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Knee pain in adults from the northeast of São Paulo, Brazil: prevalence, risk factors, and impact on quality of life

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ABSTRACT

Introduction: The existing literature describes several risk factors associated with knee pain, including personal, psychological, and work-related factors, among others. Furthermore, several studies have shown the negative impact of knee pain on quality of life; however, there is a lack of knowledge about knee pain in Latin American populations. **Objective:** This study aims to investigate the prevalence, risk factors, and impact on the quality of life of knee pain in Brazilian adults. **Methods:** This cross-sectional study was based on a population survey with 600 individuals interviewed using questionnaires including a) sociodemographic and labor aspects; b) physical activity level (IPAC questionnaire); c) musculoskeletal symptoms (Nordic questionnaire); and d) quality of life (SF-36). **Results:** The prevalence of knee pain was 25.6% (95% confidence interval: 22.3–29.3%), and it was associated with being >60 years old, black ethnicity, mean or low income, overweight, depression, gastrointestinal and renal diseases, and persons who performed occupations requiring repetitive movements, sitting while using a computer, and standing. All individuals with knee pain demonstrated significantly greater risks for summaries of the physical components. **Conclusion:** Knee pain is associated with socioeconomic variables, work aspects, and lifestyle factors and impacts the quality of life.

Keywords: pain; knee; prevalence; quality of life; risk factors.

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INTRODUCTION

Knee pain (KP) is a common musculoskeletal symptom, with about 1 in 5 adults reporting it for ≥1 day in the last month[1-3]. Knee pain has many causes, the most common of which is osteoarthritis (OA). However, disorders other than OA can also cause knee pain, such as meniscal lesions, synovial inflammation, and biomechanical factors. These disorders are important risk factors for a more rapid progression of structural deterioration of joints with OA[2]. In addition, the existing literature describes several risk factors associated with KP, such as personal (older age, body mass index, and sex); psychological (living alone and low mental health scores); and work-related factors (activities that require lifting and carrying weights, repetitive movements, kneeling, squatting, and low job satisfaction), among others[4-8].

Several studies have shown the negative impact of KP on health-related quality of life (HRQoL); however, there is a lack of Latin American research on the subject[4,9,10]. Recognizing the prevalence and factors associated with KP and its relationship with quality of life in the general population is significant for several reasons. First, musculoskeletal dysfunction in this population contributes to work-related absenteeism and disabilities in occupational and daily life activities, increasing social and economic costs for individuals, businesses, and the state[11]. Second, there is little information available in Brazil and Latin America on the epidemiology and clinical characteristics of KP and its relationship with quality of life, from population-based studies. Finally, this information is important for quantifying the effects of the disease and its treatments and helping to make decisions for the allocation of health resources, which are often limited. It also requires relevant health policies with the aim of reducing the negative impact on health and well-being, as well as developing support services capable of reducing healthcare costs[12,13].

Therefore, the present study aimed to investigate the prevalence and risk factors of KP and its impact on HRQoL in a Brazilian population-based sample of adults aged ≥20 years.

METHODS

This cross-sectional study was conducted in the urban area of Bauru City, Brazil. The project was approved by the Ethics Committee in Research with Human Beings of the Universidade do Sagrado Coração, Bauru, São Paulo, Brazil No. 1.701.049.

This study employed the methods of Maciel et al.[14]. The population of Bauru was 316,064, with 207.021 inhabitants >20 years old. Age and gender groups (called sample domains) were first defined with a minimum number of individuals per sample to allow further analysis. Six sample domains were determined: 20–35-year-old males and females; 36–59-year-old males and females; ≥60-year-old males and females. The sample size calculation was based on the following premises: (i) an estimated proportion of 50% of the population subgroups, since this is the maximum variability that leads to obtaining conservative sample sizes; (ii) a 95% confidence level in the estimation of confidence intervals (CIs); (iii) a 10% sampling error, indicating that the amplitude between the estimated sample and the population parameter should not exceed this value; and (iv) a design effect equal to 2. Therefore, the sample size for each group was at least 200 individuals (100 males and 100 females), totaling 600 participants.

The sample was drawn from a two-stage cluster. The primary sampling units were the census tracts, and the secondary sampling units were the residences. The primary sampling units were drawn by systematic sampling with a probability proportional to their sizes. The sampling units were obtained from the Brazilian National Survey of Household Samples, which produced an address list of private homes for each census tract. Fifty urban census tracts were drawn from the 476 identified tracts.

The number of households to be drawn from each sampling domain was determined, and the ratio between the average number of individuals and the number of households was then calculated. Therefore, it was decided that around 12 households should be visited for every census tract. These households were systematically drawn, and all individuals residing there were considered eligible for the interviews. A new household was randomly selected in case of a refusal.

Individuals who were not located after four visits (at least one at night and one on the weekend), and those who were not found due to traveling, were considered losses. Those who refused to answer the questionnaire through personal choice were considered refusals.

This study excluded individuals living in institutions such as nursing homes and prisons and those unable to answer the questionnaire. Older people underwent the Mini-Mental State Examination at the beginning of the interview, so their cognitive state, and the reliability of their answers, could be assessed. Participants who scored <27 points were considered to have presented with cognitive loss and were consequently excluded[15].

Interviews were conducted by 10 interviewers and senior physical therapy researchers. All interviewers underwent theoretical and practical training, including a home approach, interviewing techniques, and issues related to the research tool. A pilot study was performed as part of the training, and the fieldwork was supervised by the researchers involved in the study.

After the interviews, the questionnaires were coded by the interviewers and reviewed by the lead researcher. The supervisors also conducted a quality control procedure, comprising the administration of reduced questionnaires to 10% of the respondents.

The variable "knee pain" was observed using the Nordic questionnaire, which was validated and adapted to the Brazilian culture[16]. In the interview, individuals were asked the following question: "Did you have any pain or discomfort in the knee in the past year?" In addition to the verbal questionnaire, an image of the various regions of the body in assorted colors was also presented, so the interviewees could better specify the knee region where the pain was[16].

The demographic characteristics (age, sex, and ethnicity) and socioeconomic characteristics (income and marital status) were evaluated using a pre-coded questionnaire with closed questions. Sex was categorized as female and male; age was categorized into three age groups; marital status was categorized into single, married, and widowed/separated; and education was categorized in years as follows: 0–4, 5–8, 9–11, and ≥12 years, respectively[14].

The ethnicity (white, black, or brown) was self-reported, and income (class E=up to one Brazilian minimum wage, class D=one

to five Brazilian minimum wages, class C=five to ten Brazilian minimum wages, class B=10–20 Brazilian minimum wages, class A=>20 Brazilian minimum wages). The classification of demographic (age, sex, and ethnicity) and socioeconomic (income and marital status) characteristics were based on the definitions of the Brazilian Institute of Geography and Statistics[17].

Ergonomic variables were measured using the questionnaire prepared by Silva et al.[18]. The ergonomic variables were characterized by the perception of the interviewed people, who identified among four options (never, rarely, generally, and always), which best characterized the frequency of exposure they had at work or during the interview. The measured variables included repetitive movements, vibration/trepidation transport and weight carrying, kneeling, sitting while using a computer, and standing. The frequencies obtained in the categories "never" and "rarely" were added and categorized as a particular group, and the same process was performed for the categories "generally" and "always" to define the association between KP and the ergonomic variables[18].

Individuals who reported smoking daily (at least one cigarette per day) or occasionally (less than one cigarette per day) were considered smokers, and those who had stopped smoking for ≥6 months before the interview were former smokers[19].

Information on morbidity was collected through the interview, in which the participants answered the question: "Among the alternatives below (hypertension, osteoporosis, diabetes, osteoarthritis, respiratory diseases, gastrointestinal diseases, and urinary system diseases), choose the one(s) that match(es) a diagnosis you received from a doctor in the last 12 months[20].

The International Physical Activity Questionnaire was utilized to verify participants' physical activity levels. A threshold of 150 minutes of physical activity per week was established to classify the individuals as active (≥150 min per week) or insufficiently active (<150 min per week)[21].

The questionnaire Medical Outcomes Study 36 – Item Short-Form Health Survey (SF-36) was used to evaluate HRQoL. This tool addresses both physical and mental/emotional concepts, including scales spanning eight domains: (i) physical functioning (PF); (ii) role limitations due to physical problems (RPP); (iii) pain; (iv) general health perception (GHP); (v) role limitations due to social problems (RLS); (vi) limitations due to emotional problems (RLE); (vii) mental health (MH). Each of these domains, analyzed individually, received a score of 0–100, with 0 indicating the worst possible HRQoL and 100 indicating the best condition. Physical component summaries (PCS) and mental component summaries (MCS) were also calculated. This questionnaire was chosen because it is validated for the Brazilian culture, is simple to interpret with direct questions, is easily administered and understood, and has excellent reliability[22], presenting a Cronbach's α of 0.90.

Statistical Analysis

The analyses were performed using SPSS, version 26.0 (SPSS, Chicago, United States). Absolute and relative frequency distributions were performed for categorical variables and CIs. The Lilliefors test was performed, and the data presented a normal distribution.

To analyze the variables associated with knee pain, Poisson regression was used, respecting a hierarchical model of relations between the variables, calculating the prevalence ratios (PR) and confidence intervals (CI) of 95%.

PCS and MCS were analyzed and compared between individuals with and without pain as well as those with and without severity status using a student's t-test. Furthermore, PCS and MCS were used for Poisson regression analysis. The cut-off point was the mean value of the sample divided into two groups: individuals with values equal to or higher than the average and individuals who scored below average. For this interpretation, these scores were standardized to the normative mean values of the Brazilian population[23].

RESULTS

There were 641 eligible participants in the drawn residences, among whom 600 were effectively interviewed. The main reasons for sample loss (n=41) were: "absent residents" and "scheduled with the interviewer but did not attend." In comparison, the main reasons for refusals were: "does not respond to interviews" and "too long, it will take a long time to respond."

Table 1 shows a predominance of individuals with 9–11 years of education for both sexes, white ethnicity, married persons, low-income earners, nonsmokers, overweight, and sedentary lifestyles.

Among the participants, 25.6% (95% CI: 22.3–29.3%) reported pain in the knee at least once in the 12 months before the interview; 25.3% (95% CI: 20.7–30.5%) were males; and 26.0% (95% CI: 21.3–31.2%) were females. Table 2 shows that those ≥60 years old, of Black ethnicity, with low or medium monthly income, overweight, depression, repetitive movement, sitting while using a computer, and standing were associated with KP compared to those without these characteristics.

Table 3 shows that all participants with KP had significantly lower PCS and MSC scores than those without pain. Males with KP had lower SF-36 scores than those without pain.

All participants with KP had a significant association with PCS compared to those without pain (Table 4).

DISCUSSION

KP prevalence (25.6%) in the studied population was like those reported in Nigeria (26.0%)[24] and Saudi Arabia (28.4%)[25], lower than those in France (36.6%)[26] and China (42.3%)[9] and higher than that in the city of Salvador, Brazil (11.2%)[6].

Like previous studies[6,9], age was associated with increased KP prevalence. However, sex was not associated with KP contrary to data from other investigations[5,9]. According to Ibeachu et al.[25], different knee conditions will occur depending on the sex. For example, patellofemoral pain has higher incidence rates in females[26], whereas soft tissue injuries are more frequent in males[27]. Thus, sex differences can be balanced since all knee conditions are considered.

Table 1: Distribution of frequencies of sociodemographic characteristics, physical activity level, reported diseases, body mass index, and smoking of the sample of individuals aged >20 living in the city of Bauru, Brazil, according to sex.

Factors	Sex			
	Male		Female	
	n	%	n	%
Years of education				
0–4	52	17.3	70	23.3
5–8	65	21.7	64	21.3
9–11	126	42.0	118	39.4
≥12	57	19.0	48	16.0
Skin color/ethnic group				
White	237	79.0	243	81.0
Black	17	5.7	21	7.0
Mixed	46	15.3	36	12.0
Marital Status				
Married	180	60.0	165	55.0
Single	85	28.3	65	21.7
Widowed/separated	35	11.7	70	23.3
Income				
Low	189	63.0	200	66.6
Middle	72	24.0	68	22.7
High	39	13.0	32	10.7
Smoking				
Nonsmoker	160	53.3	203	67.7
Ex-smoker	74	24.7	54	18.0
Smoker	66	22.0	43	14.3
Physical Activity Level				
Active	99	33.0	111	37.0
Sedentary	201	67.0	189	63.0
Body mass index (kg/m^2)				
<25	141	47.0	100	33.3
≥25	159	53.0	200	66.7
Hypertension				
No	211	70.3	191	63.7
Yes	89	29.7	109	36.3
Diabetes mellitus				
No	272	90.7	259	86.3
Yes	28	9.3	41	13.7
Depression				
No	278	92.7	242	80.7
Yes	22	7.3	58	19.3
Gastrointestinal disease				
No	276	92.0	269	89.7
Yes	24	8.0	31	10.3
Renal diseases				
No	289	96.3	279	93.0
Yes	11	3.7	21	7.0
Respiratory disease				
No	277	92.3	277	92.7
Yes	23	7.7	23	7.7

Table 2: Multivariate analysis of knee pain based on risk factors in participants.

	Knee pain
	PR (95% CI); p-values
Sex	
Male	1.00
Female	1.05 (0.73–1.52); 0.87
Age Group	
20–35 years	1.00
36–59 years	1.04 (0.48–2.27); 0.90
≥60 years	3.03 (1.37–6.69); 0.01
Years of education	
≥9 years	1.00
5–8 years	1.19 (0.56–2.55); 0.60
0–4 years	1.51 (0.76–3.00); 0.48
Skin color/ethnic group	
White	1.00
Mixed	1.11 (0.63–1.93); 0.58
Black	2.37 (1.17–4.81); 0.01
Marital Status	
Married	1.00
Single	1.55 (0.90–2.65); 0.88
Widowed/separated	1.35 (0.82–2.24); 0.33
Income	
High	1.00
Middle	2.12 (1.13–4.16); 0.01
Low	2.08 (1.07–4.00); 0.01
Body mass index (kg/m^2)	
<25	1.00
≥25	1.93 (1.30–2.88); 0.01
Smoking	
Nonsmoker	1.00
Ex-smoker	1.04 (0.66–1.65); 0.55
Smoker	0.61 (0.35–1.05); 0.66
Physical Activity Level	
Active	1,00
Sedentary	0.88 (0.55–1.20); 0.34
Hypertension	
No	1.00
Yes	1.25 (0.81–1.94); 0.24
Diabetes mellitus	
No	1.00
Yes	1.54 (0.85–2.78); 0.34
Depression	
No	1.00
Yes	1.75 (1.04–2.96); 0.01
Gastrointestinal disease	
No	1.00
Yes	2.04 (0.98–3.75); 0.32
Renal diseases	
No	1.00
Yes	1.55 (0.95–7.22); 0.28
Respiratory disease	
No	1.00
Yes	0.80 (0.37–1.69); 0.34
Repetitive Movements	
Never/rarely	1.00
Always/usually	1.66 (1.12–2.43); 0.01
Vibration/Trepidation	
Never/rarely	1.00
Always/usually	1.08 (0.62–1.89); 0.87
Transport and Weight Carrying	
Never/rarely	1.00
Always/usually	0.99 (0.63–1.56); 0.88
Kneeling	
Never/rarely	1.00
Always/usually	0.92 (0.51–1.69); 0.78
Sitting while using a computer	
Never/rarely	1.00
Always/usually	3.03 (1.72–5.55); 0.003
Standing	
Never/rarely	1.00
Always/usually	1.86 (1.22–2.85); 0.01

Table 3: Summary of physical and mental components according to knee pain status

Scale	All		Females		Males	
	No pain	Pain	No pain	Pain	No pain	Pain
Physical component score	81.5‡	65.6* ‡	59.7‡	79.8*†‡	83.2‡	71.6*†‡
Mental component score	81.7‡	75.4*‡	78.1‡	78.1‡	85.3‡	79.1*†‡

*p<0.05, Significant difference between participants with and without knee pain.
† p<0.05, Significant difference between males and females with knee pain;
‡adjusted for age, sex, and BMI;

Table 4: Multivariate analysis for means of a summary of physical and mental components according to knee pain status.

Scale	PR (95% CI)		
	Knee pain vs. no knee pain‡	Males with knee pain vs. males without knee pain§	Females with knee pain vs. females without knee pain§
Physical component score	2.94 (1.88–4.76) *	3.57 (1.75–7.14) *	2.63 (1.47–4.76) *
Mental component score	1.28 (0.77–2.12)	1.44 (0.89–2.56)	1.19 (0.58–2.07)

*p<0.05, Significant difference between participants with and without knee pain; ‡adjusted for age, sex, and BMI; §adjusted for age and BMI.

KP was associated with low-income levels, like other studies[24,28], showing that living in areas with extreme poverty rates is associated with higher rates of self-reported KP. This may be because the low-income population usually engages in heavy physical work; hence, the load on the knee joints can be increased and related to KP[29].

In the present study, Black ethnicity was associated with KP, like a series of investigations that identified African Americans presented higher pain levels and limitations in daily life activities than Caucasians[30]. However, the underlying factors are poorly understood, and racial differences, meaning that factors such as body mass index (BMI), psychological variables (depressive symptoms, emotion-focused coping, and arthritis self-efficacy), exposure to occupational or household tasks, and inflammatory markers should be investigated in a more in-depth way to define what is their role in KP[31].

Several studies have reported the association between being overweight and KP[5,6,9]. It is assumed that being overweight causes increased mechanical stress on the joints and alters metabolism and joint inflammation[32]. Although this mechanism is highly plausible for the development of KP, other explanations, such as metabolic elements and lack of physical fitness, may also contribute to KP[6,9].

KP in the present study was associated with individuals who performed repetitive occupational activities, corroborating studies in the United States[33] and Thailand[4]. This study also confirmed that working while standing was associated with KP, corroborating some studies[30,34]. In contrast, this fact did not occur in other study[24].

In the present study's population, working while kneeling and being required to transport and load weight was not significantly associated with KP, in contrast to several previous studies[6,30]. In addition to limitations due to statistical power, these differences from other studies may be due to selection effects. The working population may not include participants with the most severe KP cases who could be excluded from the labor market. Some important personal risk factors for KP were unavailable in the present study, especially histories of knee injuries, tasks involving knee movements, or handling of off-load, and sports or leisure activities involving knee movements[35].

This study showed that working while sitting and using a computer for >3 hours per day was significantly associated with KP. In addition, the study's investigations on the influence of sedentary work on KP are controversial, showing that it can have a sense of protection[11] or an association[36,37]. In contrast, another study did not find an association[38].

KP in the present study was associated with individuals who reported depression. A study in Brazil[39] confirms the association of KP with depression. Comorbidities in people with knee and lower extremity pain are associated with greater impairment in physical functions and decreased participation in instrumental activities and daily life and quality of life. One study in England concluded that comorbidities increase the frequency of physical disability in patients with KP, the influence of the combination being greater than expected for pain or each associated disease alone. Understanding these associations could guide clinical care, identifying aspects of comorbidity that have the greatest impact on KP and, therefore, should be emphasized in treatment and care[39].

This study's results showed that individuals with KP achieved worse performance for PCS than those without KP. Studies previously reported in the literature have shown that individuals with KP presented significantly lower scores in all subscales of the SF-36 than individuals without KP[9,10]. In contrast, in Brazil[40], it was noted that individuals with KP presented lower values in the domains of functional capacity and limitation in physical aspects compared to healthy individuals.

It can be assumed that individuals who presented KP are more likely to have lower score averages due to the context that the physical and mental domains of the SF-36 represent. Issues such as limitations related to daily physical ability, pain, ability to work, and overall health, assessed in the physical domain of the instrument, may be associated with how the individual can perform

physical activities without limitations due to pain or intercurrences in the organism's functioning. KP may interfere with activities, causing movement and disability restrictions, and the greater the severity, the greater the impact on quality of life, as indicated by the results of the present study[40].

This study had several limitations. First, no data were collected on how the KP affected and/or limited participants' routine activities or demonstrated changes in daily routines. Second, the study design was transversal and prevented the determination of causality. Third, this study used self-reports to measure participants' work-related factors, height, and weight. Based on these limitations, care should be taken with the generalization of this study's findings and therefore, novel studies with larger samples need to be performed to confirm our results. This study had several strengths, including (i) the use of population-based sampling recruited in the various census tracts of the city and (ii) generating the first national data on KP, severity, and associated factors and their impacts on HRQoL. A bigger scope of variables to evaluate population studies is strongly recommended for future studies.

KP is a public health problem that causes substantial disability in individuals and a huge cost to the health system. Furthermore, considering the availability of data sources from population-based studies in Brazil to date on the prevalence of KP, its risk factors, and its impact on quality of life, this research will be a reference for other epidemiological investigations. The study will also contribute to the knowledge of the national estimate of the prevalence and risk factors of KP for systematic reviews and meta-analyses. Further studies on the predictors and clinical evolution of KP in different contexts are recommended.

Conclusion

This study reveals a high prevalence of KP and remarkable associations with being ≥60 years old, Black ethnicity, low or medium monthly income, overweight, depression, performing repetitive occupations, working while sitting and using a computer, and standing. Also, all participants with KP had a significant association with PCS compared to those without pain.

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