

Chapter 4

Physical Preparation

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"The harder you work, the harder it is to surrender"

Vince Lombardi



Learning Objectives – at the end of this chapter you will be able to:

- Have a general understanding of the fundamentals of physical preparation towards skiing.
- Understand which are the main physical limitations in ski performance.
- Understand how to improve your own training plan.

List of Topics :

- Physical Skills:
 - Body Alignment,
 - Balance,
 - Coordination.
- Energy systems overview.
- Energy systems training towards skiing.

Introduction

In this chapter we will give an overall review on what the physical preparation for instructors should include. In order to do so we need to go through a brief analysis of the sport's needs, so we can track back what to train and, lastly, how to train it.

Part 1

Physical Skills

When talking about physical preparation or strength & conditioning there is the general tendency to think about pure maximum strength, as in being able to grow stronger, usually by pushing weights. We can start by saying that complete physical preparation towards skiing is not just that, as much as it is not just 'cardio' in the off-season.

In this chapter we will try to pass on a wider view of the subject so that each individual can gain a more complete understanding on how to prepare towards the ski season. As this is a demanding sport, physical limitations can be one of the main elements that hold back the student's chance of improving.

For instructors, being able to recognise what physical skill is missing and how to improve it, will allow us to better understand the needs of the learner and address them appropriately.

Body Alignment



Impact of physical performance

Firstly snowsport professionals should start with an accurate analysis of the current body alignment. Because **how the body is structured will determine success or failure of the rest of the physical preparation**. The ability to produce strength, endurance, balance, coordination etc. are all directly related together and are better achieved with a body that is, comparatively, better aligned. It is not a coincidence that work on posture is becoming the norm in training protocols for all elite athletes.

Impact on injury prevention

It is mandatory to work on the body alignment also because it has a direct impact on **injury prevention**. Misalignment progressively exposes joints and muscles to injuries. Preventing is always more economical and time effective than rehabilitating.

Impact on technique

Ski technique is also directly affected. Efficient body alignment will give the best chance of learning and performing the accurate technical movements. It is unfortunate, but **alignment can be one of the main limitation factors to success**, just like any other physical disadvantage in sport (height in basketball or volleyball players, fast twitch vs. slow twitch fibers ratio in sprint athletes etc).

Virtually no one is immune to some misalignment, so **it's the norm to have to work on this**. It is necessary to get as close as possible to the ideal body alignment, even though it might require some time!

Misalignment consequences on skis:

- the body gets tired more quickly.
- increased muscle pain in specific muscles or areas.
- exposure to injury.
- limitation in the correct technical gesture.

Short term solutions:

- allocate some time for the body to recover (longer rests in between runs or skiing sessions).
- keep hydrated, as muscles rely on water to get rid of inflammations and distend.
- stretch the tightened muscles after skiing.

What to remember:

- assess the current body posture as soon as possible.
- neglect is not an excuse.
- consult a physiotherapist or posture educator to have the most appropriate check-up.
- include posture exercises in all training sessions.
- prioritise maximum health over maximum 'performance' (performance will actually become easier in the longer term).

Balance

Skiing is primarily a sport of balance.

Balance is the ability to stay upright or stay in control of body movement. General balance skills can be easily trained by trying to find control of the body in different situations.

Balance is improved in small and personal steps. Meaning each one of us have the possibility to improve, through a personal journey in terms of timing and progression.

Balance training rules:

- The starting point needs to be set by the current abilities of the learner.
- Each step in the progression needs to be fully achieved before proceeding with the new one.
- Each new step needs to be slightly more difficult than the previous one.

These rules can be applied to both off-snow and on-snow training sessions.

Off-snow training tips on balance:

- practice glide/slide sports (ice/roller skating, skate board etc).
- favour on-foot standing sports (football over swimming).
- recreational balance games/tools (slack line, skating).
- specific training using a variety of tools (balance boards, fit-ball etc).

On-snow training tips for balance:

- slow down or increase the speed of descent.
- increase height of COM to increase difficulty.
- decrease height of COM to decrease difficulty.
- standing on one foot is always more difficult than on two.



Coordination

Coordination is the ability to move two or more body parts under control, smoothly and efficiently. Skiing clearly needs a good dose of coordination to be successfully performed. Coordination is highly impacted during the growth of the child, as we develop different coordination skills at different ages.

Age and Skills:



Age 2 to 4

- + alternation of feet (ability to walk stairs).
- + jumping with two feet.
- + ride tricycle.

Age 5 – 6

- + run, hop, skip, jump.
- + ability to throw and kick a ball.
- + catch a ball with two hands.

Age 7 – 8

- + ride a bike.
- + spin around while standing on the spot.
- + complete multiple stages tasks (making the bed).
- + complete more complex movements (tie shoe laces).

Age 9 – 10

- + coordinate complex movements (accurate sport playing).
- + efficient use of tools.

Age 11 – 15

- + effectively perform technical sports along with team work.
- + endurance and strength spurs.

Age 16 – 18

- + improved visual-spatial coordination (ability to judge distance, speed and react quickly).
- + coordination progression completed.

Through the scheme above you can see how **different skills are developed during different times of our lives**. By the age of 18-19 we should have all the tools we need to express (or fully train towards) the maximum coordination possible.

When teaching youngsters, we also need to **keep in mind their growth rate in height**. As seen in the balance section, every time the COM rises, balance (and therefore coordination) will be more challenging. Sometimes the difficulties in improving is not so much the technical gesture itself, but the fact that the student is performing the same task at a higher distance from the ground. They are just taller!

Coordination can be improved through continuous training and progression. Each new exercise, as for balance, needs to be a bit more difficult (i.e. complex) than the previous one.

Off-snow Coordination training tips:

- practice sports that require multiple eye-body interactions (ball games vs. road cycling).
- when practicing sports work hard on movement accuracy (purposeful practice).
- challenge yourself by periodically trying/learning a new sport/technical gesture.
- use mirrors to help acknowledgement of the body in motion and their position in space.

On-snow Coordination training tips:

- don't fear failure.
- start simple and build up slowly but constantly.
- focus on movement accuracy (purposeful practice).
- practicing other snow disciplines can increase coordination awareness.
- use video recordings instead of mirrors.
- be specific when targeting an issue through video (focus on the specific movement, not the overall technique).



Part 2.1

Energy Systems Overview



Energy systems are the way our body creates the fuel for our activities. Depending on the duration and the intensity of such activities our organism will use one over the other. Understanding which ones are used in skiing will give the direction for the planning of our physical preparation.

Three Energy Systems:
Anaerobic A-lactic.
Anaerobic Lactic.
Aerobic.

Without going into the details of the chemical reactions we can highlight:

Anaerobic A-lactic system is used for efforts **under 20 seconds of duration**
main source of fuel: ATP.

Anaerobic Lactic system is used for efforts **between 20 seconds and 2 minutes**
main source of fuel: glucose.

Aerobic system is used for efforts **over 2 minutes of duration**
Main source of fuel: oxygen.

Primary Energy System in Skiing

Anaerobic Lactic: for the most part our descents normally last between 20 seconds and 2 minutes. As our performance needs to peak during this time frame, **we consider skiing as an Anaerobic Lactic sport (AL).**

This implies that our training should aim at improving our performance during this time frame.

Within this time frame we can decide if we want to either:

- be **moving faster** (increase the number of repetitions per second).

in skiing: make more turns per each meter of descent – slalom turn rather than giant slalom turn.

- **for longer** (increasing the amount of time we can keep on going for).

in skiing: be able to ski 50 turns rather 20 and not feel tired.



Secondary Energy Systems in Skiing

Aerobic: Skiers also need to keep the Aerobic system (A) at a high capacity level. This is because this system is responsible for the oxygenation of the tissues. In other terms, it is the system that comes in to rescue every time we need to recover from an effort.

By strengthening the aerobic system, we can shorten the general recovery time our body needs to have between skiing sessions. Whether we are thinking about recovering between runs, between training days or throughout the length of the season, a well trained cardio-vascular system will allow efficient recovery and better overall skiing quality.



Notes:

Higher altitude: the higher the terrain the more the aerobic system will play a role in recovery.
Older age: with age the recovery takes longer. Good aerobic training can balance this out.
Long working hours : more laps = longer recovery = increased need of an efficient aerobic system.

Anaerobic A-lactic: in order to train our best performance on longer time frames certain skills (like speed) need to be trained first in a short time lapse.

Training the body to perform at the fastest possible speed within the first 20 seconds of movement will increase the ability, through accurate training, to speed up the performances in the Anaerobic Lactic system (AA).

Later in this chapter we will present a few ideas on how to train the different energy systems.

Summary:

Skiing is an Anaerobic Lactic sport, so training needs to focus on improving performances between 20 seconds and 2 minutes. It is important to train the Aerobic system ($> 2'$), to help the body recover between ski sessions and throughout the season. Anaerobic A-lactic training ($\leq 20''$) can be useful to improve performances in our preferred time frame ($20''$ to $2'$).

Part 2.2

Energy Systems -Training Methods Towards Skiing

Training the Anaerobic Lactic System

As we mentioned before we can train the body to either move faster or for longer. Following this we can try to simplify the rationale and split the training into two: Lactic Peak (LP) and Lactic Endurance (LE).

Lactic Peak (LP)

During the LP training we try to be moving as fast as possible for limited amounts of time within the AL system. Following each set with medium long rest time, in order to help the body to get rid of the lactic acid and restore the glucose in the muscles.

Example with Jump Squat: 30 seconds jumps at highest speed possible + 3 minute rest time.

Aim	Method
<ul style="list-style-type: none">- Improve speed.- Improve lactic acid production.- Improve nervous system.	<ul style="list-style-type: none">- short burst of performance.- fastest speed possible.- long recovery time.

Lactic Endurance (LE)

To train the LE we will then proceed in extending the execution time going between 1 to 2 minutes, as well as shortening the rest time, in order to push the body to adapt to the new fatigue situation.

Example with Jump Squat: 1 minute jumps at highest speed possible + 1 minute rest.

Aim	Method
<ul style="list-style-type: none">- Improve lactic acid endurance.- Improve overall muscle recover.- Improve speed endurance.	<ul style="list-style-type: none">- Use of 'race like' time distances.- Keep the fastest speed possible.- Short recovery time.

A standard session would be between 6 to 12 sets per muscle group, with two to four weekly sessions, depending on the maturity of the athlete (which is not the age of the person but the training experience). Each training block can be between 4 to 8 weeks of duration.

Training the Anaerobic A-lactic system

Dedicating some time to train this system can be of great advantage, as under this time frame ($\leq 20''$) we can train skills like **maximum speed and maximum strength**.



In order to do so the efforts generally need to be between 5 and 20 seconds max, with **movements done at the maximum speed possible**. This speed is necessary in order to recruit the maximum number of fast twitch fibres as well as challenging the nerve system to adapt to the new situation.

This training can be done with just body weight or, very effectively with weights. In both cases the **execution** of any exercise **needs to be impeccable**. To achieve this, time needs to be dedicated to the learning of the correct movement pattern at slower speeds first.

Exercises need to be intuitive/easy to perform and enable the athlete to recruit all the systems (muscle and nerves) in the most effective way. Squats and lunges in many variations (also plyometrics) are all good examples of exercises for this stage.



Aim	Methods
<ul style="list-style-type: none">- improve maximum strength to improve A.L. overall capacity.- increase nervous system capacity.- increase in muscle recruitment.	<ul style="list-style-type: none">- under 20 seconds effort.- long rests.- maximum speed and load (intensity).

Training the Aerobic System



If **medium and long-distance efforts** are the athlete's preference then these lengths can be kept during the off-season. Though it would be advisable to shorten or limit the amount of sessions dedicated to long distances while getting closer to the ski season, preferring effort lengths closer to the skiing needs (lactic system).

Another way of training the aerobic system is through **Interval Training (IT)**. Even though IT has recently gained fame through the fitness world, it's a technique that has been used for quite some time in endurance training of elite athletes. It is simply alternating a phase of intense pace to a phase of active recovery. On a track field we can imagine trying to run as fast as possible for 50 meters then jog for 100, then sprint for another 50, then jog for 100 and so on. Time rather than distances can be used (and more effective for skiing) to measure the intervals.

Depending on our aim during a certain phase of the off-season programme we can plan and adjust the time of effort and recovery. In general, we can say that the shorter recovery times will help promote the body's ability to get rid of the lactic acid, while shorter 'sprints' time will promote the ability to create speed.

Aim in Skiing	Methods
<ul style="list-style-type: none"> - Improve muscle recovery. - Improve overall body recovery time. - Improve mental focus. 	<ul style="list-style-type: none"> - Medium/long efforts (30 minutes+). - Interval training methods.

Conclusions

In this chapter we tried to sum up and collect a few of the **basics** of strength and conditioning. The hope of this text book is not to be a complete S & C manual, but rather to **give some pointers that everyone can take home**. Hopefully this also **stimulates curiosity** and **interest in learning more** about the subject, a very positive outcome for a manual dedicated to ski instructing!

Today we live in an era of information, it is likely that many will try to gain information on their own. When doing so it is fundamental to **always verify the source of information and maybe prefer real life communications with experts in the field**.

There is a lot of theory behind the science of movement, but just like skiing, movement can't be improved just by reading. Like in many other professions, Strength & Conditioning coaching is really learnt through **practice, great attention to detail** and a full **acknowledgment that the learning process can never end**. Be willing to always seek new information and dedicating time to research and study is the only way S & C coaching can be brought to a higher level.

As athletes and sport practitioners it is important to **find a coach we trust in** and dedicate yourself to the sport year round. Training needs to be taken as part of the lifestyle we have chosen when signing up for ski instructing!

IASI today offers courses towards Alpine Strength and Conditioning Coaching, tailored around the needs of ski instructors and ski coaches interested in improving their personal knowledge on the subject.

Summary - key points from this chapter:

- Success in skiing is also dictated by a good physical form.
- The alignment of the body is a great factor in the success of physical preparation.
- Balance and Coordination are the fundamentals onto which we build a solid performance.
- Energy systems are the way our body creates the fuel for our activities.
- Use the energy systems to correctly train towards skiing.

Suggested Reading and Resources

Bompa, T. O., & Buzzichelli, C. (n.d.). *Periodization : theory and methodology of training*.

La Pliométrie - Gilles Cometti

Manuale di preparazione atletica - Franzon & Carlin

L'Entrainement de la Vitesse - Gilles Cometti

IASI Strength and Conditioning Coach Level 1