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# Perceptions of chronic low back pain and sleep quality among participants in aquatic physical therapy: qualitative study

## Percepção sobre dor lombar crônica e qualidade de sono em indivíduos participantes de fisioterapia aquática: estudo qualitativo

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Data availability
**The data that support the findings of this study are available from the corresponding author upon reasonable request.**
The study was carried out at Universidade do Estado de Santa Catarina, Florianópolis, SC, Brasil.

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## ABSTRACT

**BACKGROUND AND OBJECTIVES:** Chronic pain (CP), such as chronic nonspecific low back pain, represents a global challenge, affecting about 20% to 30% of the world's population**.** The objective of this study was to investigate the perception of individuals with chronic low back pain (CLBP) regarding the impacts of aquatic therapy (AT) on their pain and sleep quality (SQ).

**METHODS:** This is a qualitative, descriptive study, from a larger, experimental study, conducted with individuals with CLBP, aged between 18 and 65 years of both genders. The study was conducted at a public university in Santa Catarina. A Visual Analog Scale (VAS) and open interviews about the AT sessions were used as data collection instruments. Content analysis was used to interpret the data.

**RESULTS:** Thirteen participants (8 females and 5 male) with a mean age of 47.4 years participated in the study. The data emerged in the following categories: (1) Pain threshold in the lumbar spine when performing AT with the VAS; (2) Immediate perceptions after AT, regarding how participants felt when participating in the study; (3) Impressions of SQ, regarding sleeping well at night. The perceptions of pain and pain relief when participating in the study were reported, as well as the importance of adopting active behavior when performing aquatic exercises, the factor of belonging to the group and the comprehension of sleep in health.

**CONCLUSION:** In the perception of the individuals participating in the study, AT helped to improve pain and SQ.

**KEYWORDS:** Aquatic therapy, Low back pain, Sleep.

## RESUMO

**JUSTIFICATIVA E OBJETIVOS:** A dor musculoesquelética crônica (DC), como a dor lombar crônica inespecífica, representa um desafio global acometendo cerca de 20% a 30% da população mundial. O objetivo deste estudo foi investigar a percepção de indivíduos com dor lombar crônica (DLC) com relação aos impactos da fisioterapia aquática (FA) em sua dor e na qualidade do sono (QdS).

**MÉTODOS:** Trata-se de um estudo qualitativo, descritivo, proveniente de um estudo maior experimental, realizado com indivíduos com DLC, com idade entre 18 e 65 anos, de ambos os sexos. O estudo foi realizado em uma universidade pública de Santa Catarina. Como instrumento de coleta de dados foram utilizadas uma Escala Analógica Visual (EAV) e entrevistas abertas sobre as sessões de FA. Para interpretação dos dados, utilizou-se a análise de conteúdo.

**RESULTADOS:** Participaram do estudo 13 participantes (8 do sexo feminino e 5 do masculino), com média de idade de 47,4 anos. Os dados surgiram em categorias: (1) Limiar de dor na coluna lombar ao realizar a FA com a EAV; (2) Percepções imediatas após a FA, no que se refere a como os participantes se sentiram ao estarem no estudo; (3) Impressões da QdS, no que se refere a dormir bem à noite. As percepções de dor e o alívio dela ao participar do estudo foram relatados pelos participantes, assim como a importância de adotar um comportamento ativo ao efetuar exercícios aquáticos, do fator de pertencimento ao grupo e do entendimento do sono na saúde.

**CONCLUSÃO:** Na percepção dos indivíduos participantes do estudo, a FA auxiliou na melhora da dor e na QdS.

**DESCRITORES:** Dor lombar, Fisioterapia aquática, Sono.

## HIGHLIGHTS

- After starting aquatic therapy (AT) sessions with therapeutic aquatic exercises, the pain treshould could be reached during the first few weeks
- Exercise is recommended for pain relief (hypoalgesia)
- According to participants' reports, AT helped improve pain and sleep quality

## INTRODUCTION

Aquatic physical therapy (APT) encompasses therapeutic aquatic exercises (TAE), manual therapies, and specific methods. TAE are performed with the aim of promoting movement of the human body and enabling exercise without discomfort[1,2]. Furthermore, they are designed based on the physical therapist's assessment of the participants or a group of people with the same condition[1-3].

Thus, this individualized approach is essential, as pain is a perceptual and subjective sensation with varied etiologies, capable of causing functional impairment, kinesiophobia, and changes in sleep quality (SQ)[4]. According to the International Association for the Study of Pain (IASP), pain is an unpleasant sensory and emotional experience associated with, or resembling, actual or potential tissue damage[4,5]. In the case of chronic low back pain (CLBP), it is characterized by persistent pain between the first and fifth lumbar vertebrae, which may radiate from the 12th rib to the gluteal region and lower extremities[6,7].

Sleep quality (SQ), defined as the subjective perception of satisfaction with one's own sleep, encompasses dimensions related to the onset and maintenance of sleep, as well as the feeling of restfulness upon waking[8]. Sleep disturbance is a common problem among people with pain; approximately 50% report poor SQ[8]. Sleep is considered a fundamental biological need, accounts for one-third of human life, and plays an essential role in maintaining physical and mental health[9].

TAEs are one of the non-pharmacological approaches to pain management that can promote pain relief and improve SQ[10]. Sleep disturbances in people with CLBP are related to pain intensity. Each increase on the Visual Analog Scale (VAS) is associated with a 10% increase in the likelihood of reporting poor SQ[11,12]. Given this, the present study aimed to identify the perceptions of individuals with CLBP regarding pain and SQ after undergoing APT.

## METHODS

This is a qualitative, descriptive, and interpretive study[13,14], a sub-study of a larger quantitative study designed as a randomized clinical trial (RCT) and conducted in accordance with the Consolidated Criteria for Reporting Qualitative Research (COREQ - *Critérios Consolidados para Relatar Pesquisas Qualitativas*)[15]. The RCT aimed to assess the influence of a TAE program on individuals with CLBP, considering outcomes related to pain and SQ. Groups were organized by simple randomization, forming an experimental group and a control group. This qualitative substudy included participants from the experimental group who underwent APT.

### Ethical aspects

This study is part of a larger experimental study designed as a randomized clinical trial (RCT) and submitted to the Research Ethics Committee (CEP) for Research Involving Human Subjects at the State University of Santa Catarina (UDESC). The project was approved through the Certificate of Submission for Ethical Review (CAAE) No. 78425823.7.0000.0118, in accordance with Opinion No. 7.018.317, and is also registered in the Universal Trial Number (UTN) under code U1111-1314-4794, Brazilian Registry of Clinical Trials (ReBEC - *Registro Brasileiro de Ensaios Clínicos*), RBR-8h6m9sx. All procedures involving this research were conducted in accordance with globally recommended scientific and ethical guidelines and took place after participants were informed of the risks and benefits, the procedures for each phase, and the collection process. All participants signed the Free and Informed Consent Term (FICT). These steps were carried out in accordance with the recommendations of Resolutions 466/2012/CONEP/CNS/MS and 510/2016/CONEP/CNS/MS and their supplementary provisions. In addition, considering the ethical requirements for experimental research, this study complied with Circular Letter No. 24/2022/CONEP/SECNS/DGIP/SE/MS and its explanatory note dated October 26, 2022/CONEP, supported by COFFITO Resolution No. 393, dated August 3, 2011, and Ordinance No. 15/2022/SAES/MS.

### Participants selection

Participants were selected using a purposive, non-probabilistic sampling method[16,17], based on the questionnaire administered in the quantitative study designed as an RCT, with the objective of forming the sample for the present qualitative study.

Several instruments were used to comprehensively capture participants' perceptions regarding APT, pain, and SQ. The VAS was administered as part of the larger study to measure self-reported pain intensity[18], and based on the responses obtained, eligible participants were included in the qualitative sample of the present study. During aquatic sessions, informal conversations took place regarding body perception and SQ from the previous night, with records systematized in a field diary. In addition, open-ended interviews were conducted to analyze participants' perceptions regarding CLBP and SQ[19]. The interviews were structured around three central questions: (1) "*What did you feel in your body during the aquatic sessions?*"; (2) "*Are you sleeping well?*"; (3) "*How do you feel about participating in this research?*".

### Data collection

The TAE was coordinated by the main researcher; interviews were scheduled in advance and conducted at the conclusion of the 12 APT sessions in a private room by the research assistant. Informal conversations took place before, during, and after the sessions in an academic setting to ensure the participants' privacy. Interview data were audio-recorded using a mobile app and transcribed verbatim using Microsoft Word software, while records of informal conversations were documented in a field journal.

To ensure confidentiality of the information, participants' names were replaced with the letter P (participant), followed by a number. The transcripts were kept in colloquial language to preserve the characteristics of the accounts.

### Intervention protocol

The APT intervention process took place over six weeks, with two weekly sessions lasting 50 minutes each. the APT program prioritized TAE[1,3,20,21] and domestic orientations (DO)[22] in accordance with the scientific literature[1,3,20,21-23], as described in Table 1 (TAE) and Table 2 (DO). The pre- and post-intervention evaluations were conducted in designated rooms at the University, while the TAEs were performed in a semi-Olympic pool. Water temperature ranged from 29°C to 30°C during the study, and the water depth was 1.40 meters; the shallow end was used, and the area was demarcated by lane lines.

The components of the intervention, the TAE program, are presented in Table 1, which correlates each exercise with its execution method, set parameters, and repetitions.

Similarly, the DO recommendations are detailed in Table 2, in accessible language, for domestic use.

All DO were duly distributed to the participants in printed format and digital format via the mobile phone WhatsApp, which all had access to.

**Table 1.** Description of the therapeutic aquatic exercise program for aquatic physical therapy sessions.

| TAE |
|---|
| 1) Breathing exercise. Spine leaning against the pool wall, the water level at shoulder height, perform 5 breathing cycles without submerging. |
| 2) Walking in three directions (forward, sideways, and backward) without using any equipment to provide resistance to movement (5 min). |
| 3) Turbulent flow massage. The physical therapist uses the water flow to perform movements with the upper limbs, massaging the lumbar spine of the individual who is facing away from the therapist; this is performed for approximately 1 minute per person. |
| 4) Trunk stabilization exercise and strengthening of the abdominal and paravertebral muscles. Upper limbs inside the water, perform flexion and extension movements of the upper limbs while contracting the abdominal muscles. |
| 5) Bicycle exercise supported by the aquatube (cycles of underwater pedaling for 10 min). |
| 6) Muscle activation of the lower limbs. Flexion/extension, adduction/abduction (2 sets of 10 repetitions with 60-second intervals), in an upright position while holding onto the pool edge. |
| 7) Muscle activation of the abdomen and paraspinal muscles. Lower and upper limbs in an upright position, without support from the pool wall, water level at the height of the upper limbs at 90°: perform short, fast abduction/adduction and shoulder flexion/extension movements, keeping the trunk as stable as possible (3 sets of 20 seconds with 20-second intervals). With the spine leaning against the pool wall, water level at upper limb height, perform abduction/adduction and flexion/extension movements of the upper limbs. |
| 8) Lower limb muscle activation. Flexion/extension, adduction/abduction (2 sets of 10 reps with 60-second rest intervals). In upright position, hold onto the pool edge, and perform the exercises with the lower limbs. |
| 9) Walking in three directions using an aquatube on the upper limbs, maintaining isometric tension. |
| 10) Aquatic relaxation. The physical therapist will perform individual gliding movements on each person, supported by an aquatube. |

**Source:**[1,3,20,21-23].

**Table 2.** Description of domestic orientations (DO).

| 1 BREATHING |
|---|
| Perform 5 breathing cycles (focusing on diaphragmatic breathing, inhalation, and exhalation), either sitting or lying on your back (supine position). |
| **2 WALKING** |
| Go for walks on flat ground, wearing appropriate shoes, for 15 to 20 minutes every day. |
| **3 HYDRATION AND NUTRITION** |
| Infest two liters of water a day. |
| Eat a balanced diet of nutritious foods (real food), and avoid processed foods and excessive sweets. |
| **4 MUSCLE ACTIVATION** |
| Perform isometric contractions of the gluteal muscles (10 sets of 3-second holds) while standing. |
| It is recommended to do this exercise when getting out of bed in the morning and throughout the day whenever you experience pain. |
| **5 REFLEXOLOGY** |
| Massage your feet with a textured ball, a tennis ball, or soak your feet in warm water.<br>You can alternate between a foot soak one day and the ball massage on the soles of your feet the next. |
| **6 TRENDELEMBURG POSITION** |
| Lift your legs up, rest them against the wall, and stay in that position for about 5 minutes. Do this once a day, at a time that suits you.<br>The recommendation is doing it right before bedtime. |
| **7 CAFFEINE** |
| Avoid consumption of drinks that contain caffeine, such as coffee and teas, after 3 p.m. |
| **8 SLEEP HYGIENE** |
| Establish a bedtime routine to prepare your body for sleep. |
| Go to bed at the same time every night, take a warm bath before bed, avoid using electronic devices and watching TV for about 10 minutes before going to bed, and practice deep breathing (3 inhales and 3 exhales). |

**Source:**[22].

### Data analysis

The data were subjected to content analysis[24]. The initial organization and systematization of the material (pre-analysis) consisted of a skimming reading and preliminary categorization of the data. Next, the material was coded, with the identification of units of record and context, grouping the perceptions and experiences reported by participants related to improvements in pain and sleep. Signs of improvement were identified based on discursive indicators present in semi-structured interviews and field diary entries.

As for evaluation of pain, reports such as "*the pain has decreased*", "*it's milder*," and "*it doesn't bother me like before*" were considered, as well as comparisons between "before" and "after" the intervention, in addition to functional indicators such as "*I can do my activities*" and "*I'm moving better*.". Regarding sleep, reports such as "*I'm sleeping better*", "*I wake up less during the night*", "*my sleep is more restful*", and "*I wake up feeling more energetic*" were considered. Therefore, the analysis was based on the interpretation of the meanings attributed by the participants to their own experiences. In the third stage, the results were analyzed using the pre-established categories.

### Study design

The present study is a qualitative and descriptive work linked to a larger quantitative study designed as a randomized controlled trial (RCT). The quantitative study followed the recommendations of the CONSORT checklist, which contributed to the methodological organization of the participant selection process. The participants included in this qualitative sub-study were selected from the sample of the larger study, ensuring methodological consistency. The emphasis of the present article was on analyzing participants' perceptions through qualitative data, with the aim of gaining a deeper comprehension of their experiences related to the intervention.

## RESULTS

Thirteen individuals, aged 24 to 64, participated in the study, the majority of whom were female (n=8). The participants had diverse work backgrounds, including activities in healthcare, administration, services, self-employment, and domestic work, as well as retired and economically inactive individuals. Regarding marital status, married participants predominated, with a smaller proportion of single and divorced individuals.

Regarding the APT, behaviors varied widely, ranging from physically inactive participants to those who reported activities such as walking, weight training, Pilates, yoga, running, and soccer. Regarding SQ, some participants reported sleeping well, while others reported irregular or unsatisfactory sleep. Most participants had CLBP, a central criterion for inclusion in this qualitative study, with the exception of one participant who did not report having this condition.

### Effects of aquatic physical therapy on the perception of reduced chronic low back pain

Throughout the treatment sessions, participants reported episodes of CLBP, however, as the sessions progressed, they noticed a gradual reduction. As participant (P1) reported, "*When I'm here,* [...], *I don't think about the pain.*" [...], *"I only remember it because there's the pain scale and I have to report it"* [...]. *"And leaving here is another story, you can be sure the pain will improve*".

In the participants' perception, the effects of APT could be felt immediately after performing the exercises. This perception can be observed in the statements of participants P2 and P3. [...] *"I saw results right away in the first four sessions regarding the pain; I had a lot of pain in my spine and I don't anymore; I can notice the difference,* [...] *I couldn't sit on the floor anymore,* [...] *I sat down afterward and didn't feel any pain*" (P2). [...] *"The pain eased considerably during the sessions.*" (P3).

Among the reports obtained, P4 noted that the pain was not restricted to the lower back region but also extended to the lower limbs. After the APT, however, they reported significant improvement in both the lower back and the affected areas, as illustrated in P4's statement: [...] *"I had a lot of pain in my legs, not so much in my lower back.* [...]. *Now that I've started doing this, it's improved a lot; I don't feel no pain, I have energy, and I'm just grateful.*" [...] (P4).

Participants reported that APT helped reduce pain and increase their independence in activities of daily living (ADLs), reflecting physical and mental improvement. Participant P5 mentioned difficulties performing household chores before the sessions began, but described pain relief and a return to his activities: "[...] *the pain improved a lot.* [...] *I couldn't dust the house* [...] *and I dusted and didn't feel any pain at all.* [...] *so, it improved a lot.* [...] *it doesn't just work the spine,* [...] *it works the whole body and the mind too, right.*" (P5). Similarly, other participants reported increased energy and motivation for daily tasks, as evidenced in the statements by P6 and P7: "[...] *it helped me a lot in my daily life* [...] *before I had pain, and now I can move around without feeling so much pain* [...]*"* (P6); "[...] *I notice that when we come do the exercises in the water, I leave feeling more energetic.*" (P7).

P8 and P10 reported concerns related to a fear of water and issues with balance in the aquatic environment. These experiences had a significant impact on the participation process, highlighting subjective transformations and the overcoming of personal barriers. P8's account illustrates this aspect: "[...] *the first step was to demystify this whole thing about getting into the pool, right?* [...] *I have a pool at home and I've never gone in* [...]. *I was really afraid* [...] *I'd just put my foot in the water and thought I'd never be able to walk inside the pool* [...]. *The first step was already getting over that fear* [...], *a huge victory.*" (P8). In addition to facilitating adaptation to the aquatic environment, a positive impact on P10's sleep was also observed, as reported: "[...] *I've really gotten over my fear of water and I sleep better"* (P10).

The participants reported that the aquatic environment helped reduce pain and promoted a general sense of well-being. P7 highlighted an improvement in CLBP: "[...] *my lower back pain has improved a lot* [...]*"* (P7), while P6 emphasized the comfort and lightness provided by the water: "[...] *this activity in the pool brings me a lot of comfort* [...] *whenever I leave, I feel lighter"* (P6).

Similarly, P8 reported significant improvement and attributed a feeling of gratitude to the experience: "[...] *as for the pain, it has improved a lot, and I can only be grateful*" (P8). P9, on the other hand, quantified this progress, reporting a marked improvement: "[...] *the pain has improved by about 90%, but even today I'm pain-free; it's not hurting* [...]" (P9). These accounts demonstrate that the effects of aquatic exercise went beyond physical relief, promoting emotional well-being and personal satisfaction.

According to the participants' perception, the exercises performed in the aquatic environment were well tolerated and associated with pain reduction and a sense of physical comfort, factors that contributed to engagement and adherence to the program throughout the six-week intervention. The willingness to attend the 12 sessions reflected the participants' commitment and their perception of clinical improvement. For P10, the aquatic exercises were directly associated with relief from lower back pain and functional recovery: "[...] *I had a back problem.* [...] *I did yoga* [...] *and when they invited me to do this practice in the pool,* [...] *I was immediately interested* [...] *since then, I haven't felt any pain at all.*" (P10).

Similarly, P13 described the experience as positive, highlighting the impact of aquatic exercise on reducing physical discomfort: "[...] *it was good to try the aquatic activity* [...] *I felt my body lighter*" [...]. "*My back pain and posture improved significantly* [...]. *I had activities limited due to a lot of pain. I started with a lot of pain, level 10. Today I can say that I left here at level 4*". (P13). These accounts reinforce that aquatic therapy was directly related to pain reduction and improved physical well-being, which encouraged continued participation in the sessions and perception of treatment efficacy.

### Impact of aquatic physical therapy on the perception of sleep quality in individuals with chronic low back pain

In the participants' perception, ATP was directly associated with changes in sleep. As highlighted by P1 in his account of the relationship between sleep and pain, he mentioned that he sleeps better and experiences relief from pain symptoms upon waking. [...] "*I started monitoring my sleep and noticed a difference in my pain; when I sleep well, I wake up feeling good.* [...] *I'm managing to sleep better more days than not.* [...]" (P1). In his remarks, it is also noted that the practice in the pool was perceived as having an immediate impact on rest: "*On days of therapy, of the aquatic activity, sleep is definitely different - it's much better*" (P1).

Similarly, P2 associates the practice with nighttime rest, emphasizing not only the act of sleeping but also the improvement in the quality and restorative nature of sleep: "[...] *my sleep has improved; I didn't have that much trouble with insomnia, but my sleep quality has improved significantly, with revitalizing sleep* [...]" (P2). For P6, this perception is reinforced when they report: "[...] *I sleep better during the day*" (P6). P7, on the other hand, points to a broader change, stating that since the beginning of the intervention there has been a gradual change in SQ: "[...] *since we started this,* [...] *I've noticed that sleep quality has changed*" (P7).

These accounts point to the understanding that APT was experienced as promoting physical and mental rest, associated with the relaxation provided by TAE. In this sense, P9 summarizes this perception by reporting: [...] "*I don't wake up as tired, because I used to wake up in the morning with pain in my legs,* [...] *I'm already waking up much better.*" (P9). Here, it is evident that the impact was not limited to a good night's sleep, but extended to waking up with greater energy and less physical discomfort.

The participants' perception of being part of the study brought impacts that went beyond merely improving physical symptoms, being associated with feelings of motivation, satisfaction, and appreciation for the experience. P8 describes the intervention as a significant help, especially in coping with insomnia: [...] "*the project really helped me; I had insomnia.* [...]" (P8). Similarly, P11 reinforces the sense of well-being linked to aquatic therapy: [...] "*on the days of aquatic activity, sleep is definitely different; it's much better.*" (P11). P9, on the other hand, expands on this perception, noting improvements in sleep, pain, and body awareness: [...] "*It was real nice; my sleep and pain improved.* [...] *I really liked it; I even wanted to stay longer.* [...] *From what I could tell, I lost about two kilos after I started.*" (P9).

P3 associated their participation with the motivation to break away from a sedentary lifestyle and adopt a more active routine: [...] "*I'm enjoying it because I wasn't doing any physical activity; this motivated me,* [...]" (P3).

P4's account highlights a significant change in their sleep routine, linking ATP to an improvement in SQ: "[...] *I didn't use to do nothing; I just drove - I worked as a driver -and spent 10 to 12 hours sitting down;* [...] *I'd get out of the car and go straight to the couch, in pain.* [...] *I started doing* [...] *I'm sleeping much better* [...] *before, I'd just take a few naps, wake up, and be in pain.*" (P4). The account reveals that, in addition to reducing physical complaints, APT promoted restorative sleep, positively impacting physical rest. Similarly, P12 highlighted benefits in breathing and nighttime rest: "[...] *I liked the sessions; they helped with my breathing and my sleep; I saw that it made a difference.*" (P12). These testimonials indicate that the effects of APT extended beyond the sessions themselves, promoting relaxation, regular sleep, and an improved sense of well-being.

Table 1 provides a detailed description of the TAE program used in the sessions. The parameters adopted for the TAE program consisted of sets of two repetitions for each exercise, with a 60-second rest interval.

The DOs are described in Table 2. They were provided to the patients to ensure participation in the home environment.

All DO were duly distributed to the participants in printed format and digital format via the mobile phone WhatsApp, which all had access to.

## DISCUSSION

The participants presented schooling higher than high school and college and adhered to the TAE. They adopted this as a social activity, and the interaction was enjoyable. When it comes to CLBP, the biopsychosocial model influences the psychological, sociocultural, socioeconomic, and belief-related factors of human behavior[25]. In the association of sociodemographic factors with the practice of leisure APT, researchers observed that, for both genders, the higher the level of schooling, the greater the engagement in exercise[26].

Good SQ can be an excellent strategy for people with CLBP, whereas sleep deprivation can influence ADLs[9]. It has been recognized that sleep is an important component of health[8,9]. There is a correlation between sleep disturbance and body pain, since reduced sleep disrupts the complete circadian cycle and can increase musculoskeletal pain and sensitivity to noxious stimuli via the Delta and C nociceptive pathways conducted by the spinothalamic tracts that transmit pain to the posterior column of the spinal cord[8].

In conjunction with APT, it is important to emphasize self-care and lifestyle changes related to behavior and healthy habits, the "therapeutic alliance", through welcoming patients and offering DO[22,23]. These are important measures for SQ, directly related to hypoalgesia[27]. Pain intensity can be perceived differently by each person, influenced by the pain threshold, individual personality, and beliefs[28]. As for human perception, it can be defined as the act of interpreting and organizing a sensory stimulus to produce a meaningful experience of the world and of oneself[29]. From this, it follows that each person experiences pain and/or relief in their own unique way[21].

The participants' accounts indicate that, when performing TAE, they noticed their entire body moving through fluid dynamics. This promotes muscle activation of neural pathways during motor control exercises and encourages exploration of the aquatic environment, fostering a sense of belonging to the group while inhibiting pain sensations across various pain pathways: physical, behavioral, emotional, and cognitive[30].

Adaptation to the aquatic environment can be influenced by emotional factors, with hydrophobia considered a relative contraindication for APT[1]. However, as reported by participant P10, overcoming this fear was observed, which contributed to increased self-esteem, self-confidence, and morale, promoting significant psychological benefits[31]. This process of adaptation and involvement in aquatic activities is also reflected in the participants' greater engagement in their daily and work routines, fostering self-care and commitment to their own health[32]. Thus, the regular practice of physical activities, such as aquatic exercise, can help maintain functional independence throughout the different stages of life, contributing to a better quality of life and life expectancy[32].

Understanding nociceptive behavior and pain-reduction strategies helps improve people's perception of their ability to manage pain, as well as encourages them to rethink their approaches to achieving good health[7,33]. At the start of the study, 30.8% of participants were sedentary; however, upon performing the TAEs, they transitioned from a sedentary to an active lifestyle and experienced greater freedom from discomfort. This is because exercise, whether therapeutic or not, is recommended for the treatment of chronic diseases. Performing these movements increases blood and lymphatic circulation, promoting greater tissue oxygen supply and optimizing blood perfusion in oxygen-deprived regions[30]. In cases of pain, there is a reduction in oxygen supply to the muscles[7].

The aquatic environment, due to fluid mechanics, allows for the performance of body movements in a harmonious and pleasurable manner[3,33]. To this end, it is essential to understand these effects, which inform the design of aquatic exercise programs (AEPs), such as water temperature, immersion level, water depth, prognosis, and treatment duration, in order to leverage their benefits and apply the therapy[1].

As observed in the participants' accounts, they perform TAE by moving their whole bodies during APT, this promotes muscle activation and stimulates neural pathways through motor control exercises, encourages exploration of the aquatic environment, fosters a sense of belonging to the group, and inhibits pain sensations across various pain pathways - physical, behavioral, emotional, and cognitive[7,27]. By utilizing the physical properties of water in TAE, one can address needs and functions while prioritizing functional capacity and skills[4].

The level of activity and participation of individuals in their work and daily activities is relevant to physical, mental, and emotional balance[4]. Functional capacity requires self-care and a commitment to health, contributing to improved life expectancy[32]. Non-pharmacological measures for pain control and treatment are strongly recommended, such as a healthy diet, adequate hydration, restful sleep, physical exercise, and physical therapy[4]. Scientific evidence indicates a bidirectional relationship between sleep and chronic pain, in which disturbances such as insomnia, sleep interruptions, and excessive sleepiness can both result from painful conditions and contribute to their persistence and worsening[10].

As noted in the reports of the participants in this study (P2 and P3), people are in need of more physical movement in order to improve blood and lymphatic circulation[27]. Thus, the human body activates the innate homeostatic intelligence system through allostasis[27]. Along with the biological effects of the physical properties of water and TAEs, this forms the basis of APT[11,12].

The present study demonstrated that the correlation between participants' perceptions and the applied APT can lead to lifestyle changes through healthy habits, enabling pain relief and restorative sleep[32].

### Study limitations

One limitation of this study was the lack of health education interventions in the protocol. In addition, there was a scarcity of studies investigating the interrelationship between aquatic interventions, CLBP, and sleep quality, especially regarding sleep onset and maintenance, total sleep duration, and the feeling of restfulness upon waking, which limited the availability of specific references to support discussion of the findings.

## CONCLUSION

The participants' perceptions while performing APT were of extreme importance, as well as the influence of TAEs on their lives. This practice, grounded in scientific evidence, requires qualitative research to ensure the effectiveness of health treatments and care. This study demonstrated the understanding and significance of APT in the lives of people experiencing CLBP, as well as the sensation of pain relief and improvements in SQ. This care goes beyond pain relief. It is important to note that quality of life and pain reduction are the main predictors for achieving a healthy lifestyle.

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