

**E314\_1**

**Recovery strategies in sport and exercise**

**About this free course**

This free course is an adapted extract from the Open University course E314 Exploring contemporary issues in sport and exercise [www.open.ac.uk/courses/modules/e314](http://www.open.ac.uk/courses/modules/e314?utm_source=openlearn&utm_campaign=ou&utm_medium=ebook)

This version of the content may include video, images and interactive content that may not be optimised for your device.

You can experience this free course as it was originally designed on OpenLearn, the home of free learning from The Open University – [www.open.edu/openlearn/health-sports-psychology/recovery-strategies-sport-and-exercise/content-section-0](http://www.open.edu/openlearn/health-sports-psychology/recovery-strategies-sport-and-exercise/content-section-0?utm_source=openlearn&utm_campaign=ol&utm_medium=ebook)

There you’ll also be able to track your progress via your activity record, which you can use to demonstrate your learning.

Copyright © 2016 The Open University

**Intellectual property**

Unless otherwise stated, this resource is released under the terms of the Creative Commons Licence v4.0 <http://creativecommons.org/licenses/by-nc-sa/4.0/deed.en_GB>. Within that The Open University interprets this licence in the following way: [www.open.edu/openlearn/about-openlearn/frequently-asked-questions-on-openlearn](http://www.open.edu/openlearn/about-openlearn/frequently-asked-questions-on-openlearn) . Copyright and rights falling outside the terms of the Creative Commons Licence are retained or controlled by The Open University. Please read the full text before using any of the content.

We believe the primary barrier to accessing high-quality educational experiences is cost, which is why we aim to publish as much free content as possible under an open licence. If it proves difficult to release content under our preferred Creative Commons licence (e.g. because we can’t afford or gain the clearances or find suitable alternatives), we will still release the materials for free under a personal end-user licence.

This is because the learning experience will always be the same high quality offering and that should always be seen as positive – even if at times the licensing is different to Creative Commons.

When using the content you must attribute us (The Open University) (the OU) and any identified author in accordance with the terms of the Creative Commons Licence.

The Acknowledgements section is used to list, amongst other things, third party (Proprietary), licensed content which is not subject to Creative Commons licensing. Proprietary content must be used (retained) intact and in context to the content at all times.

The Acknowledgements section is also used to bring to your attention any other Special Restrictions which may apply to the content. For example there may be times when the Creative Commons Non-Commercial Sharealike licence does not apply to any of the content even if owned by us (The Open University). In these instances, unless stated otherwise, the content may be used for personal and non-commercial use.

We have also identified as Proprietary other material included in the content which is not subject to Creative Commons Licence. These are OU logos, trading names and may extend to certain photographic and video images and sound recordings and any other material as may be brought to your attention.

Unauthorised use of any of the content may constitute a breach of the terms and conditions and/or intellectual property laws.

We reserve the right to alter, amend or bring to an end any terms and conditions provided here without notice.

All rights falling outside the terms of the Creative Commons licence are retained or controlled by The Open University.

Head of Intellectual Property, The Open University

978-1-4730-2491-5 (.kdl)
978-1-4730-2492-2 (.epub)

# Contents

* [Introduction](#Session1)
* [Learning outcomes](#Session2)
* [1 Why is recovery important?](#Session3)
* [2 Recovery strategies: what is the best way to recover?](#Session4)
* [3  The role of recovery strategies](#Session5)
* [4  Recovery strategies: what’s the evidence?](#Session6)
* [5  Investigating recovery](#Session7)
* [Conclusion](#Session8)
* [Acknowledgements](#Session9)
* [References](#Session10)
* [Solutions](#Solutions1)

## Introduction

Recovery should be an important part of every sport and exercise participant’s training programme. All participants need to rest and recover after an intensive training session, but have you considered why this period of recovery is so important? The obvious answer to this is so that the individual is ready to take on their next training session and train to the best of their ability, but is there more to it than that?

In this free course, Recovery strategies in sport and exercise, you will examine the purpose of recovery and consider the range of recovery strategies that individuals may employ to aid their recovery from training. In doing this we will critically evaluate research evidence and media perceptions of recovery from sport and exercise, and reflect on future directions for the topic.

This OpenLearn course is an adapted extract from the Open University course [E314 Exploring contemporary issues in sport and exercise](http://www.open.ac.uk/courses/modules/e314).

## Learning outcomes

After studying this course, you should be able to:

* recognise the importance of recovery in an exercise programme
* evaluate the role of recovery strategies in sport and exercise
* identify the challenges of investigating recovery strategies.

## 1 Why is recovery important?

In order to understand why recovery is so important we need to understand how the body responds and adapts to training. The next activity will help you to do this.

Start of Activity

**Activity 1 Adaptations to training and the role of recovery**

Allow 20 minutes

Start of Question

In the following video, Nick Grantham, a Performance Enhancement Specialist who works with a range of sports governing bodies and professional athletes, talks about the importance of sports recovery. Watch the video and consider the role recovery plays in a training programme.

Start of Media Content

Video content is not available in this format.

**Video 1** Role of recovery

[View transcript - Video 1 Role of recovery](%22%20%5Cl%20%22Session3_Transcript1)

End of Media Content

Conduct an online search to help you answer the following questions:

* What is the overload principle and why do you think it is it so important to training and recovery?
* What types of exercise-induced adaptations occur in response to training?
* Why do training and recovery need to be balanced?

End of Question

[View comment - Activity 1 Adaptations to training and the role of recovery](%22%20%5Cl%20%22Session3_Discussion1)

End of Activity

Activity 1 indicates that recovery is an essential part of the training process. It is a normal response for the physiological stress placed on the body during exercise to cause what is termed ‘exercise-induced muscle damage’ (EIMD). The delayed onset muscle soreness (DOMS) commonly experienced following intensive exercise is a symptom of EIMD.

Other symptoms of EIMD include reduced muscle strength, reduced range of motion, swelling and intracellular protein in the blood (Hill et al. 2014). These symptoms are temporary, but require a period of recovery to repair. If an individual moves into their next training session without being fully recovered from the previous one, their ability to perform at their best will be inhibited. Therefore, any strategy aimed at increasing the speed of recovery is potentially advantageous.

As well as being important to making physiological changes in response to training, recovery is also important in limiting negative responses to training overload. Positive responses to overload (i.e., training gains) are an appropriate response to training, but if the body responds negatively to overload (i.e., no gains in performance, or regression) the individual may be suffering from overtraining syndrome or burnout. It is beyond the scope of this course to discuss these conditions in detail, but if you want to know more the article [Overtraining syndrome – a practical guide](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3435910/) (Kreher and Schwartz, 2012) is a useful starting point. Overtraining and burnout can occur when an individual repeatedly trains whilst fatigued. Fatigue is therefore entwined with recovery.

This section has demonstrated how important recovery is in adapting to the training loads placed on the body and combating fatigue. Increasingly sport and exercise participants have begun to integrate specific recovery strategies into their training programmes. In the next section we introduce some of these strategies.

## 2 Recovery strategies: what is the best way to recover?

The process of recovery is no longer simply a matter of resting. Sport and exercise participants now use a wide range of strategies to enhance their recovery. In the next activity you will think about a strategy you used.

Start of Activity

**Activity 2 How do you recover?**

Allow 30 minutes

Start of Question

Take a few minutes to reflect on your own use of recovery strategies. Think about what recovery strategies you have used in the past to aid your recovery and then select one and consider:

1. why you used it (e.g. what did you think the potential benefits were, did you see someone else using it?), and
2. how effective you think it was.

If you haven’t used any recovery strategies yourself, think about those that you have seen other sport and exercise participants use, or refer to this [Sports Scotland recovery guide](https://sportscotland.org.uk/about-us/our-publications/archive/recovery-a-guide-from-the-sportscotland-institute-of-sport) which provides a useful overview.

End of Question

[View comment - Activity 2 How do you recover?](%22%20%5Cl%20%22Session4_Discussion1)

End of Activity

In the next section we will look at some examples of recovery strategies used by elite athletes and will begin to critically examine how effective these strategies are.

## 3  The role of recovery strategies

So far we have seen that there are a range of recovery strategies available. In the next activity we will see some of these recovery strategies being used and consider the potential role of recovery strategies in the athlete’s training and competition schedule.

Start of Activity

**Activity 3 Recovery: the next frontier in sporting progress?**

Allow 20 minutes

Start of Question

Watch the video clip below and answer the questions that follow. The clip was filmed in 2015 as part of the Channel 4 TV series Chasing Perfection, co-produced by The Open University, and features sport scientists and coaches from the UK and USA describing their use of recovery strategies with elite athletes.

* What recovery strategies do we see being used in the clip?
* What is the purpose of recovery strategies?
* Are recovery strategies always beneficial?

Start of Media Content

Video content is not available in this format.

**Video 2** Chasing perfection

[View transcript - Video 2 Chasing perfection](%22%20%5Cl%20%22Session5_Transcript1)

End of Media Content

End of Question

[View comment - Activity 3 Recovery: the next frontier in sporting progress?](%22%20%5Cl%20%22Session5_Discussion1)

End of Activity

Hopefully you are beginning to recognise the need for evidence to support and underpin the use of recovery strategies both in general and at specific times. There is a wealth of research that has been undertaken to examine the impact of recovery strategies and we will begin to examine some of this in the next section.

## 4  Recovery strategies: what’s the evidence?

Examining the research evidence is a vital step in investigating and evaluating any topic. In relation to recovery, research evidence helps us to critically evaluate how effective and appropriate recovery strategies are.

Research examining the impact of recovery on sports performance has been around for many years. A literature search on the topic indicates that articles have been published on the topic for several decades. Interest in different recovery strategies has evolved over the years. Interest in cryotherapy as a recovery strategy began around the 1970s, whilst research on both massage and compression garments as recovery strategies did not emerge until around the 1980s.

An article written by Barnett (2006), which reviewed the research examining the effectiveness of various recovery strategies, concluded that there was no substantial evidence to support the use of the recovery strategies, however, some research has suggested benefits. For example, Hill et al. (2014) after analysing 12 studies, concluded that compression clothing can enhance recovery.

Having looked at some of the research examining recovery we now move on to considering what we want or need to know about recovery.

## 5  Investigating recovery

Having gained knowledge of why recovery is so important and having examined some of the research looking at recovery, we will now consider factors important to investigating recovery.

Most research stems from a question that needs an answer. You may have already started to think about questions related to recovery strategies that you would like to know the answer to. Obviously at this stage your knowledge of recovery is relatively limited and there may already be research out there to answer your question that you haven’t had the chance to discover yet, but equally that research may not exist and may therefore be a ‘future direction’ for research in that area.

Undertaking research to investigate the effectiveness of recovery strategies can be challenging as there are potentially lots of different variables that need to be accounted for. In the next activity we will look at some of these challenges and some of the limitations of research examining recovery.

Start of Activity

**Activity 4 The challenges of investigating recovery**

Allow 25 minutes

Start of Question

Imagine you have developed a new recovery strategy that you would like to test (e.g. a piece of equipment that you believe speeds up recovery between sessions). What challenges might you face in trying to measure the effectiveness of your recovery strategy?

End of Question

[View comment - Activity 4 The challenges of investigating recovery](%22%20%5Cl%20%22Session7_Discussion1)

End of Activity

## Conclusion

In this free course, Recovery strategies in sport and exercise, you have been introduced to the role of recovery and recovery strategies in sport and exercise. Some of the key points covered are summarised below.

* recovery is an essential component of the training-adaptation process
* intensive exercise can cause exercise induced muscle damage, a symptom of which is delayed onset muscle soreness
* failure to recover adequately from exercise can lead to performance decrements
* the aim of recovery strategies is to speed up the recovery process
* the research evidence to support recovery strategies is inconclusive and there are challenges in conducting recovery-related research
* there is some debate as to whether recovery strategies help or hinder the process of physiological adaptation to training, and it may be appropriate to use recovery strategies in some circumstances but not others
* it is important to keep up to date on recovery research and to consider future research directions.

## Acknowledgements

This free course was written by Caroline Heaney.

Except for third party materials and otherwise stated (see [terms and conditions](http://www.open.ac.uk/conditions)), this content is made available under a [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 Licence](http://creativecommons.org/licenses/by-nc-sa/4.0/deed.en_GB) .

The material acknowledged below is Proprietary and used under licence (not subject to Creative Commons Licence). Grateful acknowledgement is made to the following sources for permission to reproduce material in this free course:

**Images:**

Course image: © Cultura RM Exclusive/Corey/Jenkins/Getty Images.

**Audio-visual:**

Activity 1: With kind permission of Fireflyrecovery: YouTube weblink: https://www.youtube.com/watch?v=CmW2QqRdRJY Fireflyrecovery. Published on 13 Sep 2013.

Activity 3: from Chasing Perfection (Channel 4 television broadcast series). Produced by The Moment Productions Ltd in association with The Open University. © The Open University (2015).

Every effort has been made to contact copyright owners. If any have been inadvertently overlooked, the publishers will be pleased to make the necessary arrangements at the first opportunity.

**Don't miss out**

If reading this text has inspired you to learn more, you may be interested in joining the millions of people who discover our free learning resources and qualifications by visiting The Open University – [www.open.edu/openlearn/free-courses](http://www.open.edu/openlearn/free-courses?utm_source=openlearn&utm_campaign=ol&utm_medium=ebook).

This extract is from the course E314 Exploring contemporary issues in sport and exercise . If you are interested in this subject and want to study formally with us, you may wish to explore other courses we offer in [Study at OU](http://www.open.ac.uk/courses/modules/e314)

## References

Barnett, A. (2006) ‘Using recovery modalities between training sessions in elite athletes: does it help?’, Sports Medicine, vol. 36, no. 9, pp. 781–96.

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’, British Journal of Sports Medicine, vol. 48, no. 18, pp. 1340–46.

Kreher, J. B. and Schwartz, J. B. (2012) ‘Overtraining syndrome: a practical guide’, Sports Health, vol. 4, no. 2, pp. 128–38.

Lambert, M. I. and Mujika, I. (2013) ‘Physiology of exercise training’ in Hausswirth, C. and Mujika, I. (eds) Recovery for Performance Sport, Leeds, Human Kinetics, pp. 3–8.

## Solutions

## Activity 1 Adaptations to training and the role of recovery

#### Comment

Overload is a principle of training that suggests that fitness can only be improved by increasing the training load. The overload principle is central to our understanding of training and recovery. The video provides a nice summary of this and states that training provides a stimulus which overloads the body, and through recovery the body adapts and makes training gains (e.g. gets stronger). Recovery can therefore be seen to be an essential part of the process of adaptation to training.

Training sessions can be viewed as a form of physiological stress which cause both short-term (acute stimulus) and long-term adaptations (training stimulus). Short-term adaptations to a training session are temporary physiological changes, such as an increased heart rate, which return to normal after exercise. Long term adaptations are the physiological changes that become more permanent in response a training programme such as an increase in muscle strength. These adaptations can be split into three categories – morphological changes, metabolic changes and neuromuscular changes (Lambert and Mujika 2013). Obviously the type and extent of change will depend upon the nature of the exercise training programme.

Given the knowledge that training sessions lead to long term physiological adaptations (training gains) that occur during recovery it makes intuitive sense that training and recovery need to be balanced appropriately in order to maximise training adaptations. Inadequate recovery can lead to maladaptation, fatigue and reduced performance.

[Back to - Activity 1 Adaptations to training and the role of recovery](%22%20%5Cl%20%22Session3_Activity1)

## Activity 2 How do you recover?

#### Comment

There are a broad range of recovery strategies available to sport and exercise participants such as ice baths, cryotherapy chamber, heat, massage, compression clothing, nutrition, hydration, sleep, relaxation techniques, stretching, electromuscular stimulation, and analgesics (e.g. ibuprofen).

There are several reasons why you may have chosen to use a particular recovery strategy. For example, you may have seen it used by other participants, heard about it in the media, or read a journal article about it. It is important to consider why a particular recovery strategy is used and how it made you feel, as at this level of study it is essential to be able to critically evaluate strategies.

Critically evaluating a strategy is an important skill. The first stage of the critical analysis process is to understand the science and theory behind a particular strategy and its impact. The next stage of critical analysis would be to analyse the supporting research.

[Back to - Activity 2 How do you recover?](%22%20%5Cl%20%22Session4_Activity1)

## Activity 3 Recovery: the next frontier in sporting progress?

#### Comment

We see various recovery strategies used in the video. For example, in the section with Lindsey Anderson we see members of the Brazilian Paralympic Team using contrast baths and compression boots, and in the section with Tyler Jewell we see cryotherapy being used. Various other strategies are also mentioned.

According to those interviewed in the clip, the purpose of recovery strategies is to modulate the stress response to exercise, allowing individuals to recover more quickly and consequently train harder. Interestingly, Phillip Bell and Tyler Jewell both suggest the recovery strategies are not always beneficial and may actually inhibit the adaptation that occurs in response to hard training.

This demonstrates the need for specificity in the use of recovery strategies. For example, you may consider it inappropriate to use recovery strategies during a period of training when you want to maximise adaptation, however, you might consider it appropriate to use recovery strategies during competition (e.g. where you have several rounds or matches in a small time period) when you want the athlete to feel refreshed and recovered.

[Back to - Activity 3 Recovery: the next frontier in sporting progress?](%22%20%5Cl%20%22Session5_Activity1)

## Activity 4 The challenges of investigating recovery

#### Comment

This is quite a difficult question to answer when you have no experience of having conducted research before, but hopefully you were able to think of some of the potential pitfalls.

One of the challenges is being able to attribute any improvement in recovery time to your recovery strategy and nothing else. Recovery time can be influenced by a multitude of factors and it can therefore be challenging to assess the impact of your recovery strategy alone. For example, if you measured the impact of the recovery strategy on 100 athletes, their rate of recovery might be influenced by, for example, what they’ve eaten as well as by the recovery strategy.

Therefore, good research studies are designed to account for this type of influence as much as possible by, for example, controlling for other factors, known as extraneous variables (e.g. making all participants eat the same food), or by having a control group that does not use the recovery strategy. When you critically review research articles you should be checking for this type of thing in the method section.

[Back to - Activity 4 The challenges of investigating recovery](%22%20%5Cl%20%22Session7_Activity1)

# Video 1 Role of recovery

## Transcript

NICK GRANTHAN

My name is Nick Granthan. I'm a performance enhancement specialist. I work with a range of national governing bodies in sports as well as individual athletes.

Recovery is a key part of an athlete's training, because you don't actually get fitter from training. You get fitter from recovering from the training, so in order for our bodies to adapt, we have to go through a natural process where we present a stimulus; that causes the body to go into fatigue. At that point in the fatigue, we need time to recover so that the body adapts and comes back stronger, and fitter, and enhanced, ready for a better performance. Recovery really is actually the crucial part of an athlete's training, and it's often overlooked.

[Back to - Video 1 Role of recovery](%22%20%5Cl%20%22Session3_MediaContent1)

# Video 2 Chasing perfection

## Transcript

LANCE WALKER:

No matter how good your training is out here on the pitch, it’s only as good as your ability to recover from it. I’ve grabbed a hold of that, that recovery is no longer just this passive thing that you do in between training sessions; that there’s actually recovery training.

DR. PHILLIP BELL:

As an athlete, you want to train as intensely as you can, to be able to get fitter, faster, stronger, and the idea of the recovery strategy is to allow you to do that. There is a range of recovery techniques that are used in sport currently.

Some particularly popular modes – cold water immersions, compression garments, various nutritional antioxident-type strategies, neuromuscular electral simulations. There’s lots of different things out there; essentially, what they’re all trying to do is influence or modulate the stress response to exercise.

So things like inflammation, oxidative stress, and muscle damage – by trying to influence these stress responses to exercise, we are trying to either reduce the damage response to exercise, so that we can come back and recover faster, or we’re trying to accelerate the recovery of these damage responses.

[MUSIC PLAYING]

LANCE WALKER:

What’s normal? Well, the normal line of return back to normal is this. Can we steepen that? Are there modalities that we can use to tip that line up, like this, so now it squeezes down the timeline?

So now instead of 72 hours to recover from a really heavy strength training session, which we’ve seen historically – wow, are there some things we can do with kinetotherapy? Is there some things we can do with some of the old school dry needling? Is there some things we can do, or not do, with stretching?

Is there some things we can do with compression therapy or cryogenics? Is there some things we can do with the central nervous system, in terms of mood and changes? I mean, think of all the crazy things that- can we potentially steepen that return angle? Now, what does that allow me to do? Train more intense, and be able to train in more density.

LINDSEY ANDERSON:

So they had a hard training day today. But we still have another training day tomorrow. So we need them to start their recovery immediately, so by the time they come tomorrow, within 24 hours – 12 to 24 hours – they’re ready to train again.

So with the contrast baths, we’re going between 56 degrees and 104 degrees. They’re going to spend a little bit more time in the cold tub. They’re only going to spend a minute in the hot tub, and they’re going to alternate, going back and forth.

And what that does is it creates this natural pump, so you’ve got this constriction of the muscles, when you’re in the cold tub; and then they relax when you’re in the hot tub, and they constrict again when you’re in the cold tub. You create this natural pump that is also helping to regenerate the nervous system.

Then we’re also going to use the NormaTec boots, and get that even more compression, so we’re working out all those by-products that have now built up into their muscle, in reaction to their training, or as a product of their training, and so by actively recovering both, in a passive way, we’re just getting the body revved up to start its recovery.

[MUSIC PLAYING]

TYLER JEWELL:

I think the recovery techniques are constantly improving and changing, as well as the training techniques and the nutrition. We go down to what’s happening in the blood levels of the athlete, and of course, we look at CK, which is a precursor for muscle breakdown. If an athlete has high levels, then we know, OK, maybe today is not a good day to push the training session.

A lot of the things here we’re really pushing the limit with, and we definitely leave a lot up to the athletes. We like to set the buffet, and they either like it, and they take what they like, and they go from there. If we wait for a lot of things to be proven, then we’re a little bit behind the curve.

So in some cases, we do take a little bit of a risk, maybe, where it hasn’t been totally proven through research, but at the end of the day, if an athlete believes something is working, it’s working.

It’s very interesting to think about recovery. In some respects, it could be very important, if an athlete were going into a competition, we want to make sure that they’re recovered, but in the off season, when they’re training, that recovery modality could possibly spoil the adaptation for the athlete. Sometimes it’s good to not go in the chryosauna, not ice, or not use the compression pants, and allow that athlete’s muscles to get sore, so then they have a better adaptation to the training.

DR. PHILLIP BELL:

There’s a big head-to-head on the recovery versus adaptation story at the moment. When we do do exercise, we get these stress responses, and it’s these inflammatory and oxidative stress responses that signal to our genes to produce more proteins and adapt in response to these proteins.

Now if we start to try and dampen down these inflammatory responses, and oxidative stress responses, are we dampening down the signals to the genes that then express the proteins that then help us adapt?

[MUSIC PLAYING]

What we’re trying to do is take this a level deeper by looking at what we call the methylation of genes within the DNA. There is a theory that if something like cold water immersion is to be having a negative effect on adaptation, it may be because we are switching off some of the genes that are associated with muscle hypertrophy.

LANCE WALKER:

We’re close, but we haven’t figured it out yet, and wow, what if we could rewrite some of those curves? What if we could rewrite the steepness of return and recovery for different athletes, depending on the stimulus. Wow, what if we could do that? What if?

It’s exciting, because I think that could potentially be the new frontier, is this recovery regeneration space. It could be the limiting factor to how much training and how steep a training we can take on these athletes. Pretty exciting space.

[Back to - Video 2 Chasing perfection](%22%20%5Cl%20%22Session5_MediaContent1)