



## Original Research

## Physical activity levels in individuals with and without patellofemoral pain

Neal R. Glaviano <sup>a,\*</sup>, Andrea Baello <sup>b</sup>, Susan Saliba <sup>b</sup><sup>a</sup> School of Exercise and Rehabilitation, University of Toledo, Toledo, OH, USA<sup>b</sup> Curry School of Education, Department of Kinesiology, University of Virginia, Charlottesville, VA, USA

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## ABSTRACT

**Objectives:** Patellofemoral pain (PFP) is a chronic condition that results in long-term subjective and objective impairments. PFP has been identified to result in modification in activity levels, however it is unknown the extent of activity levels in individuals with and without PFP.

**Design:** Case-control study.

**Participants:** 20 individuals with PFP and 20 healthy individuals.

**Main outcome measures:** Physical activity was assessed by steps per day, minutes of mild, moderate, and high activity over 14 consecutive days. Anterior Knee Pain Scale (AKPS), worst pain in last week (WVAS), and Fear Avoidance Belief Questionnaire (FABQ) were also collected. Paired *t*-tests were used to compare variables between groups. Pearson *r* correlations were conducted to evaluate relationships between subjective function and activity level.

**Results:** Individuals with PFP took less steps per day ( $p = 0.004$ ) and completed less daily minutes of mild activity ( $p = 0.007$ ) and high activity ( $p = 0.012$ ). Significant correlations were seen between steps per day and subjective function: AKPS ( $p = 0.002$ ), WVAS ( $p = 0.016$ ), and FABQ ( $p = 0.002$ ) in the PFP population.

**Conclusion:** Individuals with PFP are less physically active than their healthy counterparts in both steps per day and minutes spent conducting physical activity. A relationship between subjective function and physical activity exists in individuals with PFP.

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## 1. Introduction

Patellofemoral pain (PFP) is a chronic condition that affects a variety of recreational, athletic, and military populations. It accounts for over 7% of all knee related pathologies being treated within the United States, and prevalence ranges between 7 and 28% (Glaviano, Kew, Hart, & Saliba, 2015). While the etiology is unknown, it has been suggested that the pain is a result of increased stress on the patellofemoral joint during functional tasks, such as squatting, stair ambulation, jogging, and prolonged sitting (Powers, 2003). This increased stress on the patellofemoral joint has been proposed to potentially lead to the development of patellofemoral osteoarthritis (PFOA) in this population (Utting, Davies, & Newman, 2005).

The presence of pain is common during a variety of functional activities and the location of pain in proximity to the patella varies between individuals with PFP (Rathleff, Petersen, Arendt-Nielsen, Thorborg, & Graven-Nielsen, 2016). Prolonged pain has been identified to be present up to 16 years after initial diagnosis (Stathopulu & Bailldam, 2003). The influence of pain has been theorized to alter physical activity level in these individuals, and previous reports have observed between 71 and 74% of individuals with PFP will modify or cease activity (Blond & Hansen, 1998). The presence of pain may also have a psychosocial element; such as fear or avoidance in activity in an attempt to decrease pain experienced during common daily activities (Piva, Fitzgerald, & Irrgang, et al., 2009). Improvements in fear avoidance has also been identified as a strong predictor for successful outcomes for treating PFP and accounts for 22% of pain variance in this population (Piva et al., 2009; Selhorst, Rice, Degenhart, Jackowski, & Tatman, 2015).

Investigators have also consistently observed that patients with PFP score lower on self-reported functional scales (Piva et al., 2009). These questionnaires assess the participant's ability to perform

\* Corresponding author. School of Exercise and Rehabilitation, Mailstop 119, University of Toledo, Toledo, OH 43606, USA.

E-mail address: [Neal.Glaviano@UToledo.edu](mailto:Neal.Glaviano@UToledo.edu) (N.R. Glaviano).

common activities of daily living such as walking, ascending or descending stairs and sitting for long periods of time (Esculier, Roy, & Bouyer, 2013). We assume that since individuals with PFP often present with a variety of pain provoking activities (walking, jogging, squatting, etc.) that their overall physical activity levels can be directly influenced negatively. Thus, the pathology contributes to both functional limitations and overall physical activity levels.

While individuals with PFP often present with long-term pain and functional limitations great enough to modify their activity and avoid pain-provoking tasks, it is currently unknown if differences in activity level exist between individuals with or without PFP during their normal daily activities. It is also unknown if the relationship of pain, fear-avoidance and subjective function may play on the activity level in individuals with PFP. Therefore, the purpose of this study is to compare the activity level between individuals with and without PFP. We hypothesize that individuals with PFP will be less active than their healthy counterparts. Additionally, we hypothesized that pain and fear avoidance behavior will have a negative relationship on activity level while individuals with higher subjective function will be more active.

## 2. Methods

This was a case-control study. Dependent variables were activity level, subjective function assessed by the anterior knee pain scale (AKPS), fear avoidance belief questionnaire (FABQ), and worse pain assessed by the visual analog scale (VAS). Independent variables were group, individuals diagnosed with PFP and healthy controls matched on age, mass, and sex.

### 2.1. Participants

Study recruitment was conducted from the university setting. 40 participants were enrolled in the study, 20 individuals with PFP and 20 healthy individuals (15 females and 5 males in each group). Sample size for steps per day was determined utilizing data from the first five PFP and five healthy participants. Mean difference of 2151 steps per day, with a standard deviation of 2194 steps was calculated with an alpha level of 0.05, beta of 0.20, and 20% attrition rate to determine that 20 participants in each group were necessary for this study. Enrolled participants for both groups were between 18 and 35 years old. Those in the PFP group completed a screening process to determine eligibility. Inclusion criteria requiring atraumatic knee pain for greater than 3 months, less than 85 points on the Anterior Knee Pain Scale, and pain with a minimum of 2 of the following tasks: jumping, kneeling, prolonged sitting, squatting, running, stair climbing, pressure on patella or contraction of the quadriceps (Glaviano & Saliba, 2016; Nakagawa, Serrao, Maciel, & Powers, 2013). The control participants were selected if they had no previous history of knee injury or pain. Exclusion criteria for both groups included previous knee surgery, ligamentous instability, additional sources of anterior knee pain (patella tendinopathy, patella subluxation, bursitis, etc.), history of back, hip, or ankle injury, neurological impairments that would affect gait. A single researcher (NRG) confirmed PFP diagnosis and assessed ligamentous instability and additional sources of knee pain to ensure participant eligibility. This study was approved by the University of Virginia's Institutional Review Board, and those participants who met inclusion criteria enrolled in the study by completing written informed consent.

### 2.2. Procedures

Participants reported to the laboratory for a screening session to determine eligibility. Individuals who met the inclusion criteria

were enrolled in the study. Anthropometric assessment (age, height, mass) and lower extremity history questionnaires were completed to assess duration of symptoms, previous injuries, subjective function (Tegner) etc. Participants were then distributed three subjective questionnaires for completion; the anterior knee pain scale, fear avoidance belief questionnaire and worst pain assessment with a VAS.

The Anterior Knee Pain Scale is a 13-item questionnaire that evaluates subjective function during a variety of tasks that are often difficult for PFP patients. The scale is scored out of 100 points, with 100 indicating the absence of functional impairments during the tasks. It has good reliability (ICC = 0.81–0.97) and is a common assessment tool within the PFP population (Esculier et al., 2013).

The Fear Avoidance Belief Questionnaire is a 16-item questionnaire that measures fear-avoidance beliefs in patients. The FABQ is divided into two subcategories based off the fear patients are experiencing; fear avoidance during work activities (FABQ-W) and fear avoidance during physical activity (FABQ-PA). The FABQ-W is scored out of 42 points, while the FABQ-PA is scored out of 24 points. Greater scores reflect increased subjective fear avoidance beliefs the patient is experiencing. While originally being for low back pain patients, the FABQ has been utilized in the PFP population with modifications of the physical activities listed and the word *back to knee* throughout the questionnaire (Piva et al., 2009; van Baar et al., 1998). FABQ-PA was used as the measure of fear avoidance for this study.

Worst pain was assessed with the visual analog scale (WVAS). A 10-cm line that listed "No Pain" and "Worst Pain Imaginable" was provided to the participants who were instructed to place one vertical mark on the worst pain they experienced in their knee over the last 72-h.

Following the completion of all questionnaires, participants were provided a FitBit Charge HR (FitBit Inc., San Francisco, CA) following enrollment into the study to calculate steps per day and minutes of mild, moderate and high activity levels each day. Standardized instructions were provided to all participants; wear the activity band on their non-dominant wrist at all times during the day for 2-weeks, except while showering. Participants were instructed not to change their normal activity levels during their participation in the study. Participants were provided a charging wire with a USB connector and were instructed to charge the unit every night and if the device battery died throughout the day. Participants were instructed to document when the device was not worn for an entire day and provide that information to the research team. All individuals were contacted twice a week during their study participation to monitor their adherence and retrieve the participant's documentation on their adherence. The FitBit was synced with Bluetooth with the FitBit Connect Application. Data was synced at a minimum of once a week. Data was exported from the FitBit application with each participant's activity levels. The intensity of physical activity is calculated by an algorithm that estimates metabolic equivalents, which help measure energy expenditure during activity, to classify mild, moderate, and high activity levels; however the algorithm is only available to the FitBit company (Middelweerd et al., 2017). After two weeks, participants returned to the laboratory to return their FitBit devices to the research team and were released from the study.

### 2.3. Statistical analysis

Data was analyzed with SPSS software (v23.0, SPSS, Inc., Chicago, IL, USA). Dependent variables were evaluated with skewness, kurtosis and Levene's test for normal distribution and variance. Paired T-tests were conducted to determine group differences for anthropometric data (age, height, mass), subjective function (AKPS,

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