



This is a peer-reviewed, post-print (final draft post-refereeing) version of the following published document, Accepted author manuscript version reprinted, by permission, from Journal of Sport Rehabilitation, 2017, volume 26 (6): pp478-485, <http://dx.doi.org/10.1123/jsr.2016-0029> © Human Kinetics, Inc. and is licensed under All Rights Reserved license:

**Shaw, Sarah ORCID logoORCID: <https://orcid.org/0000-0003-0723-8057>, Smith, Tina, Alexanders, Jenny, Shaw, Thomas, Smith, Lois, Nevill, Alan and Anderson, Anna (2017) The Use of Recovery Strategies Among Participants of the Bupa Great North Run: A Cross-Sectional Survey. Journal of Sport Rehabilitation, 26 (6). pp. 478-485. doi:10.1123/jsr.2016-0029**

Official URL: <http://dx.doi.org/10.1123/jsr.2016-0029>  
DOI: <http://dx.doi.org/10.1123/jsr.2016-0029>  
EPrint URI: <https://eprints.glos.ac.uk/id/eprint/4283>

#### **Disclaimer**

The University of Gloucestershire has obtained warranties from all depositors as to their title in the material deposited and as to their right to deposit such material.

The University of Gloucestershire makes no representation or warranties of commercial utility, title, or fitness for a particular purpose or any other warranty, express or implied in respect of any material deposited.

The University of Gloucestershire makes no representation that the use of the materials will not infringe any patent, copyright, trademark or other property or proprietary rights.

The University of Gloucestershire accepts no liability for any infringement of intellectual property rights in any material deposited but will remove such material from public view pending investigation in the event of an allegation of any such infringement.

PLEASE SCROLL DOWN FOR TEXT.

**THE USE AND PERCEPTIONS OF RECOVERY**  
**STRATEGIES AMONG PARTICIPANTS OF THE BUPA**  
**GREAT NORTH RUN: A CROSS-SECTIONAL SURVEY**

**Sarah Shaw, Tina Smith<sup>b</sup>, Jenny Alexanders<sup>c</sup> Thomas Shaw<sup>a</sup>, Lois Smith<sup>d</sup>, Alan  
Nevill<sup>b</sup>, Anna Anderson<sup>e</sup>**

*<sup>a</sup> School of Sport and Exercise, The University of Gloucestershire, Oxstalls Campus,  
Gloucester, GL2 9HW, United Kingdom*

*<sup>b</sup>Institute of Sport, Faculty of Education, Health & Wellbeing, University of  
Wolverhampton, Gorway Road, Walsall, West Midlands, WS1 3BD, United Kingdom*

*<sup>c</sup>School of Health and Social Care, Centuria Building, Teesside University, TS1 3BX*

*<sup>d</sup>Sport, Health and Sciences Department. The University of Hull, Cottingham Road,  
Hull, HU6 7RX, United Kingdom*

*<sup>e</sup>Physiotherapy Department, Leeds Teaching Hospitals NHS Trust, Beckett Street,  
Leeds, West Yorkshire, LS9 7TF, United Kingdom*

\*Corresponding author: Sarah Shaw

*Email address: [sshaw@glos.ac.uk](mailto:sshaw@glos.ac.uk)*

*Telephone: 01242 714619*

*Word Count: 3862*

## **ABSTRACT**

*Objective:* To investigate half marathon runners' frequency of use of recovery strategies, perceptions regarding the most beneficial recovery strategy and reasons for using recovery strategies.

*Design:* Cross-sectional survey.

*Participants:* 186 participants of the 13.1 mile BUPA Great North Run 2013.

*Methods:* A questionnaire was developed which required participants to indicate how frequently they used twelve different recovery strategies, identify which recovery strategy they believed to be most beneficial and rank six reasons for using recovery strategies in order of importance. Data was analysed using a Friedman non-parametric ANOVA and additional non-parametric tests.

*Results:* All participants used recovery strategies. Stretching was the most commonly used recovery strategy ( $p < 0.001$ ), whereas the use of nutritional supplements was the most commonly selected most beneficial recovery strategy. Over 50% of respondents indicated that they never used strategies such as kinesio tape (80%), hydrotherapy (78%) or ice baths (71%). A significant difference was observed between reasons for using recovery strategy ( $\chi^2 (5) = 292.29, p < 0.001$ ). Reducing muscle tightness (rank 4.87) and reducing injury (rank 4.35), were the most frequently chosen most important reasons for using recovery strategies, minor sex and age differences in the responses were identified.

*Conclusion:* Recovery strategy usage appears to be widespread among half marathon runners; however disparities exist between the frequency of use and perceived effectiveness of different recovery strategies. Further research in this area is needed to facilitate the development of recovery strategy guidelines which are both evidence-based and practically relevant.

## **KEYWORDS**

Running, Stretching, Nutrition, Injury reduction

## **INTRODUCTION**

The critical role that optimising recovery plays in enhancing athletic performance is widely recognized, with a diverse array of strategies being proposed to facilitate post-exercise recovery [1]. The effectiveness of such recovery strategies does however appear to vary widely. For example recent meta-analyses investigating post-exercise recovery strategies have concluded that the use of compression garments [2] and cold water immersion [3] are beneficial, but that there is insufficient evidence to support the use of stretching [4] or contrast immersion [3].

In contrast to the relatively large number of studies investigating the effectiveness of recovery strategies, very few have investigated how frequently athletes actually use recovery strategies, or coaches and athletes perceptions regarding the effectiveness of different recovery strategies. A qualitative study investigating these aspects among elite sports coaches concluded that nutrition, stretching, active recovery and contrast immersion are particularly commonly used, with practical factors such as time and cost having a major influence on the use of different recovery strategies [5]. Furthermore the coaches' perceptions of the effectiveness of different recovery strategies appeared to be determined largely by past experience rather than by scientific evidence.

The perceived effectiveness of different recovery strategies has also been investigated in athletes themselves, with a recent survey of 890 elite team athletes reporting that sleep, fluid replacement and socialising with friends are considered particularly important recovery strategies, regardless of sex, type of team sport or level of participation [6]. However, to the author's knowledge, no studies have investigated either the use or perceptions of recovery strategies specifically in runners.

Investigating this area in endurance runners is particularly important because the high levels of fatigue and muscle damage which occur in endurance sports make optimizing recovery especially crucial [7].

Due to sex differences in the metabolic, thermoregulatory and inflammatory responses to exercise the relative effectiveness of different post-exercise recovery strategies is thought to differ between males and females [8]. In addition there appear to be sex differences in the perceived effectiveness of different recovery strategies among elite team athletes [6]. Age is another factor which is believed to have an impact on post-exercise recovery [9], and hence may influence the relative effectiveness of different recovery strategies. Investigating the use and perceptions of recovery strategies in both male and female runners and in runners of different ages is therefore important.

The present paper presents a cross-sectional survey conducted among competitors of the BUPA Great North Run 2013, a half marathon event attracting both elite and non-elite endurance runners. The primary aims of the survey were to provide an insight into the competitors' frequency of use of recovery strategies, their perceptions regarding the most beneficial recovery strategy and their reasons for using recovery strategies. Secondary aims of the present study were to investigate whether the competitors' use and perceptions of recovery strategies varied with sex or age.

## **METHOD**

The study involved administering a survey on use and perceived benefits of recovery strategies to finishers of the BUPA Great North Run 2013. Data was collected from runners following completion of the run, between 11:00 and 16:00, within the BUPA post event finishers' marquee. Prior to the commencement of the survey, the event organisers granted permission for the study to go ahead and full institutional ethical approval was obtained.

### **Participants**

Out of the 56000 runners of the 13.1 mile BUPA Great North Run 2013, all participants who registered with the BUPA post event finisher's marquee were eligible to take part in the survey. Completion of the survey was entirely voluntary and all participants provided informed consent prior to completion. 186 participants (126 males and 60 females) completed the survey and none withdrew their consent. The mean age of participants was  $34.7 \pm 9.6$  years, with an age range of 18 to 59 years. Seven participants did not indicate which recovery strategy they perceived to be the most beneficial, otherwise all participants completed all sections of the survey.



## Instrument

A questionnaire was developed which investigated how frequently participants used each of twelve different recovery strategies, these twelve were selected on the basis of the most commonly used recovery interventions that are implemented within the sporting context [10]. Participants then had to select which of the strategies they believed to be the most beneficial and their reasons for using recovery strategies. Participants were required to indicate how often they used each of the twelve specified recovery strategy via a 5-point Likert scale where the scores represented; 1- never use, 2- rarely use, 3- sometimes use, 4- often use and 5- always use. They were then required to indicate which one of the recovery strategies they perceived to be the most beneficial. In order to explore why recreational runners engaged in recovery strategies six commonly promoted reasons for this were listed and participants were required to rank them in order of importance. Questions one and two are shown in table 1 and table 2.

Table 1: Question 1 of the recovery strategy survey. Participants were asked to circle how often they used each recovery strategy, and then indicate with an asterisk which recovery strategy they perceived to be the most beneficial overall.

*1. Can you circle the use of the following recovery strategies from the list below? THEN PLEASE INDICATE WITH AN ASTERIC WHICH OF THE ABOVE STRATEGIES YOU CONSIDER TO BE THE MOST BENEFICIAL OVERALL*

<b>Ice bath</b>	Always use   Often use   Sometimes use Rarely use   Never use	Cold water immersion for a period of time
<b>Massage</b>	Always use   Often use   Sometimes use Rarely use   Never use	Sports/Swedish/Relaxation massage
<b>Compression garments</b>	Always use   Often use   Sometimes use Rarely use   Never use	Garments which provide a supportive system to the body (socks, shorts, t shirts etc.)
<b>Active recovery</b>	Always use   Often use   Sometimes use Rarely use   Never use	Light exercise carried out in the 48 hours post event e.g. swimming, cycling etc.
<b>Stretching</b>	Always use   Often use   Sometimes use Rarely use   Never use	Gentle stretching of limbs
<b>Foam rolling</b>	Always use   Often use   Sometimes use Rarely use   Never use	Using a foam roller, or tennis ball, golf ball to provide a self-administered massage
<b>Kinesio Tape</b>	Always use   Often use   Sometimes use Rarely use   Never use	The use of Kinesio tape to aid recovery
<b>Relaxation</b>	Always use   Often use   Sometimes use Rarely use   Never use	Using relaxation techniques such as deep breathing exercises
<b>Hydrotherapy</b>	Always use   Often use   Sometimes use Rarely use   Never use	The use of exercises in a pool as part of post event routine
<b>Health club facilities</b>	Always use   Often use   Sometimes use Rarely use   Never use	Using health club/gym facilities such as sauna, steam, jacuzzi
<b>Nutritional supplements</b>	Always use   Often use   Sometimes use Rarely use   Never use	Using post event nutritional aids such as shakes, specific foods, energy supplements
<b>Seeing an allied health professional</b>	Always use   Often use   Sometimes use Rarely use   Never use	Visiting a clinic operated by a Sport Rehabilitator, Physiotherapist, Sports Therapist, Sport Massage

Table 2: Question 2 of the recovery strategy survey. Participants were asked to rank why they thought their selected recovery strategies assist in their recovery by numbering the reasons on the list from 1 (most important) to 6 (least important).

2. Please can you rank why you think your selected recovery strategies assist in your recovery. Number the reasons on the list below from 1-6 (1 = YOU think most important, 6 = YOU think least important).

<b>Reduce joint stiffness</b>	Decreasing the stiffness in joints such as knees/hips/ankles
<b>Reduce muscle tightness</b>	Decreasing the muscle soreness
<b>Well being</b>	Generally feel well and invigorated
<b>Injury reduction</b>	Reducing the risk of pulling muscles/ ligaments etc
<b>Enhance subsequent performance</b>	Increasing your upcoming performances in events
<b>Improve the removal of waste products</b>	Removing the buildup of lactic acid which can cause the muscle soreness

### Data Analysis

A Friedman non-parametric ANOVA was used to identify the most commonly used recovery strategy and most commonly selected important reason for using recovery strategies across all participants.

Further non-parametric test were performed to determine if there were differences in strategy preference and reasons for using recovery strategies between males and females (Mann-Whitney U-Test) and between age groups (Kruskall –Wallis test). A chi-square test of independence was performed to analyse differences between age

groups and sex, for strategies deemed most beneficial by participants who specified at least rarely using that strategy. Subsets of the whole sample were therefore used for this analysis, with participants who never used the strategy being removed from the analysis. This was to remove the bias of a strategy being regarded as not beneficial when the participant did not use it. For all age group analyses, the data was divided into 3 groups (18 to 29 y; 30 to 39 y; 40 years plus). The significance level for all statistical tests was set at  $p < 0.05$ .

## **RESULTS**

### **Most Frequently used Strategies**

Of the 186 participants who completed the questionnaire all stated that they used recovery strategies. Figure 1 illustrates the median score for recovery strategy usage across participants. The most commonly used strategy was stretching ( $\chi^2 (11) = 635.59, p < 0.001$ ), with 67% of all respondents indicating they always used stretching as a way to recover (see figure 1). Over 50% of respondents indicated that they never used kinesio tape (80%), hydrotherapy (78%), ice baths (71%), foam rolling (54%), allied health professionals (54%) or compression garments (54%).

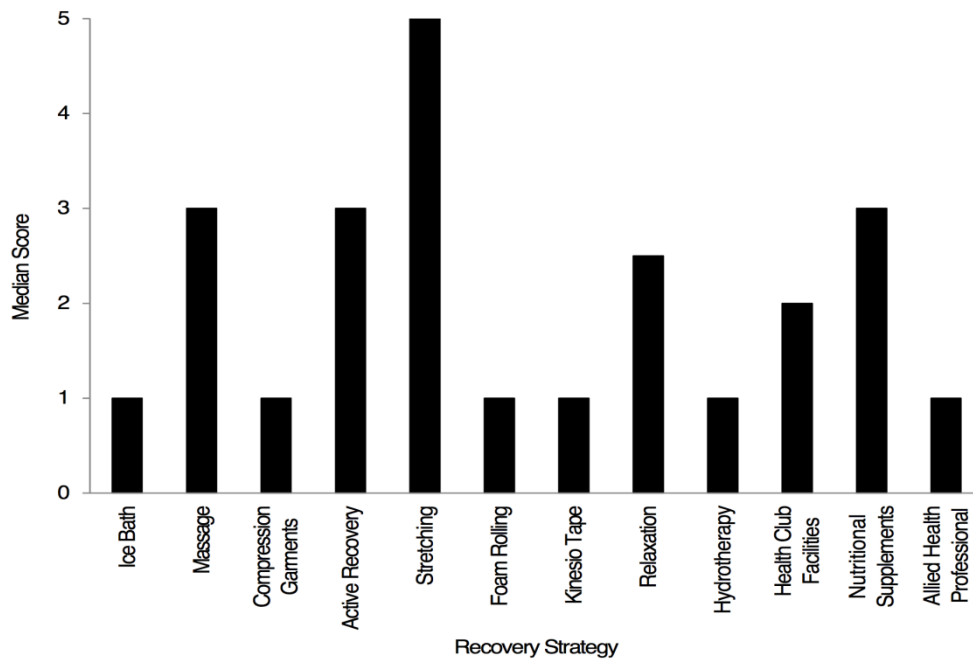


Figure 1: Median scores for the frequency of use of each recovery strategy by respondents,  $n = 186$ . Values range from 1 = never use to 5 = always use.

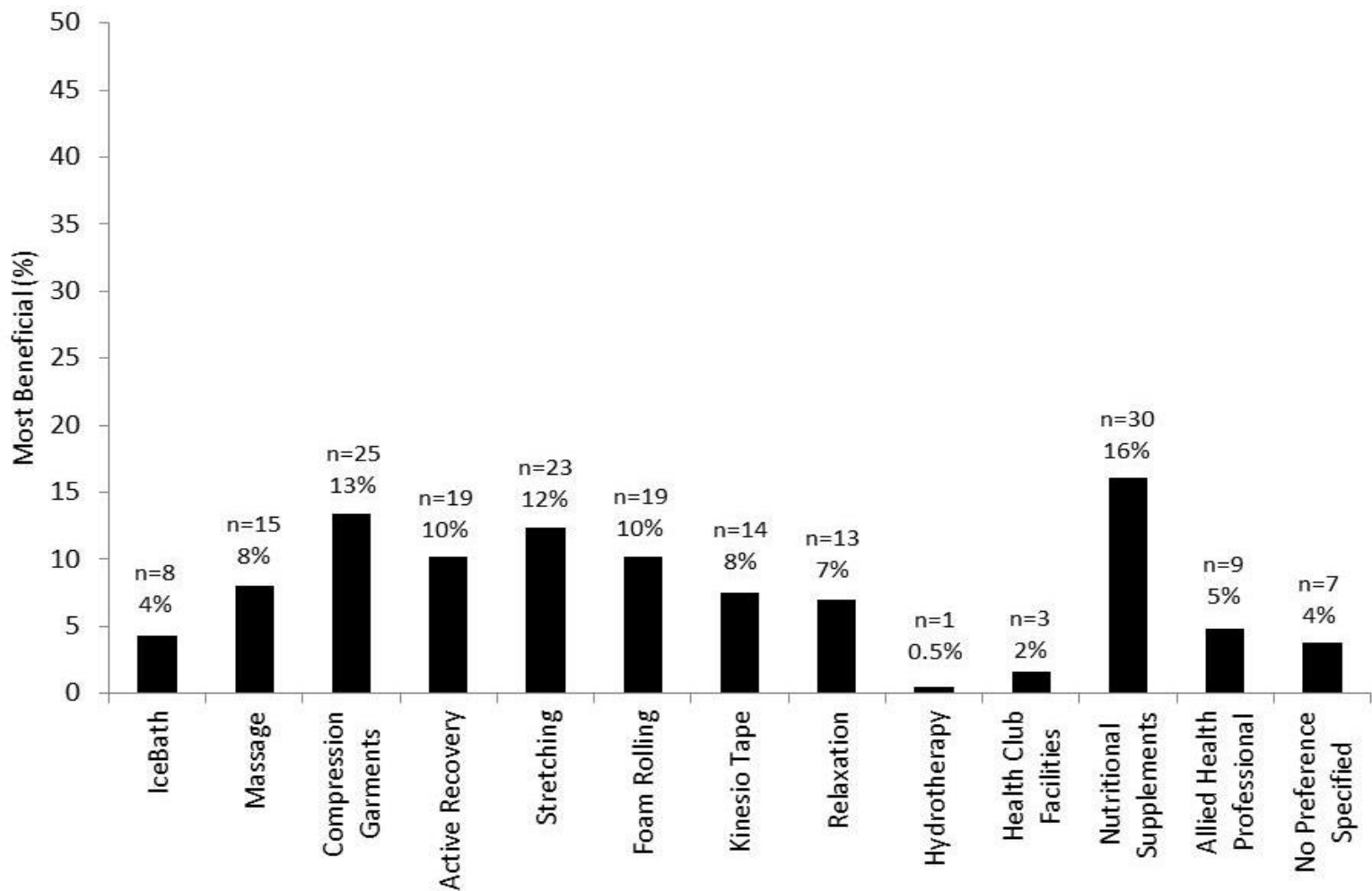
There were significant differences between males and females for the frequency of usage of kinesio tape ( $U = 3127$ ,  $p = 0.006$ ) and nutritional supplements ( $U = 3036$ ,  $p = 0.025$ ). The mean ranks indicating that females were more likely to use kinesio tape (male: 88.32; female: 104.38) and males more likely to use nutritional supplements (male: 99.40; female: 81.10). There were no significant differences between age groups for frequency of recovery strategy usage, indicating that irrespective of age group similar recovery strategies were chosen.

#### Most Beneficial Recovery Strategy

The most beneficial strategy reported by the cohort as a whole was the use of nutritional supplements (16%) followed by compression garments (13%) and stretching (12%) (figure 2a). However when the most beneficial strategy was

determined as a percentage of respondents who at least rarely used the strategy in question, the most beneficial one reported was kinesio tape (38%), followed by compression garments (29%) and nutritional supplements (24%) (Figure 2b).

a)





b)

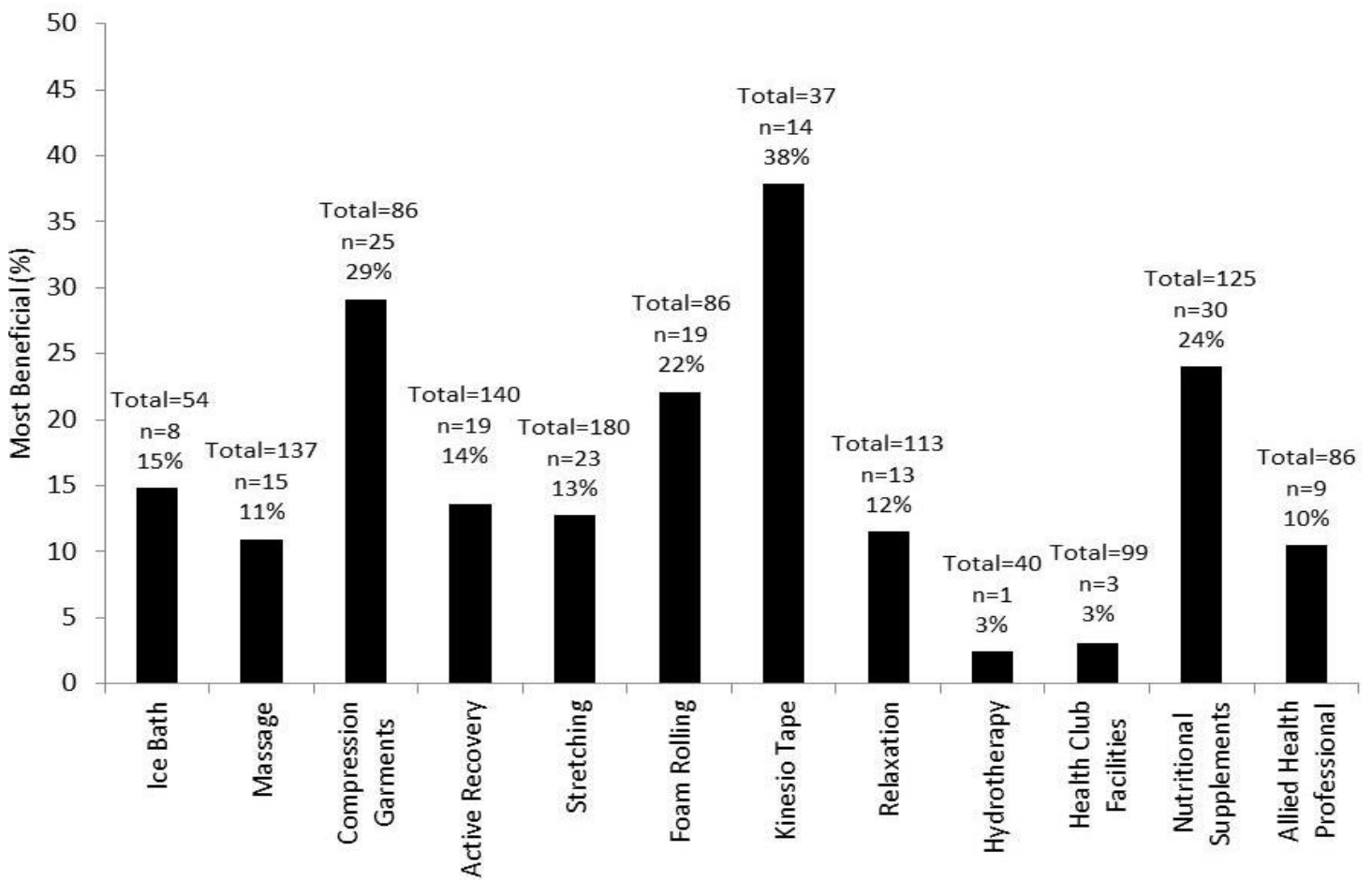


Figure 2: a) Percentage of respondents specifying individual strategies as the most beneficial. Data labels indicate number of those reporting strategy as most beneficial (n) and percentage reporting strategy as most beneficial out of all 186 respondents.

b) Percentage of respondents specifying individual strategies as the most beneficial as a percentage of the total number of respondents who at least rarely use the strategy.

Data labels indicate total number using strategy at least rarely, number of those reporting strategy as most beneficial (n) and percentage reporting strategy as most beneficial out of those that at least rarely use strategy. Seven participants did not specify a most beneficial strategy.

Significant differences were found between age groups for foam rolling ( $\chi^2 (2) = 7.46$ ,  $p = 0.024$ ) and the use of nutritional supplements ( $\chi^2 (2) = 11.32$ ,  $p = 0.003$ ). The use of foam rolling was more commonly reported as the most beneficial recovery strategy by the oldest age group (> 40 years: 39%) than by either of the younger age groups (18 – 29 years: 12%; 30 – 39 years: 14%). The use of nutritional supplements was most commonly reported as the most beneficial recovery strategy by the middle age group (30 – 39 years: 41%), and was least commonly reported as the most beneficial recovery strategy by the youngest age group (18 – 29 years: 10%). No other significant differences between age groups or males and females were identified.

#### Reasons for Using Recovery Strategies

When asked to rank six statements from 1 to 6 (1- least important, 6- most important) regarding the reasons why recovery strategies were used, the following statements, ‘to reduce muscle tightness’ and ‘reduce injury’ were most frequently reported as being the most important. The most frequently occurring response for each of the reasons to use recovery strategies are provided in Figure 3.

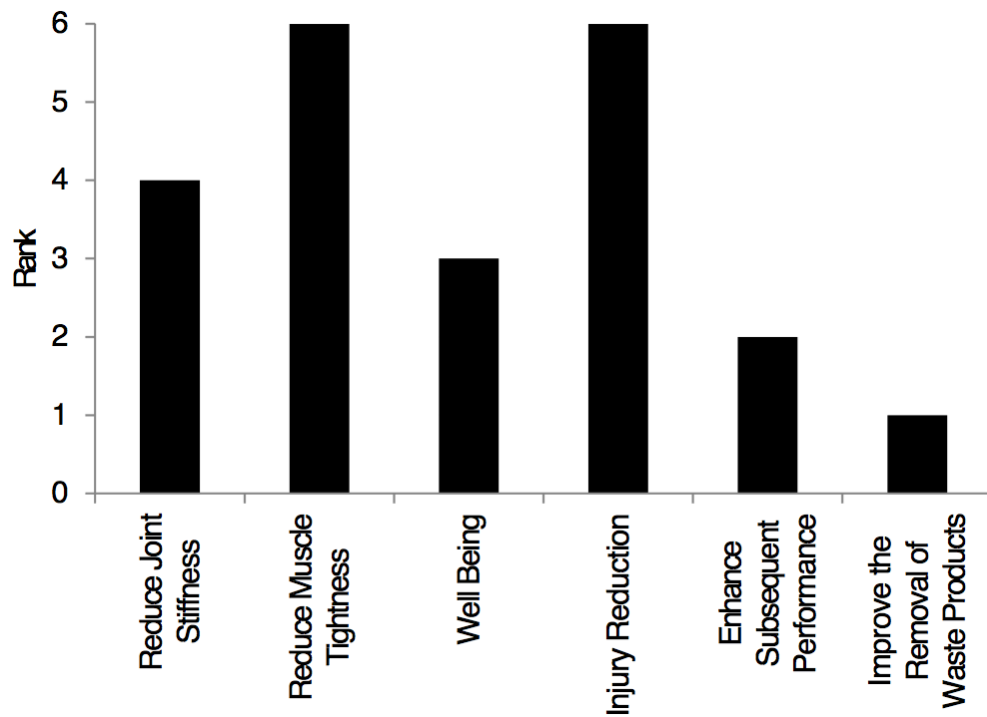


Figure 3: Most frequently reported (mode) level of importance for using recovery strategies (1 = least important, 6 = most important)

A significant difference was observed between reasons for using recover strategy ( $\chi^2(5) = 292.29, p < 0.001$ ). The ranks indicated the most important reasons were to, ‘reduce muscle tightness’ (rank 4.87) and for ‘injury reduction’ (rank 4.35), the ranks for all other reasons were  $\leq 3.96$ . Neither age nor sex was associated with the importance placed on the reasons for using recovery strategies.

## **DISCUSSION**

This cross-sectional study investigated the use and perceptions of recovery strategies among competitors of the BUPA Great North Run 2013. All of the 186 reported that they used recovery strategies, with stretching being reported as the most commonly used. Using nutritional supplements was most frequently reported as the most beneficial recovery strategy when the participants were considered as a whole; however when the results were normalised to exclude participants who did not perceive nutritional supplementation to be a pertinent strategy, kinesio tape was the strategy most frequently reported by participants as being the most beneficial to facilitate the recovery process. Reducing muscle tightness and injury reduction were most frequently reported as the most important reasons for using recovery strategies. To the authors' knowledge, this is the first study specifically investigating the use and perceptions of recovery strategies in half marathon runners; however the results do show consistencies with previous reports of recovery strategy usage in athletes considered more generally [1,5,6]. The finding that all participants in this study used recovery strategies emphasises the perceived importance of using such strategies, and correlates with evidence that the use of appropriate recovery strategies can result in physiological and psychological benefits [11].

Both anecdotal observations [11], and a qualitative study undertaken among coaches of elite athletes [5], suggest that stretching is a particularly commonly used recovery strategy. Correspondingly stretching was reported as the most commonly used recovery strategy in the present study; however stretching was not most frequently reported as the most beneficial recovery strategy. This belief that stretching is not the

most beneficial recovery strategy available is consistent with a recent systematic review and meta-analysis, which reported that there is no robust scientific evidence to support the use of stretching in reducing muscle soreness or improving muscle recovery after exercise-induced muscle damage [4]. The reasons why runners continue to use stretching, despite an awareness that its benefits may be limited, were not investigated in the present study. One possible explanation for this however is that stretching is an easily accessible and convenient recovery strategy, as it has been reported that the accessibility and practicality of recovery strategies are major factors governing their use [5].

Using nutritional supplements was most frequently reported as the most beneficial recovery strategy when participants' responses were considered collectively, potentially reflecting an awareness amongst participants that basic nutrition such as replenishing energy and repairing tissue stores is a key aspect of optimising post-exercise recovery [12]. However, participants were only questioned regarding their supplementation rather than other nutritional strategies which they may employ, limiting the potential relevance of this finding. When the results were normalised to exclude participants who did not use the recovery strategy being investigated kinesio tape was most frequently reported as the most beneficial recovery strategy. This finding should however be interpreted with caution, as only 37 of this study's participants reported using kinesio tape at least rarely. Given that kinesio tape is traditionally used in the prevention and management of injuries, as opposed to being used specifically as a recovery strategy [13], it is possible that the participants who reported using kinesio tape were doing so due to a pre-existing injury. The perceived beneficial effects of kinesio tape may therefore not be representative of the views on

uninjured runners and the use of kinesio tape as a recovery strategy warrants further investigation.

The perceived importance of nutritional supplements and kinesio tape identified in the present study contrasts with the findings of a similar study undertaken in 890 elite team athletes, in which neither nutritional supplements nor kinesio tape were ranked among the most important recovery strategies [6]. This study did however identify that males reported supplements as significantly more important than females, a difference that was also identified in the present study. It is possible that this difference may be related to the tendency of many female athletes to limit their daily calorie intake, especially in sports where a low body mass may confer a competitive advantage [8]. The only other sex difference identified in the present study was that significantly more females than males reported kinesio tape to be the most beneficial recovery strategy. Due to the existence of significant physiological differences in how males and females recover after exercise it is thought that the effectiveness of certain recovery strategies varies with sex [8]. For example cooling strategies are thought to be particularly beneficial in females due to the lower thermolytic capacities of females compared to males [8]. The lack of additional sex differences in the present study may therefore indicate a lack of awareness of how sex affects recovery. Age also appeared to have a relatively minor impact on participants' responses to the survey, with the only age differences identified being that younger participants were less likely to report foam rolling or nutritional supplements as the most beneficial recovery strategy compared to older participants. This corresponds with the relative lack of research investigating the impact of age on post-exercise recovery [9], this could also correlate to research discouraging the use of supplements to those under the age of 18 [9].

However all participants that took part in the race and the survey were over this threshold age.

In the present study the most important reason for using recovery strategies was to reduce muscle tightness, closely followed by injury reduction.

Athletes' reasoning for using particular recovery strategies has not previously been the focus of research attention. It is however an important consideration so that future research addresses recovery strategies which are relevant to the areas that athletes feel are important.

This study has provided a novel insight into the use and perceptions of recovery strategies among half marathon runners; however it does have a number of limitations. Firstly the survey only included twelve possible recovery strategies and six possible reasons for using recovery strategies, and did not include sections for participants to specify additional recovery strategies or reasons for using recovery strategies. This is particularly significant because a number of the recovery strategies ranked as important in a similar study of team athletes, such as sleep, fluid replacement and socialising with friends [6], were not included in the present study. Another limitation of the study was the minimal demographic information collected. The lack of differentiation between elite and non-elite is especially relevant given that recovery is thought to be a particular focus for high performing athletes, with professional athletes having the time and funding available to focus on all aspects of improving their performance, whereas non-elite athletes may not have the income to support certain strategies [11]. Furthermore it has been suggested that, due to physiological and psychological differences between trained and untrained individuals, it is not possible

to extrapolate the results of studies investigating the effects of recovery strategies between these two groups [7]. Due to the voluntary nature of the survey the external validity of the findings is limited by the potential occurrence of volunteer bias. In addition the findings of this survey are specific to half marathon runners and cannot therefore be extrapolated to other running disciplines, such as track or fell running, or to other athletes.

The findings of this study, together with its aforementioned limitations, highlight a number of important areas for future research. These include investigating the use and effectiveness of a wider range of recovery strategies, including psychosocial recovery strategies, in both half marathon runners and other athletes. Such research should take into account sex, age and level of competitiveness. Future research should also investigate athletes' reasoning for using recovery strategies and what factors influence their choice of recovery strategies such as financial income. This will help ensure that future research investigating the effectiveness of recovery strategies, and guidelines based on such research, are practically relevant to athletes themselves.



## **CONCLUSION**

The findings of this cross-sectional survey conducted among competitors of the BUPA Great North Run 2013 provide preliminary evidence that the use of recovery strategies is widespread amongst half marathon runners, although there appear to be discrepancies between the frequency of use and the perceived effectiveness of different recovery strategies. All of the 186 participants reporting using recovery strategies, with stretching being the most commonly used recovery strategy. In contrast using nutritional supplements was considered to be the most beneficial recovery strategy by the participants considered as a whole. The most frequently reported, most important reasons for using recovery strategies were to reduce muscle tightness and to reduce injury risk. These findings highlight that investigating the use and effectiveness of recovery strategies in half marathon runners, as well as runners' reasons for using recovery strategies, are all important areas for future research. This will facilitate the development of evidence-based and practically relevant guidelines to assist half marathon runners in optimising their recovery.

**Conflict of interest:** None

**Ethical approval:** Full ethical approval was obtained via the institutional ethics committee (Reference 1314070).

**Funding:** There has been no funding for this research paper

## REFERENCES

1. Halson, S.L. (2008). Nutrition, sleep and recovery. *Eur J Sport Sci*, 8 (2), 119-126. doi: 10.1080/17461390801954794
2. Hill, J., Howatson, G., van Someren, K., Leeder, J and Pedlar, C. (2014). Compression garments and recovery from exercise-induced muscle damage: a meta-analysis. *Br J Sports Med*, 48 (18), 1340-1346, doi: 10.1136/bjsports-2013-092456.
3. Sánchez-Ureña, B., Barrantes-Brais, K., Ureña-Bonilla, P., Calleja-González, J. and Ostojic, S. (2015). Effect of Water Immersion on Recovery from Fatigue: A Meta-Analysis. *Eur. J. Hum. Mov*, 34, 1-14.
4. Torres, R., Ribeiro, F., Alberto Duarte, J. and Cabri, J. M. (2012). Evidence of the physiotherapeutic interventions used currently after exercise-induced muscle damage: systematic review and meta-analysis. *Phys Ther Sport*, 13(2), 101-114. doi: 10.1016/j.ptsp.2011.07.005.
5. Simjanovic, M., Hooper, S., Leveritt, M., Kellman, M. and Rynne, S. (2009). The use and perceived effectiveness of recovery modalities and monitoring techniques in elite sport. *Journal of Science and Medicine in Sport*, 12(Supplement), S22. doi:10.1016/j.jsams.2008.12.057.

6. Venter, R. E. (2014). Perceptions of team athletes on the importance of recovery modalities. *Eur J Sport Sci*, 14(1), 69-76. doi: 10.1080/17461391.2011.643924.
7. Bishop, P. A., Jones, E. and Woods, A. K. (2008). Recovery from training: a brief review: brief review. *J Strength Cond Res*, 22(3), 1015-24. doi: 10.1519/JSC.0b013e31816eb518.
8. Hausswirth, C. and Le Meur, Y. (2011). Physiological and nutritional aspects of post-exercise recovery: specific recommendations for female athletes. *Sports Med*, 41(10), 861-82. doi: 10.2165/11593180-000000000-00000.
9. Borges, N., Reaburn, P., Driller, M. and Argus, C. (2015). Age-related Changes in Performance and Recovery Kinetics in Masters Athletes: A Narrative Review. *J Aging Phys Act*. Advance online publication. Retrieved from [ncbi.nlm.nih.gov/pubmed/25880787](http://ncbi.nlm.nih.gov/pubmed/25880787).
10. Gill, N.D., Beaven, C.M. and Cook, C. (2006). Effectiveness of post-match recovery strategies in rugby players. *Br J Sports Med* 40: 260–263. doi: 10.1136/bjism.2005.022483.
11. Halson, S. L. (2013). Recovery Techniques for Athletes. *Sports Science Exchange*, 26 (120), 1-6.
12. Beck, K. L., Thomson, J. S., Swift, R. J. and von Hurst, P. R. (2015). Role of nutrition in performance enhancement and post exercise recovery. *Open Access J Sports Med*, 6, 259-67. doi: 10.2147/OAJSM.S33605.

13. Williams, S., Whatman, C., Hume, P. A. and Sheerin, K. (2012). Kinesio taping in treatment and prevention of sports injuries: a meta-analysis of the evidence for its effectiveness. *Sports Med*, 42(2), 153-64. doi: 10.2165/11594960-000000000-00000.