The impact of anterior knee pain on the quality of life among runners in under-resourced communities in Ekurhuleni, Gauteng, South Africa

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Background: Anterior knee pain (AKP) is the most common injury among runners and has a negative impact on the quality of life (QOL) of many athletes.

Objectives: To determine the impact of AKP on the QOL among runners in under-resourced communities in Ekurhuleni, Gauteng, South Africa.

Methods: A cross–sectional study design was used. A population of 73 runners with AKP was included. Participants included runners aged 13 to 55 years with no history of knee surgery, traumatic or degenerative knee conditions. The SF-36 questionnaire was used to collect data. Ethical clearance, permission from club managers and consent from participants were obtained. Data were collected over six weeks and analysed using SPSS. Descriptive statistics included frequencies, percentages, means, standard deviations and ranges. Inferential statistics included the comparison of means using the ANOVA test.

Results: The lowest SF-36 mean scores were in two health domains: role limitation due to emotional problems (59) and vitality (59). Highest scores were in the general physical functioning domain (72). Females presented with lowest SF-36 scores (48) on role limitation due to emotional problems with noticeable difference (p=0.03). Youth presented with lowest scores (62) on the social functioning domain (p=0.001). Significant differences were noted on SF-36 scores between running experienced groups on the following domains: physical functioning (p=0.03), role limitation due to physical problems (p=0.01), vitality (p=0.001), general mental health (p=0.001) and social functioning (p=0.001). The most affected was the group with three-five years of running experience which presented with scores ranging between 46 and 65. Significant mean differences were also noted between BMI groups in the social functioning domain (p=0.01) where overweight and obese groups were mostly affected by AKP.

Conclusion: This study highlighted a need to prevent, treat and rehabilitate AKP. Multidimensional community-based rehabilitation programmes are recommended.

Keywords: patellofemoral pain, state of health, athletes, poor-resourced communities

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Anterior knee pain (AKP) is the most common knee problem experienced by athletes, especially long-distance runners. Patients with AKP present with pain that is localised to the anterior aspect of the knee beneath or around the patella edges which may be triggered by prolonged sitting, squatting, ascending or descending stairs.[1] Any activity that may cause compression on the patellofemoral joint could trigger this kind of pain. The causes of AKP may differ among patients, depending on their knee structures. Soft tissue, such as the lateral retinaculum and the infrapatellar fat pad, may also be cause pain among athletes.[1]

During normal knee flexion the patella usually moves towards the medial aspect of the joint in order to sit comfortably within the intercondylar notch until the 130° range is reached, after which it moves back laterally.[1] All these movements are coordinated by the quadriceps muscles, particularly the vastus medialis oblique (VMO) and vastus lateralis. The lateral structures of the knee are often much stronger than the medial aspects. Therefore any poor coordination of the knee structures, such as muscle weakness or excessive load during running, can cause irritation or pressure and pain on the patella and other associated structures. There are several internal and external factors that contribute to AKP among runners. The internal factors consist of those that are specific to each runner, including muscle and tendon forces, while the external factors are air resistance, gravity and ground reaction forces.[2]

The prevalence of AKP ranges between 15-45% globally [3], with mainly females, younger adults and adolescents affected[1,4,5]. Anterior knee pain accounted for 40% among the same population in an earlier study by these authors.[6] The following modifiable intrinsic risk factors were found to have contributed significantly to AKP among this population: tight hamstrings (p=0.051, OR=1.021); tight iliotibial band (p=0.046, OR=1.122); weak quadriceps (p=0.040, OR=0.154), weak hip control muscles (p=0.004, OR=1.131) and patellar tilt abnormalities (p=0.015, OR=1.332) [6].

Anterior knee pain has a negative impact on the quality of life (QOL) of many athletes at different sporting levels, dependent on the severity of the symptoms.[7] Anterior knee pain is not only characterised by physical features but also non-physical features which may influence the recovery of patients.[8] Physical features may include, for example, limitations in general physical functioning, physical roles, the body's pain perception.[7,9] Non-physical features may include general mental health (psychological distress and well-being), emotional problems, social functioning and in the motivation to perform a task. [7,9] This is especially so if there are no rehabilitation programmes for anterior knee pain available or if the rehabilitation programmes are not sufficiently comprehensive to address all the problems associated with this condition.

Few authors have conducted QOL studies among athletes with AKP. Some of the available studies showed that injuries impacted on individuals' QOL in a negative way.[7,9] These

experiences can also affect an athlete's rehabilitation programme and return-to-sport.[10] Maclachlan et al. [8] reported QOL that ranged from 28% to 62% among individuals with AKP.

There are limited studies on QOL for runners with AKP from under-resourced communities. It is widely known that people who live in these communities usually present with poor health outcomes compared to those in well-resourced socioeconomic communities.[11] As mentioned above, the population in the authors' earlier study already had a AKP and the associated risk factors.[6] Therefore it is important to know the impact of AKP on the QOL in this population in order to develop specific and comprehensive prehabilitation or rehabilitation programmes. This study is a continuation of these authors' previous study that determined the presence of AKP in runners in under-resourced communities.[6]

Methods

A cross-sectional study included a sample of 183 out of 347 long-distance recreational runners from six developmental running clubs in under-resourced peri-urban communities in Ekurhuleni, Gauteng, who had undergone physical screening for AKP in these authors' previous study.[6] A Raosoft statistical tool was used to calculate the sample size, taking into consideration a 95% confidence level, 5% margin of error and 50% response distribution. An equal representative number of runners were recruited from each running club using a convenience sampling method. The participants were recruited during their training sessions at their various training grounds. Participants included runners aged between 13 and 55years-old with no history of knee surgery, traumatic or degenerative knee conditions. Seventy-three runners who presented with AKP according to the results of the AKP physical screening were included in the QOL survey. The number of participants from each club were as follows: 13 from Club one, 12 from Club two, 10 from Club three, 14 from Club four, 8 from Club five, 16 from Club six.

The AKP screenings mentioned in these authors' previous study included the use of a standardised AKP questionnaire consisting of 13 short questions that assessed the participants' knee symptoms and any functional limitations associated with AKP.[6] Further objective screening by a physiotherapist was done using five physical screening tests, namely, a patellar apprehension test, vastus medialis coordination test, eccentric step test, Clarke's test, and Waldron's test.

The SF-36 questionnaire [12] was adapted to collect QOL data among the participants. A demographic profile was added as Section A and included information on gender, age, height, weight, number of races completed and running experience,. Section B was the SF-36 questionnaire which consisted of 36 items within eight health domains, all related to AKP: general physical functioning (ten items), bodily pain (two items), role limitation due physical problems (four items), role limitation due to personal or emotional problems (three items), social functioning (two items), general mental health (five items), vitality (energy/fatigue) levels (four items) and general health perceptions (five items). It also included a single item that provided an indication of perceived change in health status due to AKP in the past twelve months. The questionnaire consisted of eight scaled scores which are the sum of questions in each domain. Each scale is scored 0-100. The lower the score the greater the disability it represents and the higher the score the lower the disability. According to a systematic review done by Hart and Kang, the SF-36 is a reliable and valid tool when used in physical activity research.[13]

Ethical clearance was granted by the Biomedical Research Committee at the University of KwaZulu-Natal (BFC377/15). Permission to conduct the study among running clubs was granted by the Central Gauteng Athletics' manager. Runners were first provided with information leaflets which explained the purpose, objectives and methods of the study. All participants signed informed consent forms before they participated. Consent was obtained from the parent guardian of participants younger than 18 years. A pilot study was conducted among eight participants prior to the main study. No adjustments were required on the data collection tools used and hence the data obtained were included in the main study. During data collection, the first author hand-delivered the AKP questionnaire to the participants and physically screened them for AKP. The SF-36 questionnaire was then immediately distributed among participants who responded positively to the AKP screening procedure. Data collection took place during club training sessions over a period of six weeks. It took approximately 30 minutes to collect data from each participant.

The data were initially captured on a Microsoft Excel spreadsheet and later imported into SPSS for analysis. Descriptive and inferential statistics were used to analyse the data. Descriptive statistics included the calculation of frequencies, means, medians, modes, standard deviations and ranges. An inferential statistics ANOVA test was undertaken to compare the means for the eight SF-36 domains against the demographic profiles. The confidence level was set at 95% and the level of significance at $p = 0.05$.

Scoring of the SF-36 items was done prior to the statistical analyses in a two-step process. Firstly, coding, summing and transforming dichotomous and ranked response categories was done. The scoring of items ranged from zero (worse possible health state) to 100 (best possible health state). Scores represented the percentage of the total possible score achieved. Secondly, items in the same dimension were averaged to create the eight-scale scores.

Results

Anterior knee pain was present in 40% (73) of participants according to the AKP screening.[6] Further results from the AKP screening are presented and discussed in detail in a previous study by these authors. The following results will focus on the results obtained from the SF-36 survey.

As mentioned, seventy-three runners completed the SF-36 questionnaire. The details are indicated in Table 1 below, the

majority of participants were males (55%) and young (45%) with one to three years of running experience (30%). Most participants presented with normal body mass index (BMI) (60%).

Participants presented with high SF-36 scores in the following domains: general physical functioning (72), social functioning (70) and general health (70). These results indicate a good state of health or low possible disability in these domains among participants. Low scores were noted in the following dimensions: role limitation due to physical problems (62), role limitation due to emotional problems (59), vitality (energy/fatigue) levels (59), general mental health (68) and bodily pain (63) (Table 2). This indicates a fair state of health or a slightly high possible disability in these domains. The perceived change in health was found to have a mean of 58. (Table 2).

Table 3 presents a significant mean difference between the two gender groups concerning role limitation due to emotional problems (p = 0.03). Females presented with a poor state of health (48) compared to males (68). Older participants between 36 - 55 years presented with a better state of health in their social functioning domain (81) compared to other age groups. A higher significant mean difference was found between age groups regarding social functioning (p = 0.001). A significant mean difference was also found between running experience and the following health domains: general functioning (p = 0.03), role limitation due to physical problems (p = 0.01), vitality (p = 0.00), general mental health (p = 0.001) and social function (p = 0.001). Younger participants had a better state of health compared to other age groups. Participants with normal BMI presented with the highest scores in the following domains: role limitation due to physical problems (67) and social functioning (74). Participants who were underweight presented with highest scores in role limitation due to emotional problems (78). A significant mean difference was found between BMI and social functioning domain (p = 0.01).

No significant difference was noted between various groups regarding the perceived change in their health: gender (p = 0.33), age (p = 0.55), years of running experience (p = 0.32) and BMI (p = 0.27). A perceived change in health scored higher in males (64), indicating a favourable state of health among this group compared to females (52). Young participants (13-17 years old) scored higher in this section compared to other age groups. Runners with the least years of experience (less than one year) scored highest compared to other groups (71). Participants with BMI below normal (less than 18.5) also showed highest scores (71) compared to other groups.

Table 1. Demographics profile (n = 73)

Demographics	Categories	n	%
Gender	Male	40	55
	Female	33	45
Age	13 - 17	18	25
	18 - 35	33	45
	36 - 55	22	30
Running experience	<1 year	7	10
	1 - 3 years	22	30
	3 - 5 years	19	26
	6 - 10 years	12	16
	>10 years	13	18
Body Mass Index (BMI)	<18.5	12	16
	18.5 - 24.9	44	60
	25 - 29.9	14	19
	>30	03	4

Table 2. SF-36 descriptive statistics for runners with anterior knee pain (AKP), n = 73

SF-36 dimensions	No. of items	Mean	Median	Mode	SD	Min	Max
General physical functioning	10	72	80	80	22	25	100
Role limitation due to physical problems relating to AKP	4	62	75	100	38	0	100
Role limitation due to emotional problem relating to AKP	3	59	67	100	38	0	100
Vitality (energy and fatigue)	4	59	60	60	19	5	100
General mental health	5	68	68	52	18	20	100
Social functioning relating to AKP	2	70	75	75	17	37	100
Bodily pain relating to AKP	2	63	68	78	25	10	100
General health perception	5	70	65	50	18	35	100
Change in health	1	58	50	50	28	0	100

Data are presented as a score between 0 and 100.
SD, Standard Deviation; Min, Minimum score; Max, Maximum score

Discussion

Anterior knee pain among athletes has been widely investigated but few studies have covered QOL among runners with AKP, especially in under-resourced communities. Most studies focused on prevalence, incidence, aetiology, risk factors and the investigation of the effectiveness of different interventions, and physical therapy approaches.[7,14,15] Repetition of the opening sentence of this section. Again, this is repetition.

This study found a low SF-36 score of 59 in two health domains: role limitation due to emotional problems, and vitality. Thus the participants' ability to fulfil their various roles were impacted on negatively due to the emotional problems caused by AKP. These problems may cause athletes to reduce the amount of time spent on their running activities, thus impacting on their performance.[7,16] The low vitality scores indicate that AKP had a negative impact on the participants' energy and fatigue levels. Athletes felt less enthusiastic, less energetic, and even lost interest in their running-related activities.

The highest SF-36 score was found in the general physical functioning domain (72), indicating a better health state compared to other domains. Other SF-36 health domains in this study ranged between 59-72. All these scores were generally lower when compared to other studies. According to Cheung

Table 3. Relationship between SF-36 domains and demographic profile (n = 73)

Demographics	Parameter	Physical functioning	Role limit due to physical problems	Role limit due to emotional problems	Vitality	General mental health	Social functioning	Bodily pain	General health perception	Change in health
Gender										
Male	Mean	70	64	68	59	70	67	63	69	64
	SD	21	38	35	18	19	17	24	18	5
Female	Mean	74	60	48	61	65	73	64	70	52
	SD	22	38	40	20	17	18	26	19	4
	p	0.43	0.67	0.03	0.51	0.20	0.16	0.84	0.88	0.33
Age (in years)										
13-17	Mean	75	60	65	63	63	69	70	70	64
	SD	23	42	31	22	21	19	18	18	31
18-35	Mean	67	57	54	55	67	62	64	68	57
	SD	22	39	42	19	15	13	24	19	19
36-55	Mean	77	72	62	64	73	81	57	70	55
	SD	20	33	38	14	20	16	28	18	35
	p	0.18	0.36	0.54	0.14	0.18	0.00*	0.28	0.94	0.55
Running experience (in years)										
< 1	Mean	83	93	71	85	85	89	72	78	71
	SD	28	19	30	17	23	20	17	22	27
1 – 3	Mean	77	69	61	65	70	64	66	74	63
	SD	19	37	37	11	16	11	21	19	24
3 - 5	Mean	60	49	46	52	56	63	64	65	57
	SD	23	38	45	18	13	14	22	16	25
6 - 10	Mean	70	40	53	55	66	73	52	67	56
	SD	18	38	26	18	14	20	34	15	32
>10	Mean	78	73	74	53	73	75	62	64	46
	SD	17	33	39	20	21	18	28	19	32
	p	0.03*	0.01*	0.23	0.00*	0.00*	0.00*	0.46	0.21	0.32
BMI										
<18.5	Mean	65	50	78	54	62	57	65	67	71
	SD	28	41	26	16	19	14	24	12	26
18.5-24.9	Mean	74	67	58	57	70	74	66	68	54
	SD	20	34	40	21	18	19	23	19	29
25-29.9	Mean	76	66	52	70	70	69	57	77	61
	SD	19	42	34	11	18	8	28	18	25
>30	Mean	53	17	22	55	49	54	44	52	50
	SD	28	29	38	13	2	7	28	3	0
	p	0.23	0.09	0.09	0.13	0.15	0.01*	0.34	0.12	0.27

*Mean and SD are presented as a score between 0 and 100. * indicates significant p value < 0.05*
SD, Standard Deviation; BMI, Body Mass Index

et al, amateur athletes with AKP in China presented with higher SF-36 scores indicating a better health state than those presented in this study.[7] Their lowest score was 62 in role limitation due to emotional health problems. Their highest SF-36 score was 82 in the social functioning domain. The scores for other SF-36 domains ranged between 62–82. Athletes with AKP in better resourced communities in China presented with superior health states compared to those in this study.

There were significant differences between gender groups in this study, Females had low SF-36 scores on role limitation due to emotional problems (48) when compared to men. Youth athletes had a significantly poorer health state with regard to social functioning (62) when compared to other groups. The reason for these findings could be as a result of the high prevalence of AKP reported in various studies among females and young athletes.[4,5]. Anatomical and biomechanical factors may be the contributing factors to the high prevalance of AKP among young runners but the most common underlying reasons are overuse injuries. These affect mainly young runners as a result of a sudden increase in their intensity, duration and volume of running activity; inadequate sports-specific training; poor training techniques and inappropriate sporting equipment.[17] If professional rehabilitation services are scarce in communities (such as the communities in this study), injuries and risk of injuries are bound to increase resulting in the high prevalance of AKP in this study.

Significant differences were noted between running experience and five health domains namely, physical functioning, role limitation due to physical problems, vitality, general mental health and social functioning. Runners with 3–5 years of running experience reported with poor state of health

compared to others. Anterior knee pain affected this group's ability to participate in their general and role-specific physical activities, including running and other related activities, vitality levels (energy or enthusiasm for running-related activities), general mental health (psychological distress and wellbeing) and social functioning. All of these are critical health components required for a good state of health for runners. Participants with less than one year of running experience had better health states in these five SF-36 health domains, followed by those with the most years of running experience (more than 10 years). The most affected group was that with three to five years of running experience with SF-36 scores that ranged from 46 – 65. In a previous study by these authors, running experience was also found to have with a high level of AKP ($p = 0.04$, $\chi^2 = 8.389$ in runners with three to five years of experience.[6] The results from the previous study therefore justify why runners in this group present with poor quality of life when compared to other groups.

Notable differences were also noted among the BMI group, where participants who were overweight and obese scored lower in this role limitation due to physical problems, emotional problems and social functioning domains. These results could indicate that participants who are overweight and obese are generally not satisfied with their health state compared to those with a normal weight and who are underweight. This could be as a result of the known negative impact overweight and obese conditions have on health in general. The presence of AKP could result in feeling of low self-esteem, especially if their motive for running was to control their weight.

The results obtained in this present study shows that anterior knee pain compromises the physical and mental components of the athlete, including their psychological health. Injured athletes usually experience psychological emotions that relate to their injuries, and which can have a detrimental effect on their wellbeing and ability to perform optimally. These experiences may also affect these athletes' rehabilitation programmes and their return-to-sport.[10] An ACSM Consensus Statement , confirms that injured athletes experience stress with behavioural, physical and psychological symptoms.[10] These emotions occur when an injury is not resolved and becomes worse over time.

According to a systematic review by Maclachlan et al.[8], anxiety, depression, catastrophising and fear of movement were identified as psychological features that may be increased in individuals with AKP. These characteristics correlated with pain and reduced physical function among people with AKP have also been identified as barriers to injury recovery[18] thus limiting the potential for patients to improve during rehabilitation.[19] Therefore these need to be considered during assessment, treatment and the rehabilitation of AKP. If athletes with AKP are not rehabilitated properly, their condition may become problematic and could result in osteoarthritis, further impacting on their QOL.[7]

Poor community rehabilitation services could be one of the reasons why our current population presented with a high prevalence of AKP[6] and poor quality of life. Rehabilitation services provided by health professionals, such as the physiotherapist, biokineticist, podiatrist, psychologist, are therefore critical in the prevention, treatment and rehabilitation of injuries. The outcomes of this present study highlights the need for such services. It is suggested that comprehensive community-based rehabilitation programmes are necessary to address both the physical and psychological needs of the running population, especially from under-resourced communities.

Conclusion

This study highlighted the negative impact of AKP on the quality of life among runners and the need not only to address physical features of AKP but also the non-physical features, such as the psychosocial, emotional and mental factors when formulating strategies to improve QOL among the running population with AKP. A holistic approach in assessing, treating and rehabilitating AKP is necessary to ensure all athletes' needs are met.

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