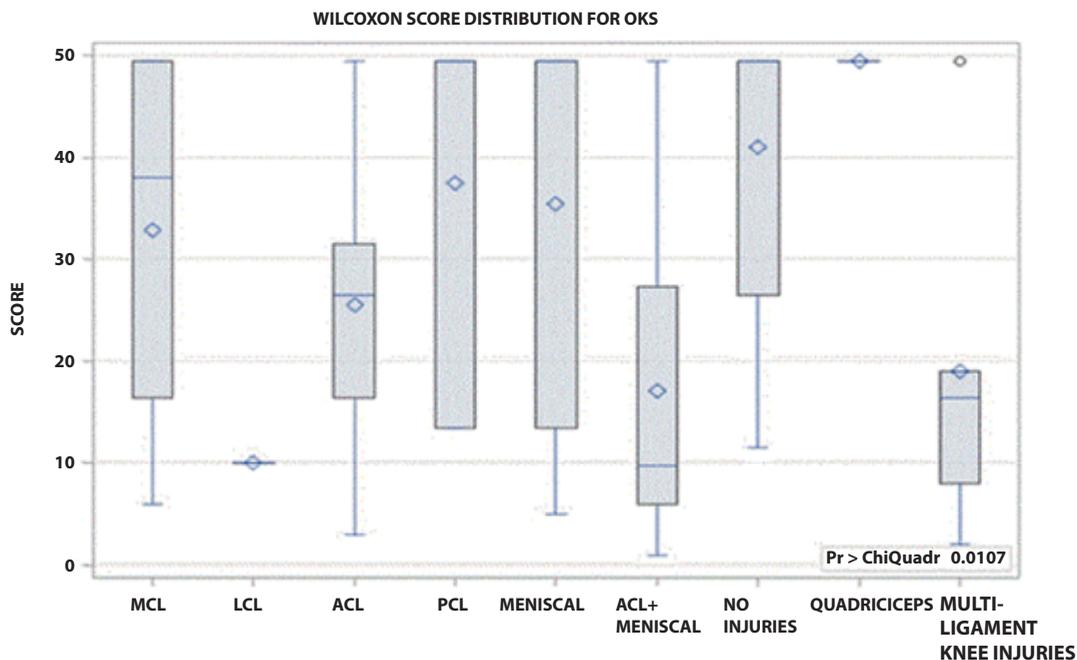
The correlation between current weight and type of career-related injury was statistically significant:  $p=0.0353$

Current OKS mean score in our population was  $43.8 \pm 5.8$ .

The current OKS mean score for the veterans who had suffered a MCL lesion, LCL lesion, ACL lesion, PCL lesion, meniscal injury, concomitant ACL and meniscal injury, quadriceps injury and multi-ligament knee injuries were:  $44.0 \pm 5.6$ ,  $37.0 \pm 0.0$ ,  $43.1 \pm 5.8$ ,  $45.3 \pm 4.6$ ,  $44.6 \pm 5.9$ ,  $37.8 \pm 8.4$ ,  $48.0 \pm 0.0$ ,  $38.8 \pm 7.6$ , respectively.

We observed the best current OKS values ( $46.5 \pm 2.7$ ) for veterans who had not sustained any injury during the career.

A statistical significance was found for the distribution of OKS values according to the type of injury ( $p= 0.0107$ ), as in Figure 1.



**Figure 1.** Shows the mean distribution of OKS value according to the different types of knee injuries suffered by veterans during their career

Current VAS mean score of our population was  $3.2 \pm 5.8$ .

The current VAS mean score for veterans who had suffered MCL lesion, LCL lesion, ACL lesion, PCL lesion, Meniscal injury, concomitant ACL and meniscal injury, quadriceps lesion and multi-ligament knee injuries were :  $4.0 \pm 2.6$ ,  $6.0 \pm 0.0$ ,  $3.1 \pm 2.5$ ,  $3.0 \pm 2.6$ ,  $3.7 \pm 3.1$ ,  $5.5 \pm 2.1$ ,  $2.0 \pm 0.0$ ,  $4.6 \pm 1.9$ , respectively.

VAS mean score for the veterans who had not suffered any injury was  $2.1 \pm 2.0$ .

A statistical significance was found for distribution of VAS values according to type of injury ( $p= 0.0211$ ), showed in Figure 2.

The current TOTSF – 12 mean values for veterans who had suffered MCL lesion, LCL lesion, ACL lesion, PCL lesion, Meniscal injury, concomitant ACL and meniscal injury, quadriceps lesion and multi-ligament knee injuries were respectively:  $83.3 \pm 9.0$ ,  $74.0 \pm 0.0$ ,  $86.4 \pm 3.2$ ,  $84.7 \pm 7.1$ ,  $81.0 \pm 7.8$ ,  $80.4 \pm 18.1$ ,  $80.0 \pm 0.0$ ,  $76.6 \pm 13.6$ .

TOTSF - 12 mean score for the veterans who had not suffered any injury was  $84.7 \pm 9.2$ .

The variables TOTSF – 12 and knee injuries did not show a statistically significant correlation ( $p= 0.5845$ ).

The current OKS mean scores for the veterans who had undergone a surgery treatment of ACL reconstruction and meniscectomy were  $38.8 \pm 8.0$ ,  $42.2 \pm 7.5$ , respectively.

OKS mean score for the veterans who had not undergone any surgery treatment was  $45.6 \pm 4.4$ .

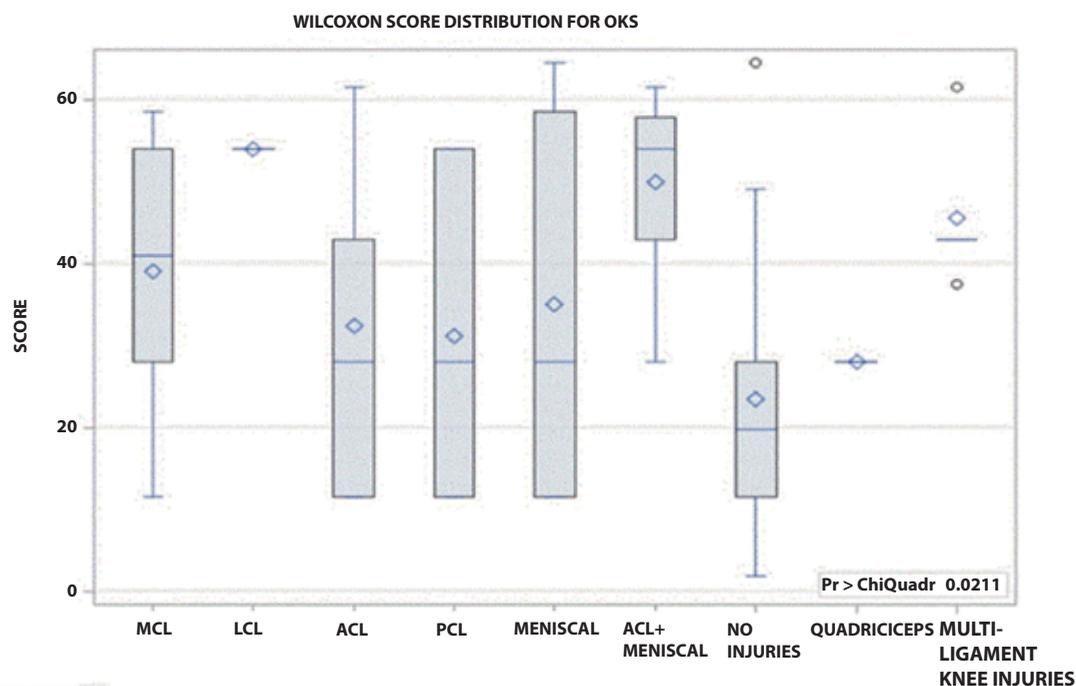
A statistical significance was found for distribution of OKS values according on type of surgical treatment ( $p= 0.0433$ ),

The current VAS mean score for the veterans who had undergone a surgery treatment of ACL reconstruction and meniscectomy were  $4.6 \pm 2.3$ ,  $3.6 \pm 2.3$ , respectively.

VAS mean score for the veterans who had not undergone any surgery treatment was  $2.7 \pm 2.5$ .

The variables VAS and surgical treatment did not show any statistically significant correlation ( $p= 0.2576$ ).

The current TOTSF - 12 mean score for the veterans who had undergone a surgery treatment



**Figure 2.** Shows the mean distribution of VAS value according to the different types of knee injury suffered by veterans during their career.

of ACL reconstruction and meniscectomy were  $77.2 \pm 15.3$ ,  $83.2 \pm 8.3$ , respectively.

TOTSF – 12 mean score for the veterans who had not undergone any surgery treatment was  $83.8 \pm 8.9$ .

The variables TOTSF – 12 and surgical treatment did not show a statistically significant correlation ( $p = 0.5380$ ).

Furthermore, the Spearman analysis showed a significant positive correlation between MENTALSF – 12 and age of retirement and TOTSF – 12 and age of retirement ( $p$  value of 0.0081 and 0.0299, respectively).

We did not find any other statistically significant correlation between clinical scores and the other investigated variables.

## Conclusions

This study analyzed the knee state of health of a semiprofessional Italian (Serie A and B Leagues) rugby players population.

In this study we have seen that most of the former players we interviewed (46,15%) played in the Serie A championship that is a semi-professional Italian league; more than the half of the population played a scrum's role.

We have seen that the majority of subjects (60,00%) suffered in their career at least a knee injury, the most frequent of which were meniscal and/or ACL injuries in line with previous epidemiological study (16).

We did not find a significant statistical correlation between the variables Role and Knee injuries, confirming results of Brooks study who underlined that there are not significant differences between the incidence of the injuries between scrums and backs (23), as reported by other studies which proved a major incidence of injuries between the two roles (24, 25).

Our study has demonstrated a decrease in the knee injuries throughout the years. This may be due to a modification of game rules and to players' characteristics which have evolved over the years as reported by Quarrie K. L. who analyzed the first matches of Bledisloe Cup from 1972 to 2004 noting a greater number of tackles, passages, rucks, try, time of play, a greater body mass index (BMI) of players and less time

of play of single players, kicks and mauls per match over the time (26).

In this study, we have observed a statistically significant correlation between the variables Weight-Type of Knee injuries.

Many researchers focused on the risk of ACL injuries for players with a greater BMI while few studies emphasized the risk of weight gain after ACL injury: in our case, we do not know if there was a positive correlation between weight and risk of injury at the time of their career; we only have a picture of the current situation and we could explain the current weight as a consequence of knee function reduction over the years that may result in a reduced ability to perform physical activity and in the adoption of sedentary lifestyle with overweight implications (27,28,29).

In line with literature we also found that veterans who suffered an ACL lesion today have a decreased functionality of the knee compared to that of the healthy subjects (5,10).

More than the half (56.92%) of the veterans underwent surgical procedures to treat sport-related injuries and the ACL reconstruction was the most frequently performed surgical procedure.

We could not draw any conclusions on the rate risk of OA in relation to the type of ACL rupture management during the career: in fact, lower OKS values were registered for all veterans who suffered an ACL lesion, regardless of the type of treatment and this is in line with other studies that demonstrated that post-ACL rupture OA will set in irrespective of whether the treatment is surgical or conservative (5,10, 30, 31).

In the '80's and '90's, ACL reconstruction techniques were not yet successful and standardized, moreover the training program and prevention of injury risk were not comparable to today standards.

To date, the exact association between early and/or OA and cumulative exposure to professional football and related activities is unknown. A study by Salzman et al. found a positive relationship between football players risk of injuries, compared to the normal population, and predisposition to early-onset OA. (32)

Gouttebauge found that former elite athletes from individual and team sports disciplines have an increased risk of developing early OA, especially in the joints of the lower limbs compared to general population (33).

Our results are in line with this conclusion: in fact we noted that the veterans who did not suffer any injuries have a current mean OKS score of  $46.5 \pm 2.7$ , while the veterans who suffered a concomitant ACL lesion and meniscal lesion have the lowest mean OKS value  $37.8 \pm 8.4$  and the current mean OKS value for the veterans who underwent an ACL reconstruction surgery is  $38.8 \pm 8.0$ .

To better clarify these results, we could correlate the OKS values with the actual functionality of the knee by means of the following subdivision (34):

OKS values between 40-48 may indicate satisfactory joint function that may not require any formal treatment;

OKS values between 30-39 is representative of a mild symptomatic joint that may indicate mild to moderate knee arthritis;

OKS values 20 to 29 may indicate moderate to severe knee arthritis.

OKS values 0 to 19 may indicate severe knee arthritis ([http://www.orthopaedicscore.com/scorepages/oxford\\_knee\\_score.html](http://www.orthopaedicscore.com/scorepages/oxford_knee_score.html))

In term of knee function, our study reveals that although Rugby is a high impact sport, the knee function of the ex-players who had not suffered any injuries after about 19 years is actually in line to that reported for the normal match-aged population (35), while for veterans with a previous knee injury a clinical assessment and x-ray may be performed to evaluate if non-surgical treatment, such as exercise, weight loss, and anti-inflammatory medication could produce a benefit and delay a further surgical procedure because in a likely condition of mild to moderate OA.

Thus, it is very important to schedule and apply a solid program of injury prevention and strengthening of muscle which stabilize the knee joint, as noted by Mhel J. who observed a decrease of knee injuries incidence of the 27% and a decrease of the ACL lesion of 51% after applying a prevention protocol. He also showed that there is no evidence of efficacy of a single exercise of prevention for ACL injuries, but there is evidence of efficacy of a program based on the muscle strength which stabilizes the knee joint and increases balance, proprioceptivity and flexibility that can be inserted into warm up session (36, 37, 38, 39).

Lower knee function in injured veterans was noted also in lower contact sport like soccer. In particular Salzmann et al. demonstrated that injuries with potential surgical consequences can be declared as the major predisposing factor for the generation of early OA among football players (32). In addition, in a recent review Petrillo et Al. showed that the prevalence rates of OA of the hip and knee, evaluated also radiographically in professional soccer athletes, are significantly higher than those reported in non-Professional soccer athletes (12).

Paxinos examined a population of 100 former soccer players noting a relevant decrease in the knee function among those who had suffered a surgical procedure or knee injuries. However, he also found this condition also in ex-players who had not suffered any knee injuries or surgical procedures: this represents a great difference with our results probably due to a real psycho-physiologic difference between different types of athletes (40).

In our study, we also showed a positive and significant correlation between the variable OKS-PHSF12 and this means that a reduction of the knee function with an early osteoarthritis correlates to a decrease in the normal daily activities. This is probably due to a higher level of pain: in fact we observed the highest current VAS results for veterans who during their careers had suffered concomitant ACL and meniscal injury, while lower values have been reported for veterans who had not suffered any injuries.

The other aspect highlighted by our study is a positive and significant statistical correlation ( $p < 0.0081$ ) between the variable MENSF12-Age of retirement: this could be explained by the fact that the players who retired later have a better mental health than those who retired earlier.

The study by Ramzi reports that sport activity can provide to the athlete a better psychological condition characterized by a higher level of motivation and the capacity to transform stress factors in opportunities of improvement, and Goutterbarga explained that retirement itself has been recognized as a potential risk factor for post-retirement psychosocial and mental health complaints in athlete. (41, 42).

Rugby players start a new professional career after retirement, completely detached from the sports world

and they need a normal psychophysical condition in order to ensure profitability for themselves and their families.

The study by Donna J. Menke and Esopenko Carrie reports that the retirement from sport must be preceded by suitable preparation for the post-retirement life, with the aim of avoiding mental disorders that may occur with the transition from sports to not sports life if they are not prepared for this step (43, 44)

In addition, we observed that most of the interviewed veterans had retired for family reasons, work reasons and for other reasons but not for injury reasons (regardless of severity). We conclude that in rugby retirement could be recognized as a potential risk factor for post-retirement psychosocial and mental health complaints in athletes more than a physical injury.

This study has several limitations: the first aspect to consider is that it is a retrospective study and it is based on the memories of former players. In fact, it was not possible to find medical records of injuries and it was not possible to carry out instrumental examinations to assess the degree of OA of this population. Moreover, it was not possible to relate the number of injuries to the number of hours played and it was not possible to divide the injuries between those occurred during training and during the game.

The second limitation is that the study was conducted on a small sample size.

The third limitation is related to the evolution of diagnostic methods and surgical reconstruction techniques and they must be taken into account; in fact different clinical approaches to injured players during the years have been able to determine diagnostic and clinical results BIAS between groups belonging to the different decades.

Our study showed that the veterans who had suffered knee injuries, especially those who sustained suffered a concomitant ACL lesion and meniscal lesion, today have a lower knee function. On the other hand, the veterans who did not suffer any injuries today have a knee function in line with the normal population of their age. In conclusion, despite rugby is a high energy sport with continuous high-energy contacts occurring from the match and training environments due to the number of physical collisions and tackles, we may affirm that it is a sport that does not increase the risk of

knee osteoarthritis in absence of serious knee injuries. Therefore, the prevention of injuries, both in terms of training programs and continuous re-evaluation of the rules of the game, should be an unequivocal priority for this sport in order to guarantee young rugby players a good quality of life without limits for a second professional career once the competitive career has ended.

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