

ATHLETES' HEALTH & TOP PERFORMANCE

Dr.med. German E. Clénin

ATHLETES' HEALTH AND TOP PERFORMANCE © Dr German E. Clénin

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the author.

National Library of Australia Cataloguing-in-Publication entry

Creator: Clénin, German E., author.

Title: Athletes' health and top performance/Dr German E. Clénin.

ISBN: 9781925497243 (paperback)

Subjects: Sports medicine—Popular works.
Sports sciences—Popular works.
Self-care, Health.
Athletes—Health and hygiene.

Dewey Number: 613.711

Published by **Dr German E. Clénin** and InHouse Publishing
www.inhousepublishing.com.au



Dedication

I dedicate this book to my wife Susanne, who keeps me grounded, has supported me very much during my professional career, and with whom I like to share my ideas and thoughts. Many hugs and lots of love to you, Susanne!

I also dedicate this book to my parents, who have done everything to enable an excellent education leading to my professional and personal development. Thanks a lot to both of you, Ma and Pa!

Table of Contents

Acknowledgements	x
Foreword	xi
Introduction	xiii
Goals for This Manual About Athletes' Health	xv
How Are the Topics Organised and Structured?	xvi
Basics to Athletes' Health	2
Safety First – You Must Protect Yourself, Others Have Different Priorities ...	2
Warming Up – Includes Sport Specific Strength and Proprioception	5
Training and Performance – the Basics of Success	9
Core Stability – Better Performance and Less Backpain	12
Core Stability Exercises – Stage I – BEGINNER	16
Core Stability Exercises – Stage II – ADVANCED	20
Core Stability Exercises – Stage III – EXPERT	24
Stretching and Gymnastic Exercises – Flexibility Is Indispensable, Go for 12 in 20	28
Regular Medical Checks – an Important Service to Your Health	34
Anti-doping – There Are No Shortcuts to Real Success	37
Hygiene in Sports – Don't Give Funghis, Bacteria, and Other Germs a Foothold	39
The Athlete's and the Coach's First Aid Kit – a Start Without Delay	41
Recovery and Regeneration – 'After the Game is Before the Game'	43
Often-encountered Sportsmedical problems	46
Unclear Fatigue – A Common Complaint, When to See a Doctor	46
Viral Infection of the Upper Respiratory Tract (URTI) – How an Athlete Should Cope	49
Mononucleosis (Epstein-Barr-Virus-Infection) – Inevitable, but Seek Professional Advice	52
Overreaching/Overtraining – When the Batteries are Completely Empty	57
Muscle Cramps – Some New Theories and Insights	62
Stress Reaction/Stress Fracture – the Sword of Damocles	67

Special Situations Warrant Special Attention	73
Prevention of Infectious Diseases – How to Support Athletes’	
Lowered Immune Response	73
Heat Illness: Still Provoking Deaths in Sports! – Goal: Zero Deaths!	78
Pre-Cooling – a Cooler Engine Works More Efficiently	83
Cooling Therapy in Sports – How Does This Work?	86
Acclimatisation to the Heat – How to Optimise Sports	
Performance?	89
Jet Lag – Good Coping Strategies	93
Altitude Training – Stay Healthy and Get a Return on Investment	97
 Musculoskeletal System	 102
Flat Valgus Foot (Pes Plano Valgus) – When is Strengthening	
Not Enough?	102
Painful Sesamoid Bones – Pain Underneath the Big Toe in Runners	108
Ingrown Toenail (Uncuis Incarnatus) – Nasty Infection of the Nailwall	111
Morton Neuroma – Pain, Tingling, and Numbness of the Forefoot	113
Splayfoot (Pes Transversoplanus) – Reason for Plantar Forefoot Pain	
and Bunion Deformity	115
Plantar Faszitis (‘Heel Spur’) – When the Heel Hurts While	
Getting Out of Bed	119
Achilles Tendinopathy – Already Achilles Was Vulnerable on	
This Tendon	122
Shin Splint – Painful Tibia in Runners	127
Runner’s Knee/ITB-Syndrome – When the Ilio-Tibial Band	
Rubs and Causes Lateral Knee Pain	130
Osgood-Schlatter Disease – Frequent Reason for Knee	
Pain in Teenagers	133
Jumper’s Knee – Found in All Sorts of Athletes	136
Patellofemoral Pain Syndrome – When It Hurts Under the Kneecap	139
Osteochondrosis Dissecans (OD) of the Knee (Ankle, Elbow) –	
Rare but Serious	144
Swimmer’s Shoulder/Thrower’s Shoulder/Impingement of	
the Shoulder – When the Mechanics Are Impaired	148
Tennis Elbow/Golfer’s Elbow – Overuse of the Outer Respectively	
Inner Side of the Elbow	154
Bursitis of the Elbow (or the Knee) – a Red, Hot, Palpable, and	
Painful Swelling	158
Myofascial Neck-Shoulder-Arm Pain – the Whole Muscle	
Chain is Painful	160

Scheuermann's Disease – Rounded Thoracic Back, Still Poorly Understood	162
Scoliosis of the Vertebral Spine – Strengthening and Physiotherapy Help	165
Myofascial Low Back Pain – When the Gluts, the Lower Back, and the Pelvic Muscle Rebel	168
Lumbar Herniated Disc With Neuroradicular Symptoms – Conservative Treatment Mostly Successful	171
Spondylolysis and Spondylolisthesis – When a Lumbar Vertebral Body Slides, Strengthening is Needed	176
Sacro-Iliac Dysfunction – An Important and Neglected Pelvic Joint	180
Athletic Groin Pain – a Similar Challenge for Athletes and Health Professionals	185
Impingement of the Hip: FAI Femoro-Acetabular Impingement – The New Kid on the Block	189
Painful Trigger Points – When the Muscle Hurts!	194
Sport Injuries	198
Tissue Repair Mechanism and Time Frame – What Does This Mean for Sports?	198
Soft Tissue Injuries in Sports – RICE, PRICE, or POLICE	203
Ankle Sprain or Tear – the Most Frequent Sports Injury, Good Management Is Essential	207
Non-Structural Muscle Injury – Quick Recovery but Stick to Your RTP	212
Structural Muscle Injury – Lasts Longer	215
Partial or Complete Rupture of a Ligament: Medial Collateral Ligament of the Knee – Treatment Plan and Time Frame	220
ACL (Anterior Cruciate Ligament) Rupture – When the Central Knee Ligament Goes	223
Meniscal Tear – When the Knee Suddenly Hurts	227
Shoulder Dislocation – Careful Attention to Prevent Repetition	231
AC-Contusion/AC-Dislocation/Acromio-Clavicular Joint Separation – When You Fall on Your Shoulder	235
Rotator Cuff Injury of the Shoulder – Acute vs Overuse	238
Concussion – Respect Your Head (and Your Opponent's)	242
Skin	246
Skin Structure and Function – How to Deal With Dry Skin in Sports	246
Atopic Dermatitis – 20% of All Athletes Concerned!	249

Interdigital Mycosis of the Feet, Other Skin Infections –	
Watch Your Feet	252
Sun Protection – Simply a Must, Like Brushing Your Teeth	254
Insect Protection While Travelling as an Athlete – About	
Mosquitoes, Ticks, and Other Bugs	261
Skin Injuries – Management of a Simple Bruise to an Open Wound	264
Eye	269
Burning Eye/Redness of the Eye – Good Tips for Self-Management	269
Conjunctivitis – When the Eye Really Matters	271
Eye Injury – Eyesight is Priceless	275
Nearsightedness, Farsightedness, Contact Lenses in Sports –	
What to Look For	278
Ear, Nose, Throat	280
Common Cold – More Frequent in Athletes Than in the	
Normal Population	280
Swimmer’s Ear (External Otitis) – an Annoying Ear Pain	282
Wrestler’s Ear – How to Prevent ‘Cauliflower Ear’	285
Allergic Rhino-Sinusitis – When the Nose Is Dripping	287
Sinusitis – Painful Pressure Within the Head	290
Pharyngitis/Angina Tonsillaris – a Sore Throat and	
Difficulties Swallowing	294
Respiratory System/Lungs	297
Upper and Lower Respiratory Tract Infections –	
Deep Coughing and Grisly Discharge	297
Exercise Induced Asthma – Frequent in Endurance Sport,	
but Check Your Diagnosis	301
Asthma in Sports – With Good Treatment Reaching the Podium	307
Cardiovascular System, Heart, Vessels, Blood	311
Fainting or Nearly Fainting Due to Hypotension	
(Low Blood Pressure) – No Real Worries	311
Sudden Cardiac Death vs Why Athletes Live Longer – a Serious	
Sports Paradox	314
Deep Vein Thrombosis, Pulmonary Embolism – Rather Seldom,	
but Good to Know	318
Varicosis – Mainly an Aesthetic Thing	322
Anaemia – Clearly Impairs Performance and Recovery	325
Iron Deficiency – Regular Checks Warranted, Have Enough	
Iron But Not Too Much	329

Hypertension (High Blood Pressure) – No Contraindication for Elite Sports, but Treatment Needed	333
Gastrointestinal System	337
Constipation – to be Settled With Good Habits and Natural Self-Treatment Options	337
Diarrhoea – Be Careful While Travelling	340
Gastroesophageal Reflux Disease (GERD) – Also Common in Athletes and Young People	344
Celiac Disease – Gluten Free Diet for Diagnosed Illness, but <i>Not</i> for Others	347
Irritable Bowel Disease in Sports – How to Cope With It in Elite Sports	350
Morbus Crohn (Inflammatory Bowel Disease) in Sports – What to Look For	352
Sports Nutrition	354
Basics of (Sports) Nutrition – Still a Source for Major Errors and Performance	354
Drinking in Sports – Keep Well Hydrated, but We're Not Camels	361
Breakfast, a Good Start to the Day – My Kingdom for a Muesli in a Bowl	364
Vitamins and Minerals – Good to Know	366
Vegetarian or Vegan Diet and High Performance – Is It Worth the Effort?	372
Supplementation – the Cherry on the Cake, But Can't Replace Any Other Thing	373
How About Beetroot Juice, Beta-Alanin, Bicarbonate, Caffeine, and Creatine? – Let's Have a Closer Look	378
Being Underweight, Being Overweight – What to Do	388
Urogenital and Endocrinological System	394
Urinary Tract Infection – When It Burns	394
Sexually Transmitted Diseases – About Safer Sex, Respect, Enjoyment, and Fun	398
Amenorrhea, Female Athlete Triad, and Relative Energy Deficiency in Sports (Red-S) – Yes, Red Flag	400
Bone Density, Vitamin D3, and Calcium – Basic Knowledge for Everyone	405
Hypothyreosis (Underfunction of the Thyroid Gland) in Sports – No Worries Under Treatment	411
Diabetes Mellitus in Sport – a Manageable Challenge	413

Psychology/Mood Disorders	417
Sports Psychology – Where is Your Head in It All?	417
Sleep/Sleep Disorders in Sports – Major Contributor to Recovery	420
Depression and Anxiety – How Prone Are Athletes?	424
Resilience in Sports – How Do Athletes Cope Best With Exposure to Stress?	429
Addiction/Dependence in Sports– Too Important to Be Ignored	432
New and Classic Therapies in Sports Medicine and Sports Physiotherapy – Do They Live Up to Their Promises?	438
Platelet Rich Plasma (PRP) – shows promising first results	438
Stem cells – still a field of research and already quite controversial	439
Shockwave – a therapy that shakes the tissues	439
Eccentric strengthening	440
Cortisone – a blessing or a curse?	441
Local anti-inflammatory treatment for tenosynovitis	442
Life After Competition Is Over – Start of Lifelong Recreational Sport!	443
Disclaimer/Feedback/Social Media	447
About the Author	448
Testimonials	450

Acknowledgements

I'm very thankful having had the great support of two friends and mates in sports: Rev. Graham Dempster (previously P.E. teacher) and Tim Bagshaw (MSc in Physiotherapy). They gave me a lot of valuable feedback and helped to make my English much smoother. Many thanks to PD Dr.med. André Leumann, Dr.med Mareike Cordes, Barbara Harisberger, and Ewa Haldemann who all made extremely valuable and constructive comments to the content of the book. Special thanks to Sabrina, Sarah, Nadine, Susanne, Rémy, and Marc-André for their support with illustrations, photos, drawings, and website. Thanks to Fran and Bob, Catherine and Andrew, Joël and Jonin for their support and great friendship. And last but not least: thanks to Ocean, Kaya, Caroline, and the whole team at InHouse Publishing – you were truly inspiring.

Foreword

As an athlete, I often push my very limits. This is essential to achieve top performance, but it is equally important not to go too far. Exactly this happened in spring, when I had a persistent cough. Following a good winter training season, I was looking forward to the start of competition season and was fully motivated to train intensively with my goals in mind. A cold turned into a cough, as it happens, but I saw no reason to adjust or alter my training.

The cough persisted and even a reduced training schedule did not lead to improvement. The warning shot and the decision to see a doctor came one night when the coughing became so severe that my chest started hurting. The next day, I immediately went to my sports medicine physician and, following a clinical examination and two x-rays, early stage pneumonia was diagnosed. Thanks to my quick action and the targeted therapy, I was able to minimise my training downtime and resume competition season within only a short time. I also found the Return to Play Plan recommended by the doctor very helpful, which made me understand that I really had to stop completely for a few days in order not to delay the healing process. Very soon, I was already able to commence with shorter training units in the extensive area of endurance.

This and similar situations are common in the career of an athlete. When can I resume training and when is a doctor's consultation a must?

The book at hand serves as an excellent and specific advisor across the entire range of sports. A variety of potential issues are presented in a well-structured manner and complemented with valuable tips of an experienced author. For me as an athlete, this book provides a great level of security, and this is one piece in the puzzle of success!



Simone Niggli-Luder

Orienteering World Champion (23-times)

World Cup Winner (8-times)

Swiss Sports Woman of the Year (3-times)

Introduction

Dear athletes, coaches, parents, and sport and health professionals, *Athletes' Health and Top Performance*. What a promising title! I do have two thoughts to share:

1. There's a broad knowledge and deep understanding in the various disciplines around the physiology of performance: novel insights in sports sciences and sports medicine, recent findings in training and recovery strategies, evidence-based and approved practices in sports physiotherapy, and new concepts in sport nutrition and successful strategies in sports psychology. Even for health and sport professionals it is a challenge to keep abreast of it all and to stay up to date. An overview in the form of a handbook for athletes, coaches, parents, and often many more involved persons is the answer to this need.
2. Athletes are good patients as they want to get back into the action, the sooner, the better. 'Doc, when'll I be back?' is one of the very first questions I hear in my practice—that's a big advantage for any health professional in the field of elite sports. However, in the life of an athlete, there are often issues that need a closer look and some patience. The approach of, 'Just train harder, it will get better then,' is neither a long term nor an effective solution—especially as the proper healing of an injury or an illness is too important for high performance and the sustainability of a sports career. *Athletes' Health* is not at all just about the absence of illnesses and sport-injuries, but as the WHO definition says:

*'Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.'*¹

That's where we should all look for. No doubt, sport is a wonderful thing, whether it's your profession, your passion, or just a leisure activity. There are many positive effects related to sports activity. To be successful you need to give much of

¹ Preamble to the Constitution of the World Health Organization (WHO) Geneva 23.3.2016 <http://www.who.int/about/definition/en/print.html>

yourself, and a consistently high level of performance in sports is extremely demanding and challenging. We all agree that elite sport is therefore quite often on the edge (and occasionally even a bit beyond). This means that with an injury, whether it be an acute trauma or overuse, there is often a pressure situation—a time pressure to be back as soon as possible, with expectations of the media, the club, the coach, and, last but not least, your very own, enhancing this dilemma. It's essential in this situation to take one step back and to make a serious analysis of what the medical diagnosis is and what treatment and return to play plan we are talking about.

Knowing the athlete's side from both my own experience, and from my professional involvement in this field, I understand how not being allowed to perform feels. But an athlete's health is as essential in leading up to top performance as it is to allowing a long lasting, successful sports-career, not to mention life after sport.

So, I hope that this manual will be a help for a better understanding for all of us.

Sincerely,
Dr.med. German E. Clénin

Goals for This Manual About Athletes' Health

1. Breaking down recent and essential findings in sports medicine and sports sciences and presenting them to you in a written and understandable manner, supported by pictures and illustrations.
2. Empowering of athletes, coaches, and parents by directly bringing you applied knowledge and practical skills to support you in your everyday life as sportsmen and women.
3. Giving practical advice for good preventive measures, early self-treatment options, and recommendations when to see a doctor.

This manual can't replace a sports medicine physician's or sport physiotherapist's diagnosis and treatment, but it will make you more self-sufficient and hopefully allow you to feel safer in your daily work as an athlete and coach.

How Are the Topics Organised and Structured?

Topics are organised according to organ systems throughout the table of contents, with a focus on important sport relevant information. The structure follows this order:

Title: Disease XY – Additional Information

The first part is a neutral medical title. While the second part works as a catchy description and reminder. This second part is personal coloured by experience and possibly not always 100% objective. But I feel that makes it more interesting and, hopefully, is an added value for you. For example: Runner's knee – when the ilio-tibial band rubs and causes lateral knee pain.

Symptoms

Describes the classical symptoms, as you may observe them. Possibly with an illustration or a figure to assist recognition.

► Figure 1: or Illustration 1:

Background

Gives background information to the illness or injury, as far as necessary.

Prevention and Treatment Table for XY

Prevention	What to do or not to do so that an illness, an overcharge, or an injury is NOT going to happen.
Treatment by Yourself	Showing good and easily applicable treatment options.
When is a Doctor Needed?	To make you feel safer in your decision-making when to see a doctor.
Return to Play/Sports	Gives an idea about the time frame. Some propositions how to start training again and for alternative training may be given.

What Does the Doctor Do?

Tells you what a doctor does when seeing you. How the diagnosis is confirmed, what the treatment options are, and which one may most likely be chosen.

Basics to Athletes' Health

Safety First – You Must Protect Yourself, Others Have Different Priorities ...

This is a highly important issue because it's about staying alive. Yes, it's that serious! I recall a few sportsmen and women who had a severe accident while they were training—some were killed (e.g. South African Olympic cross-country mountain biker Burry Stander) or rendered paraplegic after the incident (e.g. Swiss Triathlete Dr.med. Christian Wenk). So do everything that is reasonably feasible to protect yourself. You may say, 'I cannot prevent everything. When it is going to happen, it will happen.' I don't agree on that, neither do many studies in the field of injury prevention. Certainly, an element of risk remains, but it's up to you to do everything to reduce it to a minimum. What does this mean? Be prepared, plan your training day, have good and safe material, and be well-equipped. Train hard but be alert. Have a cautious attitude in traffic.

Road cycling

Wear clothes in bright colours and wear a helmet all the time (many studies have shown that wearing a helmet reduces significantly your risk of a severe brain injury). Do your training session in daylight. If it's a long session, take good visible lights with you (there are products that fit on your training bike and you just can leave them on). Wear gloves. Take a raincoat in your jersey (protection against cold and rain, preferably with reflecting colours).

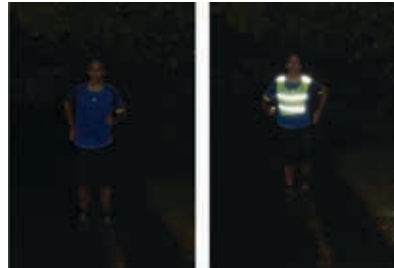


Mountain biking

As above. In remote areas don't bike alone but with a partner, have your mobile phone with you, possibly download specific rescue apps (e.g. Swiss Alps www.rega.ch). Depending on your choice of track for a lot of downhill sessions, you should have more protection. For gravity downhill mountain biking, full protection with a full face helmet, back protector, shoulder pads, knee and shin pads, and gloves are warranted. A Leatt brace (neck protector) is highly recommended.

Running/Jogging

Wear running clothes in bright colours. Do your training sessions in daylight, choose a reasonable route (especially concerning road traffic and mountain hazards) as this reduces the risk of not being seen by car drivers and of unnecessary risk exposure in the mountains. When you consider running at twilight or at night, you must wear a reflective vest and take a torch or head lamp with you.



Alpine snow sports

Wear a helmet, gloves, and, depending on your discipline, a back protector all the time. Be aware of the cold—wear underwear (e.g. Merino wool) that keeps you warm and wicks away the moisture. Follow instructions of the ski station and their safety experts to the letter.

On-water sports

Wear a life vest at all times. You may be the best swimmer but if you're unconscious you will drown! Depending on your discipline you must wear a helmet (whitewater canoe or kayaking).

Equipment

When it comes to your equipment, don't be stingy; don't go for the cheap product. Your sport is your passion, so go for quality. It doesn't have to be the most expensive either, but choose good stuff to a reasonable price.

Heat illness

A very specific topic but to be named in the field of safety, as even today we see athletes die on the field from simple overheating. As it is that important to me, I dedicate two separate chapters to this topic, one focusing on safety aspects (see 'Heat illness') and one focusing on performance (see 'Heat Acclimatisation').

Warming Up – Includes Sport Specific Strength and Proprioception

The warming up is a must! Not only are you preparing for your physical workout by enhancing respiration and blood flow (lungs, heart, vessels including the finest capillaries in your tissues) and are getting all body structures alert and ready for effort (neurons, muscles, tendons, ligaments, cartilage, bone), but you are preventing accidents and severe injuries. Warming-up includes a neuromuscular activation in order to raise your proprioception. The word *proprioception* comes from Latin *proprius* meaning 'one's own', 'individual'; and *capere*, to take or grasp. It is the sense of the relative position of neighbouring parts of the body and sensitises their changes in movement (adapted from Wikipedia).

Many studies, especially those done in Scandinavian countries, show what a good warm-up should look like:

- **General warm-up (5–8min):** Light jogging or cycling to get the circulation and the blood flowing to all the tissues. Also moving shoulders, arms, hands, and trunk to get the whole body involved.
- **Balancing exercises (5–8min):** Related to the demands of your sport. Start in a standing position on uneven ground (wobble-board, etc.) then moving to jumping and landing exercises first with both legs, then making it more difficult on one leg, progressing to including your sports equipment (e.g. playing passes with the ball on uneven ground or while jumping and landing).

- **Sport-specific strengthening exercises (5-8min):** Perform strengthening in two ways:
 1. As close as possible to your sport specific needs, may it be single leg squats or hamstrings lower or another exercise being close to your sports discipline. The Nordic hamstrings lower exercise has the goal to train the hamstrings muscle and seems to be efficient in preventing knee injuries (e.g. rupture of the ACL, anterior cruciate ligament—see this chapter) as well as direct hamstrings injuries (e.g. structural muscle lesion—see this chapter).
 2. By activating your core muscles (see also chapter 'core stability') by integrating a couple of exercises

► **Examples of balancing exercises:**



e.g. single leg stance touching heel and touching toes; single leg jumps with line crossing; practicing headers or passes on one leg; partner exercises with one leg jumps; if available practising shots on wobble board

► Examples of sport-specific strengthening exercises:



e.g. Single leg squat with good leg axis control “knee over toe”; Nordic hamstrings lower exercise; partner exercise, sport specific single jumps while practising passes, etc.

Literature

- Kristianslund E et al. Sidestep cutting technique and knee abduction loading: implications for ACL prevention exercises. *Br J Sports Med.* 2014 May;48(9):779-83.
- Wingfield K. Neuromuscular training to prevent knee injuries in adolescent female soccer players. *Clin J Sport Med.* 2013 Sep;23(5):407-8.
- Myklebust G, Skjølberg A, Bahr R. ACL injury incidence in female handball 10 years after the Norwegian ACL prevention study: important lessons learned. *Br J Sports Med.* 2013 May;47(8):476-9.
- Herman K et al. The effectiveness of neuromuscular warm-up strategies, that require no additional equipment, for preventing lower limb injuries during sports participation: a systematic review. *BMC Med.* 2012 Jul 19;10:75. doi: 10.1186/1741-7015-10-75.
- Engelbrechtsen AH et al. Prevention of injuries among male soccer players: a prospective, randomized intervention study targeting players with previous injuries or reduced function. *Am J Sports Med.* 2008 Jun;36(6):1052-60.

Myklebust G et al. Prevention of noncontact anterior cruciate ligament injuries in elite and adolescent female team handball athletes. *Instr Course Lect.* 2007;56:407-18.

Verhagen E et al. The effect of a proprioceptive balance board training program for the prevention of ankle sprains: a prospective controlled trial. *Am J Sports Med.* 2004 Sep;32(6):1385-93.

Myklebust G et al. Prevention of anterior cruciate ligament injuries in female team handball players: a prospective intervention study over three seasons. *Clin J Sport Med.* 2003 Mar;13(2):71-8.

Definition of Proprioception: retrieved on the Wikipedia Website 3.6.2016
<https://en.wikipedia.org/wiki/Proprioception>.

Training and Performance – the Basics of Success

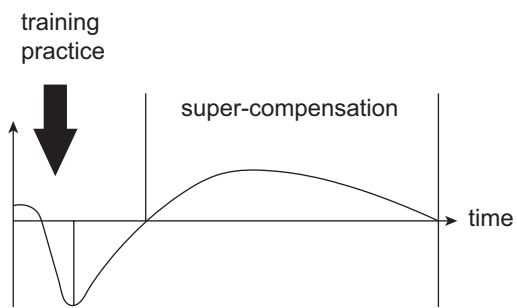
To talk to athletes and coaches about training and performances would seem like carrying coals to Newcastle. But what a training session causes, triggers, and hopefully initiates in our organism is important. Figure 1 shows a typical training session with a training load inducing a certain temporary fatigue and structural load on your body. It's natural that this training stimulus triggers structural, physiological, and neuro-muscular changes, and after the recovery makes the body stronger, faster, more explosive, with more endurance—depending on what has been trained (super-compensation in Table 1).

Table 2 shows how a series of training should enable an athlete's performance to improve. The new training stimulus should allow enough recovery time in order to have a rising training effect.

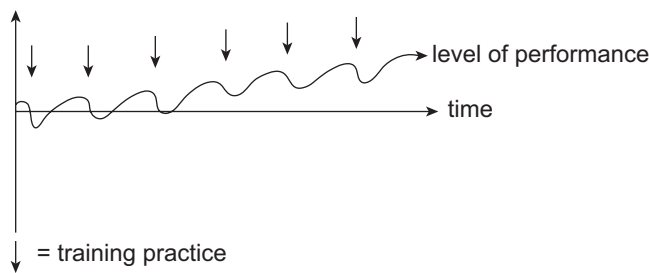
Having a look at the factors determining performance in sports (Table 3), we come closer to an understanding how comprehensive and complex sport performance needs to be understood. There are a multitude of factors influencing, and sometimes limiting, performance. And that's exactly where the work of the athlete and the coach starts. A detailed training program to improve performance and enhance all contributing factors is established and regularly adjusted in order to reach your top performance.

Table 4 gives already a deeper insight in these processes as it tries to show recovery times and super-compensation from a training stimulus. The intention is to plan the next specific training practice ideally timed in the phase of super-compensation in order to get an optimal rise in level of performance.

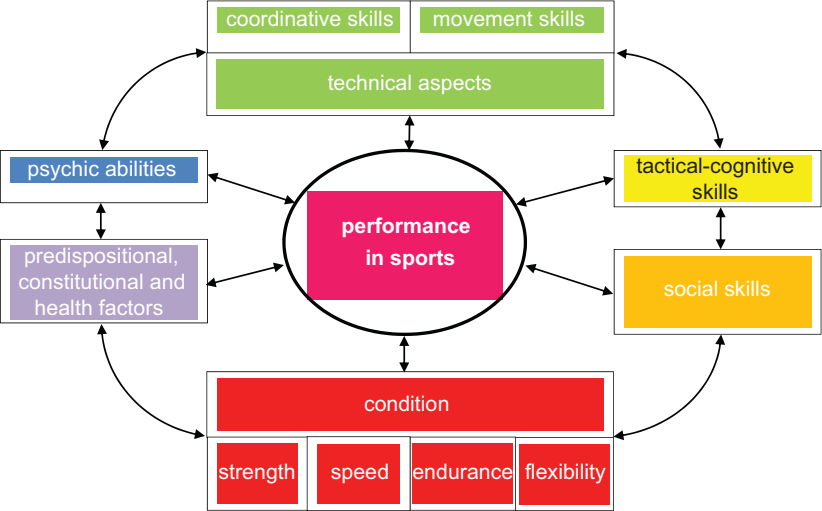
► Table 1: Effect of Training



► Table 2: Effect of a series of training practices

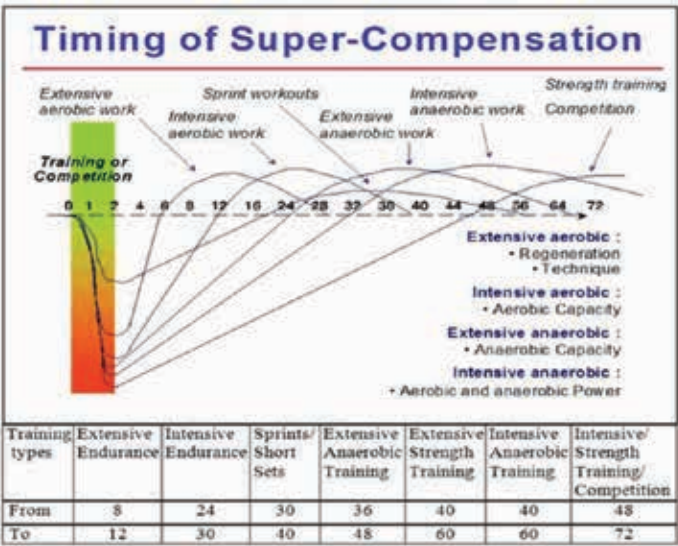


► Table 3: Factors Determining Performance in Sports (translated and adapted after Weineck 2009)



► Table 4: Ideal timing of Super-Compensation (courtesy JanOlbrecht).

After a specific training, as indicated with arrows, e.g. extensive aerobic work, the super-compensation will take place in certain range of hours, as indicated in the table below, e.g. extensive endurance from 8 to 12 hours.



Literature

Olbrecht J. The Science of Winning: Planning, Periodizing and Optimizing Swim Training, Dec 17, 2013 Kindle eBook, F&G Partners, 2015 ISBN 9078158069, 9789078158066.

Weineck J. Optimales Training, Spitta; 16th edition (1st December 2009), Balingen Germany, ISBN 978-3-938509-96-8.

Core Stability – Better Performance and Less Backpain

Imagine the vertebral column with all its bony vertebrae, the rib cage in front, just a column of bony bins with a few ligaments to hold things together. To keep our body on the one hand flexible and on the other hand stable if needed, that's the job of our trunk's muscular system, more commonly known as the core muscles.

Let me compare it with a circus tent, which needs to be put up with several poles and secured with tensioning ropes from all sides. The better the tensioning ropes are placed, the stronger they are, and the better they are coordinated in their action, the better the stability. Now with this example it is easier to understand that our body muscles in the rear (back and lumbar muscles), the ones in the front (abdominal muscles), and the ones on each side (lateral muscles) need to work together to hold the core of our body stable (see Figure 1). The advantage of a muscular system, compared to a more stiff construction like a house, is that we are able to move, to change position, to transmit, and even to further develop power. This means, for example, in case of a shot putter, the power of the start-up and the explosivity of the legs can be transferred in the one movement behind the shot to reach top performance.

Naturally core stability is not just about one single performance peak (maximal strength for one movement) as in the shot putter, but also about all adaptations that happen in other sports, like the 110m hurdles sprint (adapted explosive strength for 11–12 seconds) and like the long term stabilisation task in a marathon runner (strength endurance for 2h 10min). It's also about stabilising the body during many hours of training and competition and, last but not least, throughout daily life.

So to understand how this core stability really works, we are talking about global and local systems of muscles. The *global system of core muscles* consists in the rear of the big back and lumbar muscles (erector spinae, longissimus dorsi, latissimus dorsi, quadratus lumborum) and in the front of the big abdominal muscles (rectus abdominis, see Figure 2). Their job is to do the big things, the greatest work; they are involved in all major movements, especially the peak power output (e.g. shotput) and the tasks asking high explosivity (e.g. 110m hurdles). Underlying the global muscle system there is the *local system of core muscles*. This consists of the small back muscles (multifidi) and the transversal abdominal muscles (transversus abdominis, partially externus and internus abdominis, see Figure 3). The latter gives the local stabilisation and is ideally able to stabilise the trunk by a co-contraction around the vertebral column on the needed level. This means the contraction of a muscle segment all around the core of our body (i.e. on either side of the vertebral column), helping stability and firmness, but still ready for adaptations if needed. To summarise core stability allows a continuous and focused energy transfer and secures an optimised coordination between the local/global core muscles and the involved muscle chains, and therefore improves power output.

► Figure 1: Circus Tent, Core Muscle System of the Body

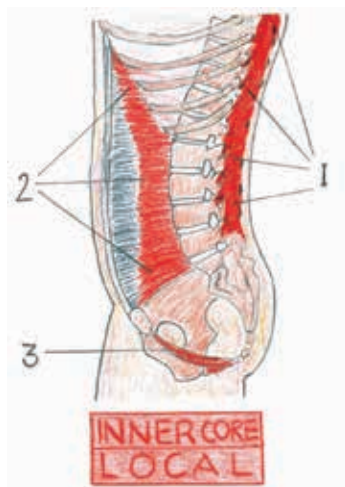
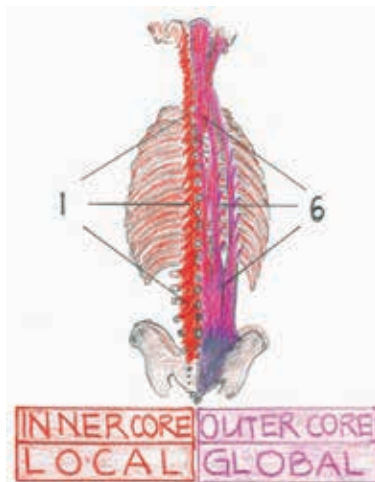
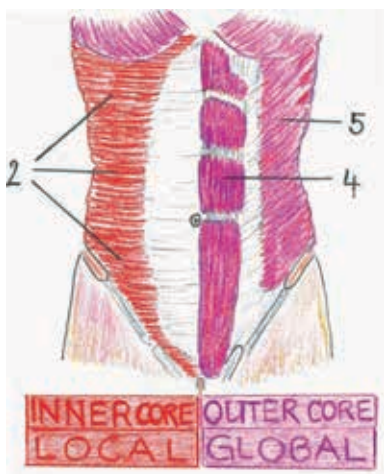


Inner core muscles / LOCAL

1. Multifidus muscle
2. Transversus abdominis muscle
3. Pelvic floor muscles

Outer core muscles / GLOBAL

4. Rectus abdominis muscle (i.e. abdominals; abs)
5. Abdominal external oblique muscle
6. Erector spinae muscle



What about back pain? Is it frequent in sports?

Yes, back pain is a quite frequent complaint in both daily life and in sports. Studies clearly show that regular training of core stability and strengthening of endurance of the core and the whole trunk muscle system reduces the number and duration

of back pain episodes. So core stability is a must for all athletes (in fact for all human beings). And yes, as athletes have a higher exposure to stop and go movements, to shearing and rotational forces on the trunk, and to impacts of all kind the level of core stability and strength endurance of the trunk muscles needs to be by far superior to that of a normal person. Some sports are even more demanding than others on the core stability system: especially gravity disciplines (e.g. downhill MTB, alpine skiing), martial arts (e.g. judo, taekwondo, karate), and team sports with direct opponent contact (e.g. AFL, rugby, handball, ice hockey just to name a few). In these disciplines, core stability is an absolute must, as the core and trunk muscle systems act like a corset in stabilising and protecting the body.

Core stability exercises should be done on a regular basis by every single athlete. So make sure you integrate these exercises in your training program. As an elite athlete starting up, you may go ahead with 3–4 times 30–45min for 2 or 3 months. Once you're on a good level, twice a week 30–45min is sufficient (for master and recreational athletes once a week is fine). And I promise strengthening your core stability will make you feel better.

Practical Exercises – See the following pages

Stage I – BEGINNERS

Stage II – ADVANCED

Stage III – EXPERT

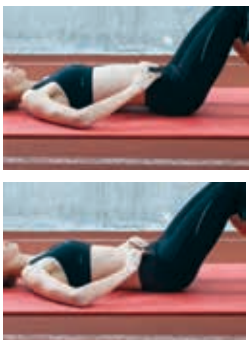
Literature

- Prieske O et al. Neuromuscular and athletic performance following core strength training in elite youth soccer: Role of instability. *Scand J Med Sci Sports*. 2016 Jan; 26(1):48–56.
- Stuber KJ et al. Core stability exercises for low back pain in athletes: a systematic review of the literature. *Clin J Sport Med*. 2014 Nov; 24(6):448–56.
- Schmidt CP et al. Prevalence of low back pain in adolescent athletes – an epidemiological investigation. *Int J Sports Med*. 2014 Jul; 35(8):684–9
- Shinkle J et al. Effect of core strength on the measure of power in the extremities. *J Strength Cond Res*. 2012 Feb; 26(2):373–80
- Petering R, C Webb. Treatment Options for Low Back Pain in Athletes. *Sports Health*. 2011 Nov; 3(6): 550–555.



Core Stability Exercises – Stage I – BEGINNER

Perform three series of these 8 exercises – once you manage them well and your core stability and body awareness have improved, you may move up to the Stage II – ADVANCED exercises.



1. Pelvic tilting

	Instructions	Time
	<p>In supine position, tilt your pelvis by releasing and activating your abdominal muscles.</p> <p>Goal: better awareness of the positioning of the pelvis.</p>	12 repetitions



2. Activating the local core muscle system at rest – in different positions

	Instructions	Time
	<p>Activate your local core muscles: transverse abdominal (anterior), pelvic floor (below), and multifidus muscles (back). Gents: balls up. Ladies: as you would close the zip of tight jeans.</p>	Activate and hold for 10sec, 5sec rest. Repeat 8 times
	<p>Once you are familiar:</p> <p>a) Do the same exercise in a four point kneeling.</p> <p>b) Do it in upright position.</p>	



3. Train the local core muscle system under slight movement

	Instructions	Time
	Supine, hip flexed, one foot on the ground the other in the air. After activating the local core muscles move one leg forward, control the firm pressure of the lower, lumbar spine muscles to the ground with one hand, the activation of the local abdominal muscles with the other hand.	Right leg: 30sec Left leg: 30sec

4. Plank exercise (global anterior muscle chain)



	Instructions	Time
	Holding the plank position, raise your right foot about one foot in the air, alternate left-right, keeping your body stable. Important: control your lower back and pelvis by activating the local core muscles. Don't allow your hips to drop.	Start with 45sec, later 60sec
If too hard at the beginning, you may do the same exercise on your knees. A shorter lever will make it easier.		

5. Global lateral muscle chain


 	Instructions	Time
	Come up and down in a rhythm of one second per movement.	Start with 20sec, then 30sec, later 45sec

If too hard at the beginning, you may do the same exercise with bent knees, having a shorter lever (only until your knees).


6. Global back muscles (posterior chain)

 	Instructions	Time
	In four point kneeling position. Crosswise lift the right arm – left leg and vice versa, always having a good control of the lower back and pelvis (don't fall into a hollow back).	60sec
	Slightly advanced: stay with the left arm-right leg exercise for 30sec, instead of a rest when coming down, knee and elbow touch under your body, and continue.	30sec R leg – L arm, 30sec for L leg – R arm

7. Global abdominal muscles

	Instructions	Time
	Supine, hip flexed, lower legs in the air, hands together. Come up across your body, changing left and right side, always lifting the shoulder completely off the ground.	60sec


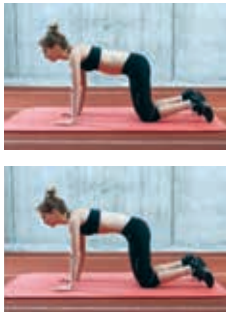
8. Local back muscles

	Instructions	Time
	On your knees, bend very slowly forward, 'feeling each vertebra', and come up again. While bending forward, rotate your shoulder inwards. While coming back up again, rotate your shoulder outwards (activation of rhomboid muscles).	60sec Allow a slow execution, counting 1-2-3-4 for 8-10sec for one complete exercise

Core Stability Exercises – Stage II – ADVANCED

Perform three series of these 8 exercises. Once you manage them well, you may progress to the Stage III – EXPERT exercises.

1. Activating the local core muscle system at rest – in different positions

a)	Instructions	Time
	<p>Activate your local core muscles: transverse abdominal (anterior), pelvic floor (below), and multifidus muscles (back). Gents: 'balls up'. Ladies: 'as you would close the zip of tight jeans'.</p>	<p>Activate and hold for 10sec, 5sec rest. Repeat 8 times</p>
<p>b)</p> 	<p>Alternate positions:</p> <ul style="list-style-type: none"> a) Lying sideways. b) Four point kneeling position c) Four point kneeling position, one knee slightly lifted d) Upright position. 	
<p>c)</p> 