Participants' Experiences of a New Menstrual-cycle Phase-based Anterior Cruciate Ligament Rehabilitation Programme: A Post-hoc Qualitative Study

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ABSTRACT

Anterior cruciate ligament (ACL) ruptures are a common problem within the sporting population. Reconstructive surgery and rehabilitation are commonly utilised to improve knee function. Women are disproportionately represented in the ACL rupture population and have poorer clinical outcomes. Research has shown that phasing exercise with the menstrual cycle improves clinical measures of muscle performance. A recently completed randomised controlled trial examined the efficacy of a menstrual cycle synchronised ACL rehabilitation programme. This study aimed to gain participant perspectives of this new menstrual cycle phase-based anterior cruciate ligament rehabilitation programme. Six women participated in research interviews via video conferencing in 2023. All had completed the intervention with satisfactory clinical outcomes. Three themes were constructed from the interviews using reflexive thematic analysis: Acceptability, connectedness, and strength. Overall, the programme was perceived as acceptable. Participants reported positive connections with their physiotherapists and their bodies throughout the programme. An increased sense of strength, both physical and mental, was also experienced. The phasing of the programme was also found to improve motivation. These factors are shown to improve patient engagement in long-term rehabilitation. Therefore, this study supports the premise that menstrual cycle-synced rehabilitation may enhance participant engagement in the rehabilitation process.

Hickey, J., O'Loughlin, E., & Reid, D. (2025). Participants' experiences of a new menstrual-cycle phase-based anterior cruciate ligament rehabilitation programme: A post-hoc qualitative study. *New Zealand Journal of Physiotherapy, 53*(2), 69–79. https://doi.org/10.15619/nzjp.v53i2.470

Key Words: Anterior Cruciate Ligament; Female; Menstrual Cycle; Rehabilitation; Resistance Training

INTRODUCTION

Anterior cruciate ligament (ACL) ruptures are disabling traumatic knee events that frequently occur among physically active populations. This significant injury commonly arises in sports environments, caused by either a high force direction change or rapid deceleration, rupturing the ligament (Parsons et al., 2021). Physiotherapy and/or reconstructive surgery are usually required to restore knee function post-rupture (Beynnon et al., 2005; Fjellman-Wiklund et al., 2022). Boys and men account for a larger percentage of these injuries (Fjellman-Wiklund et al., 2022); however, when adjusted for sex differences in sporting participation, women are more likely to sustain ACL ruptures (Sutherland et al., 2019). A combination of individual and environmental influences contribute to women's ACL injury risk, which is two to six times higher than men's (Bruder et al., 2023). Additionally, women return to their preinjury level of sport at a significantly lower rate than men (52% versus 61%) (Ardern et al., 2014).

Current ACL reconstruction (ACLR) protocols prescribe progressive overload to increase knee strength prior to return to sport (RTS) (O'Loughlin et al., 2023). However, these protocols are predominantly based on research conducted on men, despite evidence that women have specific physiological and psychological needs during rehabilitation (Bruder et al., 2023; O'Loughlin et al., 2023). This lack of female-centric guidelines impacts the quality of care that female ACLR patients receive (O'Loughlin et al., 2022a). Standardised rehabilitation protocols have been repeatedly found to be demotivating and arduous, with patients, especially women, expressing that individualised approaches are more effective in reaching their goals (DiSanti et al., 2018; Dunphy et al., 2022; Scott et al., 2018; Welling et al., 2022).

Furthermore, ACLR patients' sense of autonomy over their situation is predictive of perceived barriers to engaging in rehabilitation (Burland et al., 2020; Welling et al., 2022). Men and women who undergo ACLR are aware of the importance of engaging with prescribed exercise postoperatively

(Kaur et al., 2019), but struggle to find the motivation to do so (Kaur et al., 2019; Mahood et al., 2020; Scott et al., 2018). Burland et al. (2020) and DiSanti et al. (2018) observe that a combination of psychological, physical, and environmental factors affect experiences of motivation and perceived disability during rehabilitation. Overall, the current androcentric medical and research biases may be correlated to inequities in ACLR outcomes.

One physiological factor that has been largely overlooked in ACLR rehabilitation is the menstrual cycle (O'Loughlin et al., 2023). The menstrual cycle has four phases, during which the two main female steroid hormones, oestrogen and progesterone, fluctuate at varying ratios over the duration of a month (Janse de Jonge et al., 2019). The two main phases of this cycle, follicular and luteal, are characterised by the peaks in oestrogen and progesterone levels respectively (Janse de Jonge et al., 2019). Existing research has shown the effectiveness of phasing strength and power-based exercise programmes in alignment with the menstrual cycle to promote strength gains and muscular hypertrophy (Sung et al., 2014). Oestrogen effects anabolic changes on skeletal muscle, while progesterone has been thought to have a catabolic effect (Sims & Heather, 2018). Repeated follicular phase-based strength training has been shown to provide improvements in lean muscle mass and strength, and affect strength gains and muscular hypertrophy for eumenorrheic females in some studies (Markofski & Braun, 2014; Wikström-Frisén, 2017), but not all (Sakamaki-Sunaga et al., 2016). These conflicting results may be due to the small sample sizes and incomplete hormonal profile verification (O'Loughlin et al., 2023; Elliot-Sale et al., 2021). A recent systematic review has supported the potential of cycle-based training for improving strength gains and muscular hypertrophy (Thompson et al., 2020) (Figure 1).

Despite the growing research in sex specific training, sex and gender considerations remain underexplored in ACLR rehabilitation research. Existing qualitative research has established the importance of customising ACLR rehabilitation prescription according to individual needs (DiSanti et al., 2018; Kaur et al., 2019). Lisee et al. (2020) identified gendered differences in patient experience during ACL rehabilitation, as they noted that women observed more fluctuations in mood, motivation, and strength than men; however, they did not consider a correlation between menstruation and these variations. Understanding how hormones affect rehabilitation experiences and outcomes may inform improved care for women.

Currently, only one study by O'Loughlin et al (2024) has researched the effect of menstrual cycle synchronised rehabilitation on ACLR outcomes. Participants had similar limb symmetry following menstrual cycle synchronised rehabilitation versus good quality usual care. Therefore, this study recommended ACLR patients and physiotherapists may consider undertaking such rehabilitation as a feasible option, particularly for women who prefer this individualised, menstrual cycle-synchronised training. Another aspect of the work leading to the randomised control trial (RCT) was to ask participants how they might engage in a menstrual synchronised programme (O'Loughlin et al., 2022a). Now that the results of the RCT have been published (O'Loughlin et al., 2024), the aim of this paper was to understand how participants in the RCT found the co-designed programme. This study aims to build on the research by O'Loughlin et al. (2024) to further understand participants' experiences of the programme.

METHODS

Ethics approval was granted by the Auckland University of Technology Ethics Committee (reference number 23/40). This study follows a qualitative descriptive design, within an interpretivist paradigm, allowing for contextual understanding of the research findings as applied to the participant group. This project is informed by a feminist lens, as addressing sex-based inequities in healthcare is central to the primary researcher's positionality (Grant & Giddings, 2002). This research utilises a relativist ontology (Fox & Ramazanoglu, 2008). It is designed to better understand patient experiences of a rehabilitation programme targeting health outcomes for women. Reflexive thematic analysis pioneered by Braun and Clarke (2006) is used to ensure this research was coded by females and therefore useful to the people it seeks to benefit. The study is reported in line with Consolidated Criteria for Reporting Qualitative Research (COREQ) guidelines (Tong et al., 2007).

Participant recruitment and eligibility

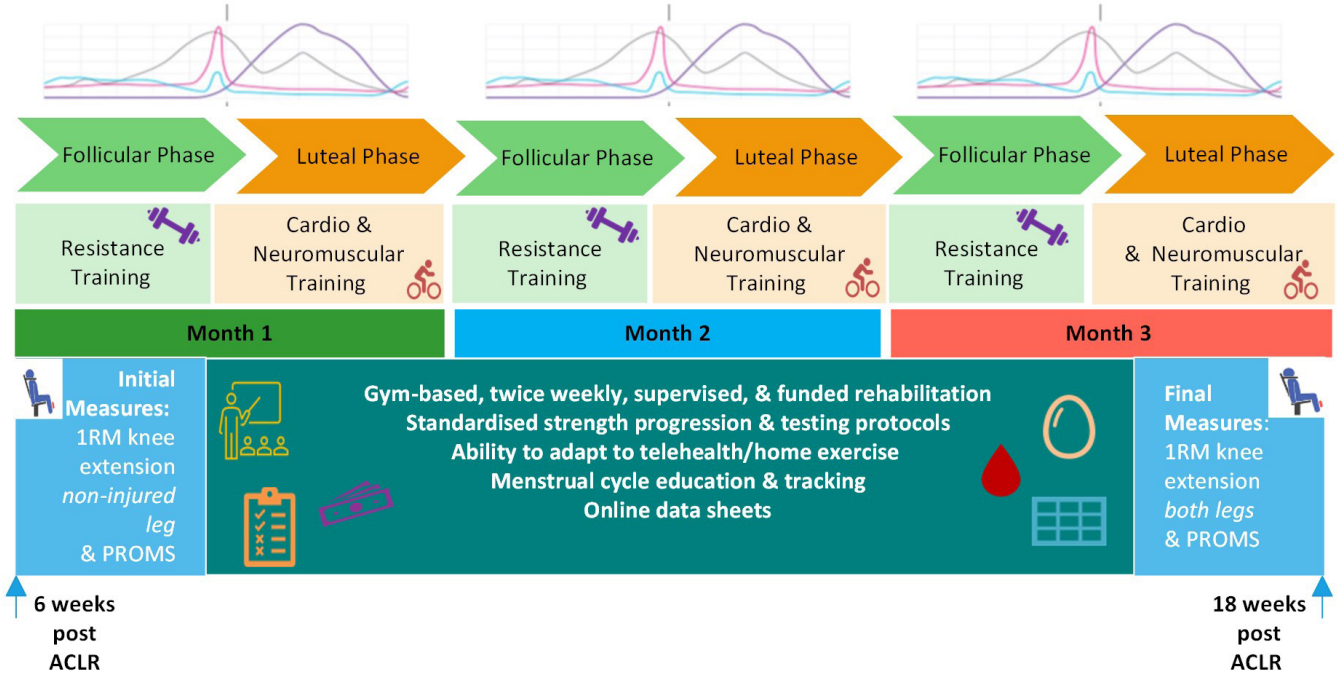
Using a purposive recruitment strategy, 19 intervention group participants who had completed the menstrual cycle synchronised rehabilitation previously (O'Loughlin et al., 2024) were emailed by the lead researcher (EOL) to ascertain their interest in further research participation. These participants underwent a 12-week fully funded, gym-based, post-operative ACLR rehabilitation programme synchronised with their menstrual cycle. As part of the programme, participants confirmed their menstrual cycle phases using calendar tracking, basal body temperature, and urinary ovulation testing. All participants included in the final analysis were regularly cycling and ovulating. They carried out resistance training twice weekly in the follicular phase of their menstrual cycle, and neuromuscular and cardiovascular exercise twice weekly in the luteal phase. Those who could converse in English were eligible. Seven potential participants who expressed interest were provided the primary researcher's (JH) contact details. When contacted, JH supplied information and consent forms. The primary researcher provided participants with the reasons for doing the research, including her interest in female-specific musculoskeletal research. Six participants agreed to participate in the research, yielding a response rate of 31.6%. The first two participants had two interviews each, as the primary researcher added questions to help refine the interview process following their initial interviews. Participants were not financially incentivised to participate in the study; however, a koha was offered in thanks for their participation at the conclusion of the research project.

Data collection

The primary researcher and interviewer (JH) was a female

Figure 1

Menstrual Cycle Synchronised Anterior Cruciate Rehabilitation



Note. PROMS = patient reported outcome measures; 1RM = one-repetition maximum.

Visual representation of the menstrual cycle phase-based quadriceps resistance training programme. Training commenced at six weeks post-surgery and continued until 18 weeks post-surgery. Participants attended twice weekly at a gym-based setting for supervised rehabilitation. These sessions were adapted if needed, i.e., telehealth. The researcher, physiotherapist, and participants entered all data into an online datasheet. Females received menstrual cycle education and inputted information into their datasheet to establish their menstrual cycle phase. Participants engaged in resistance training in the follicular phase sessions, and cardiovascular and neuromuscular exercises in the luteal phase sessions. Physiotherapists used standardised strength testing to measure outcomes and standardised progression protocols to prescribe strength exercises. Funding was available for females to attend sessions. Image used with permission (O'Loughlin et al., 2022a).

physiotherapy honours student in the final year of study. The other two researchers were a female early career physiotherapy researcher (EOL) and an experienced male physiotherapy professor (DR). EOL and DR were lead investigators in the previous RCT study. A set of pre-determined questions (Table 2) were collated in collaboration with DR and EOL to guide the interviews. The questions were based on previous literature (O'Loughlin et al., 2024) and aimed to explore both logistical and psychological experiences of women who underwent the menstrual cycle-synchronised programme. Follow-up questions were used to gather more data where appropriate (Carter & Lubinsky, 2015). Video interviews took place between March and August 2023. All interviews were audio recorded via Zoom recording (Zoom Video Communications, Inc., San Jose, CA, USA) and on the researcher's mobile phone, to ensure a technology failure would not cause a loss of data. All interviews lasted approximately 30 min. Interviews were conducted until the research team deemed that the information gathered was of adequate power, richness, and detail to answer the research question and so no further recruitment was carried out (Malterud et al., 2015). Audio recordings were transcribed verbatim using Otter AI (Otter. AI, Mountain View, CA, USA). Only the researcher and participants were present for the interviews. Transcripts were reviewed by JH to ensure accuracy, and any discrepancies were edited and corrected. Transcripts were not returned to participants, and no repeat interviews were carried out.

Data analysis

Throughout the research process, the primary researcher (JH) kept a research journal, utilising reflexivity and reflection to enhance the research process (Thorne, 2016). Thematic analysis was utilised as informed by Terry et al. (2017), to create themes from the data collected during the research interviews. Reflexive thematic analysis was selected as it aligns with the interpretive framework of this study and recognises the active role of the researcher in theme development, rather than viewing themes as passively emerging from the data. This approach is particularly appropriate in qualitative health research, such as in this study, where the researcher's subjectivity is viewed as a resource, not a threat to rigour (Braun & Clarke, 2021). Thematic analysis followed the six phases of thematic analysis as outlined by Terry et al. (2017) including familiarisation with the data, initial code generation, searching for and reviewing themes, defining and naming themes, and report production.

Table 1

List of Research Interview Questions

	Research interview questions
1	How did you injure your ACL?
2	What was the goal of your ACL rehabilitation and surgery?
3	What was your previous exercise experience?
4	What was your previous experience of injury rehabilitation (if any?)
5	Have you previously followed a prescribed exercise plan?
6	What kind of plan was it?
7	Where was it from (i.e., physiotherapist or other professional)?
8	Have you worked with a physiotherapist previously?
9	How do you think this programme was compared to previous injury rehabilitation programmes you have followed/ used?
10	What was your experience of the volume of physiotherapy (twice weekly sessions)?
11	Was it a good amount?
12	What did you think of the emphasis on strength training during the programme?
13	Was this something new to you?
14	Did you find it enjoyable?
15	What about it was enjoyable?
16	What do you think about the level of supervision provided during the programme?
17	Which aspects of the programme did you find the most difficult?
18	Which aspects did you find the most useful or enjoyable?
19	What do you feel you have gained from the programme?
20	Is there any aspect of the programme that you think could be changed to help you gain more from the programme?
21	How did you find tracking your cycle – including taking your temperature, peeing on the urinary stick, and noting your periods on the chart?
22	Was it difficult? What about it was difficult?
23	Did you enjoy it? Do you feel you learned anything from it?
24	How did you find entering your data on the spreadsheet?
25	Is this sort of phased training something you intend to use in future? Why/why not?
26	Would you consider using it again while injured? Why/why not?
27	Did you find it to be a positive experience overall and if so, why?

Note. ACL = anterior cruciate ligament.

The primary researcher (JH) led the initial stages, repeatedly reading the transcripts to support familiarisation. She also drafted preliminary codes and candidate themes inductively and iteratively and coded the data in Microsoft Word (Microsoft Corporation, Version 365, 2024, Redmond, WA: Microsoft Corporation). JH then discussed the codes and candidate themes in depth with the other two members of the research team (DR and EOL). These discussions, with all members of the research team, encouraged critical reflection, alternative interpretations of the data, and refinement of themes (Braun & Clarke, 2021). The team, overall, helped to ensure the themes were robust and grounded in the data (Braun & Clarke, 2023).

RESULTS

Six participants participated in qualitative interviews. All were women who had completed the menstrual cycle phase-based ACLR programme within 12 months of their interview. All six participants were physically fit and active prior to injuring their ACL. The participants were familiar with using gym facilities, and most had previously participated in team sports. Full details of participant demographics can be found in Table 2. All participants had previously seen a physiotherapist for a musculoskeletal injury. Participant (P) 1 had previously ruptured the ACL of her contralateral knee and undergone reconstructive surgery. This provided important context for her data, as she directly compared her experience of the menstrual cycle phase-based programme to her previous ACLR. Participant 2 (P2) had previously had patellofemoral stabilisation surgery. She noted difficulty rehabilitating her knee following the surgery and experienced considerable loss of muscle tone, which provided context for her comparisons of previous knee surgery rehabilitation. Both P1 and P6 initially attempted conservative treatment to rehabilitate their injured knee; however, due to unsatisfactory outcomes, they underwent reconstructive surgery. The other four

Table 2

Demographic Characteristics of Participants

Participant	Age (years)	Sex	Ethnicity	Resistance training status [a, b, c]	ACL rupture date	ACL surgery date	Sport [d]	Rehabilitation goal [e]
1	41	F	NZ European	Trained	1 July 2021	7 May 2022	Soccer	Return to sport WKS
2	38	F	NZ European	Trained	8 April 2021	21 September 2021	Soccer	Return to normal daily activity WKS
3	35	F	NZ European	Trained	24 July 2022	28 September 2022	Netball	Return to normal daily activity WKS
4	42	F	Asian	Untrained	19 January 2022	20 April 2022	Skiing	Return to sport WKS
5	21	F	NZ European	Untrained	2 October 2022	19 May 2022	Skiing	Return to sport WKS
6	37	F	NZ European	Trained	1 July 2021	18 January 2023	Netball	Return to normal daily activity WKS

Note. ACL = Anterior cruciate ligament; F = female; NZ = New Zealand; WKS = without knee symptoms.

[a] *Resistance training status* refers to training frequency in the six months prior to injury. [b] Trained = resistance training ≥ 2 times per week. [c] Untrained = resistance training < 2 times per week. [d] *Sport* indicates the primary physical activity or sport the participant engaged in prior to injury. [e] *Rehabilitation goal* was self-reported by participants during the interview process.

All interviews were undertaken using Zoom video conferencing.

participants elected to have surgical treatment early in their ACL journey. Three main themes were identified from the data: Acceptability, connectedness, and strength.

Theme 1: Acceptability

All six participants found the menstrual cycle phase-based programme highly acceptable, including the session dosage, bi-phasic training, and rehabilitation outcomes. This was evidenced by five participants continuing to utilise menstrual cycle phase-based training past the end of the trial: "I've made my strength stuff within that first week … the same sort of concept and then I focus on … slower, easy runs … on the second" (P2, 38 years). Participants provided different reasons for continuing with this method of rehabilitation training: "I … liked it and I found my body coped really well … [if given the option in future] I would try the one with the … menstrual cycle" (P4, 42 years). Only one participant did not continue using menstrual cycle synchronised training on the conclusion of the trial, noting she found the administration of tracking her cycle too time consuming when she returned to work: "… it was a little bit tricky to keep [it up]" (P5, 21 years).

The session dosage was highly acceptable to the participants. Two physiotherapist-guided sessions per week were accommodated with minimal issues: "twice a week was definitely, definitely good" (P6, 37 years), and "…my main goal was to get back into … life as quick as I can, so I … made time for it" (P3, 35 years). Several participants noted that more sessions would have been difficult to attend: "…the volume of exercises … was quite like hard to fit in … once I went back to work, it was kind of … hard to find the time" (P3, 35 years). In contrast, at times, some participants worried about not training enough: "I was almost worried that it wasn't enough" (P2, 38 years).

Most of the participants liked the programme variation, as the bi-phased training allowed both progressions and prevented boredom. All participants liked knowing that their programme would be changing in advance. This awareness helped facilitate engagement when they were struggling to self-motivate:

> …because I could see that there was going to be a change … for two weeks and then different for two weeks of the month … I was more motivated … Knowing that I only had two weeks to do heavy weights … I really wanted to push myself in that two weeks. (P1, 41 years)

Overall, the participants were satisfied with both the programme and their rehabilitation outcomes. Several credited the structure of the menstrual cycle phase-based ACLR as benefiting their ACL journey: "…just really structured and you knew what you're doing, which is nice" (P5, 21 years). In comparison to previous injury rehabilitation, several participants believed this programme to be preferable: "I think I got better rehab. I think I recovered from my surgery quicker … I've … had the same surgery on the other knee about four years ago" (P1, 41 years). Measuring incremental improvements throughout their ACLR empowered

participants to visualise their progress: "Having the … strength testing … at the beginning and the end … was really satisfying" (P1, 41 years). This reinforced perceived improvements in strength and increased programme satisfaction.

The acceptability of methods utilised to track the participants' menstrual cycles varied. Younger women noted more difficulty with entering their menstrual cycle data, and some found it "annoying" or expressed difficulty remembering to gather and record the data: "…when you commit to the programme you have to do it, and you just do it" (P4, 42 years). Those who had previously tracked their menstrual cycle to facilitate conception did not find the process as bothersome: "I've had three kids, so I was kind of fine with it" (P2, 38 years). Some participants found the data collection interesting: "It was quite cool to see … I really enjoyed the data collection side of it" (P5, 21 years). P5 noted that a specific application may improve patient adherence and compliance by improving ease of data collection and entry: "…maybe just an easier way to put in the data. Like, I know apps are super expensive to make, but … it was a bit of a hassle, putting it in on Google Sheets" (P5, 21 years). Several participants questioned the accuracy of ovulation tracking and whether it was directly useful, or essential for the research: "I didn't think it was … important to know the exact day of ovulation, especially when … often it would fall when I wasn't going to physio" (P1, 41 years).

Theme 2: Connectedness

The menstrual cycle phase-based ALCR programme positively influenced connections to clinicians, the participants' bodies, and other women. Participants felt physiotherapist support and encouragement augmented their self-motivation: "I enjoyed going to see the physio twice a week and her pushing me … I knew that … I was … gonna progress as fast as I could … being like, safely … monitored" (P3, 35 years). Although P2 expressed concerns about muscle atrophy from not training hard enough, her physiotherapist provided reassurance and education. The participants' respect for the clinical expertise and insight provided appeared to be invaluable in building rapport and progressing with their rehabilitation: "It was … nice to have proper feedback given in a session [regarding my form] … that supervision was really beneficial and helpful" (P6, 37 years).

Most participants experienced increased awareness of and connection to their bodies, resulting from the increased knowledge sustained throughout the RCT. The extent of this varied, with several participants describing increased awareness of the different stages of their menstrual cycle and how it affected them individually. The increased cognisance of their cycles appears to be associated with a sense of curiosity about the way their bodies were affected by menstrual cycle phase-based training: "…it felt like the right thing to be doing" (P1, 41 years). Most participants experienced an awareness of increased energy and strength during their follicular phase, contrasting with fatigue and demotivation during their luteal phase: "…the biggest thing I got from [this programme] … was the way that it felt … I definitely felt sorer and … niggly … in that second phase. It's really obvious" (P2, 38 years).

Understanding the connection between hormonal changes and mood or energy levels appeared to facilitate increased self-understanding:

> I've enjoyed … listening a little bit more to my body, when like … you feel strong … you can push yourself and then … [during] those two later weeks of your cycle … if you don't … feel as, you know, motivated … [you can] dial back a little bit on the strength. (P3, 35 years)

Another important concept within the theme of connectedness was female bonding. Three participants mentioned conversations with peers about the programme and their experiences: "I talked to other friends too about that … I have been teaching them about it … they wanted to know" (P1, 41 years). One participant felt she was aware that empowering herself and others to have these discourses, fighting the "stigma" surrounding female bodies and hormones: "I mean, it's like … when I'm talking to my friends … they were all … super intrigued [about] … what's going on" (P5, 21 years).

Theme 3: Strength

The concept of strength developed in different ways throughout the interview discussions. This included both physical strength, regarding the knee's physical performance, and mental strength, including self-motivation and trust in their post-surgery knee. The programme phasing and repeated strength testing enabled participants to visualise improvements in physical strength: "I've known since three months that … I was strong" (P1, 41 years).

Satisfaction with their strength was important to most participants. Several expressed feelings of vindication seeing the weights increase on the gym machines as they progressed through their rehabilitation: "…it was hard at the time. But I think … seeing the progress … watching that weight go up … that sense of achievement. So that's what I quite liked about it" (P6, 37 years).

Several participants remarked that they progressed faster than expected, and expressed increased trust in their knee and awareness of strength improvements throughout the programme: "When you feel strong … you can push yourself" (P3, 35 years). Participants then understood that the programme positioned them well for their remaining ACL journey: "I think if I didn't do it, I probably wouldn't have come out with such a good outcome" (P2, 38 years). The two participants who had previously undergone knee surgery and post-surgical rehabilitation felt their rehabilitation outcomes were comparatively better: "I think I got better rehab. I think I recovered from my surgery quicker" (P1, 41 years). This increased trust in their injured limb was contextualised in the participants' RTS: "I need to have a strong muscle [to go] back to the ski field … it's going to protect my knee [against further injury]" (P4, 42 years). In contrast, P5 noted the focus on quadriceps strength resulted in a relative hamstring imbalance at the end of the programme, which concerned her and her treating physiotherapist: "once I finished the programme … my hamstring strength was … a shock" (P5, 21 years).

DISCUSSION

The three themes collected from the data in this study – acceptability, connectedness, and strength – were experienced and expressed in diverse ways by different participants. Overall, the programme was well received; however, this research observed differences in which aspects participants enjoyed, found interesting, and gained personal insights. This reflects the variation in patient engagement and experiences of rehabilitation programmes, even when following the same rehabilitation prescription (Dunphy et al., 2022).

Programme acceptability

The menstrual cycle phase-based programme that these ACLR participants followed throughout the first 12 weeks of their postoperative journey was acceptable to all participants interviewed in this study. Several participants expressed their satisfaction that the programme was tailored to their individual menstrual cycles. Patient buy-in is an essential component of adherence to lengthy exercise prescription (Wassinger et al., 2022). Motivation and engagement throughout the extensive process of ACLR is impacted by perceived results, and interest in the exercise prescribed (Pizzari et al., 2002). Previous ACLR programmes have followed a more traditional progressive overloading method of prescription, which participants often report as "arduous" and boring (Heijne et al., 2022; Piussi, Krupic et al., 2022; Piussi, Magnusson, et al., 2022). Furthermore, the repetitive nature of standard ACLR protocols was concluded to be demotivating and disengaging by Pizzari et al. (2002). Participants in this study described the bi-phasic structure of the programme as refreshing and motivating, particularly due to the mostly predictable two-weekly variation of rehabilitation, and alignment with their menstrual cycles. Consequently, the findings of this research suggest that the bi-phased nature of this menstrual cycle phase-based rehabilitation may be helpful for patient engagement and supports further research into female-centric rehabilitation frameworks (O'Loughlin et al., 2023. While participants largely found the programme acceptable, one participant discontinued cycle tracking post-trial, noting the administrative burden of monitoring her cycle as a barrier. Future iterations of menstrual cycle-synchronised rehabilitation may benefit from tracking tools such as mobile apps or wearable technology to enhance adherence.

These findings must be interpreted with caution due to the small sample size. This qualitative study provides good depth of understanding; however, we acknowledge the results may not apply across all patient populations. Yet, adherence data collected during the original RCT (O'Loughlin et al., 2024) supports these findings. In that trial, adherence rates were high across both groups; however, participants in the intervention group had slightly higher session attendance. This combination of qualitative and quantitative data provides preliminary support for the consideration that phasing rehabilitation with the menstrual cycle may support engagement. Nonetheless, larger samples are needed to confirm this relationship.

Several participants experienced improved perceived outcomes due to participation in the menstrual cycle phase-based rehabilitation, only two of whom had previously undergone knee surgery. Consequently, these assertions had little context for the participants to draw their conclusions. While P1 had previously undergone ACL reconstruction and rehabilitation, the four years between her surgeries may have affected the treatment received. Her age and life stage may have influenced both the physiotherapy care prescribed and her engagement in rehabilitation. Best-practice physiotherapy standards for ACLR continue to evolve in response to new research (Piedade et al., 2023), which may further influence differences in care participants receive for the same injury sustained years later. Furthermore, in general, most participants in this study were over 35 years of age, which may have influenced the acceptance of the programme. Older participants may have had different life responsibilities and levels of body awareness, especially regarding the menstrual cycle. For example, several participants had previous experience with menstrual cycle tracking for planning their families, which may have made the intervention more acceptable or familiar.

Connectedness to self and others

Another theme that was experienced in different ways was connectedness, including increased connection to the treating physiotherapist. Previous research has found therapeutic relationships are vital to patient engagement and satisfaction during ACLR (Burland et al., 2020; Lisee et al., 2020). Recent qualitative research by Haberfield et al. (2025) highlights that women recovering from ACL injury value clear rehabilitation structures, empathetic relationships with health professionals, and individualised approaches that align with their realities and needs. Many of these themes were outlined as experiences of the participants in this current study. Therefore, menstrual cycle-synchronised rehabilitation may address both physiological and psychosocial needs during rehabilitation.

Similarly, an interesting finding of this research is that several participants described increased connection to women in their lives, either through passing on and sharing of information or through increased empathy with those struggling with sports injuries. This sense of body awareness described by these participants aligns with previous studies that connect improved outcomes with increased body literacy (Kaur et al., 2019; Scott et al., 2018. In contrast, previous research has found that ACLR participants often feel isolated throughout the rehabilitative process, demonstrating the importance of feeling connected to peers (Hildingsson et al., 2018; Lisee et al., 2020; Piussi, Krupic et al., 2022; Scott et al., 2018). In this way, the current study provides insight into how this type of rehabilitation can address these gaps in ACL rehabilitation, specifically for women.

Furthermore, Piussi, Krupic et al. (2022) linked feelings of isolation to increased depressive symptoms, reduced physical performance, and slower recovery post ACL reconstruction. Only two participants (P2 and P4) did not disclose increased

connections to their peers resulting from participation in the RCT. However, P2 was the only non-Pākehā participant, and cultural differences may account for different attitudes towards talking about menstruation and hormones outside medical contexts (O'Loughlin et al., 2022b). Considering variation in levels of comfort women experience discussing menstruation, and the importance of menstruation in this research, some participants may experience these benefits differently (O'Loughlin et al., 2022b).

Previously, three studies have established that ACLR patients often experience a sense of disconnect to their physical bodies (Kvist et al., 2023; Scott et al., 2018; Thing 2006). This is attributed to physical changes both post-injury and throughout ACLR. Piussi, Magnusson et al. (2022) found that ACLR patients identified as "copers" reported increased learning about self and body during their rehabilitation. The new rehabilitation protocol discussed in this paper has explored the influence of female hormones on ACLR (O'Loughlin et al., 2024) and provided an opportunity for participants to learn about and connect with their bodies. Participating in the menstrual cycle phase-based protocol appears to have empowered ACLR patients to gain new understandings about their bodies. Considering previous research has noted gendered trends in the psychological experience of rehabilitation (Lisee et al., 2020), further exploration of this phenomenon may provide additional insights.

Strength and satisfaction

The third theme emerging from this research was strength. The increased sense of strength the participants experienced following the menstrual cycle phase-based protocol is of particular interest. Previous ACLR research found patients were often dissatisfied with their physical performance at the end of their initial postoperative rehabilitation (Heijne et al., 2022; Kaur et al., 2019; Piussi et al., 2023). ACLR patients are aware of the need to engage in exercise-based rehabilitation to improve and maintain the health and function of their knee (Burland et al., 2018; Kaur et al., 2019). However, experiences of altered function and persistent knee symptoms demotivate and disengage patients from ACLR (Kaur et al., 2019; Pizzari et al., 2002; Truong et al., 2022). The increased awareness of their strength may have been partially due to the regular strength assessments utilised throughout the protocol. These findings are consistent with those of Pizzari et al. (2002) whereby patients utilise benchmarking to motivate and assess their recovery progression throughout rehabilitation.

Mental strength and perseverance were also exhibited by the participants in this study. Previously Piussi, Magnusson et al. (2022) and Scott et al. (2018) have drawn connections between the importance of perceived self-growth and patient–clinician relationships for fostering these attributes during rehabilitation. Existing qualitative literature largely explores patient experiences of fear and trauma associated with ACLR (Kaur et al., 2019; Kvist et al., 2023; Little et al., 2023; Mahood et al., 2020; Ross et al., 2017). However, the participants did not extensively discuss this during their interviews. A few participants briefly mentioned concern about re-injury, disclosing awareness of re-injury risk or taking care during RTS participation. Consequently, the participants' experiences and perceptions of the protocol could be partially attributed to their mental strength.

Strengths and limitations

These findings align with a recent study advocating for more individualised, gender-specific rehabilitation strategies following ACL injury. The recent systematic review by Bruder et al. (2023) calls for more sex- and gender-informed research and rehabilitation approaches. The present study contributes to this gap by offering initial evidence that tailoring rehabilitation to the menstrual cycle may be one strategy worth exploring further. The principal limitation of this research was time availability, which limited sample size and, as discussed previously, may have impacted the research findings. This research is also limited by the homogenous nature of the interview population. Participants were mostly of European descent; therefore, cultural influences on perceptions of this type of training may affect its viability with other populations. Furthermore, the age of included participants may limit applicability to other populations. Previous research found that younger women are less comfortable discussing their menstrual cycle with peers (O'Loughlin et al., 2022b). This is due to learned stigmas and social expectations around the taboo of menses (Wootton & Morison, 2020), and this stigma may cause some people to disengage from such discourse. Furthermore, all participants were able to discuss their hormones and ACLR at length with the interviewer. Previous researchers have determined that individuals with good health literacy are more inclined to participate in healthcare research, causing less health-literate populations to be underrepresented (Anderst et al., 2020). Therefore, this study may not have captured the women who have reduced health literacy. Additionally, it is possible some participants in the initial RCT who found the intervention less useful and had a less positive experience did not respond to the advert to participate in the study, introducing an element of selection bias.

Clinical implications

Previous research found that menstrual cycle-synchronised rehabilitation provides similar quantitative strength outcomes for sportswomen (O'Loughlin et al., 2024). This study demonstrates that the experience of biphasic training of menstrual cycle-synchronised rehabilitation appears to be favourable for participants following ACLR. Therefore, considering these qualitative results, patients and physiotherapists may consider undertaking such rehabilitation if that is their preference, as menstrual cycle phase-based training may result in favourable qualitative outcomes, such as high acceptability of their rehabilitation programme, strong perceptions of connection to self and others, and a strong perceived feeling of strength.

CONCLUSION

The menstrual cycle phase-based ACLR programme was established to be acceptable and favoured by those who participated in this research. In general, participants

found their outcomes to be satisfactory and felt that the programme was beneficial to their post-ACLR improvements in strength and power. The participants indicated that minor modifications to the menstrual cycle tracking utilised alongside the rehabilitation exercise prescription may lead to better patient experiences and may facilitate optimal compliance in future populations. Participants expressed an increased connection to their physical bodies and female peers through their experience of menstrual cycle phase-based ACLR. The therapeutic relationships built with their treating physiotherapists facilitated greater understanding of themselves and were perceived to contribute to better clinical outcomes from the programme. Previous research found that menstrual cycle phase-based exercise provides similar quantitative results for sportswomen, while the qualitative results of this data set provide insight into how this programme may be experienced, and may support engagement for some women following ACLR. Therefore, overall, this research suggests that menstrual cycle-synced rehabilitation could enhance engagement and recovery, offering a promising new approach for women with ACL injury.

KEY POINTS

1. Previous research found that menstrual cycle phase-based exercise provides similar quantitative results for sportswomen; this study adds that participants also found the experience qualitatively favourable during ACL rehabilitation.
2. Minor modifications to the menstrual cycle tracking process – such as using a simpler app – may lead to better patient experiences and support engagement in future populations.
3. Participants reported increased connection to their bodies and physiotherapists through their experience of menstrual cycle phase-based ACLR, contributing to overall programme satisfaction.
4. Menstrual cycle-synchronised rehabilitation may offer a promising approach to engagement and recovery in the rehabilitation process.

DISCLOSURES

Funding source: The primary author (JH) received a scholarship from the New Zealand Manipulative Physiotherapists Association (NZMPA) in 2020 and at the time of the study was an employee of the Accident Compensation Corporation (ACC). ACC provided funding for her PhD fees as part of her continuing professional development allowance. In addition, EM had a research fund that provided funding for the trial.

Conflict of interest: No conflicts of interest exist that may be perceived to interfere with or bias this study.

PERMISSIONS

This study was approved by the Auckland University of Technology Ethics Committee (reference number 20/224). Permission has been granted by the *New Zealand Journal of Sports Medicine* to republish Figure 1 in the *New Zealand Journal of Physiotherapy*.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the women who gave their time to complete the interviews. In addition, the authors would like to thank all the women who completed the original randomised controlled trial. Finally, the authors would like to acknowledge the New Zealand Manipulative Physiotherapy Association, which provided funding for the randomised controlled trial.

CONTRIBUTIONS OF AUTHORS

Conceptualisation and methodology, JH, DR, and EOL; validation, formal analysis and data curation, JH, DR, and EOL; writing – original draft, JH; writing – review and editing, JH, DR, and EOL; supervision, DR and EOL; project administration, JH, DR, and EOL; funding acquisition, DR and EOL.

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