motricidade

ORIGINAL ARTICLE

https://doi.org/10.6063/motricidade.36750

Work-related musculoskeletal disorders and the effects on work performance of fitness professionals in Portugal: Cross-sectional study

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ABSTRACT

This study aimed to identify the main factors that caused, reactivated and/or aggravated musculoskeletal disorders in fitness professionals' perception, the effects of musculoskeletal disorders on fitness professionals performance and recovery, characterise musculoskeletal disorders, compare groups and correlate the number of musculoskeletal disorders per fitness professional with several variables. 466 fitness professionals answered the VidaProFit survey online. Descriptive statistics, the T-test, and Pearson's correlation were used. 46.2% of the fitness professionals reported musculoskeletal disorders (mean: 1.11 ± 1.61 number of musculoskeletal disorders per fitness professional). Most reported musculoskeletal disorders were in "joint/ligaments", in the "knee", from "overuse", "identified by a specialist" and "aggravated" by work. Most fitness professionals keep working during musculoskeletal disorders recovery and consider that this fact prolongs the recovery. Around half of the musculoskeletal disorders were "recurrent", "caused" and/or "reactivated" by work. Almost half of the fitness professionals resorted to sick leave, considering "insufficient recovery time" as the main factor for musculoskeletal disorders, and feel pain/discomfort during work. "Females" and "working as fitness professionals" were the groups with significantly higher mean of number of musculoskeletal disorders per fitness professional. Age, professional experience, number of group fitness classes/week, body&mind group fitness classes/week, maximal group fitness classes/day, paid and unpaid working hours/week were correlated with number of musculoskeletal disorders per fitness professional. Results support the need to create programs or guidelines targeted to musculoskeletal disorders prevention to ensure the continuity of fitness professionals in the fitness sector.

Keywords: injuries; fitness instructors; job characteristics; occupational injuries; fitness occupations.

INTRODUCTION

According to the International Health Racquet & Sportsclub Association (IHRSA) reports, the global fitness industry experienced considerable growth until 2019 (IHRSA, 2017, 2018, 2019, 2020). From 2016 to 2019, this growth was evident with $96.7 billion in revenues, more than 184 million customers, and almost 210,000 clubs registered in 2019 (IHRSA, 2017, 2018, 2019, 2020). This trend of growth has suffered a setback caused by the COVID-19 pandemic (IHRSA, 2021; Pedragosa & Cardadeiro, 2021; Pedragosa et al., 2022; Rutgers et al., 2021). The Portuguese fitness industry, which had grown until 2019 (Pedragosa & Cardadeiro, 2017, 2018, 2019, 2020), had a slow recovery. The 2021 Fitness Barometer (Pedragosa et al., 2022) indicated a decrease in customer numbers and revenue (compared to 2020 and 2019). The 2023 Fitness Barometer (Pedragosa

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Conflict of interests: nothing to declare. Funding: This work was supported by National Funds by Foundation for Science and Technology under the project UID/04045/2025 (http://doi.or/10.54499/UID/04045/2025) and Sport Physical Activity and Health Research & Innovation Center and Portuguese Foundation for the Science and Technology UID/06185/2025 [https://doi.org/10.54499/UID/06185/2025]; UID/PRR/06185/2025 [https://doi.org/10.54499/UID/PRR/06185/2025]; UID/PRR2/06185/2025.
Received: 18th July 2024. Accepted: 26th December 2025.
Edited by: Diogo Monteiro
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et al., 2023) reveals growth, but in 2023, revenues are still below the values reported in 2019 (Pedragosa & Ferreira, 2024). According to Smith (2022), the IHRSA 2022 Report data make clear that the quality of in-person instruction is a critical factor for customers. Fitness professionals (FP) are undoubtedly a crucial part of the fitness industry and perform a substantial role in the quality of the services provided and participants' retention (Eskiler & Safak, 2022; García-Fernández et al., 2018; Glaveli et al., 2023; Xu et al., 2021). Studies of fitness trends in Portugal also highlight the importance of these professionals, once "Licenses (titles) for FP" and "Employing certified FP" frequently appear at the top (Franco et al., 2021, 2022, 2023, 2024).

Nevertheless, in Portugal, the number of FP working at full-time equivalent (FTE) has been decreasing since 2018, even in years when the number of gyms, customers, or revenues increased (Pedragosa & Cardadeiro, 2019, 2020, 2021; Pedragosa et al., 2022, 2023).

> "*The amount of work can be measured by the number of hours worked and by its conversion into the equivalent of hours worked by a full-time worker (40 hours/week), thus estimating the FTE – Full-Time Equivalent number corresponding to the hours worked in the various employment schemes.*" (Pedragosa & Cardadeiro, 2019, p. 17).

The number of FP working FTE grew only in 2023, but still remained below 2020 levels (Pedragosa & Ferreira, 2024). Between 2010 and 2021, 33,359 FP licenses were issued (Instituto Portugês do Desporto e Juventude [IPDJ], 2021). By 2021, 11,413 (34.2%) of these licenses were no longer valid (IPDJ, 2021). At that time, there were 21,946 valid FP licenses: 16,604 for Physical Exercise Technicians and 5,342 for Technical Directors (IPDJ, 2021). Because a valid Physical Exercise Technician or Technical Director license is legally required to work as an FP in Portugal (Portugal, 2009, 2012), it can be concluded that, since 2010, at least 34.2% of FP have dropped out of the profession (noting that licenses are valid for 5 years). These numbers raise concerns for the Portuguese fitness industry and highlight the need to determine whether FP face a fast-wear profession, and if so, what can be done to address it.

In fact, being a fitness instructor can be a physically demanding occupation, considering, for example, the (real) amount of working hours, the number of preparation hours added to the schedule of paid working hours (Ramos et al., 2021b), and the practical exercise volume (Bratland-Sanda et al., 2015; du Toit & Smith, 2001; Francis et al., 1985; Garrick et al., 1986; Richie et al., 1985) (at work, in work preparation, and/or personal workout, which can be important for a good performance at work or injuries prevention), that does not always allow the necessary recovery time (Bratland-Sanda et al., 2015; Francis et al., 1985). It was suggested that FP in group fitness classes need to work too many hours to earn a decent salary, and that they may be exceeding their tolerance to mechanical stress (Francis et al., 1985). Recent research based on the Portuguese context may provide some support for this hypothesis. A study on FP job satisfaction (Ramos et al., 2021a) revealed the lowest levels of satisfaction regarding salary, the (lack of) chance of promotion, and hours of work. In a quality-of-life study of FP, the environment domain (which includes finances) yielded the lowest average scores (Vieira et al., 2022), further supporting this hypothesis.

Fourteen studies were found with a focus on musculoskeletal disorders (MED) among the FP population (Bratland-Sanda et al., 2015; Domene et al., 2017; du Toit & Smith, 2001; Ferreira et al., 2024; Francis et al., 1985; Garrick et al., 1986; George & Abraham, 2022; Malliou et al., 2014; Merati et al., 2021; Richie et al., 1985; Romaine et al., 2003; Shinde & Sahasrabuddhe, 2021; Stephen et al., 2019; Thompson et al., 2001). However, they were focused on one specific activity, such as aerobics (du Toit & Smith, 2001; Francis et al., 1985; Garrick et al., 1986; Richie et al., 1985), zumba fitness (Domene et al., 2017), step (Malliou et al., 2014), and kickboxing (Romaine et al., 2003), included only group fitness classes FP (Bratland-Sanda et al., 2015; Merati et al., 2021; Thompson et al., 2001), or did not define a clear FP population (George & Abraham, 2022; Shinde & Sahasrabuddhe, 2021; Stephen et al., 2019). A gap can be identified here in the research of FP MED, since the function of accompaniment in the exercise room and/or personal training also has characteristics that could represent a MED risk for them. Spending a lot of time in the stand position, demonstrating exercises, or helping with assisted stretching, resisted exercises, or lifting loads without a proper warmup are some of the situations these professionals are exposed to.

The research on this topic usually addresses the characterization of each MED identifying the anatomic location (Bratland-Sanda et al., 2015; Domene et al., 2017; du Toit & Smith, 2001; Ferreira et al., 2024; Francis et al., 1985; Garrick et al., 1986; Malliou et al., 2014; Merati et al., 2021; Richie et al., 1985; Romaine et al., 2003; Shinde & Sahasrabuddhe, 2021; Stephen et al., 2019; Thompson et al., 2001), with the main findings pointing to the highest prevalence of MED on the lower extremity (i.e., foot, ankle, lower leg, and knee were the most reported) (Bratland-Sanda et al., 2015; Domene et al., 2017; du Toit & Smith, 2001; Ferreira et al., 2024; Francis

et al., 1985; Garrick et al., 1986; Malliou et al., 2014; Merati et al., 2021; Richie et al., 1985; Romaine et al., 2003; Shinde & Sahasrabuddhe, 2021; Thompson et al., 2001). The type of injury was reported in a few studies (Domene et al., 2017; Ferreira et al., 2024; Francis et al., 1985; Garrick et al., 1986; Malliou et al., 2014; Merati et al., 2021; Romaine et al., 2003; Thompson et al., 2001), and the most common were in muscles and tendons (Domene et al., 2017; Ferreira et al., 2024; Malliou et al., 2014; Merati et al., 2021; Romaine et al., 2003; Thompson et al., 2001). Some studies also address the nature of the disorder (acute/overuse) (Bratland-Sanda et al., 2015; Garrick et al., 1986; Malliou et al., 2014), recurrence of the injury (defined as the same type and location as a previous injury occurring within 3 months of recovery) (Malliou et al., 2014), sick leave (Bratland-Sanda et al., 2015; George & Abraham, 2022), and need of medical care or treatment (Bratland-Sanda et al., 2015; du Toit & Smith, 2001; George & Abraham, 2022; Malliou et al., 2014; Richie et al., 1985; Romaine et al., 2003). In Malliou et al. (2014) study, "70% of the step-aerobics instructors indicated overuse as their most common mechanism of injury" (Malliou et al., 2014, p. 365). Activities with repetitive movements (monotonous exercise) were considered risk factors for this type of injury (Bratland-Sanda et al., 2015). Although some studies showed evidence that led to a belief that they also considered this variable, only one study was found that refers specifically to recurrent injuries (Malliou et al., 2014), characterising them as chronic injuries (overuse). Bratland-Sanda et al. (2015) examined sick leave due to musculoskeletal pain and found a 3.5 times higher risk of FP with higher instructional load. One study reports that instructors were prevented from exercising for 5 weeks (on average) because of an injury (Thompson et al., 2001); however, it does not refer to sick leave. According to Richie et al. (1985), only 28.5% of the injuries required treatment. The Romaine et al. (2003) study showed a slightly higher result, with treatment required for 38.9% of the injuries. Nevertheless, du Toit and Smith (2001) found that 38.5% of the instructors who sustained an injury did not resort to professional treatment, and instead opted for self-treatment. Sick leave reduces work efficiency, and ME disorders are also expensive to treat (George & Abraham, 2022).

Work-related variables and sociodemographic characteristics were used in studies to analyse correlations with MED and to identify characteristics more likely to be associated with a higher incidence or prevalence of MED. The results showed that more years of experience as a FP (Bratland-Sanda et al., 2015), more hours of exposure (frequency and duration) for the same period of time (Bratland-Sanda et al., 2015; du Toit & Smith, 2001; Francis et al., 1985; Garrick et al., 1986; Richie et al., 1985), higher number or hours of high impact (Bratland-Sanda et al., 2015; du Toit & Smith, 2001) or higher intensity group fitness classes/week (defined in the studies by the cadence in BPM – beats per minute) (Francis et al., 1985), were some of the characteristics more prone to develop or aggravate a MED. Despite these findings, Thompson et al. (2001) found no association between injury incidence or prevalence and the exposure variables (number of group fitness classes or total time exercising per week).

From another perspective, quality of life research on FP (Vieira et al., 2022) found a negative association of the physical domain with body&mind group fitness classes/week and the maximal number of group fitness classes/day (a higher number of group fitness classes was associated with lower quality of life indices). This study suggests that the findings related to the body&mind group fitness classes/week may be a consequence of FP adapting to remain in the profession, as these classes require less physical effort for the instructor. Therefore, it is important to address this adaptation hypothesis to avoid misinterpretation of results regarding the type of group fitness classes. Regarding the FP opinion, fatigue, high-impact group fitness classes, and too many working hours were the primary causes of injuries (Malliou et al., 2014).

Concerning gender, the prevalence of ME pain in FP seems higher in males when compared to females (Shinde & Sahasrabuddhe, 2021), as does the severity of the pain (Shinde & Sahasrabuddhe, 2021). The prevalence of ME injury was also higher in male FP (Shinde & Sahasrabuddhe, 2021), and males were 11.9 times more likely to get injured than females (Malliou et al., 2014). However, these results seem to be concerning specific activities. A study among group fitness classes FP (in general) had different findings, with a higher prevalence of ME pain, instruction-related overuse injuries, and sick leave in females compared to males (although these differences were observed only in the group with low instruction loading) (Bratland-Sanda et al., 2015). Height, weight, and body mass index (BMI) were data included in many studies, but none of them revealed an association between MED and these measures (Bratland-Sanda et al., 2015; Domene et al., 2017; du Toit & Smith, 2001; Garrick et al., 1986; Malliou et al., 2014; Merati et al., 2021; Richie et al., 1985; Thompson et al., 2001). Thompson et al. (2001) showed that age was also not relevant, suggesting that increased knowledge should lead to a decreased risk of injury and could explain these results. Despite this statement, no association was found between MED and educational qualifications, such as academic degrees or professional qualifications (Bratland-Sanda et al., 2015; Garrick et al., 1986; Thompson et al., 2001).

No study was found that has considered the possible (and expected) changes in the FP total metabolic and mechanical load over the years, since the associations were established with the current FP activity. However, the fitness industry is always in constant adjustments, regarding new services, activities, and/or approaches (Franco et al., 2021, 2022; Kercher et al., 2022; Thompson, 2021, 2022), and the functions performed by the FP are therefore different over the years, regarding the type of group fitness classes and exposure time. This reality could be distorting the results obtained (and, consequently, their interpretation), and should be further addressed to better understand the effects of work-related variables on the prevalence of MED among the FP population.

Considering the available evidence, this study aims to identify the main factors that have caused, reactivated, and/or aggravated MED on FP perception, and the effects of MED history on current FP performance. It also intends to characterise the reported MED and some aspects of the recovery phase. Finally, considering the number of MED reported per FP (nMED/FP), the analysis aims to compare groups and to analyse the correlation between nMED/FP and sociodemographic or work-related variables.

METHODS

Participants

The present study was directed to FP in Portugal, with a valid title of Physical Exercise Technician or Technical Director.

The sample of this study was a convenience sample, as the survey was not disseminated to the entire population of FP working in the Portuguese fitness industry. Of the 466 participants who answered the MED survey, 424 were included in characterisation, comparison, and correlation tests, and 42 were excluded because they reported a problem but did not answer the remaining questions about it. Nevertheless, the power of the sample size was ensured at the 95% confidence level, considering a population of 21,946 FP with a valid title, with a sample of 424 participants (p = .047).

Regarding socio-demographic characteristics (Table 1), 49.4% were females and 50.6% were males. The average age was 30.39 ± 7.82 years. Professionals had 6.81 ± 6.69 years of experience as an FP. The sample comprised 58.5% Physical Exercise Technicians and 41.5% Technical Directors. Of these, 80.4% were working as an FP at the time. For group fitness class variables, the average number per week was 7.32 ± 7.16. Cardio group fitness classes/week had a mean of 2.36 ± 3.71. Strength group fitness classes/week had 1.75 ± 2.86. Mixed group fitness classes/week had 2.19 ± 4.77. Body&mind group fitness classes/week had 1.01 ± 2.21. The maximal number of group fitness classes/day was 2.92 ± 2.34. The average paid working hours/week were 39.60 ± 19.57, while the unpaid working hours/week were 8.98 ± 7.23.

The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics and Scientific Board of the Santarém Polytechnic University (No. 8A-2022 ESDRM), and informed consent was obtained from all subjects involved.

Instruments

A survey (VidaProFit) assessing sociodemographic and work-related variables of the FP intervention was administered (Ramos et al., 2021b).

To research the MED of FP in Portugal, a part of this survey has been developed and validated (the process is described in the next point of this section). This survey was divided into three main parts: 1) identification of any MED related to the work as FP; 2) characterisation of each MED reported; and 3) characterisation of MED reported in general.

Table 1. Socio-demographic characteristics: frequency, mean and standard deviation.

(n = 424)	Frequency (%)	Socio-demographic characteristics	M ± SD	Minimun-Maximun
		Age (years)	30.39 ± 7.82	19–62
Gender		Professional experience (years)	6.81 ± 6.69	0.1–42.6
Female	49.4	Group fitness classes/week (no.)	7.32 ± 7.16	0–42
Male	50.6	Cardio group fitness classes/week (no.)	2.36 ± 3.71	0–42
Professional title		Strength group fitness classes/week (no.)	1.75 ± 2.86	0–31
Physical Exercise Technician	58.5	Mixed group fitness classes/week (no.)	2.19 ± 4.77	0–35
Technical Director	41.5	Body&mind group fitness classes/week (no.)	1.01 ± 2.21	0–18
Currently working as a fitness professional		Maximal group fitness classes/day (no.)	2.92 ± 2.34	0–15
Yes	80.4	Paid working hours/week (no.)	39.60 ± 19.57	2–105
No	19.6	Unpaid working hours/week (no.)	8.98 ± 7.23	0–114

M: mean; SD: standard deviation; no.: number.

In the first part, the participants answer the question "Do you have or had any MED caused, aggravated or reactivated by your work as a FP?" ("yes" or "no").

In the case of a positive response to this question, participants had to complete the second part of the ME survey specifying each problem reported regarding the type (8 options), anatomic location (23 options), was identified by a specialist ("yes", "no", or "there was attempt but no"), recurrent problem ("yes" or "no"), nature of the problem considering the first occurrence ("acute" or "overuse"), problem caused ("yes" or "no"), aggravated ("yes" or "no"), and reactivated ("yes" or "no") by the work as a FP.

In the third and last part, the participants receive instructions to answer the questions considering all the MED reported in general. This part was composed of the following questions: "Have you ever resorted to sick leave?" ("yes" or "no"), "How frequently do you keep working as a FP during the recovery phase of a MED?" (5 options), "Do you consider that keep working as a FP contributes to prolongate the duration of the recovery phase of a MED?" ("yes" or "no"), "According to your perception, mark the main factors you consider that have caused, reactivated and/or aggravated your MED (can select more than one option)" (18 options), and finally, "How the history of your MED is affecting your current performance as a FP?" (18 options).

All questions with the option "other" were followed by a request to specify.

Development and validation process of musculoskeletal disorders survey

The MED survey was developed and validated according to the literature recommendations (Hill & Hill, 2004; Moreira, 2004), using the following procedures:

- First version, based on preliminary research. A panel of five experts collected information for the construction of the first version of the survey, based on the existing literature on MED of FP, which could be work-related. The experts have experience as FP, as trainers/teachers of FP, as researchers in the field of exercise and sport sciences and/or in the development and validation of surveys.
- Second version, based on content validation by experts. The purpose of this phase was to verify the relevance, clarity, and understanding of the questions. The first version of the survey was submitted to a content validation phase by the second panel of experts (different from the first one). This second panel consisted of 5 experts, with professional experience in medicine and injury treatment (a doctor, an orthopedist and a physiotherapist). The experts of this panel raised some questions to be considered and made changes to suggestions about the first version of the survey. All the information was taken into consideration by the authors of the study (first panel of experts), giving rise to the second version of the survey.
- Third version, based on pilot application to the target population. The second version of the survey was transformed into an online version on the SurveyMonkey platform and applied to 10 FP (Physical Exercise Technician and Technical Director). This phase resulted in the third (and last) version of the survey, elaborated based on respondents' opinions regarding the clarity and understanding of the questions and the layout.
- The third version was submitted to the reliability test. The survey was administered with a two-week interval between applications. 30 participants completed the two phases of the test.

Scale variables

- Internal consistency was calculated based on the Intraclass Correlation Coefficient (with absolute agreement) and Cronbach's Alpha (p = .957, p = .964, respectively). Internal consistency was considered very good (> 0.9 - very good) (Pestana & Gageiro, 2020).
- Normality test was performed, and Spearman correlation was applied. Four variables obtained correlation values below 0.70 (anatomical location "pubic area" - p = 0.695; anatomical location "lower back" - p = .695; Identified by a specialist "No" - p = 0.695; Recurrent "No" - p = 0.685). Given that the values are very close to a high correlation (≥ 0.70) and the need to maintain survey coherence, the authors opted to keep these variables. In the remaining variables, Musculoskeletal Disorders of FP, 14 obtained correlation values between 0.70 and 1 (high to very high), indicating strong correlations (Pestana & Gageiro, 2020).

Nominal variables

- The level of agreement was calculated based on Cohen's Kappa. All the variables obtain values between 0.61 (good) and 1 (very good) (Pestana & Gageiro, 2020).

The third and final version was the survey used in the present study to collect data on MED.

Procedures

Data were collected between November 2019 and March 2020. The isolation decreed in Portugal in March, in response to the coronavirus disease (COVID-19), enabled the collection to be completed ahead of schedule, avoiding the data

from being skewed by changes that have also occurred in the fitness sector. The surveys were available on SurveyMonkey, an online platform. Dissemination was provided through social networks, fitness sector associations, higher education institutions, training providers offering sport and fitness programs, and fitness events and conventions.

Statistical analysis

SPSS version 29.0 was used for statistical analysis. Descriptive statistics, using central tendency (mean) and dispersion (standard deviation) measures, were applied to the quantitative characterization variables (age, professional experience, number of group fitness classes/week, cardio group fitness classes/week, strength group fitness classes/week, mixed group fitness classes/week, body&mind group fitness classes/week, maximal group fitness classes/day, paid working hours/week, and unpaid working hours/week), and to the nMED/FP. In the descriptive analysis of the remaining characterisation variables (gender, professional title, and currently working/not working as a FP), frequency analysis was used. This statistical technique was also used to characterise the existence of a MED and the nMED/FP. The nMED/FP is a variable that represents the total number of MED that each FP reported (including the FP that reported that they don't have or had any MED). The frequency analysis was also used with the characterization of qualitative variables of each MED reported (type, anatomical location, identified by an expert, recurrent, nature, caused, aggravated, and/or reactivated by the work as a FP), and with the general qualitative variables related to the existence of MED (main factors that had caused, reactivated and/or aggravated MED, sick leave, keep working as a FP during the recovery phase, keep working as a FP contributes to prolong the duration of the recovery phase, and the effects of the history of the MED on the current performance as a FP).

The nMED/FP variable was used for comparisons and correlation analyses. The sampling distribution is expected to be approximately normal, and this assumption was made for all variables with at least 30 individuals per group, based on the Central Limit Theorem (Pestana & Gageiro, 2020). The T-test was used for comparisons between groups (gender, professional title, and currently working/not working as a FP), and the effect size was calculated (< 0.20 very small; 0.20–0.49 small; 0.50–0.79 medium; ≥ 0.80 large) (López-Martín & Ardura-Martínez, 2023). To correlate the nMED/FP with other variables (age, professional experience, number of group fitness classes/week, cardio group fitness classes/week, strength group fitness classes/week, mixed group fitness classes/week, body&mind group fitness classes/week, maximal group fitness classes/day, paid working hours/week, and unpaid working hours/week) Pearson's correlation coefficient was used and the correlation levels adopted were: < 0.20 very weak, 0.20–0.39 weak, 0.40–0.69 moderate, 0.70–0.89 high, and ≥ 0.9 very high (Pestana & Gageiro, 2020). The level of significance adopted was $p < .05$.

RESULTS

Characterisation of the FP

Of the 466 participants that answered the question "Do you have or had any MED caused, aggravated, or reactivated by your work as a FP?", 51.1% said "yes". However, as can be observed in Table 2, 9.0% of individuals answered "yes" but did not complete the rest of the survey, so they were not considered for the remaining statistical analysis. Considering the 424 participants, the majority (53.8%) had not experienced a work-related MED so far, 14.8% had experienced only one problem, 14.4% two problems, 9.4% three problems, and 7.8% had experienced four to eleven MED caused, aggravated, and/or reactivated by their work as FP (Table 3). A total of 472 MED was reported, which puts this study sample with an average of 1.11 ± 1.61 (M ± SD) nMED/FP (Table 3).

Table 2. Number and frequency of the musculoskeletal disorders.

	n	Frequency (%)
Work-related MED		
Yes	238	51.1
Specify MED	196	42.1
Did not answered to MED[1]	42	9.0
No	228	48.9
Total	**466**	**100.0**

MED: musculoskeletal disorders. [1]These cases were not considered in the rest of the study because they did not specify MED.

Table 3. Number and frequency of the total musculoskeletal disorders per fitness professional.

	n	Frequency (%)
Total MED per FP (n = 424)		
0	228	53.8
1	63	14.8
2	60	14.2
3	40	9.4
4 to 11[1]	33	7.8
Total	**472**	–
		M ± SD
Total MED (n = 472) per FP (n = 424)		1.11 ± 1.61

MED: musculoskeletal disorders; FP: fitness professional; M: mean; SD: standard deviation. [1]All the options with frequencies lower than 5.0% were included in this category.

Characteristics of all the musculoskeletal disorders in general reported by the fitness professionals

A total of 472 MED were reported by the FP in this study, and the characterisation results are presented in Table 4. By type, the most common MED identified by the FP was "Joint and ligaments" (37.1%), followed by "Muscles and tendons" (33.9%) and "Bone fractures and stresses" (6.1%). The FP could not identify the type of 12.5% of the MED reported. "Knee", "Shoulder" and "Lower back" were the anatomical locations most reported (21, 14, and 12.7%, respectively). 73.1% of the MED were identified by a specialist, 17.8% were not, and in 8.9% there was an unsuccessful attempt to identify them. 50.8% of the MED reports were not recurrent. Regarding the nature of the MED, 55.9% were "Overuse", and 42.8% "Acute". Of the 472 MED identified, in FP perception, 74.6% were aggravated by the work as an FP, 57.0% were caused, and 56.6% were reactivated.

Characteristics of musculoskeletal disorders prevalence and incidence reported by the fitness professionals

The following results pertain to the history of MED in general, as reported by the FP. The results in Table 5 reveal that 39.9% of participants who reported at least one MED related to work as a FP had already resorted to sick leave. Regarding maintaining activity as a FP during the recovery phase of a MED, 29.5% did it "Always", 24.4% "Sometimes", and 20.7% "Never". Nevertheless, 85.5% of the participants believe that continuing to work as a FP during the recovery phase of a MED prolongs that phase.

Regarding the main factors that FP considered that had caused, aggravated and/or reactivated the MED (Table 6), "Insufficient recovery time between classes/training" was at the top of the list, with 46.1%, followed by "Perform professional activity (fitness) during the recovery phase of the problem", with 41.5%. Four of the main factors considered were in relation to group fitness classes ("Excessive hours of repetitive movements group fitness classes/week" – 40.9%; "Excessive hours of group fitness classes/week" – 39.4%; "Excessive hours of high-impact group fitness classes/week" – 37.3%; and "Excessive hours of mechanical load group fitness classes/week" – 26.9%). "Sleep quality" (38.3%) was also referred to at the top of the list.

Table 7 presents the effects of MED history on the FP's current performance. 40.4% of the FP "Feel pain/discomfort during professional activity", and 28.0% refer that their current performance at work was not affected by their history of MED. Eight options concerning to group fitness classes

Table 4. Frequency of the 472 musculoskeletal disorders reported (possibility to choose more than one option).

	Frequency (%)
Type	
Joint and ligaments	37.1
Muscles and tendons	33.9
Can't identify	12.5
Bone fractures and stresses	6.1
Contusions, lacerations, and skin lesions	5.7
Other[1]	4.7
Anatomical Location	
Knee	21.0
Shoulder	14.0
Lower back	12.7
Foot	6.1
Ankle	6.1
Hip joint	6.1
Neck (cervical zone)	5.7
Other[1]	27.8
Can't identify	0.2
Identify by a specialist	
Yes	73.1
No	17.8
There was attempt but no	8.9
Missing	0.2
Recurrent	
No	50.8
Yes	49.2
Nature	
Overuse	55.9
Acute	42.8
Missing	1.3
Problem caused	
Yes	57.0
No	36.0
Missing	7.0
Problem reactivated	
Yes	56.6
No	32.2
Missing	11.2
Problem aggravated	
Yes	74.6
No	22.2
Missing	3.2

MED: musculoskeletal disorders. [1]All the options with frequencies lower than 5.0% were included in this category.

Table 5. Frequency of sick leave and recovery phase.

(n = 196)	Frequency (%)
Sick Leave	
No	60.1
Yes	39.9
Keep working as FP during the recovery phase	
Never	20.7
Sometimes	24.4
Frequently	14.5
Very often	10.9
Always	29.5
Keep working as FP contributes to prolongate the duration of the recovery phase	
Yes	85.0
No	15.0

FP: fitness professional.

Table 6. Frequency of fitness professional perception of the main factors considered to have caused, reactivated and/or aggravated the musculoskeletal disorders (possibility to choose more than one option).

n = 196	Frequency (%)
Insufficient recovery time between classes/training	46.1
Perform professional activity (fitness) during the recovery phase of the problem	41.5
Excessive hours of repetitive movements (monotonous exercise) group fitness classes/week	40.9
Excessive hours of group fitness classes/week	39.4
Sleep quality (e.g.: insufficient number of hours, wake up at night, ...)	38.3
Excessive hours of high-impact group fitness classes/week	37.3
Excessive hours of work per week	33.7
Excessive hours of mechanical load group fitness classes/week	26.9
Inadequate nutrition	17.6
Excessive hours of personal workout	16.6
Number of years working as a fitness professional	15.0
Poor hydration	15.0
Inadequate working environment conditions (e.g.: floor, ventilation, material conditions, ...)	12.4
Other[1]	20.2

[1]All the options with frequencies lower than 10.0% were included in this category.

were considered by the FP on this subject: "Adapt the way of instructing group fitness classes and/or workouts" (39.4%); "Reduced the number of hours of group fitness classes/week" (16.6%) and "Reduced the number of hours of high-impact group fitness classes/week" (11.9%) were the most referred.

Table 7. Frequency of the effects of the history of the musculoskeletal disorders on the current performance as a fitness professional (possibility to choose more than one option).

n = 196	Frequency (%)
Feel pain/discomfort during professional activity	40.4
Adapt the way of instructing group fitness classes/workouts	39.4
Does not affect	28.0
Reduced the number of hours of group fitness classes/week	16.6
Reduced the number of hours of high-impact group fitness classes/week	11.9
Don't instruct certain types of group fitness classes	11.4
Reduced the number of hours of work/week	9.8
Don't instruct high-impact group fitness classes	8.3
Don't instruct mechanical load group fitness classes	7.8
Don't instruct group fitness classes	6.7
Don't instruct repetitive movements (monotonous exercise) group fitness classes	5.7
Don't instruct certain types of workouts	3.1
Reduced the number of hours of personal trainer per week	2.6
Reduced the number of hours of accompaniment in the exercise room/box per week	2.1
Don't do accompaniment in the exercise room/box	1.6
Other(s)	
I'm on sick leave at this point, for a knee operation	0.5
I'm unemployed	0.5
I don't perform functions as a fitness professional anymore, I changed my professional area	0.5

Comparisons between groups by gender, by groups of active and non-active professionals and by types of professional licenses considering the number of musculoskeletal disorders per fitness professional

A comparative analysis of the nMED/FP between female and male (gender), between Physical Exercise Technician and Technical Director (professional title), and between currently working/not working as a FP (Table 8) was done. The results revealed significant differences between females (1.40 ± 1.73) and males (0.83 ± 1.44), and between FP that were currently working (1.25 ± 1.67) and those who were not (0.57 ± 1.18) (both with $p < .001$). A small effect size was observed for gender, and a medium effect size for currently working/not working as a FP. Regarding professional title, there were no differences between the Physical Exercise Technician (1.15 ± 1.78) and Technical Director (1.06 ± 1.34) groups.

Number of musculoskeletal disorders per fitness professional correlations

Pearson's test identified significant correlations between the nMED/FP and seven variables (Table 9). Age, professional experience, number of group fitness classes/week, body&mind group fitness classes/week, maximal number of group fitness classes/day, paid working hours/week, and unpaid working hours/week, all revealed significant, but very weak, correlations. No significant correlations were found between nMED/FP and cardio, strength, or mixed group fitness classes/week.

Table 8. Mean, standard deviation, T-Test and effect size of total musculoskeletal disorders per fitness professional between groups.

	Total MED per FP	
	M ± SD	T-Test effect size
Gender		
Female	1.40 ± 1.73	< .001*
Male	0.83 ± 1.44	.363
Professional Title		
Physical exercise Technician	1.15 ± 1.78	.585
Technical Director	1.06 ± 1.34	.054
Currently working as fitness professional		
Yes	1.25 ± 1.67	< .001*
No	0.57 ± 1.18	.428

M: mean; ST: standard deviation. *Significant differences for $p < .05$; Effect size: < 0.20 very small; 0.20–0.49 small; 0.50–0.79 medium; ≥ 0.80 large.

Table 9. Correlation of total musculoskeletal disorders reported per fitness professional with the variables.

Variables	Total MED per FP	
	r	p
Age (years)	.105	.031*
Professional experience (years)	.161	.003*
GFC/week (no.)	.155	.004*
Cardio GFC/week (no.)	.071	.193
Strength GFC/week (no.)	.094	.087
Mixed GFC/week (no.)	.046	.397
Body&mind GFC/week (no.)	.162	.003*
Maximal GFC/day (no.)	.113	.038*
Paid working hours/week (no.)	.116	.034*
Unpaid working hours/week (no.)	.175	.002*

MED: musculoskeletal disorders; FP: fitness professional; no.: number; GFC: group fitness classes. *Significant correlation for $p < .05$; *r*: Pearson´s correlation coefficient; Correlation levels: < 0.20 very weak, 0.20–0.39 weak, 0.40–0.69 moderate, 0.70–0.89 high, and ≥ 0.9 very high.

DISCUSSION

A cross-sectional study was conducted among FP in Portugal to assess the prevalence of MED and its potential impact on professional activity. The results of the present study showed a lower number of FP reporting MED caused, reactivated, and/or aggravated by the work as a FP, than other studies, once most of these studies found higher frequencies (above 75%) of FP with, at least one, work-related MED (du Toit & Smith, 2001; Francis et al., 1985; Garrick et al., 1986; Malliou et al., 2014; Richie et al., 1985; Shinde & Sahasrabuddhe, 2021). Regarding nMED/FP average, this study reports lower results than those of Garrick et al. (1986) but similar to those of Thompson et al. (2001). It should be noted that the results of the present study considered a sample that included all FP with a valid professional title, including not only group fitness classes FP but all FP, regardless of the functions performed or whether they were currently working as FP. Considering the positive correlation between the number of hours of group fitness classes and work-related injuries found in other studies (Bratland-Sanda et al., 2015; du Toit & Smith, 2001; Francis et al., 1985; Garrick et al., 1986; Richie et al., 1985), these differences in the target population suggest that, if this study sample focuses only on group fitness classes FP, the average of nMED/FP would probably be higher.

According to Garrick et al. (1986, p. 68), "people seek medical care for a variety of real and imagined problems"; however, this study reveals that most of the MED were identified by specialists, which lends some credibility to the reported problems. du Toit and Smith's (2001) findings show that the instructors who did not ask for medical assistance to relieve pain or symptoms implemented a self-treatment process. These two options (seeking medical care or self-treatment) are probably related to the severity of the MED; however, that was not addressed in the present research.

The MED characterisation revealed some results in concordance with the literature. According to the type of injury, these study results are in line with other studies, as the most reported MED involved joints and ligaments, and muscles and tendons (in this order), with very similar frequencies. In general, other studies placed these types of MED in the first positions (du Toit & Smith, 2001; Ferreira et al., 2024; Malliou et al., 2014; Merati et al., 2021; Romaine et al., 2003; Thompson et al., 2001), although some of them with an inversion of position (Ferreira et al., 2024; Malliou et al., 2014; Merati et al., 2021; Romaine et al., 2003).

Concerning to the anatomical location, the knee (Bratland-Sanda et al., 2015; du Toit & Smith, 2001; Ferreira et al., 2024; Francis et al., 1985; Garrick et al., 1986; Richie et al.,

1985; Romaine et al., 2003; Thompson et al., 2001) , shoulder (Bratland-Sanda et al., 2015; Romaine et al., 2003; Shinde & Sahasrabuddhe, 2021; Thompson et al., 2001) and back (Bratland-Sanda et al., 2015; Ferreira et al., 2024; Francis et al., 1985; Richie et al., 1985; Romaine et al., 2003; Shinde & Sahasrabuddhe, 2021; Thompson et al., 2001) have been highlighted in the top three on several studies with FP. The knee was the most common injury in three studies (Domene et al., 2017; Ferreira et al., 2024; Malliou et al., 2014), and it was also among the most frequently reported anatomical locations for overuse injuries (Bratland-Sanda et al., 2015; Malliou et al., 2014).

This research reported a lower frequency of overuse MED than did Bratland-Sanda et al. (2015) and Malliou et al. (2014). Nevertheless, about half of the reported MED in the present study were still due to overuse, and the recurrence frequency results were similar, as were the problems that had been reactivated by the work as a FP. Despite this, acute micro-injuries can also lead to chronic injuries that impair work performance (Shinde & Sahasrabuddhe, 2021). Nevertheless, a high percentage of MEDs had been aggravated by the work as a FP. It is possible that some of the primary consequences of this aggravation are already or may lead to the transformation of the MED into a recurrent and/or chronic problem. The long-term consequences could be lower indices of quality of life and/or even dropout from the profession in fitness. These possibilities suggest the urgent need to understand what this MED aggravation really represents, so that this issue can be addressed more efficiently.

From another perspective, there is also the hypothesis that the FP are making the choices and changes that allow them to fully recover from MED and/or prevent problems from becoming recurrent and/or chronic.

Almost half of the FPs who reported a MED had already been on sick leave at least once. The percentage of FP that always stop working during the recovery phase of a MED was very low, and one-third said they always continue the work activity despite this phase. Bratland-Sanda et al. (2015) found that the group of FP with a higher number of instruction hours reported a higher prevalence of sick leave, performing instruction despite injuries or sickness. Almost all the FP that reported a MED, had the opinion that keeping the work activity during the recovery phase of a MED contributes to prolonging the duration of this phase, and it was also pointed by the FP as the second main factor that caused, reactivated and/or aggravated a MED. So, the option to keep working does not seem to be a lack of knowledge, but rather a reflection of necessity. There was a suggestion that FP are performing too many hours of group fitness classes to have a suitable salary (Francis et al., 1985). Note that, considering the results of studies conducted in Portugal (Ramos et al., 2021a), the lower levels of job satisfaction of FP in Portugal were concerning salary, opportunities for promotion, and job security (Ramos et al., 2021a) and 68% of the FP in Portugal were freelancers (Ramos et al., 2021b).

FP in Portugal also appears to have a good understanding of the risks that certain work-related variables could pose to MED. Their perception of the main factors that had caused, reactivated, and/or aggravated a MED, and the modifications that they had made in their intervention as FP, are in line with several findings in the literature in relation to some of the work-related risk factors for injury or pain identified, and some of the suggestions that have been made to prevent those. Despite the possibility that this knowledge becomes available through experience with a work-related MED, it could be useful for controlling existing MED or preventing the recurrence of future ones.

Among the main factors that caused, reactivated, and/or aggravated MED in FP perception, the insufficient recovery time between classes/training was identified as the top item on the list. A recent study found that fatigue, high-impact classes, and long working hours were the primary causes of injuries in aerobic FP, according to opinion (Merati et al., 2021). The recovery time has been addressed by some authors (Bishop et al., 2008; George & Abraham, 2022; Judge & Burke, 2010; Malliou et al., 2014; Talpey & Siesmaa, 2017). An inappropriate recovery time between training sessions could lead to fatigue and impair the muscles' capacity (Judge & Burke, 2010). Different training stresses require different recovery durations (Bishop et al., 2008), and when training stress is not adequately balanced with recovery, the risk of injury increases (George & Abraham, 2022; Talpey & Siesmaa, 2017). The FP chose the insufficient time of recovery between classes/training above excessive hours of group fitness classes/week and excessive hours of work/week, suggesting that the organization of the exercise load over the week is an important factor to consider. This result is also supported by the positive correlation between nMED/FP and the maximal group fitness classes/day observed in the present study.

Additionally, among the main factors that caused, reactivated, and/or aggravated MED in FP perception, four were related to group fitness classes/week. Some studies support this FP perception (Bratland-Sanda et al., 2015; Domene et al., 2017; Francis et al., 1985; Garrick et al., 1986; Malliou et al., 2014; Merati et al., 2021; Richie et al., 1985), but Thompson et al. (2001) found no correlation between the group fitness classes/week and the rate of injuries. On the other side, Bratland-Sanda et al. (2015) had very similar

findings to the present study results, referring the monotonous exercise modality as a risk factor for overuse injuries, the volume (hours/week) of high-impact classes as one of the variables explaining injuries, and the total instruction loading (number of hours of instruction of group fitness classes per week) even more important explanatory variable than the high impact classes. In the present research, a positive correlation was found between the nMED/FP and the number of group fitness classes/week. Concerning the type of group fitness classes, the only correlation was between the nMED/FP and the body&mind group fitness classes/week. No studies focusing on MED of FP were found with similar results (in relation to body&mind group fitness classes/week). However, a study on the quality of life of FP in Portugal (Vieira et al., 2022) found a negative correlation of this variable with the physical domain, suggesting that these findings could be the result of FP adaptation, to be able to persist working in fitness, once this type of group fitness class is less physically demanding. The effects of the history of MED on the current performance as a FP that were reported in this study confirm that the FP are changing their intervention, especially in terms of group fitness classes (eight of the top ten effects considered by the FP were concerning group fitness classes).

Excessive hours of work/week were identified as one of the main factors for MED by a third of the FP, and the correlation test results of this study revealed a positive association between nMED/FP and paid and unpaid working hours/week, reinforcing the FP perception. These findings are in line with the study by Vieira et al. (2022), which found that unpaid working hours per week were negatively associated with FP quality of life across all domains. In the Malliou et al. (2014) study, working hours were identified as a primary cause of injury and a strong predictor of absence from group fitness classes due to chronic injuries. In addition, based on the effects of MED history on the FP's current performance, the FP in the present study reduced the number of work hours/week and the number of hours spent in specific functions, which appears to be a professional option consistent with the FP's main factors for MED.

Another factor reported by the FP was concerning sleep quality. A study with soccer players (Silva et al., 2020) revealed a correlation between lower sleep quality or nonrestorative sleep and an increased number and severity of musculoskeletal injuries. There are also studies attributing disturbed sleep to work stress (Åkerstedt et al., 2002; Van Laethem et al., 2013, 2015), with strong evidence for a negative relation between job demands and sleep quality (Van Laethem et al., 2013). High physical workload was associated with increased sleep problems and fatigue (Åkerstedt et al., 2002), whereas sleep quality was associated with increased work-related stress over time (Van Laethem et al., 2015). However, no studies were found regarding the sleep quality of FP.

Inadequate nutrition and excessive hours of personal workouts were also mentioned by a few FP as the main factors of the MED reported. The literature indicates a higher prevalence of eating disorders and compulsive exercise in FP than in the general population, and also reports a correlation between the two (Gjestvang et al., 2021; Höglund & Normén, 2002; Lichtenstein et al., 2017). Eating disorders were considered a risk factor for ME injuries and/or pain in FP (Bratland-Sanda et al., 2015; Thompson et al., 2001), and excessive exercise for overuse injuries (Lichtenstein et al., 2017; Weinstein & Weinstein, 2014). This does not mean that FP should not exercise; they need to do so to prepare for the job's physical demands and ensure safer performance. However, they need to do it with the right purpose and balance the volume and intensity of training with the work's physical demands.

Professional experience was one of the variables that revealed a positive correlation with the nMED/FP, and this finding is supported by other studies (Bratland-Sanda et al., 2015; Malliou et al., 2014). Considering the results, it is possible that only the most experienced FP in this sample have considered this as one of the main factors that caused, reactivated and/or aggravated a MED. Looking at the mean and SD values of the professional experience variable, FP were not even in the middle of (a normal) work life. These findings should represent a big concern for the fitness industry because more years of professional experience as FP have been associated with a lower risk of clients' ME pain (Ahmed et al., 2022). Ahmed et al. (2022) suggest that "care should be given by ensuring standard experience when appointing fitness trainers to the centre".

At the bottom of the list of main factors reported on the FP perception were poor hydration and inadequate working environment conditions. Some studies addressed athletes' hydration or its importance during physical exercise (Casa et al., 2005; Krabak et al., 2013; Sawka et al., 1992) suggested that hydration may affect the risk of musculoskeletal injury. Despite no studies found focused on hydration as one of the risk factors for MED in FP, hot or hot-dry environments could lead to dehydration and exhaustion from heat strain (Sawka et al., 1992).

Considering the work environment conditions, the first studies found on FP injuries subject suggested the type of floor as one of the risk factors (Francis et al., 1985; Garrick et al., 1986; Malliou et al., 2014; Richie et al., 1985); however, recent research investigated the type of floor, ventilation, and lightning of the work environment, with no significant correlation results as risk factors for injuries (Malliou et al., 2014). Gray and Finch (2015) present a list of other causes of injuries

in fitness facilities that may be related to the organisation of the material/machines in the space and material conditions.

Concerning the correlation results, significant positive correlations were found between nMED/FP and age, professional experience, number of group fitness classes/week, maximal group fitness classes/day, body&mind group fitness classes/week, and paid and unpaid working hours/week. Despite age and body&mind group fitness classes/week, all the other variables represent some form of volume measure that affects the workload, physical demand, time of exposure, or recovery time of the FP. Considering the findings in the literature exposed throughout the present study, these results were expected. Throughout the discussion of the results of the perception of the FP in relation to the main factors that caused, reactivated and/or aggravated a MED, many of the nMED/FP correlation results had already been addressed. Therefore, the continuity of this discussion will be directed to the remaining ones.

Regarding age, Richie et al. (1985) found no correlation with increased risk of any injury, and Domene et al. (2017) found that this was not significant for injury prediction or group differentiation (injury vs non-injury). Ramos et al. (2021a) suggest that as professionals get older and more experienced, their job satisfaction increases, and Vieira et al. (2022) suggest the same concerning quality of life. If only the results of the studies mentioned above (Domene et al., 2017; Ramos et al., 2021a; Richie et al., 1985; Vieira et al., 2022) were considered, a significant positive correlation between age and nMED/FP would not be expected. However, it seems normal that greater age and more years of experience also mean greater exposure to MED risk factors and, therefore, a greater probability of having a higher number of MED. Nevertheless, considering the low averages of age and professional experience, it would be interesting (and important for the fitness industry) to understand whether the latest growth in the fitness market had led to a more recent increase in the number of FP, and therefore they are younger, and/or whether older FP are, in fact, dropping out of the profession in fitness due to the lack of working conditions and/or MED. The low averages in age and professional experience, along with the nMED/FP correlation results and the changes in work performance that the FP have already undergone, suggest that FP have a physically demanding profession, possibly with fast wear. This raises concerns about the health and well-being of FP and undoubtedly questions how viable it is to maintain the profession over the years.

Regarding the comparison between groups with different professional titles, no differences were found between Physical Exercise Technicians and Technical Directors. It should be noted that in Portugal, only two levels of license (EQF 5 and 6) are available; occupational tasks are not completely distinct (Portugal, 2012); and the majority of workers are graduated FP (IPDJ, 2021). Therefore, these results were expected. It is possible that some Physical Exercise Technicians perform coordination functions, as Technical Directors do. It is also probable that many Technical Directors perform, as well, fitness instructor functions in the present or have performed in the past, once the law itself includes the Physical Exercise Technician functions in the Technical Director functions (Portugal, 2012). In line with this observation, the study of the quality of life of FP in Portugal also found no differences in the physical domain across professional titles (Vieira et al., 2022).

According to gender, females had a significantly higher nMED/FP than males. Bratland-Sanda et al. (2015) reported similar results regarding musculoskeletal pain, but only in the group with the fewest hours of instruction. The quality-of-life physical domain of FP in Portugal (Vieira et al., 2022) also shows lower, significant results for females. Richie et al. (1985) found no gender differences in injury risk, and Ramos et al. (2021a) also found no gender differences in job satisfaction among FP in Portugal. Some studies reported the opposite result to the present study, finding a higher prevalence of injury or pain among males (George & Abraham, 2022; Shinde & Sahasrabuddhe, 2021). It was suggested that the divergences observed may be related to the type of activity performed by each gender, rather than to the gender itself.

There were also differences between the groups that were currently working and not working as a FP, with a higher nMED/FP for the group that was currently working. No studies were found on FP MED that support this result; however, it is suggested that FP with a valid professional title who are not currently working as a FP are no longer exposed to work-related risk factors in MED, supporting the hypothesis that FP have a fast-wear profession. On the other hand, given that most FP continue their work activity during the recovery phase of a MED, it is expected that some adaptations will be needed to protect the FP and avoid aggravation of the MED. However, these adaptations may also lead to decompensation, which can trigger other MED. Not currently working as a FP could give time for recovery without the need for adaptations, and therefore be less propitious for sustaining new MED.

Finally, although the effects of the history of MED on current performance as FP had already been mentioned throughout the discussion, it is important to highlight that almost half of the FP who reported a problem currently work with pain, and almost half adapt the way they instruct group fitness classes/workouts. Adaptation is necessary, but

again, not if this leads to decompensation. Another important point is related to the amount and type of functions that FP were reducing (fewer hours of), and even more importantly, the functions that FP just did not perform anymore. The average number of years of professional experience was too low to justify the FP's many adaptations due to MED. Despite the low frequency of the "other" option, it is necessary to give due attention to the effects mentioned by the FP who have chosen it. At least one person has completely abandoned the profession of FP due to MED history, one was unemployed, and the other was on sick leave, waiting for a knee operation. It should be noted that many FP are freelancers or have fixed-term employment contracts, which, in the event of an injury, may result in the termination of services or the non-renewal of the contract.

Some studies have been conducted to better understand the main risk factors for MED in FP, particularly work-related factors. However, FP's work schedule is always changing, and therefore, the type of group fitness classes, exercise volume, recovery time, workload, and intensity also change. This means it is difficult to identify risk factors for MED based solely on the type of group fitness class and current workload or intensity, because a significant portion of MED is due to overuse. The characterisation of the main factors that had caused, reactivated, and/or aggravated a MED by the FP perception, along with the effects of the history of MED on the current performance as a FP, brings a new perspective. Results based solely on current performance as a FP can be misleading because current performance may reflect adaptation, and exposure to the real risk factors (responsible for causing, aggravating, and/or reactivating the MED) no longer exists, despite the current existence of the MED. FP work with MED of their clients every day; therefore, they have the knowledge to not only identify their own problems but also modify behaviours, change functions, and reduce hours of exposure to MED risk factors. Because the exposure of the FP to work-related risk factors for MED is always changing, it is suggested that the consideration of this new approach, which implies not only considering the FP's opinion about the factors responsible for having caused, aggravated and/or reactivated the MED, but also the changes that they have already made in their work performance. This new approach is important for the fitness industry to recognise the adjacent implications of MED in FP, so that changes can be made for the benefit of all parties (FP, gym owners, and clients).

Strengths and limitations

The present study has some strengths. The topic is poorly explored in the literature, and the FP population, which uses two validated tools, has a large sample and is specific to the Portuguese context.

Regarding limitations, this study uses self-reported surveys, and because the surveys were not sent to all fitness professionals with a valid professional title, it is a convenience sample and therefore not representative of the population. The definition regarding the professional title, which does not completely distinguish occupational functions, also represents a limitation.

Implications for professional practice

The data allow us to characterise the Portuguese context regarding the work-related MED of FP and are useful for developing strategies for injury prevention and for promoting job satisfaction and better QoL indices among FP.

The effects of the MED history on the current work performance of the FP, especially considering the years of professional experience of FP participants in this study, represent a real concern. The average of nMED/FP could not seem too high, but it is already affecting FP, in particular, and the fitness industry, in general. There is clearly a need to consider the main factors for MED identified by FP, because they are not only adapting how they perform their functions at work, but also avoiding or leaving behind some essential functions for most gyms. These changes that FP are making, due to the history of MED, may force the fitness industry to work with professionals with little experience, in an attempt to maintain the offer of activities. The fitness industry cannot represent health and physical well-being without considering those ideals for the FP that represents it. One aspect that could be addressed by FP and gym employees is the maximum number of group fitness classes/day. It is important to distribute the training load in a balanced way throughout the week to allow recovery, and it is also important that FP vary the type of exercise over the week, including group fitness classes, other types of training instruction, and personal workouts. Nonetheless, the concern is not only with FP because, if FP has already avoid/leave functions, with so few years of professional experience, but this could also be affecting the service quality and the safety of fitness industry clients. To ensure sustainable growth of the fitness industry and FP work-life, there is an urgent need for educational programs and guidelines for employers and FP employees in this industry that address MED prevention for these professionals.

Implications for future research

The present cross-sectional study raised the following questions to be addressed in future studies: 1) What kind of information and strategies should be included in FP training

programs? 2) What is the impact expected after developing, validating, and implementing an MED prevention program for FP? 3) What are the main reasons for FP dropout from the profession?

CONCLUSIONS

Almost half of the FP reported a MED caused, reactivated and/or aggravated by the work as FP. The main factors considered responsible for MED include "Insufficient recovery time between classes/training", "Perform professional activity (fitness) during the recovery phase of the problem", and four additional main factors related to group fitness classes. The most frequently reported effect of MED history on current FP performance was pain and/or discomfort during work, and almost half of the FP adapted the way they instruct group fitness classes/workouts.

In the characterisation of MED, the most reported type was "joint/ligaments", the anatomical location was the "Knee", the nature was "Overuse", and "identified by a specialist". Around half of the MED were "caused" and/or "reactivated" by work, but most of them were "aggravated" by work. The FP also reported that around half of the MED were "recurrent".

Considering the FP who reported at least one MED related to the work, almost half had already resorted to sick leave; most kept working during the recovery phase of a MED, and most consider that continuing to work as a FP during this phase contributes to prolonging it.

A comparative analysis of the nMED/FP between groups reveals significantly higher means in "Females" and "working as FP" groups.

A nMED/FP positive correlation was established with age, professional experience, number of group fitness classes/week, body&mind group fitness classes/week, maximal group fitness classes/day, paid working hours/week, and unpaid working hours/week.

CREDIT AUTHORSHIP CONTRIBUTION STATEMENT

Isabel dos Santos Vieira – Conceptualization; Data Curation; Formal Analysis; Investigation; Methodology; Validation; Writing – Original Draft; Writing – Review & Editing.

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