

Research report

Thermal/Cryo Therapy in Weightlifting

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EXECUTIVE SUMMARY

This research project investigates the role of warm-up and recovery practices in weightlifting, with a focus on thermal and cryotherapy interventions. Through benchmarking of existing products, structured interviews, and observational analysis, the study identified common injuries, user behaviours, and barriers to effective recovery.

Key findings highlight that while warm-up and recovery methods are recognised for their benefits, they are often inconsistent in practice due to barriers such as crowded gym environments, time constraints, and limited access to suitable equipment. Benchmarking revealed a clear gap in the market: premium devices offer advanced performance but remain costly and inaccessible, whereas affordable options lack versatility and functionality.

The study concludes that there is an opportunity to design a portable, mid-range device tailored to weightlifters that integrates both heating and cooling functions safely and effectively. Such a solution would address unmet needs by balancing affordability, usability, and evidence-based recovery outcomes.

AUTHENTICITY & AI USE STATEMENT

Authenticity Statement

This is to certify that to the best of my knowledge, the content of this report is my own work. This report has not been submitted for any subject or for other purposes. I certify that the intellectual content of this report is the product of my own work and that all the assistance received in preparing this report and sources have been acknowledged.

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AI Use Statement

I have utilised AI (Chat GPT, Co-Pilot) in this report to assist in making some areas of writing more clear. AI are also used to mark and receive feedback on my work using the provided CRA.

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1.0 INTRODUCTION

Weightlifting has experienced significant growth as both a recreational activity and a competitive sport, with participants increasingly seeking ways to optimise performance, reduce injury risk, and accelerate recovery. While established factors such as technique, structured training, and nutrition are well understood, warm-up and recovery practices remain less consistently explored, despite their critical role in supporting muscle function, flexibility, and overall training effectiveness. This project focuses on these practices within the context of thermal and cryotherapy devices, aiming to bridge the gap between existing research and real-world application.

The aim of this project is to explore the effectiveness of common warm-up and recovery devices, identify the features that contribute to their success, and evaluate how these insights can inform the design of a new thermal and cryotherapy product.

The report is structured into three main sections:

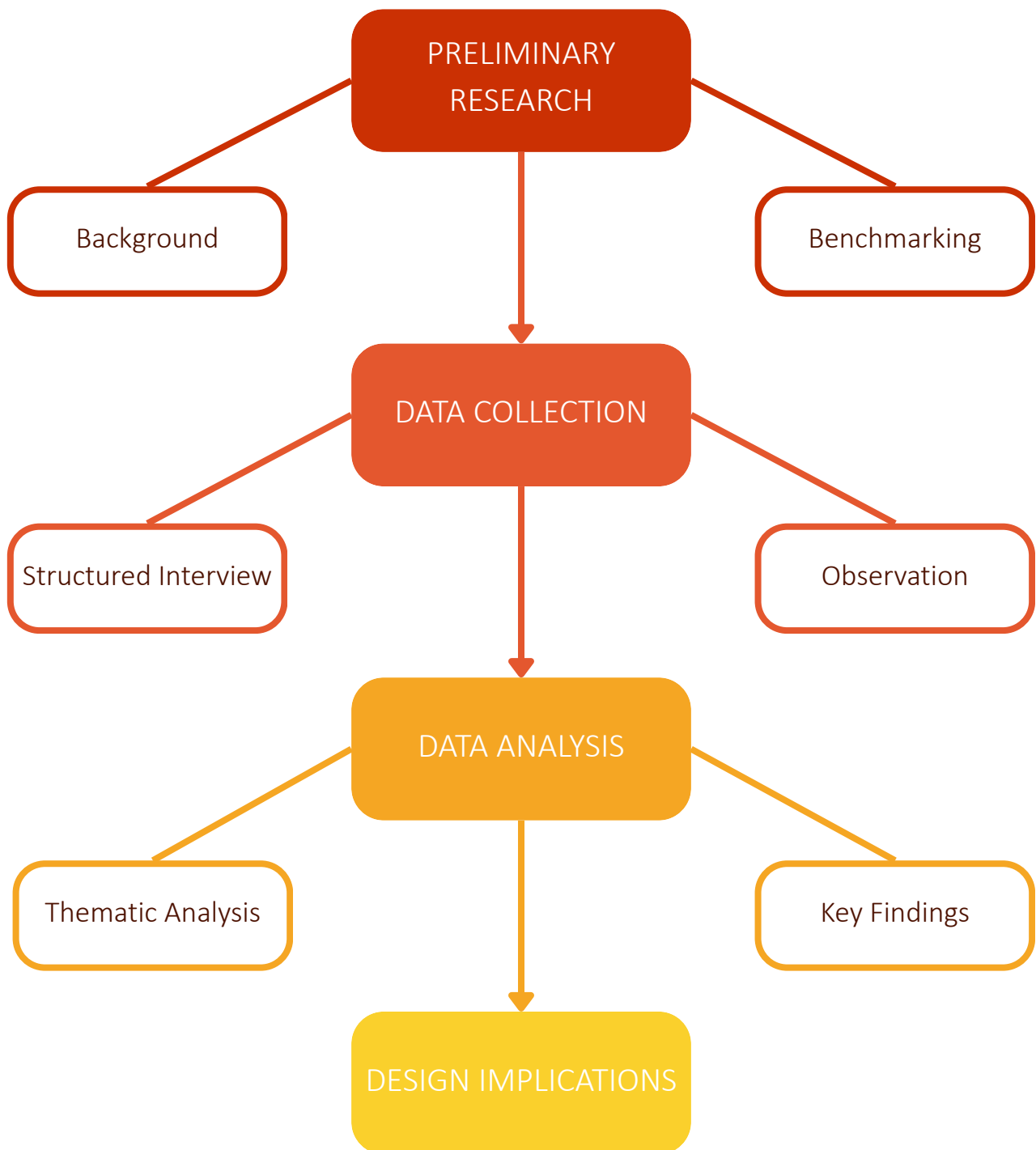
Section 1: Background and Benchmarking, reviews current literature on warm-up, recovery and thermal therapy strategies and examines existing products in the market, highlighting gaps and opportunities for innovation.

Section 2: Research, Analysis, and Findings, outlines the structured research methods used, including interviews and observations, and presents analysed data to reveal patterns in user practices and device effectiveness.

Section 3: Discussion, Design Implications, and Conclusion, interprets the findings in relation to existing knowledge, explores implications for product design, and summarises key insights.

Together, these sections provide a comprehensive exploration of the topic, combining evidence-based research with practical design considerations.

Project Structure



2.0 BACKGROUND

Introduction

In order to gain an extensive and in-depth understanding of the key components of weightlifting, this section reviews two core areas: the prevalence and nature of common weightlifting injuries, and the effectiveness of warm-up, thermal and cryotherapy, and recovery methods. This literature review provides the foundation for identifying opportunities for innovative design solutions that enhance muscle growth, reduce soreness, and prevent injuries in weightlifting.

Common Injuries of Weightlifting

Weightlifting is associated with a range of injuries, most commonly affecting the shoulder (19%) and leg (18%), as identified in a large-scale questionnaire with 55,000 participants. These injuries are generally classified into acute injuries (64%) and overuse injuries (36%). Among them, muscle or tendon strains and tears are the most frequently reported (59%), followed by sprains, twists, or ligament injuries (19%) (Noteboom, 2023). Research highlights that strains are more likely to occur in gym environments due to the predominance of eccentric loading (David A. Opar, 2012). Delayed onset muscle soreness (DOMS) is also a common outcome of weightlifting, caused by eccentric muscle contractions that result in small tears or disruptions (Figure 1) (Cheung, Hume, & Maxwell, 2012). While DOMS is a natural stimulus for muscle growth, it can negatively affect strength, flexibility, and coordination for 3 to 7 days. In addition, overtraining syndrome, often arising from insufficient recovery, is a key contributor to underperformance in athletes (Kreher & Schwartz, 2012).

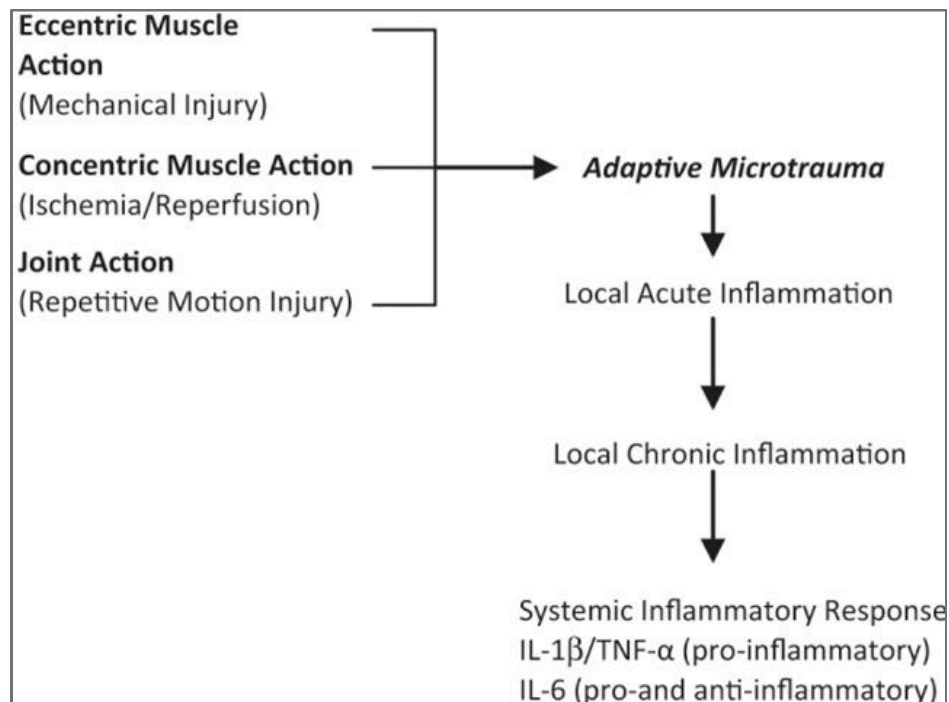


Figure 1 - Proposed etiology of OTS through exercise

Effects of Thermal and Cryotherapy

Research consistently demonstrates the benefits of warm-up and recovery interventions in weightlifting. A meta-analysis of 32 studies reported that 79 percent of participants experienced performance improvements following proper warm-ups, with gains ranging from 1 to 20% (Fradkin, Zazryn, & Smoliga, 2010). Similarly, a 2018 Sports Medicine review found that structured warm-up routines reduced injury risk by approximately 30% among both amateur and elite athletes. Additionally, survey data from 132 competitive strongman athletes showed that 71 percent regularly incorporated competition-style warm-ups into their training. Thermal therapy (40 – 42C), such as low-temperature heat wraps applied immediately after exercise, has been shown to significantly reduce DOMS ($P < 0.01$), with smaller benefits observed when applied 24 hours later (Figure 2) (Petrofsky, et al., 2017). Heat application promotes the expression of heat shock proteins, enhancing muscle repair, protein synthesis, and nutrient delivery (Figure 3) (Valentin Dablainville, 2025). Cold therapy (5 – 15C), effective 24 to 72 hours post-exercise, reduces inflammation and DOMS, though it may also suppress anabolic signalling (Pacheco, 2020). A review of 59 randomized controlled trials found hot packs applied within 24 hours produced the most substantial recovery effects, followed by cryotherapy methods (Wang, 2022).

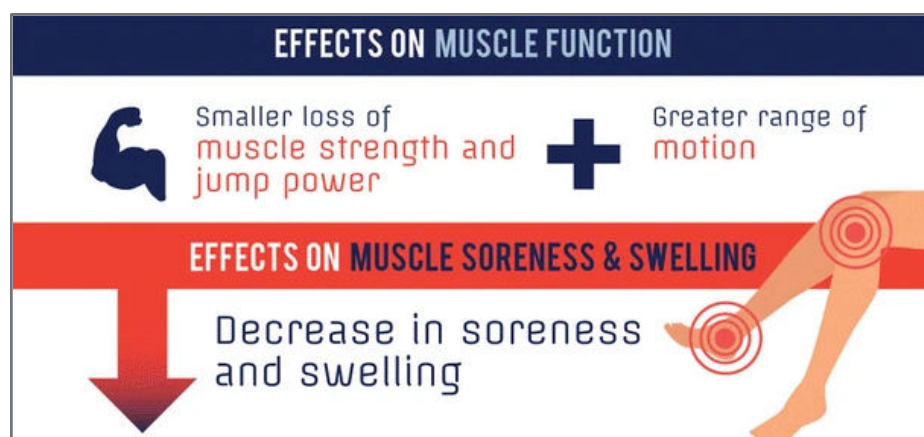


Figure 2 - Effects of Heat on Muscle Function

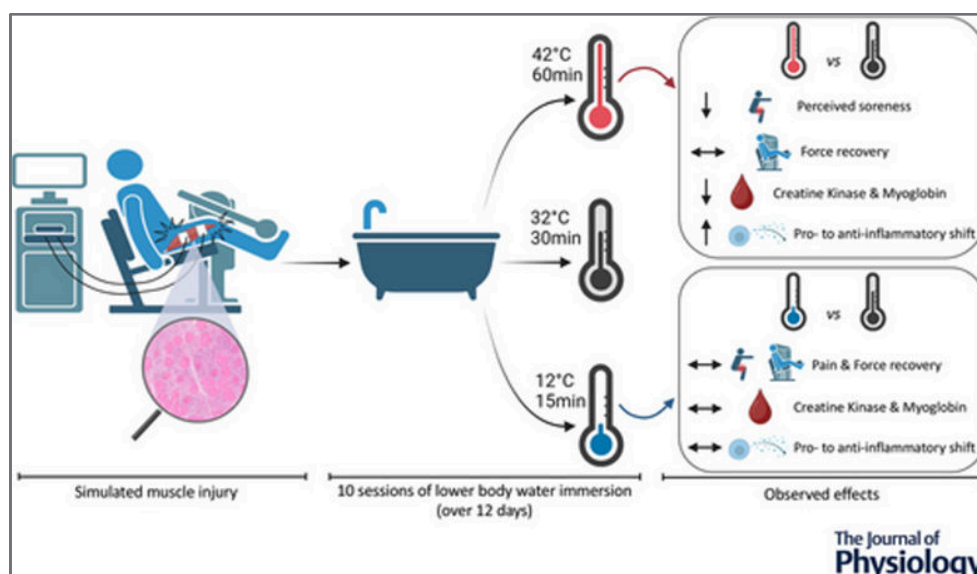


Figure 3 - How the Experiment was Conducted

Summary

Weightlifting commonly results in injuries such as muscle strains, tendon tears, and delayed onset muscle soreness, as well as risks associated with overtraining. Evidence from large-scale studies demonstrates that these effects can be mitigated through proper targeted warm-up and recovery interventions. Warm-ups improve performance, enhance flexibility, and reduce injury risk. Heat therapy immediately before and after exercise promotes protein synthesis, muscle repair and nutrient delivery, whereas cold therapy is most effective 24 to 72 hours post-exercise for inflammation and soreness management (Figure 4). These findings highlight an opportunity to develop a warm-up and recovery devices that integrate evidence-based strategies, offering practical solutions to enhance recovery, prevent injuries, and support effective muscle growth in weightlifters.

Journey Map for Optimal Warm Up and Recovery				
	15 mins before Gym	Weight Lifting	Within 48 hours after	24 - 72 hours after
Therapy	Thermotherapy (Heat)	Muscle Breakdown / Exhaustion	Thermotherapy (Heat)	Cryotherapy (Cold)
Process	Warm Up or apply heat to the targeted muscles before gym, increasing blood flow within the body. Enhance anabolic (growth) signaling via the mTOR pathway, especially when paired with strength training	Weight lifting breaks down muscle fiber, known as "microtears", allowing for rebuild which increase muscle strength and size	Applying heat for 60 mins to targeted muscles within 24 hours greatly reduces cellular damage, promotes expression of heat shocked protein, assists muscle growth	Apply cold to targeted areas for 10 - 15 mins reduce swelling, pain and inflammation, boosts neuromuscular recovery. However, cold therapy causes vasoconstriction, lower nutrient delivery and protein synthesis
Benefits	• Tissue Protection • Reduce DOMS • Improve Performance	• Gain in Muscle Size and Strength • Avoid Muscle Atrophy	• Promotes Muscle Gain • Reduce Soreness • Promotes Nutrient	• Decrease DOMS • Lower injury risks • Increase Recovery • Reduce Inflammation
Drawbacks	• -	• -	• -	• Vasoconstriction

Figure 4 - Journey Map for Context

UX Benchmark Scoring

Using UX benchmark metrics (Kendrick, 2020) and Author's perspective, a benchmarking table was created (Table 2). Products were rated numerically (1–10) across variables including performance, usability, cost, portability, and safety/ergonomics. Scores were colour coded to provide a clear visual comparison. For example, Normatec received the highest score in performance (10) but ranked poorly in affordability (2), highlighting its limited accessibility.

Variables	Normatec 3	Heated Massage Gun	Sauna / Baths	Reusable Heat and Ice Packs	Compression Wrap	Thermal Belt / Wraps
Functionality	10	7	8	5	7	8
Effectiveness	9	9	10	5	6	9
Style	9	7	8	3	6	6
Ergonomic	7	7	7	2	5	5
Affordability	2	5	0	9	7	4
Portability	4	7	0	8	8	6
Safety	6	7	6	4	10	6
Reusability	9	9	9	10	10	9
Average Score	7	7.3	6	5.8	7.4	6.6

Existing Products Benchmarking Table

Table 2 - UX Benchmarking

Venn Diagram

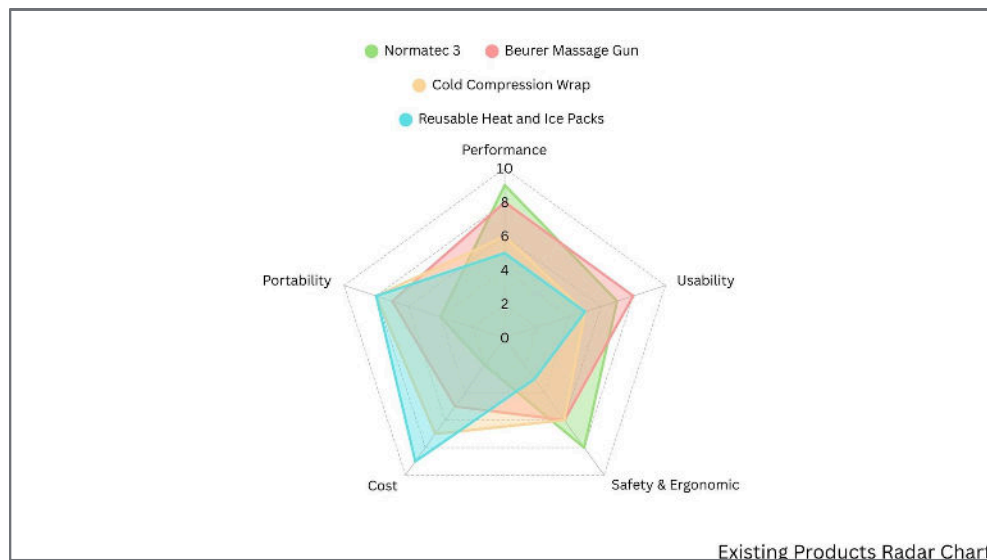
The Venn diagram (Graph 2) illustrates whether existing products rely on thermal or cryotherapy. The graph shows there is very limited overlap where products incorporate both functions.



Graph 2 - Venn Diagram for Thermal / Cryo Functions

Radar Chart of Key Products

To capture a representative spectrum of the market, the selection of existing products are narrowed into 4 key designs for closer analysis (Graph 3): the Normatec 3 Air Compression System (high-end), Beurer Massage Gun (mid-high), Cold Compression Wrap (mid-range), and Reusable Heat and Ice Pack (low-end).



Graph 3 - Radar Chart of Key Products

Detailed Benchmarking of Key Products

Normatec 3 Air Compression System

From the author's perspective, the Normatec 3 is the benchmark for premium recovery technology, using dynamic air compression to improve circulation and reduce muscle swelling (Hyperice, 2022). While performance is excellent and clinically recognised, the system is large, non-portable, and costly (\$1500–\$2000). Safety is reliable, but its setup limits convenience for everyday lifters.

Beurer Massage Gun

Priced at approximately \$250, massage guns combine percussive therapy with heating or cooling attachments (Beurer, 2025). Their performance is solid for targeting specific muscle groups, and from the author's perspective, their portability and usability make them attractive for gym-goers. However, they are less effective for whole-body recovery, and improper use may risk muscle strain.

Cold Compression Wrap

At around \$40, cold compression wraps balance affordability and performance, reducing swelling and aiding recovery after intense sessions (MedicalNewsToday, 2017). From the author's perspective, their simplicity and foldable design make them highly portable and safe, though they are limited to cooling functions and lack versatility for warm-ups (ProTec, 2025).

Reusable Heat and Ice Pack

As the most basic option (\$20–\$30), reusable packs offer targeted hot or cold therapy. They are portable, low-cost, and sustainable, but provide only surface-level relief. From the author’s perspective, they are convenient but have safety risks such as frostbite or burns if misused (ActiveWrap, 2025).

Gaps and Opportunities

Benchmarking reveals a market divide: premium devices are high-performing but expensive, while budget products are accessible but limited. No product fully integrates affordability, portability, safety, and thermal function tailored for weightlifters. This highlights an opportunity to design a compact, reusable device that combines heating and cooling safely and ergonomically at a mid-range price.

Summary

The benchmarking review demonstrates that while warm-up and recovery devices are abundant, the market remains polarised. From the author’s perspective, addressing the unmet need for a balanced, weightlifter-focused solution would create significant value by supporting both warm-up and recovery in a portable, affordable, and effective design.

4.0 Research

Introduction

To explore how warm-up and recovery are applied in practice among weightlifters, primary qualitative research was conducted through structured interviews and direct observations. Interviewing and observing the same participants provided triangulated qualitative data (Gomez, 2025), enabling comparisons between self-reported behaviours and actual practices. This approach helped minimise bias and improved the reliability of the findings. The participant group consisted of six individuals of different experience and background: one expert, two intermediates, and three beginners. This distribution offered a range of perspectives while representing a suitable sample size to capture habits across varying levels of experience (Table 3).

Participants Information (Interview & Observation)						
Participants	1	2	3	4	5	6
Gender	Male	Male	Female	Male	Male	Male
Years of Training	0.5	3	0.6	4	0.4	8
Experience	Beginner	Intermediate	Beginner	Intermediate	Beginner	Expert
Location	Goodlife (Robina)	Goodlife (Burleigh)	QUT (KG)	Goodlife (Bundall)	-	Goodlife (Bundall)

Table 3 - Participation Information

Interviews

Structured interviews were selected as the high standardization allows for easy aggregation and comparison of answers across different participants and consistency across key themes (Clarke, 2024). The questions are designed to focus on participants’ current routines, use of thermal or cryotherapy, perceived benefits, and frustrations with existing equipment. The aim was to capture individual perspectives on the role of warm-up and recovery, and to identify gaps between knowledge, practice, and device use.

Procedure for Interview (Figure 5)

1. The interview questions were first drafted and refined by the researcher through self-testing to ensure clarity and remove repetition.
2. Participants were contacted and scheduled for 15-minute sessions. Each was provided with a consent form in line with QUT ethics policy, and their identities were anonymised for reporting.
3. Interviews followed a structured format, focusing on warm-ups, recovery practices, and equipment use. This ensured consistency across participants while still capturing individual experiences.
4. Responses were initially recorded as notes, but later audio recorded and transcribed to improve accuracy and preserve detail for analysis.

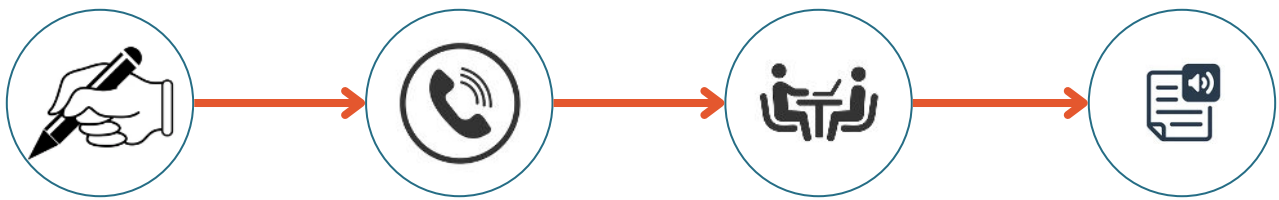


Figure 5 - Procedure for Interview

Observations

Observations were employed to validate or challenge the interview responses by documenting participants' actual warm-up and recovery routines within a gym environment. By accompanying and engaging in participants' routines during their sessions, it was possible to assess whether practical behaviours aligned with the reported practices from the interviews. Observations also highlighted situational factors, such as time constraints, equipment availability, and personal habits, which influenced the participants' decisions and approaches.

Procedure for Observation (Figure 6)

1. Five of the six interview participants agreed to take part in observations, which documented their full gym routine from arrival to recovery.
2. Participants were informed of the process and asked to demonstrate their normal routines, including warm-up, workout execution, and recovery practices.
3. A prepared checklist was used to record details such as duration, sequence, and whether any types of thermal or cryo methods applied.
4. Notes, sketches, and photographs (with consent) were taken to supplement the data, while session lengths varied depending on workout intensity and targeted muscle groups.

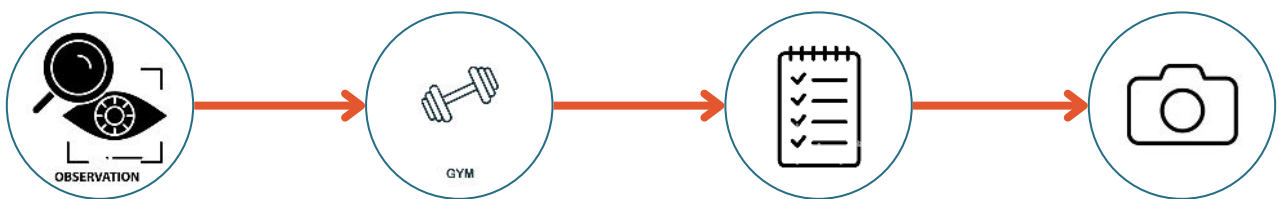


Figure 6 - Procedure for Observation

Summary

Together, the interviews and observations provided complementary insights. The interviews revealed participants' knowledge, beliefs, and attitudes toward warm-up and recovery, while the observations clarified how these practices were applied in reality. This combination ensured a more accurate picture, highlighting consistencies and contradictions that would have been overlooked. By triangulating both perspectives across a diverse participant group, the research created a solid foundation for identifying the warmup and recovery habits of gym goers.

5.0 Analysis & Findings

Introduction

In this section, the analysis process is outlined, and the findings are presented. Interview and observation data were examined using a thematic approach, with responses categorised into main themes and subthemes to identify patterns, similarities, and contradictions. The results are supported with tables and figures that highlight key behaviours and perspectives, providing the basis for discussion and design implications in the following sections.

Interviews Analysis

The analysis process followed thematic coding approach to ensure reliability and consistency in identifying themes across the interview data. This approach combined transcription, iterative reviewing, and thematic grouping to ensure that the findings were accurate, relevant and grounded in participants' responses.

The process was carried out in the following steps:

1. **Transcription:** Most interviews were transcribed using Restream.io, while two were summarised manually due to missing audio. This provided raw accurate data for subsequent analysis.
2. **Initial Thematic Segmentation:** As the interviews followed a structured format, the standardised questions naturally separated responses into broad topics, offering a preliminary framework for analysis.
3. **Highlighting Key Points:** Each transcript was carefully read, and key points were highlighted. During this stage, preliminary subthemes were noted to capture recurring ideas or patterns within the responses.
4. **Ensuring Consistency:** Transcripts were reread to confirm that coding and subthemes remain consistent and accurate across participants.
5. **Consolidation of Data:** Highlighted points were compiled into subthemes in a single document, formatted into quotations, and tagged with participant identifiers (e.g., P1, P2).
6. **Grouping into Main Themes:** Related subthemes were then grouped together to form five overarching themes that reflected the broader patterns within the data.
7. **Framework Presentation:** Findings were structured into "Themes → Subthemes → Codes and Quotes," linking overarching insights with supporting evidence.

Interview Analysis (Table 4)

Theme	Sub-Theme	Code / Transcript Example
Theme 1: Warm-up Practices	Types of Warm-ups	- Dynamic stretches, yoga stick, treadmill, warm-up sets. “For push, use the wooden yoga stick to warm up shoulders.” (P1) “I kind of go for a walk on the treadmill... then stretch, like arm circles and leg swings.” (P3)
	Time and Consistency	- Warm-ups vary from 30 seconds to 15 minutes depending on time, motivation, or type of session. “I’ll try and make it as quick as possible... thirty seconds.” (P5) “On leg day I’d usually do 5–10 minutes cardio beforehand.” (P6)
	Skipping Warm-ups	- Often skipped when tired, busy, or gym is crowded. “If gym is crowded then warm up will be skipped.” (P2) “Depends on how much time you got within a day, how much effort you want to put into it” (P6) “Yes, when busy or when I don’t feel like it.” (P1)
	Perceived Effectiveness	- Most agree warm-ups reduce stiffness, improve performance, and prevent injury. “Warm up 100% affects performance as muscles are a lot stiffer without it.” (P2) “If I don’t use the yoga stick before bench, I get shoulder pain.” (P1)
Theme 2: Recovery Practices	Nutrition and Hydration	- Protein shakes, meals, hydration central to recovery. “Refill on protein by protein shakes or carbs, no other recovery.” (P2) “Get enough food in, the right food, whole foods, and high protein.” (P6)
	Tools and Techniques	- Foam rollers, saunas, ice baths, massage guns used occasionally. Many reports limited or inconsistent use. “I have a foam roller but rarely use it, nothing else.” (P1) “Massage gun... great relief, heat is essential.” (P2) “I’ve seen a lot of people do ice baths, but I don’t think it’s on my bucket list.” (P3)
Theme 3: Attitudes Toward Equipment	Cost and Complexity	- Devices seen as expensive, overcomplicated, or designed for elite athletes. “Air Compressor.... they’re real pricey one and stuff. \$2000.” (P4) “Some things are a bit complicated... it often feels like it’s made for more advanced athletes.” (P3)
	Preferred Features	- Simplicity, affordability, portability, comfort. “Something simple, affordable, and beginner friendly.” (P3) “If it’s nice and simple and does its function well, then that would be good.” (P4)
Theme 4: Barriers and Struggles:	Time Constraints	- Skipping warm-up or recovery due to busy schedules or impatience. “Skipped warm up when I was in a rush.” (P6) “When I want a short session but warm up drags it out.” (P1)
	Knowledge and Motivation	- Beginners unsure how to use recovery tools or find them boring. “I did try a foam roller once, but I didn’t really know what I was doing.” (P3) “I don’t usually do recovery because it’s pretty boring.” (P1)
	Situational Factors	- Warm-up and Recovery choices influenced by convenience, access, or mood. “If it’s a nice sunny day, I’ll jump in the ocean. If I’m exhausted, I’ll use the sauna.” (P4) “Convenience... I know stretching is quick and easy.” (P2)
Theme 5: Benefits and Perceived Outcomes	Performance and Injury Prevention	- Warm-ups linked to better lifts and lower risk of injury. “Warm up dictates how well your actual workout will be.” (P6) “The reason why I do it is, so I don’t injure my shoulder or back.” (P4)
	Enjoyment and Motivation	- Some view recovery (e.g., sauna, ice baths) as enjoyable rituals. “I enjoy it... it’s something people should look at as enjoyable rather than a chore.” (P4) “You go in the sauna and then you feel super relaxed.” (P6) “Hot shower is really good... keeps your blood pumping.” (P3)

Observation Analysis

The observation analysis applied a thematic approach, using some of the same main themes from the interview analysis: Warm-up Practices, Recovery Practices, and Barriers and Struggles, to allow triangulation between reported and observed behaviours. This ensured consistency and highlighted where actions aligned with or diverged from interview responses.

The process was conducted using the following steps:

1. **Data Collection:** Each participant was observed during their gym session, with notes recorded on warm-up routines, recovery practices, and contextual factors such as space, equipment availability, and time pressure.
2. **Theme Alignment:** The observation notes were categorised under the three main themes, ensuring consistency with the interview analysis and allowing direct comparison between datasets.
3. **Subtheme Classification:** Within each theme, observations were further grouped into relevant subthemes (e.g., type of activity, intensity, time spent, tailored routines, situational influences).
4. **Data Tabulation:** The categorised notes were transferred into tables, with each participant's behaviours clearly presented. This format allowed for quick comparison across participants and highlighted recurring patterns, contradictions, and contextual differences.

Observation Analysis (Table 5)

Theme 1: Warm-up Practices

Participants	1	2	3	4	6
Activities	- Wooden stick - Warm up sets	- Rowing - Arm circle - Warm up sets	- Treadmill - Leg swing - Arm circle - Warm up sets	- Static back pull - Warm up sets	- Elastic band stretch 2kg side raises - Warm up sets - Pull ups
Tailored to Workout	Yes	Yes	- Yes - Generic	Yes	Yes
Intensity	- Focused - Casual	Focused	Casual	Focused	Focused
Time (mins)	5	10	15	10	20

Theme 2: Recovery Practices

Activities	Food	Foam rolling	- Leg stretches - Slow walk	- Static back pull - Lower back foam roll 4 sets lower back extensions	- Protein bar - Generic stretches - Foam roll - Sauna
Tailored to Workout	Generic	Yes	- Yes - Generic	Yes	- Yes - Generic
Intensity		Focused	Casual	Focused	- Focused - Casual
Time (mins)		5	10	20	30

Theme 4: Barriers and Struggles

Crowdedness	Crowded	No crowd	Quiet gym	No crowd	Crowded
Time Pressure	Yes	No	No	No	No
Space	Small space	Big space	Small space	Big space	Big space
Equipment	Good equipment	Great equipment	Good equipment	Great equipment	Great equipment

Findings

Using the data produced from interview and observation analysis, Table 4 and Table 5 are created to summarise the key points. The key findings were identified across the five main themes, with thematic triangulation employed to cross-reference and validate patterns between the two data sources (Table 6).

1 Warm-up Practices

Warm-ups were found to be performed inconsistently (Table 4 & 5), with most participants relying on familiar routines rather than varied or structured approaches (Table 4). The data also shows that experience plays a role, as more experienced participants engaged in warm-ups and recovery practices more consistently (Table 4 & 5).

2 Recovery Practices

Some participants incorporate recovery equipment into their routines, while others prefer self-massage or stretches (Table 5). However, recovery sessions are often skipped due to busy gym environments and post-workout fatigue (Table 4 & 5).

3 Attitude Towards Equipment

Recovery equipment is often perceived as complex, leading to avoidance (Table 4), while simpler or more familiar options are generally preferred (Table 4 & 5).

4 Barriers and Struggles

Crowded gym spaces and busy environments often restrict opportunities for proper warm-up and recovery (Table 4 & 5). Time constraints are also a frequent reason for skipping recovery (Table 4 & 5), while personal factors such as motivation and habit play a key role in maintaining routine consistency (Table 4).

5 Benefits and Perceived Outcomes

Recovery is widely recognised for its benefits in reducing soreness and enhancing performance (Table 4). However, these perceived advantages do not always translate into consistent recovery practices among participants (Table 5).

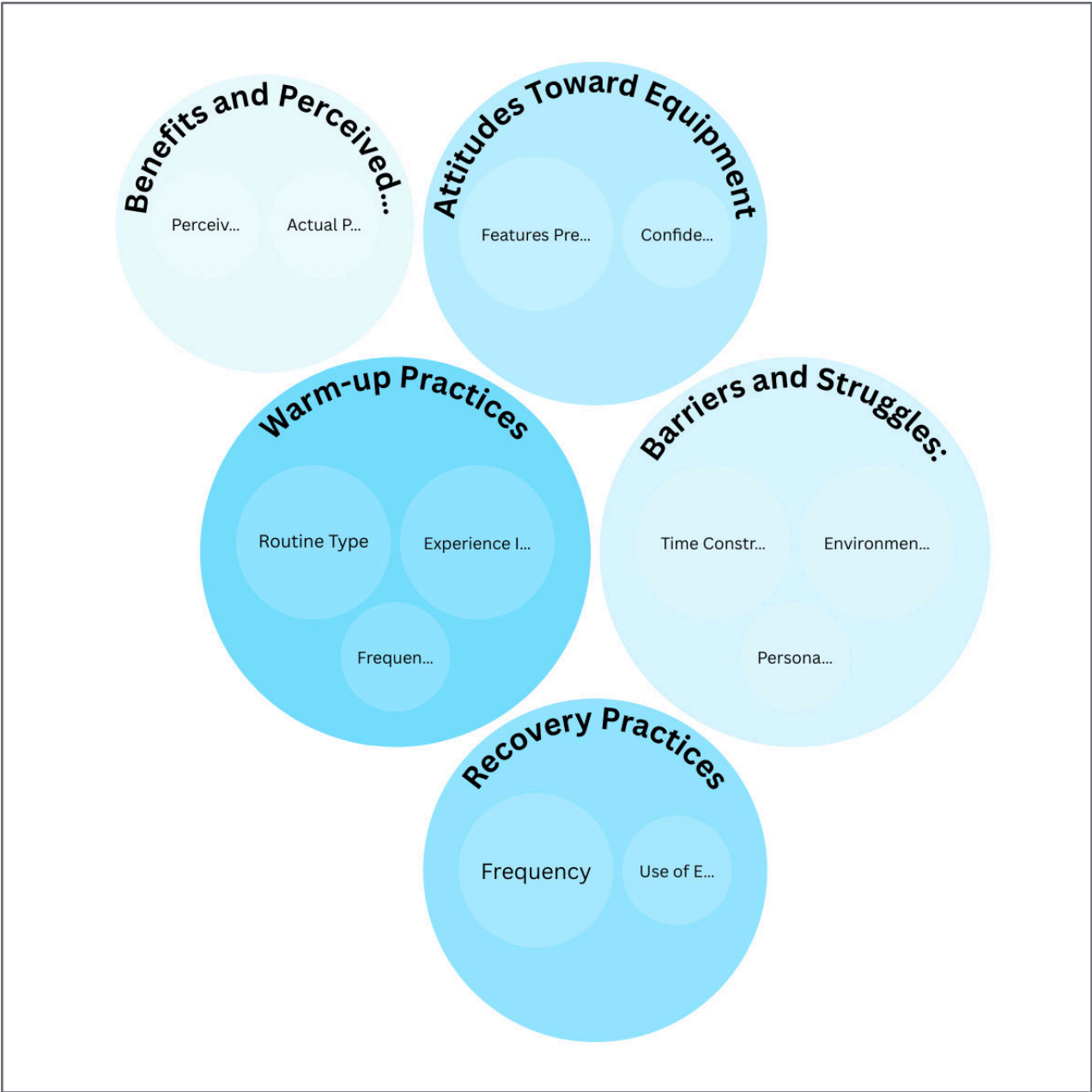


Table 6 - Key Themes from Cross Reference

Summary

The analysis of interviews (Table 4) and observations (Table 5) revealed key patterns in participants’ gym behaviours. The analysis is categorised into themes, subthemes, and supporting codes/quotes, which are summarised and presented in detail in the findings section to clearly highlight participants’ routines, attitudes, and behaviours.

6.0 Discussion

Introduction

The research data from interviews and observations, alongside the background literature, highlighted several pain points in gym-goers' warm-up and recovery practices. These pain points reveal why evidence-based warm-up and recovery strategies are often underutilized and provide insight into potential opportunities for intervention.

1

Inconsistent Application of Warm-ups and Recovery



WARM UP

Participants perform warm-ups and recovery routines inconsistently, often relying on familiar routines or skipping them due to time constraints or fatigue (Table 1 & 2). This is significant because structured warm-ups and targeted recovery improve performance and reduce injury risk (Fradkin, Zazryn, & Smoliga, 2010). Even more experienced participants, while more consistent, still show variability in adherence, highlighting a gap between knowledge and practice.

2

Environmental and Logistical Barriers



Crowded gym spaces, limited time, and post-workout fatigue were frequently reported as barriers to performing warm-ups and recovery (Table 1 & 2). These practical challenges help explain why participants do not consistently apply recovery techniques, despite their known benefits in reducing soreness and preventing overtraining (Cheung, Hume, & Maxwell, 2012); (Kreher & Schwartz, 2012). Additionally, the environmental and contextual barriers highlight how external factors beyond individual motivation can strongly influence commitment to evidence-based routines.

3

Complexity and Accessibility of Recovery Methods



Participants often avoided recovery equipment due to complexity, lack of confidence, or unfamiliarity (Table 1). This aligns with literature showing that thermal and cryotherapy interventions, while highly effective in promoting muscle repair and reducing DOMS (Petrofsky, et al., 2017); (Valentin Dablainville, 2025); (Wang, 2022), are underutilized when access or usability is limited. The evidence highlights the need for simple, convenient, and user-friendly solutions to support appliance.

Summary

These findings demonstrate a clear gap between the proven benefits of warm-up and recovery practices and their actual application in everyday gym routines. Understanding these pain points provides evidence for designing interventions that address time, accessibility, and complexity barriers, ultimately improving adherence and effectiveness of warm-up and recovery practices.

7.0 Design Indications

Introduction

The findings from structured interviews, observations and benchmarking of warm-up and recovery products highlight barriers that limit consistent recovery practices while revealing opportunities for innovation. The literature review confirmed the benefits of structured warm-ups, thermal therapy, and cryotherapy in reducing soreness and injury, yet the research showed these practices are not consistently applied in real-world gym settings. Benchmarking revealed that existing products are often bulky, gym-dependent, or single-function, with few combining both heat and cold therapy in a portable and convenient way. These insights guide the design of a solution that addresses key pain points and enhances accessibility. The following implications are structured into Must, Should, and Could priorities.

Must

- Be safe, reliable, and easy to use in gym environments.
- Deliver both thermal function effectively.
- Remain affordable for regular gym users.

Should

- Be portable and lightweight for convenient use.
- Offer adjustable temperature and timing settings.
- Use durable, sweat-resistant materials.

Could

- Integrate smart tracking or app connectivity.
- Feature interchangeable attachments for different muscle groups.
- Include rechargeable or eco-friendly power options.

Solving Time, Environment, and Situational Constraints

Literature highlights that thermal therapy is most effective immediately before or after training, yet recovery is often skipped due to time pressures and crowded gym environments. Portability consideration is essential so the device can be used beyond the gym, such as during commutes or at home, integrating recovery seamlessly into everyday routines.

Thermal Function

Benchmarking shows a gap in the market where most devices offer either heating or cooling, with the Beurer massage gun being the only dual-function option yet requiring handheld operation. A design pathway here is the development of thermal functionality in a hands-free and ergonomic format to increase practicality and differentiation.

Portability and Convenience

Interviews and observations reveal that users value compact and easy-to-carry solutions. Designing a wearable, lightweight device that remains comfortable during commutes or light activity provides a pathway for consistent recovery without disrupting lifestyle habits.

Safety and Usability

Low-cost options such as ice packs or wraps often pose risks like frostbite or burns if misused. Prioritising safe temperature regulation, intuitive controls, and ergonomic design offers a pathway to increase trust, comfort, and long-term adoption.

Affordability and Accessibility

Premium devices such as Normatec excel in performance but are priced out of reach for many gym-goers. Positioning a device in the mid-range, with balanced cost, portability, and thermal function capability, creates an opportunity to make recovery solutions more inclusive and accessible.

Summary

In summary, the device must be portable, thermal functional, intuitive, and quick to use, directly addressing the most pressing barriers. It should also prioritise targeted application, ergonomics, and integration into daily routines, while optional features such as reminders and sustainability could enhance its value. These design implications, informed by benchmarking and user research, provide a foundation for a practical and effective recovery device suited to gym-goers' everyday needs.

8.0 Conclusion

This research explored gym-goers' warm-up and recovery behaviours, aiming to identify barriers and opportunities for improving consistent engagement with evidence-based practices. A qualitative approach was employed, using structured interviews, direct observations of participants' routines, and benchmarking of existing recovery products. This combination of methods allowed for a triangulated understanding of user behaviours, environmental constraints, and gaps in current product offerings.

The literature review established a foundation by highlighting the prevalence of weightlifting injuries, delayed onset muscle soreness, and the effectiveness of structured warm-ups and thermal or cryotherapy in enhancing performance and reducing injury risk. Benchmarking revealed a shortage of portable, user-friendly devices that integrate both heat and cold therapy for flexible pre- and post-gym recovery.

Findings from the interviews and observations identified three consistent pain points: inconsistent application of warm-ups and recovery routines, environmental and logistical barriers such as crowded gyms and limited time, and complexity or inaccessibility of existing recovery equipment. While experienced participants demonstrated greater consistency, practical and motivational barriers often prevented these routines from being applied regularly. Design implications suggest that an effective recovery solution must be portable, intuitive, and time-efficient, with adaptable heat and cold therapy to meet varied recovery needs. By overcoming both practical and psychological barriers, such a solution could improve engagement, consistency, performance, and injury prevention for gym-goers.

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