TUG OF WAR INTERNATIONAL FEDERATION

TRAININGS BOOKLET

Guidelines for trainers and coaches for indoor and outdoor tug-of-war.

The aim is to show the possibilities of planning, executing, competing, and recovering.

A horizontal extension for new things to try out.

Finally, it depends on each individual member, up to the team structure, to achieve the success.

The difference between the top 5 Tug of War nations is minimal.

Ambition to be the best nation amongst many other reasons.

Analysis also questions if the other nations cannot or do not want to put in the same effort.

This booklet is intended as a collection of ideas for trainers and coaches.

Whenever the sweat runs down your forehead, your breathing is more difficult than usual and you try to keep a clear head despite the great physical exhaustion, you ask why?

1st edition May 2021

TAC (Technical Athletes Committee) TWIF

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1. Introduction

Tug of War has evolved over time. From its beginnings to today, the demands of technique, tactics, strength, and fitness have increased.

2. Performance in sports

To be able to deal with these enormous pressures, you must have a reason. A goal in mind, a motivation for your actions. The challenge in team sports lies in the community, working out goals together and pursuing them consistently but flexibly.

2.1 Motivation

What performance in sport means depends on the ideas that motivate us to perform sport?

Performance in school sports - (individually or as a group) take on challenges, meet expectations through effort and achieve goals they have set for themselves.

Students put fairness above success.

Performances in recreational and adventure sports - individually chosen requirements for self-affirmation and self-realisation are chosen.

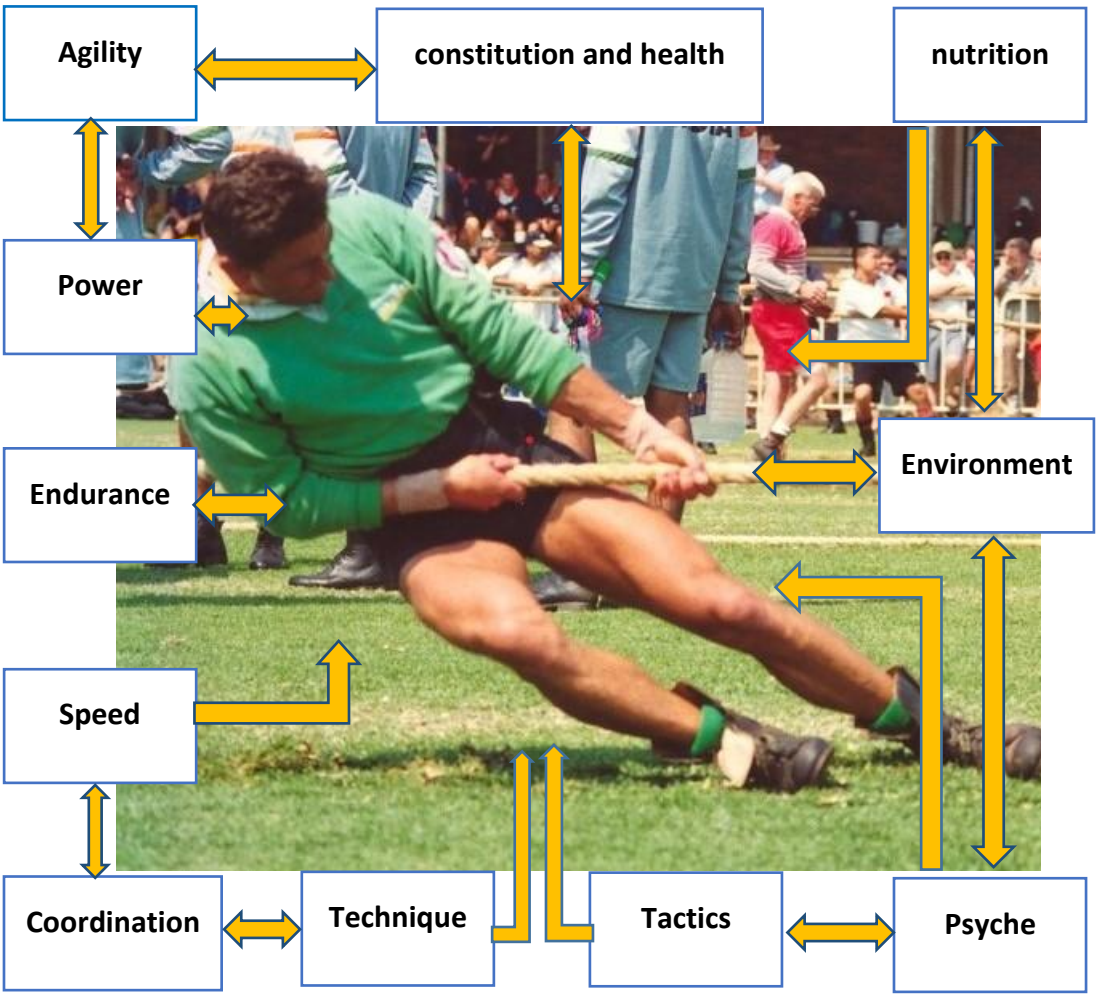
Sporting activities maintain or improve the diversity of possibilities for action and increase the quality of life.

Winning the national championship, selection for the national team, a victory is realised against a stronger opposing team.

Winning a European or World Championship title.

2.2 Performance condition

Any performance in sport requires the coordinated use of different resources and competences.



2.3 Endogenous:

This factor includes genetically determined predispositions, developmental stage and age, mental-emotional, intellectual-cognitive, and sensory-motor-coordinative abilities and technical skills as well as conditional abilities.

2.3.1 Genetic predisposition, development, and age:

- Predisposition, gender, and hormone balance
- Constitution (physique, body proportions, body size and body mass)
- Tissue characteristics (resilience and muscle fibre spectrum)
- Developmental and adaptive potential (trainability)
- Flexibility

2.3.2 Psycho-emotional and intellectual-cognitive competences:

- Psychological stability, self-control
- Willpower, motivation, and motivational ability as well as willingness to perform, ambition and decisiveness.
- Intelligence, mental agility, ability to innovate and experiment, evaluation, reasoning and decision-making skills
- Willingness to learn, learning ability and memory
- Concentration and attentiveness
- Perceptual, orientation and anticipation skills
- Diligence, determination, perseverance, and stamina
- Imagination, abstraction capacity and creativity
- Communication skills, interaction skills and the ability and willingness to cooperate
- Mental strength and resilience: conflict tolerance and ability to cope with stress, willingness to take risks, stress tolerance and ability to cope with stress as well as resistance to frustration and tolerance of frustration.

2.3.3 Sensomotoric - coordinative and technical skills:

- Ability to act optimally under time, precision, complexity, and stress pressure skills
- Ability to balance, react, rhythmist, link, differentiate, adapt, adjust, and learn skills
- Technical capability

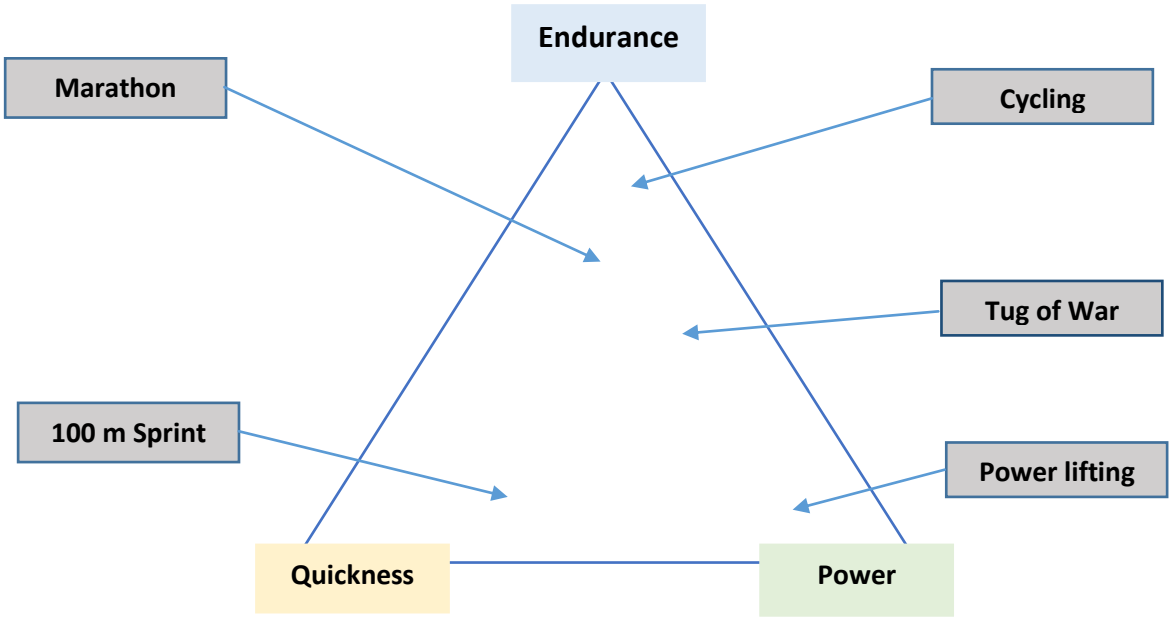
2.3.4 Condition: athletics and agility:

The term (condition) means physical condition, physical performance and includes agility as well as athletics.

- Athletics: strength and speed (exposure) and endurance (fatigue resistance, endurance and critical power)
- Agility: adroitness, dexterity, agility, flexibility, nimbleness

Athleticism depends on the properties of the muscles, the energy metabolism, and the regulating activity of the nervous system.

Agility depends on cognitive and coordinative parameters and is characterised by quick perception and comprehension, anticipation skills, correct timing and lightning-fast reactions and actions. Athletics are important in all disciplines. However, strength, speed and endurance are weighted differently.



2.4 Exogenous:

The exogenous performance prerequisites have an external effect on the individual and his or her performance. They can be influenced to some extent and can have a positive and/or negative effect. If you want to achieve optimal performance, you must create exogenous conditions (if necessary, with the support of a staff member).

- The social environment: family, friends, partners, and team members,
- Competitors, trainers, physiotherapists, sports instructors, coaches and
- Officials, association authorities
- Opponents
- Media and press
- Season, climate and weather, temperature, altitude exposure
- Competition organisation, competition facilities
- Ground conditions, material, and equipment

3. Training

The term training is used in different ways.

Training: is a targeted, planned, complex process of action with the aim of maintaining or increasing stress tolerance and performance and adaptive potential.

Goals: Recreational and health athletes train to maintain a healthy level of bone and muscle mass, fitness, exercise tolerance and quality of life.

Competitive athletes seek to exploit their development potential through training to perform at their best in competitive situations.

Planning, control and evaluation: Competitive athletes plan training in the long, medium and short term. They keep a training diary, consistently evaluate the development of performance, and draw conclusions for further planning and continuation of training from their experiences.

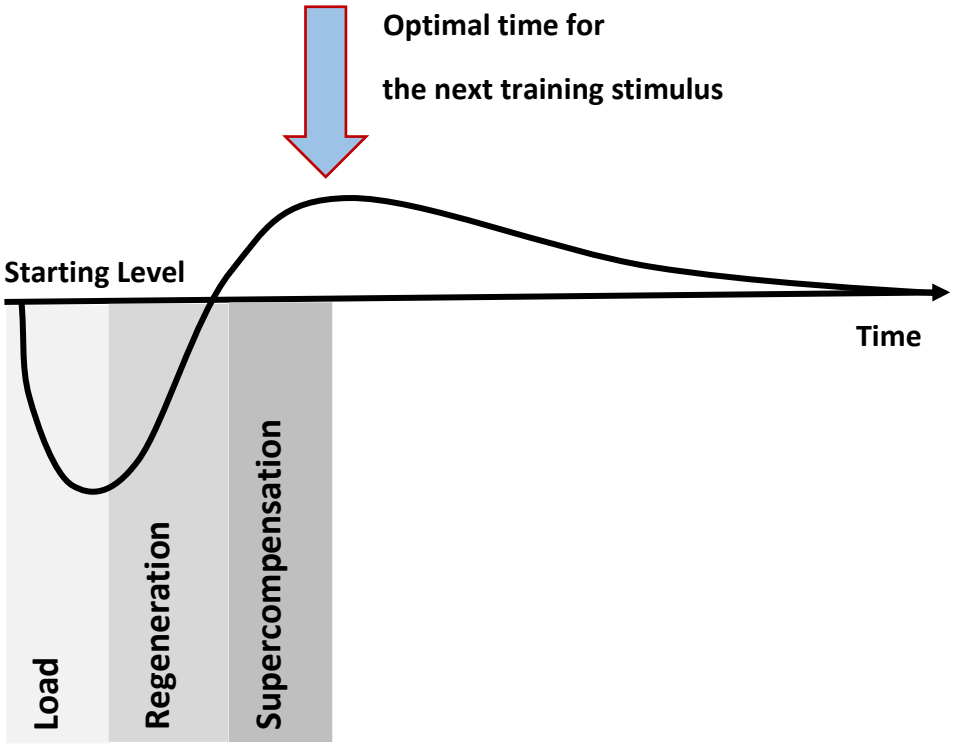
3.1 Biological aspects

Normally, there is a balance in our organism between anabolic and catabolic processes. This balance is called homeostasis.

The homeostasis is disturbed by training stimuli in the sense of excessive stress on cell, tissue, and organ function. The catabolic processes predominate, there is a temporary increase in substance breakdown and the energy reserves, especially the creatine phosphate and glycogen stores, are emptied.

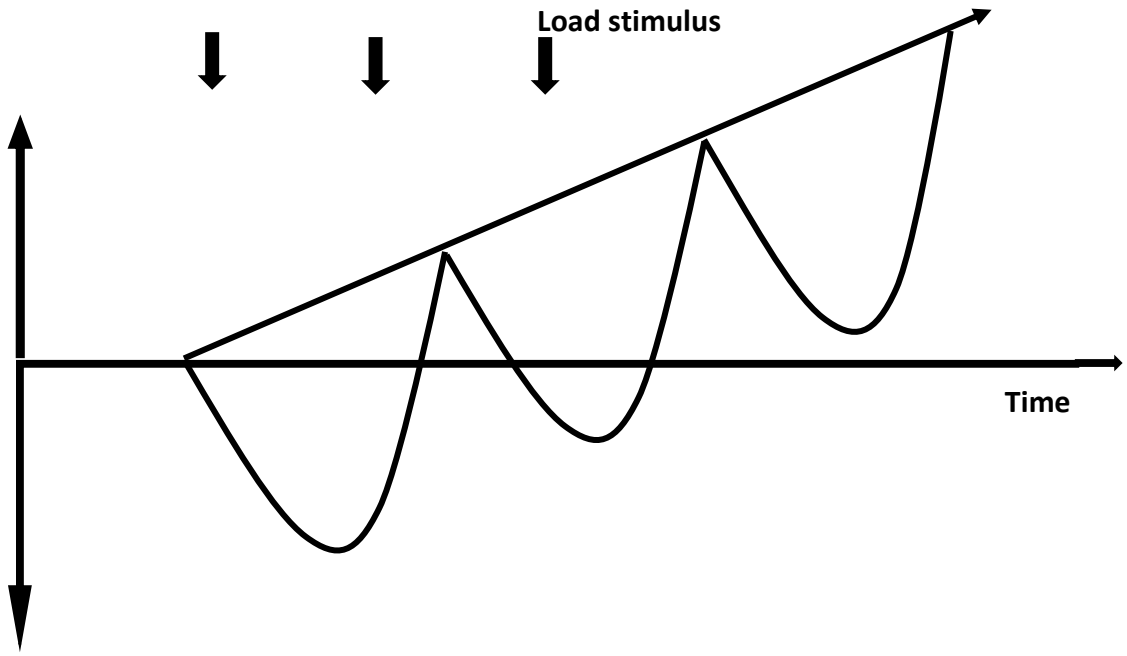
The homeostasis disturbance provokes the cells to intensify the anabolic processes. In the regeneration phase, the loss of substance is compensated and, under the most favourable conditions, overcompensated. Affected structures become more resilient, the muscle fibres accumulate greater energy reserves, and the organism becomes more efficient and resistant to fatigue.

Training effects regress within a short time if new stimuli are not provided within a useful period.



Improving athletic performance through optimally set training stimuli

Level of athletic performance



3.2 Regeneration phase / processes

Load	Training content	Complete recovery
Aerobic endurance training	endurance run	after about 24 - 28 h
Mixed aerobic- anaerobic endurance training	fast endurance run	after about 24 - 36 h
anaerobic-alactacidic and anaerobic-lactacidic endurance training	tempo runs	after about 48 - 72 h
Maximum strength training	1 h hypertrophy training	after about 72 h
Maximum strength training	1 h IK training with barbell	after about 72 h

When the priority is not to recover quickly (e.g., for a competition) but to adapt and improve performance potential, competitive athletes sometimes refrain from taking recovery-promoting measures immediately after training, so that the anabolic effect of messenger substances released during training lasts longer and is strengthened.

Time frame	Regeneration process
Instant regeneration within seconds or minutes	Creatine phosphate depots are replenished. (The half-life for the replenishment of the creatine phosphate stores is 30-60 s)
Short-term regeneration within 6 hours	The accumulated O2 deficit is reduced, the heart rate, blood pressure and respiratory rate are reduced to a resting value. (the half-value time for lactate reduction is between 10 and 25 minutes, depending on the blood lactate level). the fluid and electrolyte balance are normalised. The muscle fibres begin to replenish their glycogen stores.
Medium-term regeneration within 6 to 36 hours	The glycogen and lipid stores in the muscle fibres and in the liver are replenished.
long-term regeneration (days weeks)	the more complex protein synthesis is completed
very long-term adjustments (months)	The connective and supporting tissue adapt

3.3 Training principles

Ethical and educational: the requirements of sport must be in harmony with the social environment, especially with the demands of family, school, and education. The dignity of the human being, his development, his health, his individuality, and his joy of life always have priority over success in sport.

Children differ from young people and both differ from adults in some respects.

This must be considered in coaching, in setting goals and in planning training, in choosing training methods and in dosing the load.

When we organise competitions for children and define rules of play or test regulations, we have to take into account that children have different needs and conditions than adults.

Coaches in sport with children and young people influence the personal development of young people and are obliged to always behave in an exemplary manner when dealing with them.

General methodical training principles: the training must be adapted to the individual needs as well as to the psychological, mental, emotional, and physical prerequisites of the trainees.

The signals of the body must be heard: if you are ill or have just had an infection, you must refrain from activities that put a strain on the heart. The limits of endurance must be respected without compromise.

Weak stimuli do nothing, and too strong stimuli do harm.

Example: training stimuli that improve endurance performance are not suitable for strength training.

The most important prerequisites for optimal recovery include sufficient sleep, a healthy lifestyle, adequate hydration, and a balanced diet.

To increase the load, the following sequence is recommended: first increase the training frequency and then the load density.

Similar training stimuli lose their effect over time. therefore, it is necessary to vary the training parameters systematically and to bring variety into the daily training routine.

Psychophysical stress tolerance must be developed in parallel with the conditional characteristics and the competition-specific prerequisites.

The annual training plan therefore normally has a clear structure with one or two highlights and a preparation, pre-competition, competition, and transition period.

Assessments (tests and competitions) are used to evaluate the effects of training and the development of performance potential.

Load sequence: Coordinatively demanding training contents such as speed and technique training require a recovered state and are at the beginning of a sports lesson (after the warm-up). Strength training is usually done before any endurance training.

Athletes who have reached a high level of performance experience that strength training is not highly effective if followed by endurance training.

Therefore (in competitive sports) strength training must be geared to the requirements of the discipline and be in harmony with technical and speed training.

3.4 Types, content, means and methods of training.

3.4.1 Types of training:

In fitness training: strength and endurance training, high-speed strength

In technique training: slalom, header, and hurdle training

Tactics training: attack, defence, and counter-attack training

Psyche and cognitive: willpower, motivation, attitude, concentration, assertiveness, etc.

3.4.2 Training content (training exercises):

Since practice is the basic activity in the training process for the development of athletic performance, the forms of practice are at the centre of the content of athletic training. The extent to which and the speed with which athletic performance can be improved depends on their correct selection.

We differentiate between:

- General development exercises:

  Create a broad basis for later specialisation.

- Specialised exercises:

  Contain elements of competition discipline and make demands.

  on the organism. Discipline-specific demands on the organism.

- Competition exercises:

  Are largely or completely identical to the discipline.

3.4.3 Training equipment

are facilities, equipment or measures that make training possible.

- Organisational: circuit training, station training.
- Material: Mountain bike, dumbbells, barbells, weight machines,

  weight belts, hurdles, jumping mats, jumping boxes.

- Informative: series pictures, audio-visual media, video feedback

  heart rate monitors.

3.4.4 Training methods

are procedures with which the training content is implemented.

Examples:

- Endurance training:
  Endurance methods, interval methods,
  repetition methods, control, and competition methods.
- Strength training:
  Pyramid training, in technique training: holistic methods.
  Partial methods, mental and observational training
- Tactics training:
  exercises with reduction of the number of players in sports games 3:3, 4:4 etc.

3.5 Loading components

Training frequency: number of training sessions per week.

Stimulus density: Ratio between load and recovery time within a training session.

Loading extent: sum of the exertion stimuli in a training session; distance covered; number of repetitions or series, accumulated ram distances overcome.

Stimulus duration: duration of a single training stimulus or series.

Stimulus intensity: strength of a training stimulus, power (force x speed), degree of effort and quality of execution.

A high stimulus intensity contributes to the development of maximum strength.

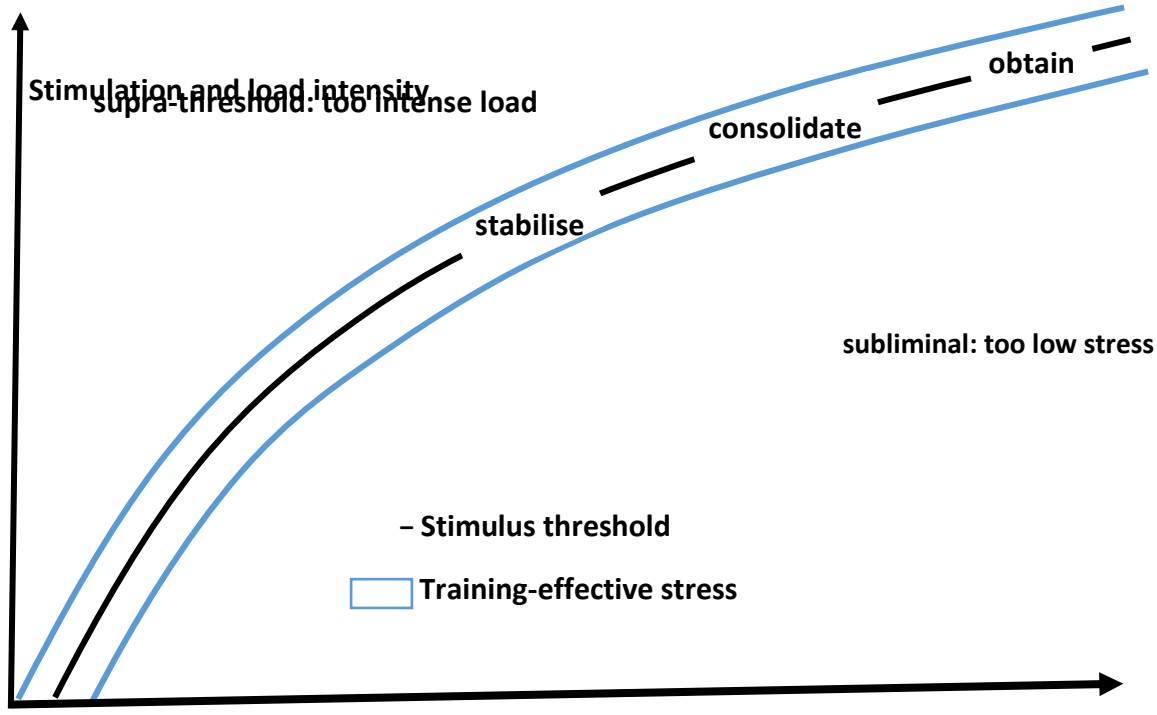
A high stimulus duration is increasingly used to promote strength endurance.

3.6 Load principles

Various factors have an impact on the training process, such as biological, pedagogical, and psychological.

Knowledge of these different principles of load is essential for effective training.

For the training to trigger the desired effect, a certain stimulus threshold must be exceeded. This threshold increases with the level that has already been reached.



Increasing load:

By gradually increasing the load and then the intensity, a stronger disturbance of the homeostasis is induced, thereby increasing supercompensation.

Is mainly used in the youth sector to prevent athletes in growth from being overloaded. Is used in elite sport.

The jumping method is based on a good performance foundation. it is used when there is a stagnation in performance development. The abrupt increase in intensity and volume leads to a further homeostasis in trained athletes and thus to an adaptation.

Alternating load:

Especially in complex sports, such as Tug of War, an important role. This load affects the organism during endurance training the energy stores of the muscle. In strength training, it is the protein metabolism that is stressed. The correct alternation of load allows a wider range and intensity during training.

Periodic loading:

The load cannot remain within the limit of the individual load throughout the year, training planning, periodisation.

The preparation period: Aim = development of athletic form

The competition period: Aim = further development of athletic form through competition participation- peak form.

The transition period: Aim = Active recovery and regeneration of the athlete. To prevent a too strong drop of the performance, a level maintenance is to be aimed at during this time by means of compensatory sports.

Within a training session, the correct load sequence must be selected. At the beginning there are exercises whose effectiveness requires a high condition.

Coordination and Quick strength exercises	**Quickness and Maximum strength**	**Speed and Strength endurance**	**Endurance**

3.7 Training's planning

With the training and competition planning, the goals, the structure, the contents, the methods and the organisation of the training for a defined period are determined.

S	**specific**	this is exactly the success parameter I want to achieve.
M	**measurable**	this is exactly how I will know that I have achieved the goal.
A	**attractive**	that's why it's worth it for me to invest time and train for it.
R	**realistic**	the goal corresponds to my possibilities and prerequisites.
T	**terminate**	at this point I want to have achieved the goal.

3.7.1 Long-term training planning in competitive sport

In long-term, multi-year planning, we distinguish between basic, fundamental, advance, follow-up, and high-performance training.

Basic training:

In childhood, the joy of movement, play and sport is awakened when the innate urge to learn and move can be acted out. The prerequisites for sport to become a lifelong habit and for success in competitive sport not to be excluded a priori must be laid in childhood: age-appropriate, fun-oriented, varied and yet goal-oriented movement, play and sport. Coordination skills are developed, elementary forms of movement (running, jumping, throwing, etc.) are applied and refined, and the technical building blocks are acquired with which complex movement tasks can be solved.

Fundamental training:

is the first stage of sport-specific development. A solid foundation is laid.

- Enjoyment of sport, training and competing
- Attitudes and habits as well as psychological-emotional
  skills such as determination, willpower, concentration ability
  and perseverance, which are important for progressing in sport.
- Psychophysical loads and conditional abilities
  (speed, strength and endurance)
- Movement patterns, core movements and technique building blocks
  on as high a quality level as possible
- Technical and tactical skills
- Physical, cognitive and mental prerequisites for a target-oriented

The following applies to fundamental training:

- Targeted versatility instead of one-sided special exercises.
- the highest priority is long-term, sustainable development, not the achievement of
  the achievement of spectacular success in a particular discipline
- the sport-specific movement repertoire is built up
  without neglecting the comprehensive movement experience

- The physical prerequisites for performance are appropriately

  and harmoniously developed.

- Generally developing training contents are in the foreground and are

  are accompanied by sport-specific support measures.

Young people must also have the opportunity to develop their personality through practical knowledge and experiences in sport. target-oriented build-up training

Advanced training:

is the second stage of sport-specific development of young athletes. The load (volume and intensity) is continuously increased. The specialization is continued and completed. The training is now focused on success and competition. The objectives and the choice of training contents, training means, and training methods are increasingly oriented towards competitive sports.

Follow-up training:

Enables the transition from development to high-performance sports training. The training load (environment and intensity) is increased again. The athletes gain experience in national and international competitions and orient themselves to these standards.

High Performance Training:

This is where the athletes feel their way towards peak performance. They fully exploit the potential for adaptation and development in order to participate successfully in national and international competitions. Means and methods are used that require very high stress tolerances.

Each phase of long-term youth development has its own characteristics in terms of goal setting, the implementation of training principles, the choice of content and the use of means and methods.

3.7.2 Medium-term training planning in competitive sport

Set goals:

We set realistic annual and seasonal goals and are guided by the S-M-A-R-T criteria.

Targets can often only be defined precisely once the requirements profile has been drawn up and the performance profile has been ascertained.

Identify target value:

We analyse the sport and ask ourselves the following questions:

- What physical requirements must be fulfilled in order to achieve the mental and physical stresses in training and competition?
- Which emotional-effective, psycho-mental and intellectual-cognitive abilities are crucial for training and competition?
- Which coordinative and tactical abilities and which technical skills are necessary?
- Which conditional qualities are mandatory for the desired success?

Determine actual value:

We create a performance profile and ask ourselves the following questions:

- what about the resilience and the physical-constitutional prerequisites?
- What about motivation, mental strength, psycho-emotional, mental and cognitive prerequisites?
- How does the athlete behave in training and before, during and after competition?
- What are the physical and coordination prerequisites, what technical and tactical skills does the athlete has.
- How has the athlete trained up to now? What has proved successful? What training aids and methods have been used? How has the performance potential developed?
- What are the current and future conditions and what influence do they have?

An important basis for the diagnosis is a systematic documentation of previous training, test and competition data (training manual).

Take stock:

We compare the performance profile with the requirement profile and elicit the development potential:

- Which requirements have already been met? Which skills are already properly developed? Which skills are available?
- Which strengths can be further developed?
- Where are the deficits and how big are the differences to the requirements profile, to discipline-specific norms, to potential opponents or the best?
- Which deficits can or must be reduced? Which weaknesses can or must be compensated?

Create a concept:

We draw the consequences from the actual-target-value comparison, define the cornerstones of the project based on our experience. We create a concept for training planning.

- Which findings and principles should be implemented?
- Which priorities and focal points should be set?
- How should the loads be dosed, varied and distributed?
- What should be the relationship between volume and intensity?
- How should monotony be avoided and how should variety be brought into the daily training routine?
- How should the regeneration processes be optimised?

The concept forms the basis for planning the training. The training types, contents, methods and means are usually not determined in the training plan, but in the planning of the individual training units.

Design a yearly plan:

We implement the concept in a medium-term training plan and divide the year into preparation, pre-competition, competition and transition periods.

- Where are the highlights of the year or season? Are there one or two competitions that are more important than others?
- How is training periodised?
- When are assessments, tests and competitions?
- Which concrete goals (also partial and intermediate goals) should be achieved and when

(S-M-A-R-T criteria)?

Example: what it could look like

Phases	Type of training	Analysis/ adjustments
Transition phase approx. 1-2 months September- October	**Maintenance training** Balancing sports, sports application training flexibility	with review and outlook target definition season Training design squad/coaches
Preparation phase I approx. 2-3 months October - December	**Basic endurance** Strength training with high recovery numbers approx. 25-30 Compensatory training Longer periods 1-1.5 hours Playful elements, coordination, mobility, etc	Training control pre- and post-training
Preparation phase II approx.2-4 months January - April	**strength building** Strength training with low repetitions approx. 8-12 Preparation of specific muscles: shoulders, legs, torso and hands. Rope work: technical area Circuit and station training for endurance	phase analysis team building
Competition phase approx. 5 months May - September	**Rope training** rope-specific competition pre- and post-processing Regeneration training input setting	position statement corrections if necessary competition analysis

Modify goals and plans:

Occasionally, interruptions in training due to injury or illness, or unexpected successes or failures, force us to redefine our goals, modify our training plan and question our training tools.

The training journal and the evaluation of the training and performance development form the basis for such measures.

3.7.3 Short-term training planning in competitive sport

In the short-term training plans, the objectives, contents and methods as well as the organisation of the training are defined for a micro-cycle (from two to about 14 days). Based on this planning, the individual training units are structured.

3.7.4 Training journal: Basics of Reflection

The evaluation shows the performance development and forms the basis for a possible adjustment of the planning or the goals. Contents, means and methods. All relevant information is recorded in the training book:

- Date and time, place and framework conditions
- Content and methods
- Training load (quality, intensity and scope) of the training.
- The subjective assessment of the person being trained (RPE value)
- Development of performance potential based on test and competition results
- State of health, regenerative measures, if necessary, quality of sleep, body weight and nutrition.
- Sensations and emotions that accompanied or influenced training have shaped

A suitable tool for training evaluation is training monitoring according to Foster:

The RPE scale (1-10) is used to quantify the training load:

0= as at rest; 1= very low; 2= low; 3 and 4= somewhat hard; 5= hard; 6 and 7= very hard; 8 and 9= extremely hard; 10= the hardest training, the hardest competition ever.

The coach defines the planned load for the individual training sessions within the framework of a micro or macro cycle.

The athlete indicates 30 minutes after each training session how he/she felt the load.

In addition, the monotony value is used to record how varied or monotonous the corresponding cycle was.

Foster's tool allows the comparison of the load planned by the trainer and the load perceived by the trainee.

3.7.5 Evaluation criteria: Basics for training evaluation

The basis of the training manual can be used to scrutinise the objectives, the training plan and the implementation of the training, to compare effort and return and to draw conclusions for further planning and for the design of the training.

Medium-term planning therefore also includes defining criteria for evaluating the training and assessing performance development.

- What data should be collected, when, by what means and for what purpose?
- How can I recognise that the goals have been achieved?
- How will the data be evaluated? What criteria will be used to assess performance and success?

In addition to the information from the training book and test and competition results, health and sports medicine aspects must also be included in the evaluation.

3.8 Training in childhood and youth

When planning sports lessons and/or training in childhood and the youth, the principle of individuality and age appropriateness is paramount.

The development of each person is individual and the biological age in childhood and the youth often differs from the calendar age (date of birth). The biological age is the age corresponding to the biological stage of development.

The stage of development shows how far the physical characteristics and intellectual-cognitive, psycho-emotional, mental, affective and social competences are developed.

To determine the biological age, there are statistical average values (norms) for various developmental characteristics:

- The body dimension: growth in length and width as well as body weight and body mass index (BMI).
- The passive musculoskeletal system based on ossification centring on the carpus.
- the physical maturation based on (Tanner stages)
- in relation to motor skills on the basis of coordination tests
- strength and aerobic and anaerobic capacity based on performance diagnostic procedures (field and laboratory tests).

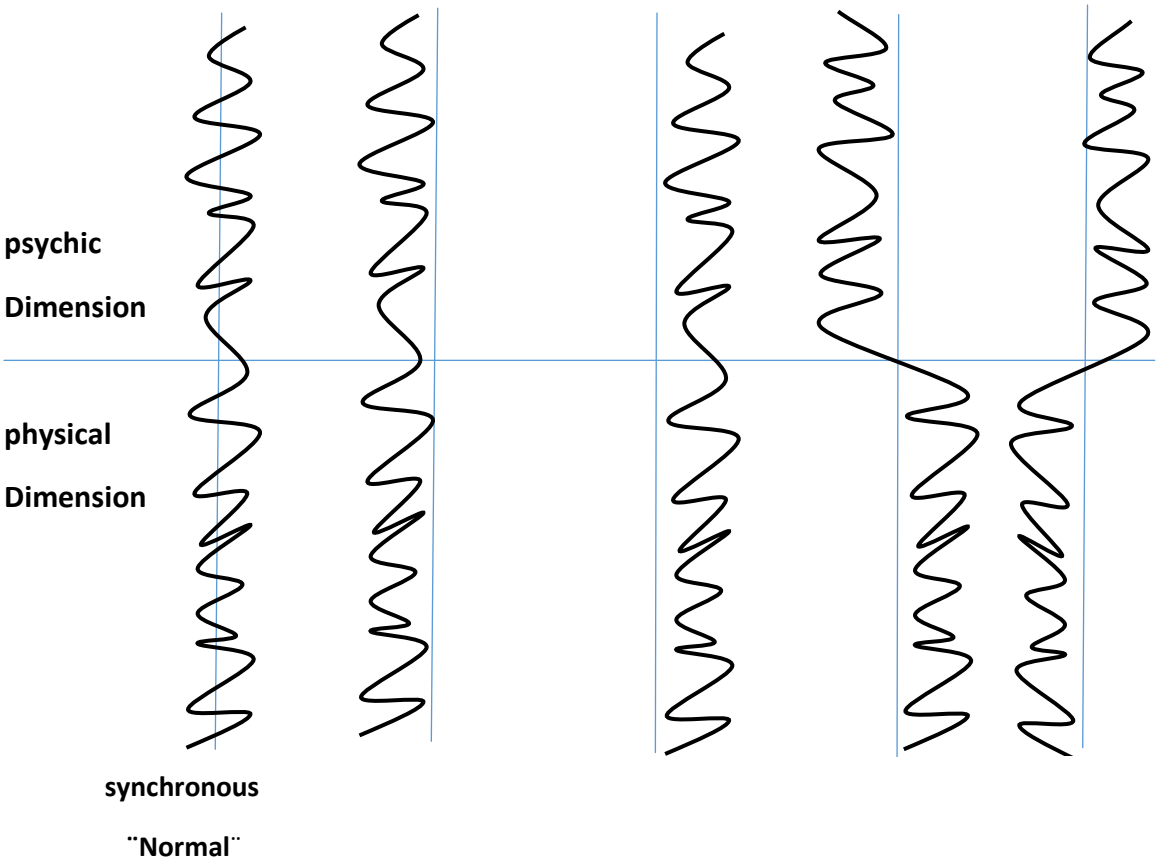
The biological age can differ from the calendar age by several years. For example, among fifteen-year-olds there are those who are thirteen in biological terms and others who are eighteen.

When young people are divided into age groups at a competition, it is not surprising that the accelerated are superior to the retarded and normally developed in certain disciplines. Accelerated athletes are often successful in strength, endurance and game sports (among their peers), while retarded athletes tend to be well prepared for compositional sports such as figure skating, gymnastics and artistic gymnastics.

We distinguish between the following types of development:

- Synchronously-normally-developed individuals correspond to the normative
  the norms in both the biological and the psychological-emotional dimensions.
- Synchronously retarded people are (still) behind the normally developed in all areas.
  behind the normally developed
- Synchronously accelerated people are more developed than the norms in all areas.
  the standards.
- Asynchronously-developed people show a greater discrepancy between physical and
  discrepancy between physical and psycho-emotional development.

between physical and psycho-emotional development.



Retarded children and adolescents still have the significant developmental leaps ahead of them and often have greater developmental potential than accelerated children and adolescents.

Childhood is an important phase for the development of the central nervous system and coordination skills.

Pubescence and adolescence are important phases for the development of physical performance. It is important to make optimal use of both phases.

Children and young people who are supported in a variety of ways have a better chance of success in the long term than those who are too early and one-sidedly supported in a single discipline.

Children and adolescents in competitive sport must receive sports medical care.

4-year plan to develop the basics for training at junior age.

The development of the coordinative-technical and physical athletic basics is shown by means of an example (squats with the barbell).

Year 1 preparing exercises	**Year 2** Training exercises
Development of the physical conditions Trunk stability Leg axis stability Strength legs without or with low load (e.g., pistol squats) mobility in the ankles Mobility in the hip joints	**Further development of the physical and coordinative-technical prerequisites** Integration of the squat exercise into the training process Control of movement quality with low to medium loads
Development of the coordinative-technical prerequisite Different forms of squats with a wooden bar: Pull squat, front squat, back squat Lunges	**Training volume** 3-5 sets of 6-10 repetitions **Implementation modalities** Different speeds of movement Low to medium loads
Test exercises Pistol squats Pull squats Shoulder through with stay Deep squat along a bar	**Test Exercises: 5RM** and technique analysis

Year 3 Performance exercises	**Year 4** Performance exercises
Improve muscle performance Phase 1: Hypertrophy Phase 2: Intramuscular coordination **Phase 1: Scope and intensity** 3-5 sets of 6-8 repetitions Eccentric slow-concentrated quick 60-70% 1RM **Phase 2: Scope and intensity** 3-5 sets of 3-5 repetitions Eccentric slow-concentrated explosive 80-90% 1RM	**Optimising muscle performance** Phase 1: Hypertrophy Phase 2: Intramuscular coordination **Phase 1: Scope and intensity** 3-5 sets of 6-8 repetitions Eccentric slow-concentrated quick 70-80% 1RM **Phase 2: Scope and intensity** 3-5 sets of 3-5 repetitions Eccentric slow-concentrated explosive 90-95% 1RM
Test Exercise: 5 RM and Technique Analysis	**Test Exercise: 3 RM**

4 Physical performance factors

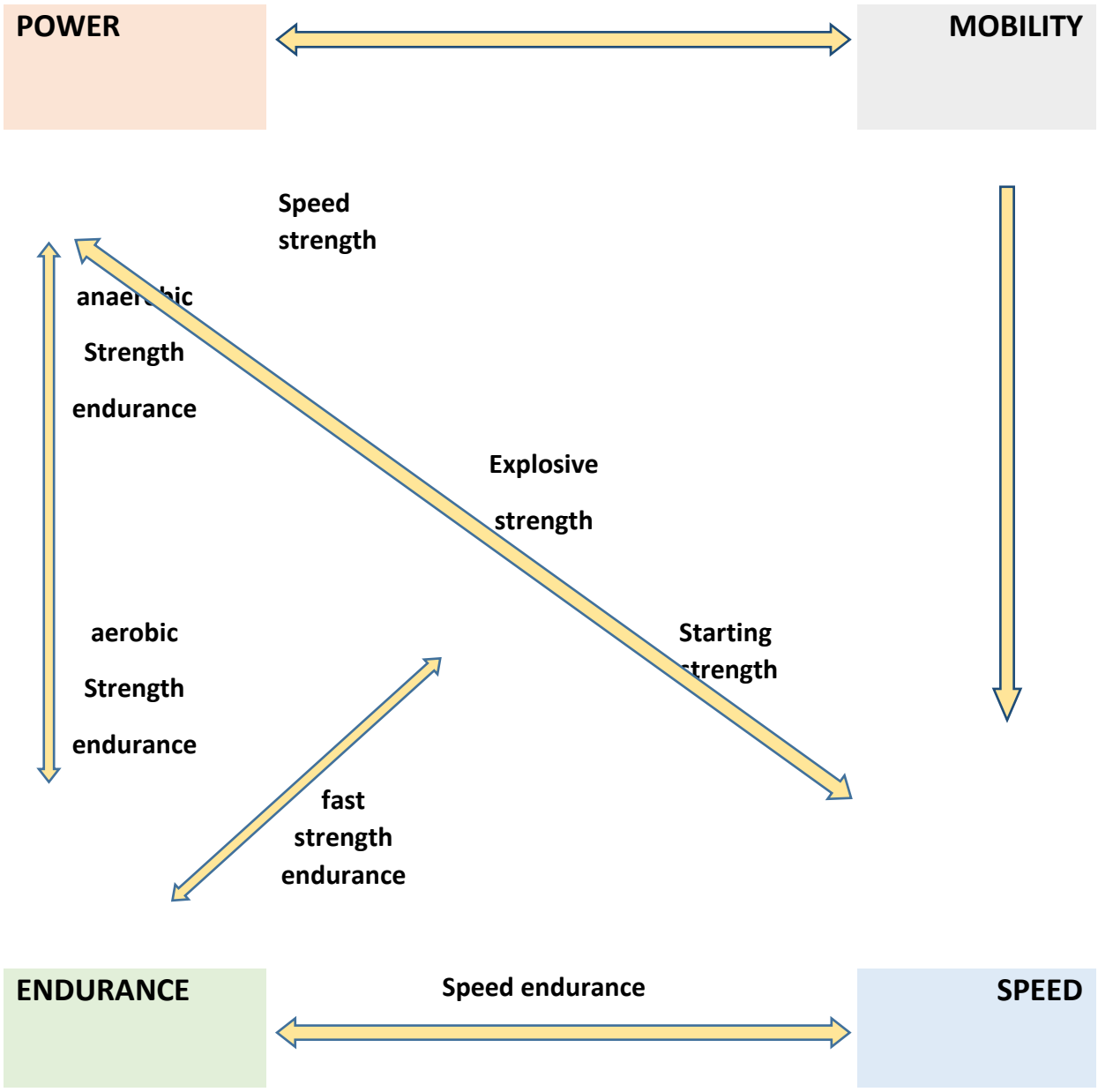
4.1 Endurance training

Definition

Endurance is generally understood as the athlete's psycho-physical resistance to fatigue.

Psychological endurance is the athlete's ability to withstand a stimulus that prompts him to stop exertion for as long as possible.

Physical endurance is the fatigue resistance of the organism or individual subsystems.



Endurance plays an important role in almost all sports. In a way, it is the basis for conditioning and rope pulling training. Poorly developed basic endurance prevents effective training because premature fatigue makes an intensive programme impossible.

Individual pulls can range from about 45 seconds to 10 minutes. The tournament can run more than 2 hours, endurance takes a dominant position.

Under no circumstances should the other physical performance factors (strength and speed) with their interrelationships be neglected.

Outdoor

Indoor

4.2 Types of endurance

Endurance structures	Types of endurance	Time allocation
Training area	Basics I + II	
	Competition endurance (sport-specific)	
Stressed musculature	General endurance: > 1/7 to 1/6 of the total muscle mass.	
	(during static or dynamic exercise)	
	Local endurance: < 1/7 to 1/6 of total muscle mass	
	(during static or dynamic exercise)	
Physiological aspects (energy)	Aerobic capacity: performance at the anaerobic threshold	Basics I
	Aerobic capacity: fatigue resistance at aerobic threshold performance	
	(with sufficient oxygen uptake)	
	Anaerobic capacity: Performance that can be achieved above the anaerobic threshold.	Basics II
	Anaerobic capacity: tolerance of acidosis,	
	(insufficient oxygen uptake)	
Conditional interrelationships	Strength, quickness, speed and sprint endurance	
Duration of the stress	Short-term	30 s -2 minutes
	Medium duration	> 2 - 10 minutes
	Long-term endurance I	> 10 - 30 minutes
	Long-term endurance II	30 - 90 minutes
	Long-term endurance III	90 - 360 minutes
	Long-term endurance IV	> 360 minutes

Static and dynamic endurance	Force application (Maximum Isometric Strength MIS)	
	Aerobic path	< 15 %
	Aerobic/anaerobic path	15 -50 %
	Anaerobic path	> 50 %

The illustration shows that there is no such thing as endurance.

Instead, from a metabolic point of view, there is a multitude of gradually graduated sport-specific mixed forms of an aerobic-anaerobic nature.

These fill the space of the polar opposing aerobic and anaerobic energy supply.

4.2.1 Importance of basic endurance

Although endurance is a fundamental prerequisite for the athlete's performance, it must not be seen in relation to the requirements of the respective sport. The importance of an individual factor must therefore always be seen in relation to the whole.

A well or sufficiently developed basic endurance - it is a basic prerequisite for all sports to increase athletic performance - has a positive effect:

Increasing physical performance has a favourable effect on both the competition performance itself and the resilience in training. Premature fatigue is shortened.

Optimising the recovery capacity of the endurance-trained athlete can eliminate fatigue substances more quickly and compensate for energy bottlenecks more effectively. In addition, the athlete recovers more quickly after training and competition.

Minimise injuries: Athletes who are better trained are less likely to get injured than those who tire early.

Increasing mental resilience: Athletes have an increased resistance to stress and greater mental stability. they are better able to cope with failure. (Motivation)

Consistently high reaction and action speed due to better recovery ability. The central nervous system is less affected in its performance.

Avoidance of fatigue-induced tactical misbehaviour: due to the lower level of over-acidity, the athlete remains tactically disciplined.

More stable health: the endurance-trained athlete (hardened) improves his immunological defences so that he is less often ill with banal infectious diseases such as colds, coughs, influenza, etc. Health is the athlete's highest asset, because only a healthy athlete can work hard.

4.2.2 Methods and contents of endurance training

Continuous methods The endurance method focuses on continuous exercise of low to medium intensity and relatively long duration of aerobic endurance capacity.		
Training effect	Basic endurance Strength endurance	
Distinction	Extensive: Intensive:	aerobic range Anaerobic threshold
Physiological effect	Economisation of the metabolism Cardiovascular regulation Capillarisation Oxygen uptake capacity	
Pedagogical-psychological effect	Willpower Perseverance Hardness against oneself	
Interval methods The interval method sets distinct training stimuli regarding heart enlargement as well as the improvement of carbohydrate metabolism. (anaerobic and aerobic capacity). The intensity, the distance and the length of the course		

	are pronounced.	
Training effect	Extensive:	Basic endurance
	Intensive:	Special staying power
		Speed endurance
Physiological effect	Extensive:	Improved capillarisation
		Increased oxygen uptake capacity
		Economisation of muscle metabolism
	Intensive:	Cardiovascular regulation
		Economisation of metabolic processes
Pedagogical-psychological effect	Willpower	
	Ability to increase.	
	Switching ability	

	Repetition methods The repetition method is therefore a very efficient method for improving the special auditory system, which contributes to improving the regulatory mechanisms and capacities of the cardiovascular and respiratory systems as well as metabolism in an extraordinarily complex, but very differentiated controllable way. The principle of complete rest to avoid premature fatigue build-up is in the foreground.	
Training effect	Short	Maximum strength
		Quick strength
		Maximum speed
		Acceleration ability
		Speed endurance
	long	Increase aerobic capacity
		Improvement of the special stamina
Physiological effect	Muscle growth (during short runs with max. intensity)	

	Economisation of the metabolic processes Increase in energy reserves.
Pedagogical-psychological effect	Willpower Increase to the highest individual performance. Competition-specific load tolerance

Competition method

With the help of the competition method, only the special endurance skills of the competition discipline are trained. In addition to this high degree of specialisation, this method also offers the possibility of acquiring competition experience and competition toughness, improving tactical behaviour and the tactical study of opponents. It is the most complex training method, as it trains all the skills specific to the respective sport (Tug of War) at the same time.



4.2.3 Special forms of training

Altitude training

High altitude training is the training method that results in the most pronounced relative increase in red blood cells; otherwise, due to the parallel increase in blood plasma, there is an absolute increase in this oxygen-transporting blood fraction.

The great art of altitude training is to set loads in such a way that they contribute to the development of the cells and do not destroy them.

Variable-pace-running

Due to the periodic alternating accelerations, there is a temporary increase in the use of anaerobic capacity. The organism - especially the muscle cell - is therefore constantly forced to switch between aerobic, aerobic-anaerobic, and anaerobic energy production and constantly adjust to the different metabolic requirements. The repeated crossing of the -anaerobic threshold- leads to special changes in the enzyme systems responsible for aerobic and anaerobic energy production and has a particularly favourable effect on the ability to endure and compensate for temporary bottlenecks in oxygen supply.

This method is especially important within the Tug of War training. The constant alternating movement, which can change the loads.

Rope specific Example:

cardiovascular training

In the Tug of War, good basic endurance is important because it not only increases performance, but also helps prevent injuries, strengthens the immune system and the psychological and physical forms of stress.

The different types of load should be considered in the training.

The best basis for the time load should be at least 50 minutes.

Biking, ski touring, jogging, etc. By increasing the intensity in the meantime (sprints, cadence increase), it is also possible to improve the aerobic threshold.

strength endurance at the gantry

The aim is to improve the aerobic capacity of the body.

the weight can be freely defined on the trestle. The variable floor conditions (hard, soft, sand, stairs) also contribute to the competition conditions.

Time limit 6 -8 minutes, weight from 66-76% of maximum power potential

Repetition limit, 16 times, weight 56-66% of maximum power potential

In addition to the cardiovascular system, variable posture work can be used to train the legs, back, shoulders or arms and hand strength.

(sports hall) general interval training

Different variants can be carried out in the sports hall. Whether it's ball tables, partner exercises, playful forms, barbells or dumbbells. Circus training is often used. It is important to consider the stage of preparation the athlete is in. Basic training, I or II, strength training (extensive) or competition preparation (intensive).

The individual forms of training are adapted to the time parameters.

e.g., warm-up with movement exercises, playful ball games such as hockey, football, basketball.

Set up a circuit with about 10 stations.

Execution of exercise = 1 min, break = 1 min. exercise = 2 min, break = 2 min, exercise = 3 min, break = 3 min.

after the first round approx. 10 min. break and then another round.

As a rule, the harder the training, the shorter the total time of the session.

Run out and stretching after training.

on a rope:

The same methods are used for this as in the sports hall. For variety, the surface can be varied.

Sand track, stairs, hard natural ground, wet deep natural ground form the basic conditions. The load is between 63-78% of the maximum performance. 1-2 teams are needed, depending on the execution of the training sessions.

In preparation for the competition, when the 5 m distance is covered before the time limit, the runner returns to the starting position and continues in the same way.

A lot of attention is demanded from the trainers and coaches. That can optimally address and improve the physical performance increase of the athletes.

4.2.4 Endurance training in childhood and adolescence

Since the cardiovascular system of children and adolescents does not react differently to training stimuli than that of adults, no damage is to be expected when performing endurance training, but rather positive adaptive changes.

Children show a considerable improvement in their endurance performance when they are trained regularly, whether through runs over longer distances - periods of time - or through running games such as football.

The joy of endurance training stands and falls with the way it is carried out.

Methodological principles:

Endurance training in childhood and adolescence primarily serves to develop good basic endurance and thus to improve aerobic capacity.

The test distances should not be the 600 to 1200 metre runs that have usually been required up to now, as they contain too many anaerobic components. Instead, 5-, 10- or 15- minute runs should be chosen, initially at any desired running speed.

Endurance training should be carried out in some form, especially making use of the Small and Big Games, to a sufficient extent in every sports lesson.

For aerobic endurance training, there is at most a start too late, but not too early!

Aerobic endurance capacity is best trained by girls in the 12th/13th year of life and by boys in the 13th/14th year of life.

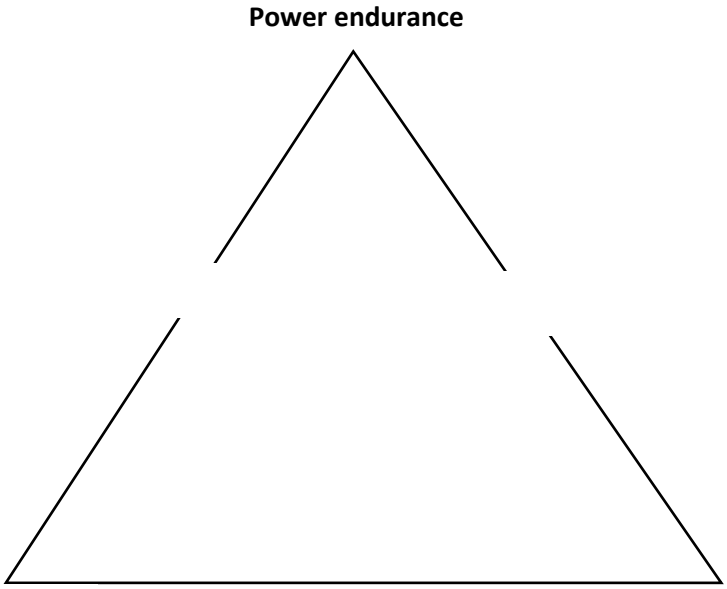
Endurance training should be extensive and not intensive.

Endurance training should be varied, entertaining and appropriate for children. It should be fun and meet the children's imagination.

The selection of training methods and contents should correspond to the psychological preconditions of the children and adolescents.

5 Power training

Power is the most important prerequisite for withstanding the earth's gravitational field. It is the basis of all physical performance and an important element of quality of life. Power training improves the load tolerance of the active and passive structures of the movement and support system and prevents injuries. It develops the stability of the trunk and joints and optimises the prerequisites for performance in everyday life and sport. Moreover, power training can strengthen self-esteem and self-confidence by also influencing physical appearance.



5.1 Types of power

Before going into a special subdivision of the types of power, it must be stated in principle that power or its various manifestations can always be considered under the aspect of general and special power.

General power is understood to be the sport-independent power of all muscle groups. Specific power refers to the typical manifestation form of a particular type of sport and its specific muscle correlate (i.e., the muscle groups and fibre types involved in a particular sporting movement).

character of muscle tension is extraordinarily varied and influenced by a multitude of factors.

A precise definition of the concept of power is therefore only possible in connection with the following types of power manifestation.

5.1.1 Maximum power

A distinction is made between static and dynamic maximum power. The static maximum power is the highest power that the nerve-muscle system can exert during voluntary contraction against an insurmountable resistance. The dynamic maximum power, on the

other hand, is the highest power that the nerve-muscle system can realise during voluntary contraction within a movement sequence.

The maximum power depends on the following components:

- the physiological muscle cross-section
- Inter-muscular coordination (coordination between the muscles working together in each movement).
- intramuscular coordination (coordination within the muscle)

An improvement in maximum power can be achieved via each of these three components.

With the help of Intramuscular Coordination Improvement, it is possible to increase power without a significant increase in cross-section and weight. This is especially important in sports where the body's own weight has to be accelerated.

5.1.2 Absolute power

Only the absolute power is higher than the maximum power. It represents the sum of maximum power and power reserve, which can only be mobilised under special conditions (fear of death, hypnosis, etc.).

Power deficit is the difference between absolute power and maximum power. The higher the level of training, the smaller the power deficit.

5.1.3 Quick power

The quick power includes the ability of the nerve-muscle system to move, the body, parts of the body (legs, arms) or objects (e.g., balls, locks, discs etc.) at maximum speed.

Higher speeds can be achieved with lower resistances and lower speeds with higher resistances.

The quick power is therefore dependent on the start, explosive and maximum power.

The similarity of the power curve characteristics with the competition exercise is an important selection criterion for sport-specific and thus effective training exercises!

At low resistances, the starting power dominates, with increasing load and thus prolonged use of power, the explosive power dominates, with very high loads, finally, the maximum power dominates.

5.1.4 Relative power

Relative movement behaviour is the ability of the organism to realise the highest possible concentric power impulse in a short time from a decelerating (eccentric) movement.

In Tug of War especially when blocking a counterattack and executing a counterattack.

5.1.5 Power endurance

Power endurance can be defined as the organism's ability to withstand fatigue during prolonged power output. Depending on the intensity of the contraction power developed, power endurance may have more aerobic or anaerobic or mixed metabolic components.

In training practice, the respective sport-specific load situation must be considered through appropriate training.

The following basic requirements must be observed:

- Power endurance skills are a performance-determining factor in all endurance sports with clear discipline-specific demarcation and growing importance
- higher resistances than in competition
- multiple repetition of training stimuli
- The approximation/conformity of the training forms with the force-time sequences of the movement structure of the competition.
- targeting of major muscle groups (agonists and antagonists)
- a controlled physiological effect
- a blocking of the micro cycle

Discipline-specific strength skills require year-round development/stabilisation until relatively close to the key competitions. This requires increasing strength training stimuli throughout the mesocycle and macrocycle of the year.

The main content of the strength training must match (be aligned) with the main task of the training in the respective micro cycle and mesocycle.

6 Methods and contents of strength training

6.1 Methodical aspects of strength training

The structure of strength includes 4 stages, which are passed through with different accents and priorities in school, health, and senior sports, as well as in fitness training and in competitive and high-performance sports.

LEVEL	Goal	Methods, training tools and training intensity	Structure
4	Improve stiffness Reactive strength and Increase explosive power	Reactive muscle power with short or long stretch-shortening cycle (polymetric training) Complex and contrast method	
3	Improve intramuscular coordination. Recruitment, synchronisation, and frequency ability	IK Training Explosive-concentrated muscle work with 85-95% 1RM, 2-5 reps/set breaks 3-4 min, 2-5 sets, set breaks 5-10 min Eccentric muscle work; low jumps	3-week cycles 100%; 80%; 30%
2	Develop muscular strength potential, build muscle mass and increase exercise tolerance.	Hypertrophy training Time under Tension 90-120 s slow muscle work 4-10 s concentric, 2 s hold, 4-10 s eccentric until local exhaustion Sets with pre- and post-fatigue, forced and assisted repetition	4-week cycle 60%; 80%; 100%; 30%

1	Working out the basics Acquire techniques of strength training Improve load tolerances, trunk, and joint stability	Extensive strength training with the Thera band, on machines (12 repetitions with 60-70% 1 RM), with small dumbbells, training with the Swiss ball, jumping rope, jumping on mats; forwards, backwards, sideways, functional training.	the basis, especially the stability of the torso, must be permanently developed further.

6.2 Control variables in power training

Depending on the goal and purpose of the strength training and depending on the needs and prerequisites, we choose different types of stimuli, a higher or lower stimulus intensity, a smaller or greater stimulus volume, a smaller or greater training frequency, different training means and corresponding execution modalities.

Control variables	**Examples**	
Stimulus type	static (isometric)	Tense the muscles continuously or intermittently. Apply the force slowly or quickly to explosively against a rigid resistance.
	Dynamic (auxotonic)	Apply the power concentrically, eccentrically, isokinetically, stato-dynamically, elasto-dynamically, or relatively.
Stimulus intensity	Performance: Power x speed	In hypertrophy training: 70-80% 1 RM isokinetic use. In IK training use 90-100% 1 RM explosively.
Stimulus duration	Load duration (circumference or volume)	In hypertrophy training 90-120 s (Time under Tension!)
	Number of repetitions per set	In hypertrophy training: 8-12 reps. In IK training: 2-5 reps.

	Number of sets per Training session	1-set training doer 3-8 sets per exercise (whereby the exercises should be varied)
Stimulus density	Ratio of load and recovery within the framework of a training session	Duration of the pauses between sets: in hypertrophy training: 2-3 min In IK training: 3-5 min
Training resources	Training with or without equipment	Own body mass, dumbbells, barbells, medicine balls, elastic bands, weight machines, etc.
Number of sets	**In health and fitness sports**: Optimal ratio between effort and return: 1 set leading (within 90-120 s) to local exhaustion, momentary muscle failure. **In competitive and high-performance sports** (3-8 sets): distinction between ¨High Volume Training¨ and ¨High Intensity Training¨. High volume training: relatively large volume with medium to high power input (70-80% 1 RM) and a tensioning time of 90-120 s (hypertrophy training). High intensity training; 1-5 repetitions with large, explosive power input (IK and explosive training). (IK and explosive training)	
Execution-modalities	**In basic and hypertrophy training**: continuous, slow-isokinetic (4-10 s concentrically, 2 s hold, 4-10 s eccentrically) or as a series of sets of 3-5 repetitions, with pauses of 5-10 s between the sets (cluster method). **In explosive power training**: explosive, reactive, plyometric: training with the greatest possible impulses.	

6.3 Recommendations for strength training

How do we want to design the strength training? What are the needs and requirements of the trainees? What should be achieved with the strength training?

6.3.1 Recommendation for the design of a training session

In strength training, it is advisable to follow the generally applicable methodical training principles and to proceed as follows in a training session:

Prepare yourself physically and mentally for the training, warm up, mobilise the joints and increase the reflex and contraction readiness of the muscles through toning measures.

- Choose the methods, the loads, the number of repetitions and sets as well as the execution modalities according to your individual prerequisites and goals.
- Perform each exercise correctly, especially stabilising the torso. Quality is more important than quantity.
- Adapt your breathing to the exercises and, as a senior and health athlete, refrain from press breathing.
- Start with the big muscle groups
- If necessary, stretch the corresponding antagonists before the individual exercises.
- Ensure the transfer of the training effects by recalling complex coordination patterns from everyday motor skills or competition disciplines after a simple coordination exercise.
- Actively recover between sets; drink, loosen muscles and stretch lightly.

Initiate regeneration with gymnastic exercises, mobilise the joints, stretch the muscles slightly, run, but do not do endurance training if you are primarily interested in gaining strength. Drink enough, eat according to your needs, relax consciously, and avoid alcohol.

6.3.2 Recommendations for the choice of training exercises

For general strength training in school, recreational and fitness sports as well as in basic and supplementary strength training for competitive sports, we choose:

- which promote trunk and joint stability
- which address the various muscle groups in a balanced relationship
- which use the functional units of the neuromuscular system (extensor and flexor loops) as a whole
- which place appropriate demands on the stability and balance of the body, and which require tone control and optimal coordination of the muscles. (sensorimotor training).
- which include a stretching component
- where the muscles are activated dynamically (concentrically and eccentrically), and those in which they do not perform holding work.
- in which a large push of force is generated in a short time, so that the fast motor units are activated and trained (IK training).
- in which the muscles work reactively, in that a short eccentric phase is followed by an explosive concentric effort (development of reactive strength and stiffness).
- On weight machines, when the main aim is to increase or maintain the mass of individual muscles.

6.3.3 Special aspects of strength training in competitive sports

In technique-oriented strength training, we focus on:

- on the performance-determining muscle groups and fibre types
- on the discipline-specific dynamics of the use of strength
- on the relevant types of adaptation and joint angle ranges

In supplementary strength training in competitive sports, we pay special attention.

- Balance and harmonisation: care of the less stressed muscles
- Developing the load tolerance of all performance-determining muscle loops

- Prevention of neuromuscular imbalances and damage that can result from overload and overuse.

Competitive athletes also pay attention to

- that the effects of strength training are only available after a time delay of several days or weeks (long-term delayed training effect).
- that the transfer of the training effects must be ensured by accompanying technique training.
- Strength and endurance cannot be trained at the same time
- that the effects of strength training quickly disappear if the training is not carried out.

6.4 Organisational forms in strength training

The following forms of organisation have proven successful in strength training:

6.4.1 Station training

Training is done at 3-5 stations. At each station 2-5 sets (with the same or different exercises) are done for the same muscle group. Then you move on to the next station. pauses between sets 2 min; between stations 3-5 min.

Examples with three stations:

1st station: 3 sets of 8x bench press each.

2nd station: 3 sets of 8 barbell deadlifts each

3rd station: 3 sets of 8 pull-ups each

Station training takes a relatively long time, but it is efficient and the most frequently used form of organization in competitive sports.

6.4.2 Circuit training

Training takes place at 5-12 stations. When arranging the stations, make sure that the muscle groups are addressed in a sensible sequence. At each station, a set (a certain exercise) is done and during a break you change to the next station, in total 2-4 runs are completed.

Load time per station: 30s to 2 min

breaks between the stations 10-30 s, between the rounds 2-3min.

Example exercises of a circuit training: one for the arm flexor - one for the leg extensor - one for the anterior trunk muscles - one for the arm extensor etc.

Application: Fitness training in schools and clubs, general fitness in performance training.

6.4.3 Set training

Training is done at 3-8 stations. At each station 2-3 sets are done in direct succession, with each set targeting a different muscle group.

Pause between sets 10 s, between stations 3 min.

Example:

One station includes 3 sets: 1 set of pull-ups, 1 set of squats and 1 set of bench presses.

Used in competitive sports when an efficient strength training programme is to be completed in a relatively short time.

Super sets, variation A: 2 sets with 2 different exercises for the same muscle group are combined into a series and completed directly one after the other. The (more complex) ¨main exercise¨ is performed first.

Example:

1st series: 1 set of squats with barbell and 1 set of knee extensions on the machine

2nd series: 1 set of box jumps and 1 set on the leg press.

3rd series: 1 set of bench presses and 1 set of butterflies with dumbbells

Variant B: 2 sets of exercises for a pair of antagonists (flexors and extensors) are combined into one series and completed directly one after the other.

Example:

1st set: 1 set for the leg extensors and 1 set for the leg flexors.

2nd series: 1 set of bench presses and 1 set of pull-ups

3rd series: 1 set for the hip flexors and 1 set for the hip extensors.

Breaks between sets 20 s, between series 3 min.

Use in competitive sports as hypertrophy or IK training, depending on the choice of exercise and type of execution.

6.4.4 Pyramid training

the same exercises are completed several times in a row. The load is increased from set to set while the number of repetitions is reduced.

pauses between sets 2 min.

Example:

Bench press: 8x80% 1RM,4x90% 1 RM,2x95% 1RM and then 1x 100% 1RM.

6.4.5 Contrast method

2 exercises are combined in direct succession to optimise the discipline-specific strength set.

Example:

Jumping force: optimisation of the vertical drive

3x squats with the barbell and then 5 double-legged hurdle jumps

Pull optimisation of acceleration at take-off.

5x left and right single-legged squats and then running jumps over 30 m.

6.4.6 complex method

Several series of strength exercises are done and then followed by several series of discipline-specific strength sets.

Example:

5 sets of 5 deep squats each, single leg left and right, and then.

5 sets of 5 hurdle jumps each

6.4.7 cluster method

within a series of 5-10 short sets of 3-5 brisk repetitions (with approx. 80% 1 RM9 pauses of 5-10 s are made.

Example: (3/7 protocol

5 sets with increasing number of repetitions and a load of 80% 1 RM

1st set: 3 reps. 2nd set: 4 reps, 3rd set: 5 reps, 4th set: 6 reps, 5th set: 7 reps,

8 s rest between each set

6.5 Dynamic versus static strength training

A breakdown of the different training methods seems to make sense under the aspect of the types of tension.

Dynamic strength training is divided into positive dynamic and negative dynamic strength training.

6.5.1 Positive dynamic strength training

= overcoming = concentric = shortening = accelerating strength training

Depending on the type of exercise and the number of repetitions, dynamic training can be used to train maximum strength, high-speed strength, or strength endurance.

It is particularly suitable for muscle-building training, as it is not too physically or mentally demanding with low to medium resistance levels, a moderate speed of execution and a high number of repetitions. After concentric exercise, the muscles recover more quickly from the load than with other training methods.

The methods used are classical, contrast, decreasing load, pyramids, pre- and post-fatigue and should be given more attention as the variety for the muscles is always exposed to new stimuli.

6.5.2 Negative dynamic strength training

= yielding = eccentric = braking = decelerating strength training

Note: To prepare for eccentric training with heavy weights, the athlete should first practise slowing down with negative dynamic exercises with their own body weight. Only then should they work with progressively descending additional loads. Increasing the load in this way helps to prevent injury.

Eccentric training should never be done on its own, but always with concentric methods - also other combinations.

Eccentric training enables muscular tension peaks that are far above the positive dynamic and static values.

Methods used are: 120-80, eccentric-isometric, note that these methods are only suitable for high-performance athletes who are used to eccentric loads and are prepared accordingly.

6.5.3 Isokinetic strength training

has the characteristic of uniform movement (iso = equal; kinetic = moving). Isokinetic training equipment ensures constant resistance and speed in every phase of the movement.

Both positive and negative dynamic work is performed.

This form of training mirrors the forces exerted on the athlete during the Tug of War.

This method serves as a specifically important training for the athletes in the Tug of War.

6.5.4 Plyometric training

Also known as low jump training.

is an interplay between negative dynamic and positive dynamic training. Plyometric training in combination with other training methods can be highly effective in improving all levels of speed, reactivity, and quickness.

6.5.5 Static or isometric strength training

Isometric training in its various forms should never be used in isolation to improve maximum or rapid strength or strength endurance. In combination with the following plyometric, concentric, or eccentric training, however, the method is highly effective, as the muscle is fully activated, and the nervous capacity can be fully utilised.

Example without additional loads:

Holding the push-up position elbows bent 90° = strengthening the arm extensors

Holding the pull-up position arm flexor 90° = strengthening of the arm flexors

Holding the one-legged squat knee bend angle 90° = strengthening of the leg extensors.

The same exercises as above can be performed with additional loads.

Additional loads = lead waistcoat, sandbag, partner, weight plates etc.

6.5.6 Maximum isometric

Maximum back pressure is generated against a fixed resistance (e.g., horizontal bar) over a period of four to six seconds. This method is only useful if it is performed with maximum effort. Goal: Maximum strength development

6.5.7 Total isometry

In this method, low to high loads are held at a specific angle - e.g., half squat - until fatigue sets in. The strong muscle activation that occurs here represents a strong hypertrophy stimulus = muscle growth.

6.5.8 Electrostimulation

can be carried out in isometric form but also in dynamic form. A distinction is made between local and whole-body stimulation.

With electrostimulation, muscle contraction does not occur via a central nervous controlled voluntary impulse, but via an electrical stimulus. It is suitable for increasing muscle strength or hypertrophy training, but not for technical-coordinative training.

Electrostimulation training therefore has a potential for injury and damage that should not be underestimated if it is used incorrectly.

It can be used in many ways in prevention (sarcopenia and osteoporosis prophylaxis) and rehabilitation (rapid muscle development after injuries).

Enables isolated and thus targeted training of important muscle groups.

6.6 Power training in childhood and adolescence

The general value of training-integrated (homework) strength training in childhood and adolescence results from quite different needs.

The school is obviously not able to compensate for the strength deficits caused by the chronic lack of exercise in our time, which not only relate to the trunk but also to the entire extremity's musculature, the club must take over these tasks. If possible, this should be done in cooperation with the school.

Targeted and age-appropriate strength training in the sense of postural prophylaxis to increase athletic performance is therefore necessary.

It is also important to note that untrained, weak pupils improve through dosed strength training. Thus, strength training appropriate for children develops characteristics that have a mixed effect on increasing general athletic performance.

If the training is exclusively sport-specific and only involves typical forms of stress, the muscles are loaded one-sidedly. Some muscle groups are trained very strongly (e.g., the running and jumping muscles of the legs), while other muscle areas are criminally neglected (e.g., the shoulder or trunk muscles).

This can lead to the development of muscular imbalances already in childhood - this can be observed very often - which later impede further performance development and promote muscular injuries.

6.6.1 Tips of strength training in childhood and adolescence

In selection, dosage and application, the lower load capacity of the bone and cartilage tissue must always be considered.

In the execution of strength exercises, incorrect stresses on the spine should be avoided.

Apparently harmless exercises suitable for children are always dangerous if they are used as training exercises with constant regularity.

Partner exercises are attractive, but the weight of the partner as a load is often an unacceptable burden in training with adolescents.

Training must be tightly controlled to minimise the risk of injury.

If the load can be increased, the number of repetitions should be increased first and then the load level.

Please note: the fact that the performance of the child's body around the postural and musculoskeletal system is reduced does not speak against, but rather for the necessity of strengthening the musculature. The problem lies in the correct dosage of stimuli.

6.6.2 Methods and contents of strength training in children at different ages

Pre-school age:

Suitable at this age is above all obstacle gymnastics in climbing gardens with rope pyramids, support, slope, and traction equipment that is suitable for every strength level and addresses the various muscle groups in a variety of ways.

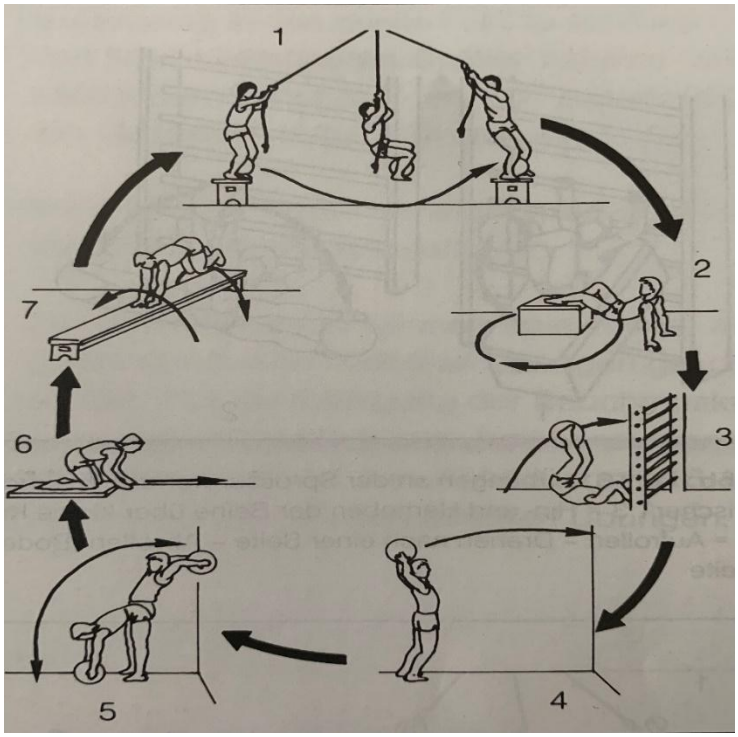
Schoolchildren aged six to ten: the focus is on playful, varied, and harmonious strengthening of the musculoskeletal system.

Dynamic training is the exclusive training method, as the child's organism has unfavourable conditions for static muscle work due to its low anaerobic capacity. First and foremost, the aim is to train quick strength.

Since younger children can usually only concentrate on one task for a short time, circuit training has proven to be particularly beneficial for this age group.

The exercise time should hardly exceed 20 seconds, with a pause length of 40 seconds (exercise pause ratio of 1:2). The fastest possible execution speed.

Examples:



1. swinging on the rope from long bench to long bench

Aim: Arm, shoulder, and core strength

2. push over box in recumbent position

   Aim: arm extension

3. roll in with ball on wall bars (with knees bent)

   Knees) Feet up to wall bars.

   Aim: abdominal muscles

4. throwing exercise against the wall with medicine ball

   Aim: to strengthen the throwing muscles (arms, shoulders, torso).

5. wood chopper with medicine ball from a standing position backwards to the wall. The ball is alternately brought to the floor or over the torso extension to the wall.

   Aim: Back and shoulder muscles.

6. kayak on a carpet tile. the student kneels on a carpet tile and

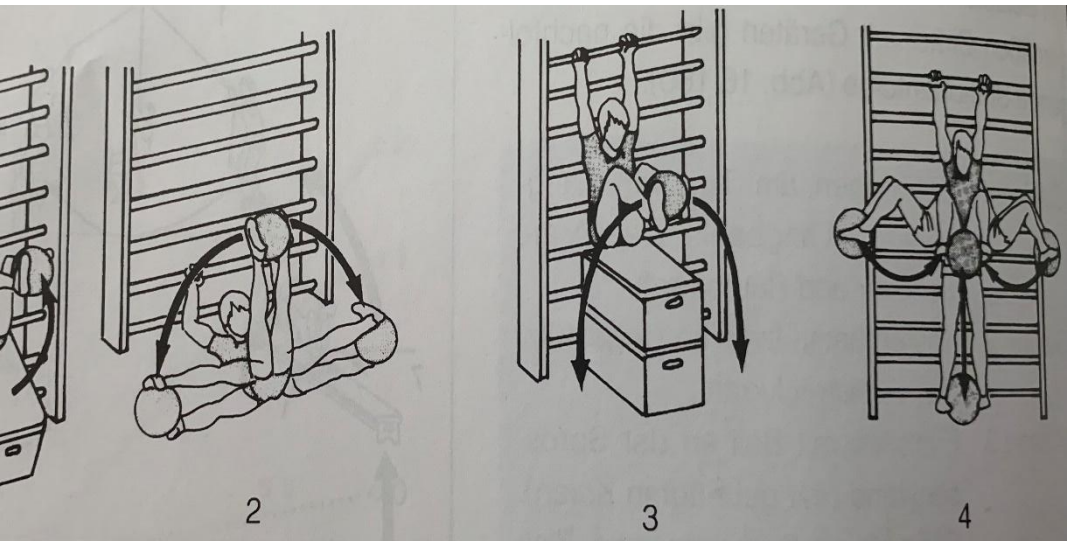
   carpet tile and pulls himself forward with both arms.

   Aim: arm extensors

7. alternating support hopping over the long bench to the left and right.

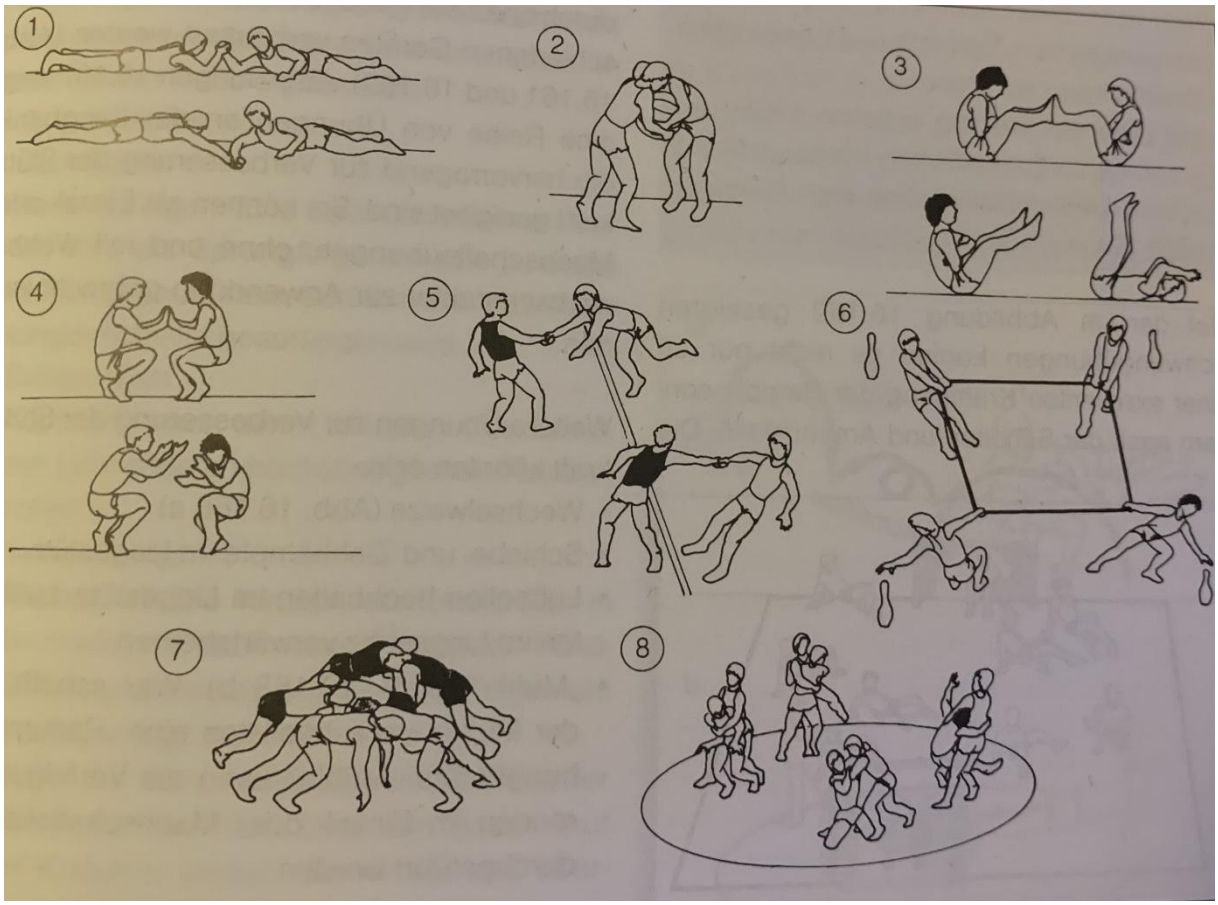
   Aim: jump power

Exercises on the wall bars



1. roll up on the slanted box lid
2. windscreen wiper
3. lifting back and forth over small boxes, each with brief relaxation. Ground contact
4. roll up - turn to one side - roll down (ground contact for relief) - roll up - turn to the other side.

Forms of play for general conditioning with the help of pushing and pulling fights as well as various scrambling games.



1. arm wrestling, 2. fight for the medicine ball, 3. foot pushover, 4. push over, 5. pull over the line, 6. tug of war in a square, 7. rugby-style pushover, 8. out of the circle

Late school age ten to twelve:

It ends with the onset of puberty - the general and long-term strengthening of the important muscle groups is further increased by exercises that involve overcoming one's own body weight or by adding small additional weights (medicine ball, iron rings, sandbags, etc.). The training content is added to those already mentioned:

Exercises to strengthen the abdominal and back muscles as well as the arm extension muscles (e.g., partner exercises).

Exercises to improve arm support strength such as wheelbarrow driving, fidget handstand, alternately dribbling a ball with the hand in a push-up, holding up a balloon, etc.

The exercises should be predominantly playful, but increasingly specific exercises can be interspersed in the play material.

Stand-up girls: Supine position, ball in front of the chest, pushing the ball up with the arms, standing up and catching it with the head, the chest, the thigh, the tension of the sole.

Kangaroo: standing, ball between the knees; when called: west! - East! - South! - North! fast hopping with the turning movement in the commanded direction Target reaction and attention, strengthening the ankle and adductor muscles.

Hurdle jumping/hoop jumping in combination.

Sack hopping combined with ball guidance (as relay, number race): A hops in the sack to the turning mark, leaves the sack and guides the ball to the starting strip. B starts with the ball, slips into the sack, and hops back. As a number race: 1 starts the first time with the sack and comes back with the ball; the second time he starts with the ball and comes back with the sack etc. Sack hopping chase/catch, jumping up/downstairs etc.

Strength training in pubescence (first pubertal phase):

As the trainability of the extremities is particularly high in adolescence compared to childhood, special attention should be paid to their training, especially in the form of accentuated jumping and kicking power training.

In addition to general strength training, which mainly includes circuit training (now age-adapted, already adult-oriented, various jumping exercises, pulling and pushing, as well as gymnastic exercises with and without equipment (balls, medicine balls, ropes, etc.), this age group should also be introduced to sport-specific technical-conditional exercise combinations.

Throwing, shooting, and throwing power as well as dual strength can be trained through appropriate forms of play according to age.

Examples:

Throwing exercises: All target, long range and team throwing games are suitable.

Skittles: who will be the first to knock over the skittles in the centre of the circle? Note age-appropriate throwing distance.

Target throw at the wall: Targets of different sizes are painted (glued) on the wall of the hall and must be thrown in free (or fixed) order.

Shooting exercises are suitable: Determination of the long-distance world champion: who can shoot the longest total distance with 2-3 shots (partners operate on a marked playing field and are checked). The competition can also be held as a team competition, etc.

Jumping exercises: catch on one leg; note: limited space so that the number of jumps biz to success are short!

Circle hopping left hand holds partner's right leg, right hand rests on partner's shoulder: hopping in a circle. etc.

One-on-one training: Fighting with the ball: two players try to wrest a medicine ball from each other.

Pulling fight: pulling across a dividing line between the two partners; standing; push-up.

Tug of war etc.

Strength training in adolescence (second pubertal phase)

Since the anaerobic capacity is now also well developed, exercises that cause strong local fatigue, i.e., are strenuous, and serve the purpose of special strength training can now also be used - although still with appropriate restraint.

Possible forms for improving strength and endurance:

Riding football: Games and running are only allowed with a rider. the rider may change over as often as necessary (piggyback). Note Equal weight players together!

Jumping: Can be done normally in a row or circle formation, but also integrated into the game.

A lift the ball off the ground with his foot and passes it over partner B, jumps over him with a straddle jump, stops the ball and passes it back to the spot. B does the same twice, three rounds per partner.

Bouncing ball: Exercise sequence: bounce the ball on the floor from a sitting position, stand up and catch it at the highest point while jumping. Repeat several times.

7 Speed training

Furthermore, speed is not only the ability to run fast, but it also plays an important role in acyclic movements (jumping, throwing, pushing, hitting) and other sport-specific cyclic movements. Speed is one of the main motor skills that, like agility, can be attributed to the conditional skills, endurance, and strength, as well as to the coordinative skills.

For athletes, quick strength can be devised as follows:

Ability to perceive competitive situations and their changes in the shortest possible time = perceptual speed.

Ability to mentally anticipate the development of the competition and in particular the behaviour of the direct competition team in the shortest possible time = anticipation speed.

Ability to decide on one of the potentially possible actions in the shortest possible time = decision-making speed

Ability to react quickly to unforeseeable developments in the competition = reaction speed.

Ability to act as quickly and effectively as possible in the competition, taking complex account of one's cognitive, technical-tactical, and physical capabilities = speed of action.

7.1 Elementary speed

Is the ability to realise elementary time programmes. It includes:

7.1.1 Reaction speed

Respond to a signal with a simple movement.

7.1.2 Action speed (also movement speed)

To perform a single movement against minimal resistance at high speed

7.1.3 Frequency speed

Carry out cyclic repetitive movements with minimal resistance at high speed.

7.2 Complex speed

In everyday life and in sport, the requirements are complex: it is necessary to react and act to expected or unpredictable signals with actions appropriate to the situation and using strength.

7.2.1 Power speed / fast power

includes the ability to deliver the highest possible force to resistors (throw, push) in the shortest possible time.

7.2.2 Speed strength endurance

Resistance to fatigue-induced deceleration at maximum contraction speed during acyclic movements with increased resistance.

7.2.3 Maximum speed stamina

Resistance to fatigue-induced deceleration at maximum contraction speeds during cyclic movements

7.3 Speed training for children and adolescents

Note: The age groups of 7-9 years for boys and girls and 11-13 years (girls) or 13-15 years (boys) are so-called ¨sensitive phases¨, which have particularly favourable conditions for the development of speed. Due to age-specific growth and maturation processes, there is an increased plasticity and adaptability (biological, neurological, biomechanical) in these periods, which should be used.

Schematic representation for sprint:

Training content	**Basic training**		**Advanced training**
	(Basic training) 8 to 11 years	(Goal-oriented practice 12 to 15 years	(1st phase) 12 to 15 years
Forms of games and competitions	- Sports games - Small games with selected focuses - Enthusiasm for practising together	- Coordinative and/or Conditionally targeted (jumping, throwing, pushing, running) - Sports games (technique)	- Predominantly sports games (possibly modified for specific purposes, e.g., basic endurance)
Sprint ABC technique	- technically clean ankle work - Run as a ball of the foot	- technically clean execution of all Sprint ABC exercises - Basic coordinative Requirements	- Deep start - Sprint runs - relaxed running in different intensities - hurdling
Coordinatively varied locomotion training	Forms of games and competitions with variation of the - Direction of Movement - Movement type - Movement Frequency - amplitude of movement forms of	- different movement direction types - Maximum frequencies - differentiation left right leg - asymmetric training	- in preparation and as part of acceleration and speed training units

	play and betting. with coupling of the above aspects		
Relay training	game and relay forms with baton handover	- Relay forms Baton handover Decisive	- Competition Baton change, whereby Baton time decisive Is
Acceleration/speed training (sprint runs)	No focus (at moderate intervals as a control)	Mainly for the realisation of technical-coordinative focal points at moderate intervals as a test or control	systematic development of the 30 m low launch and 30 m flying time
Speed endurance training		individual game forms in partial phases lactacid stressing	Beginning speed endurance training mainly extensive, with short runs

In basic training, the focus is more on elementary performance requirements, while in advanced training, the focus is more on complex performance requirements.

8 Agility

Agility is the ability to perform movements and postures beyond the anatomically possible range of motion of the joints and muscles involved, with an acceptable, non-painful stretching sensation and against a sub-maximal, non-obstructive stretching resistance.

In general, optimally developed mobility leads to increased elasticity, stretchability and relaxation of the muscles and tendons involved and thus makes an important contribution to good load tolerance and injury prevention.

despite the intense strength and static loads in the Tug of War, mobility is a very important factor for performance improvement and recovery. the aspects of a qualitatively better movement execution, a larger movement radius, an important contribution to injury prevention make a good developing mobility indispensable for the Tug of War athlete.

8.1 Types of Agility

Agility can be subdivided into general and special, active, and passive agility, as well as self-extension and external extension.

8.1.1 General

are at a sufficiently developed level in the most important joint systems (shoulder and hip joints, spine). This is therefore a relative measure, as general agility will vary depending on the level of difficulty (recreational, high performance).

8.1.2 Special

if the agility refers to a specific joint. e.g., hurdler = hip joint

8.1.3 Active

is the maximum possible range of movement in a joint that the athlete can achieve.

8.1.4 Passive

is the maximum range of motion in a joint that the athlete can achieve through the application of external forces (partners, traction devices).

8.1.5 Static

holding a stretching position for a certain time also called stretching.

8.2 Methods in stretching.

8.2.1 Stretching during the warm-up

in the immediate preparation for loads, dynamic-active stretching is carried out. this increases the stretch tolerance of the musculature without impairing the contraction and reflex readiness.

anyone who does bobbing and swinging gymnastics too intensively or ¨in a cold state¨ up to the limit of their joint's risks injuring themselves.

8.2.2 Stretching while running out

Actively initiates regeneration by running out. Intermittent stretching: assume the stretching position, hold for 3-5 seconds, relax, slightly change the stretching position, and stretch the same muscle group again. Repeat 2-5x.

8.2.3 Stretching in agility training

static stretching has become established. to increase the effect, the muscles to be stretched are isometrically contracted in the stretching position for about 5-10 seconds, then briefly relaxed and then stretched.

Dynamic-passive stretching is often used in flexibility training, where the stretching is forced to a greater or lesser extent by a partner.

8.3 Stretch recommendations.

based on muscle physiological findings, some tips for stretching and flexibility training can be formulated:

- Stretch your muscles regularly, preferably daily.

- learn a stretching technique that suits your needs, and

develop a sense for the optimal stretching stimulus.

- Warm up the muscles before stretching and consciously relax.

- take enough time for stretching and refrain from intensive stretching immediately intensive stretching immediately after a heavy workout.

- Slowly assume the stretching position and then approach the maximum stretch with subtle, bobbing movements to the maximum stretch position.

- Increase the intensity from repetition to repetition, while respecting the pain threshold.

- Stretch agonists and antagonists alternately.

- Always combine stretching with strengthening and strength training with stretching.

8.4 Principles for flexibility training in children and adolescents

1. Agility is very well-developed in childhood (up to about the age of ten), after which a strong emphasis on agility training is required to maintain the level achieved up to that point.

2. Up to the age of ten, general flexibility training should be carried out

3. Agility should not be developed without limits, especially in childhood and adolescence because overdeveloped ability to move can have a detrimental effect on the development of other movement characteristics and can lead to postural damage.

4. For example, a developmental increase in spinal agility need not correspond to an increase in agility in the hip joint. This must be considered when training agility.

5. Agility training should be performed in an age-appropriate manner.

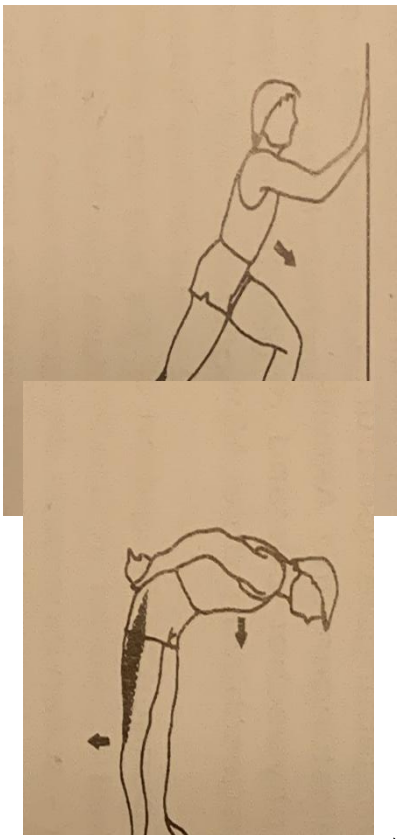
6. The various flexibility exercises should be selected primarily from the range of active stretching exercises. passive or static stretching exercises should not be used until adolescence.

7. If excessive mobility is found in conjunction with signs of postural weakness, emphasis should be placed on muscular strengthening, but not on further stretching of the already weak passive musculoskeletal system, to avoid additional worsening of the postural condition.

Agility training should therefore always be seen in conjunction with targeted strength training: the more a muscle group is strengthened, the more it must be stretched and loosened immediately after the strengthening.

8.5 Stretching basic program

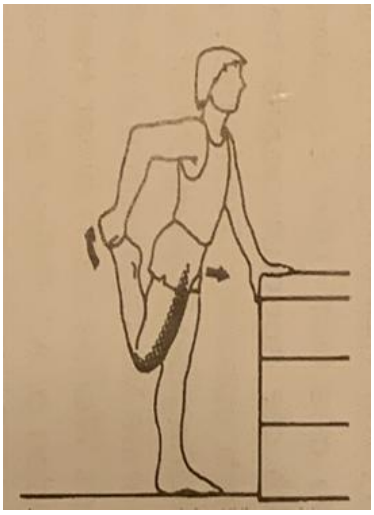
Rear lower leg muscles



Press heel to the floor

Tilt body evenly forward

Front thigh musculature



Advance pelvis

Pull foot against buttocks

Posterior thigh muscles

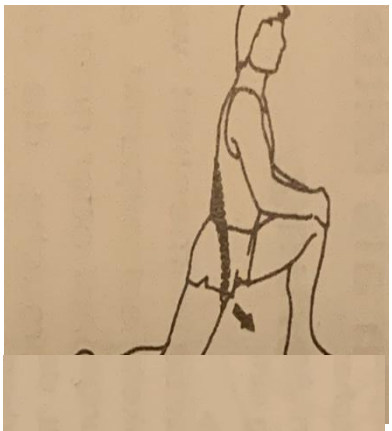
Knee stretch

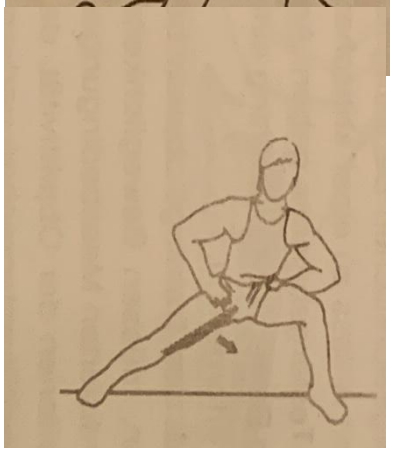
Lean the upper body Forward

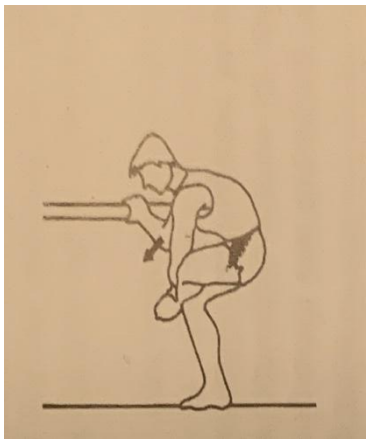
Front hip muscles

Rear hip muscles

Inner hip muscles







Push hip forward an angle

Lean the upper body Forward

Push the tank down at an angle

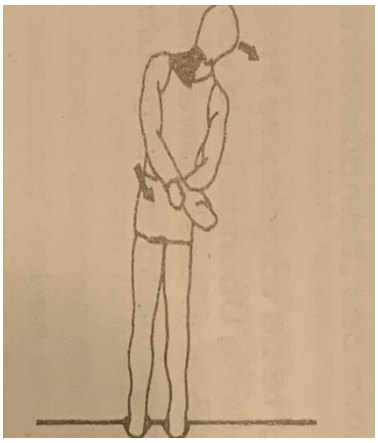
<u>Back muscles</u>

<u>Lateral trunk muscles</u>

<u>Chest muscles</u>

- Stretch knee
- Strengthen hunchback
- Pull the torso to the opposite side
- Push hip sideways
- Step forward with an equal leg
- Shift shoulder forward

Shoulder belt muscles

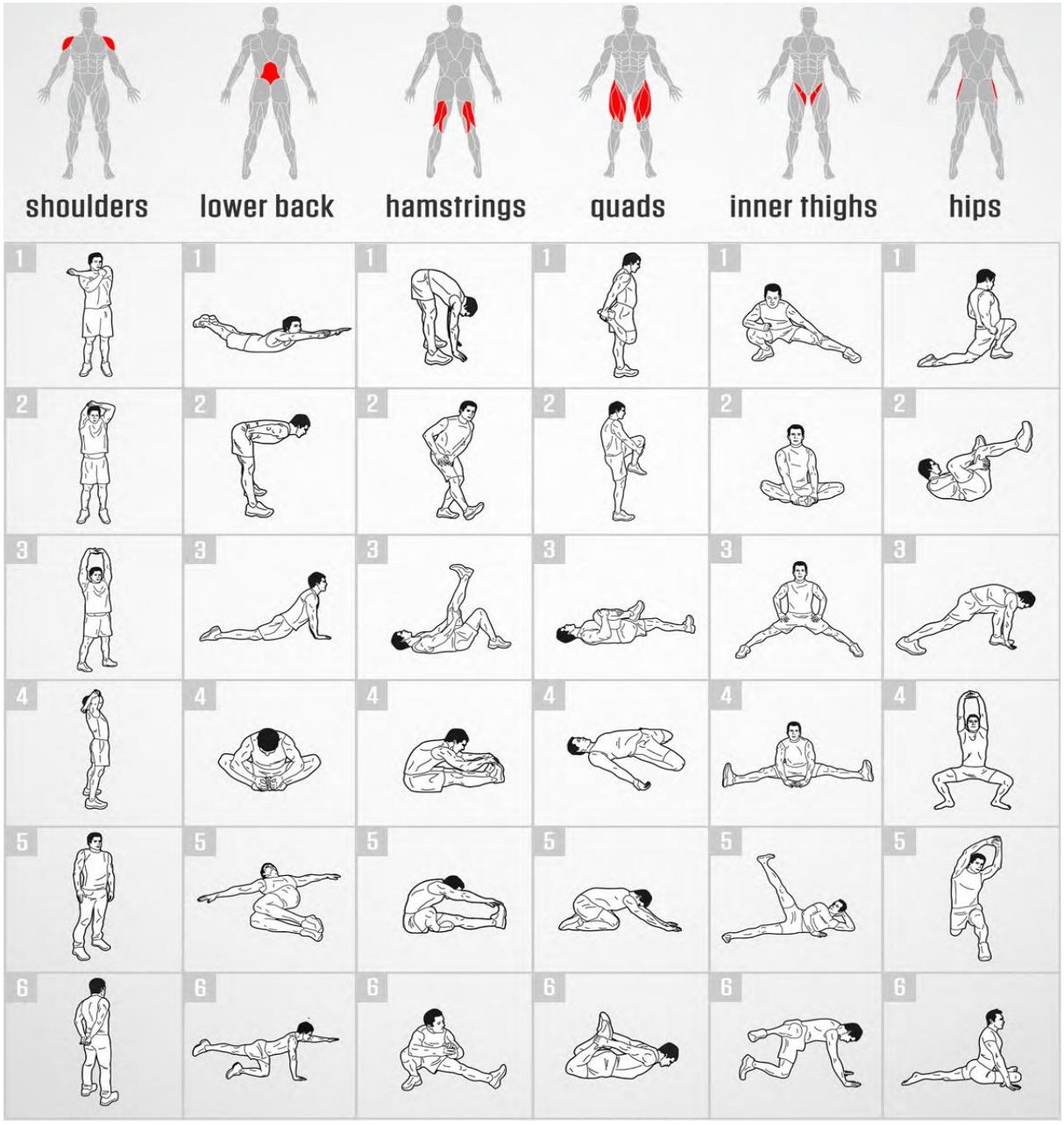


Tilt head to the opposite side

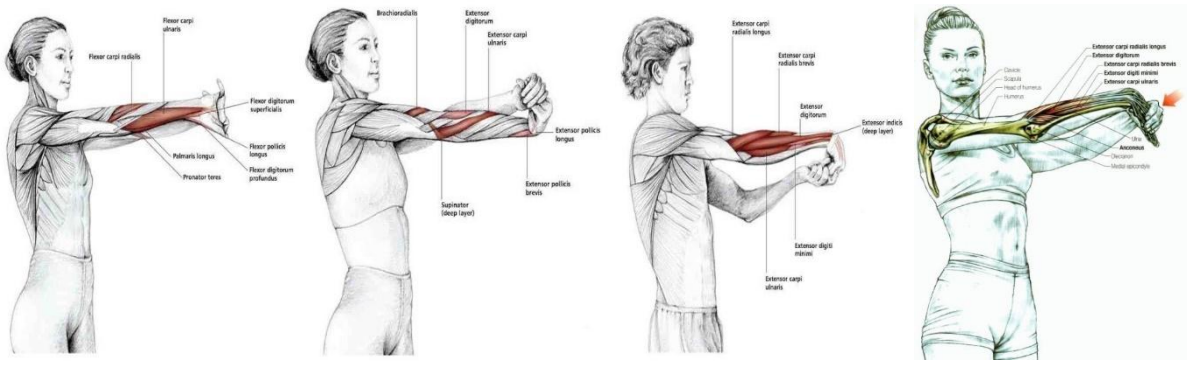
Pull arm down.

Other examples

- Assume the stretching position shown.
- Slowly change the position in the direction of the arrows, this will increase the stretch.
- Avoid sudden movements.
- A slight pull in the muscle to be stretched is normal.
- Hold this position for 15-30 seconds.
- Breathe regularly and calmly, try to relax.



Forearm stretching



9 Specific Strength Training

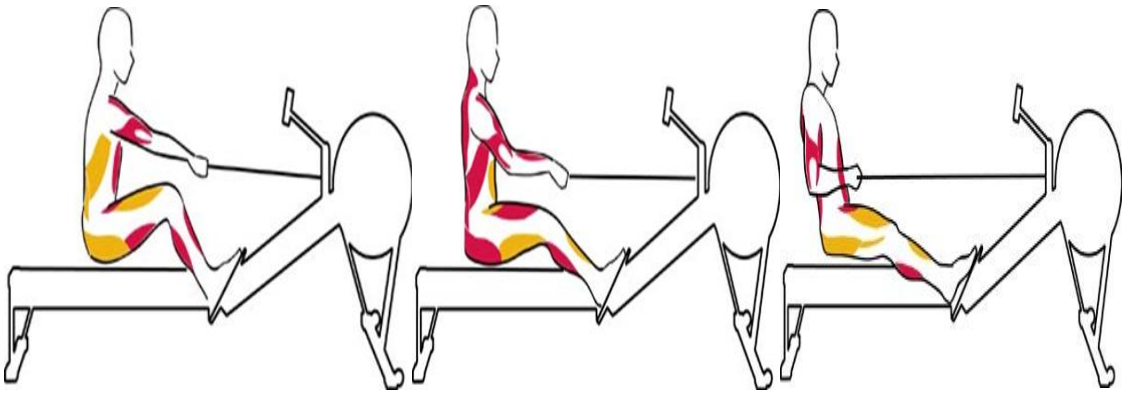
See the preparatory phases under the heading (3.7.2)

Preparation Phase I should be completed between October and December and the general strength building programmes (this refers to outdoor the peak is in September, indoor usually has a different monthly cycle as the peak World Cup is usually in the region of February except for World Games the intermediate target is in June or July for both).

The following preparation phase II where the specific strength training is applied, and the loads are increased. It is important that the basic training is further combined with the training to prevent muscular imbalance.

9.1 Special exercises related to Tug of War

9.1.1 back muscles



The rowing movements on the rowing machine or power tower or with dumbbells or barbells demand strength from the back, shoulders, and arms. This synchronised work is a good preparation for starting an attack from the defensive. it serves as a block in the stooped defence when the opponent launches an attack. The exercises can be performed positively, negatively or isometrically on the tower, depending on the training module.

9.1.2 Leg muscles

Footwork is of central importance in the Tug of War, and in addition to the various methods of strength, agility and speed in training should be invested in the necessary time. The training methods can be carried out in different types of running, such as stairs, to combinations of balance exercises on moving materials and single-leg dexterity exercises.

In Tug of War, the ground conditions can be more or less important. On hard, dry floors, the direct use of leg strength is more important than other physical requirements.

9.1.3 Hand power

In Tug of War, it is one of the decisive criteria for the practice of our sport. Without sufficient hand strength endurance, the technical and tactical scope for action is decisively limited.

The challenges of hot, wet, or cold weather. The training sessions are not measured by quantity but by quality. It is not the forearm muscle volume that counts, but the endurance capacity of the muscle that is decisive. Training methods are not only trained on the rope in different variations but also with dumbbells or barbells and even with the weight of the body on the hanging rope.

9.1.4 Core musculature

To ensure the stability of the back muscles, which play a central role in Tug of War, great attention must be paid to strengthening the trunk. To counteract any possible imbalance. Torso stability is an important part of the training sessions. this can be developed using static or dynamic methods.

9.1.5 Circuits for elite athletes in the sports hall

Basic training in the aerobic area Preparation phase I

Strength training in the aerobic zone Preparation phase II

Material from the sports hall equipment

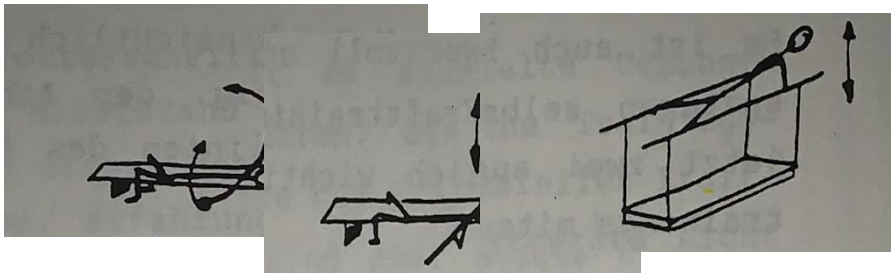
first round 1.5 min work / 1.5 min rest medium slow movement execution

second round 1 min work / 1 min rest slow movement execution

there are two athletes at the post, 1 athlete works, 1 athlete has a break

The exercises are performed cleanly and correctly

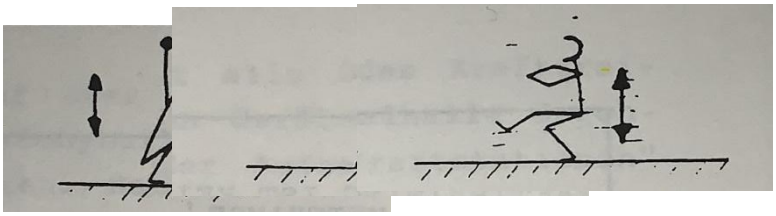
(Different variations to combine)



Barbell bench: balls, dumbbells

with Horizontal bar

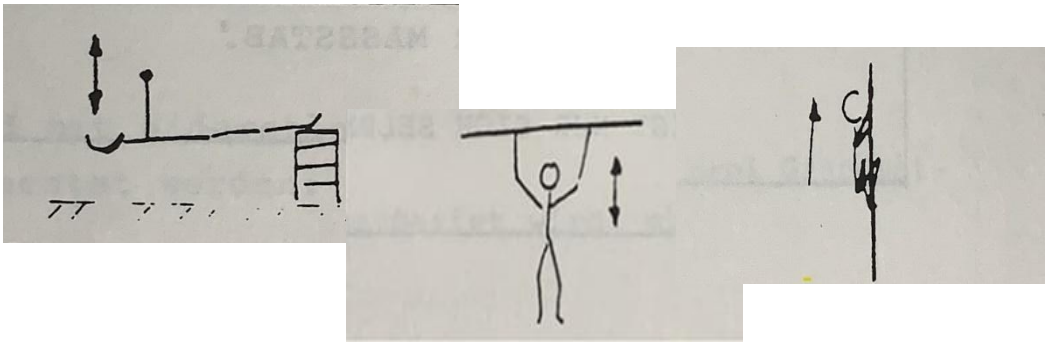
Bars push-ups – lift with arms almost outstretched



Deep knee bends with high bar

on two to three box sections with dumbbells in your hands

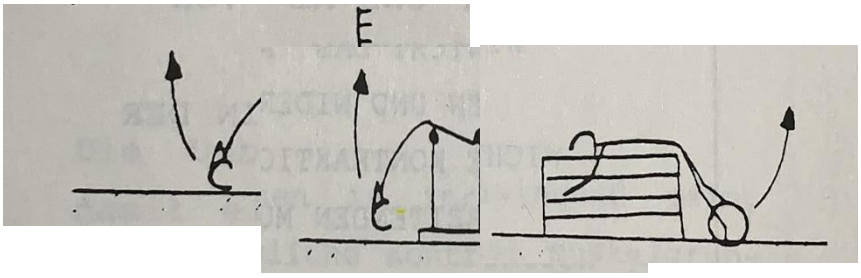
one-legged squats on wall bars



feet on box as straight as possible pull up on horizontal bar

Pull-ups on a horizontal bar

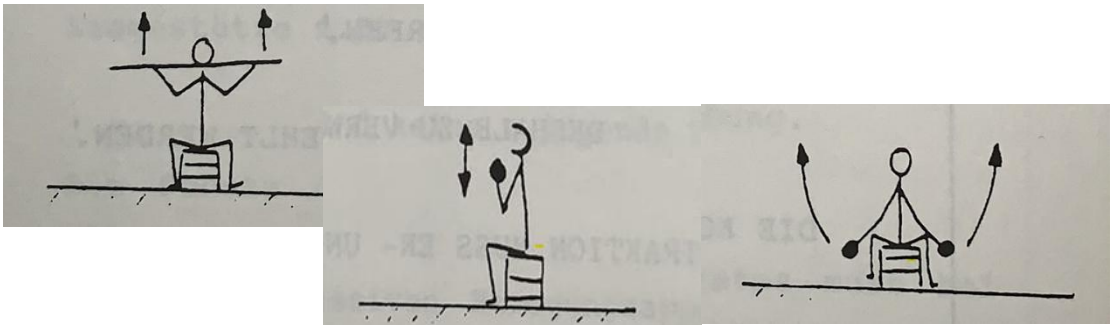
climbing hanging rope



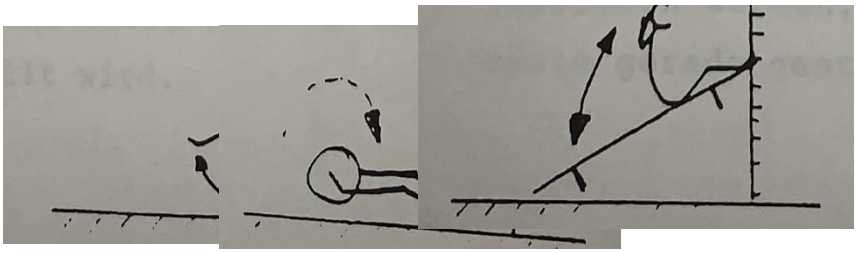
Upper body lift on box feet wall bars suspended

Upper body lift lower legs under the bars hooked

Raise legs with medical ball between feet



sitting behind the neck press horizontal bar	sitting in front of the head dumbbell lifts	Sitting lifting light weights e.g., balls



leg lift hanging on the wall bars	hovering with legs circling or writing numbers with medicine ball	torso lift on inclined. long bench feet hooked. into wall bars

9.1.6 Pyramid training on the rope

The same percentages or more finely tuned percentages can be used as described in 6.4.4.

To determine the RM: this means to determine one repetition on the gantry.

For advanced athletes, work on the stairs, otherwise on sand or dirt.

Breaks of two to four minutes.

For maximum strength training = repetition numbers of approx. 1-5 selected corresponds to 80-100% of the 1 RM.

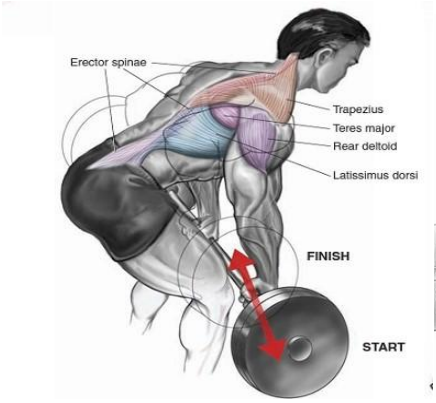
8-12 repetitions = muscle building training =60-80% of 1 RM

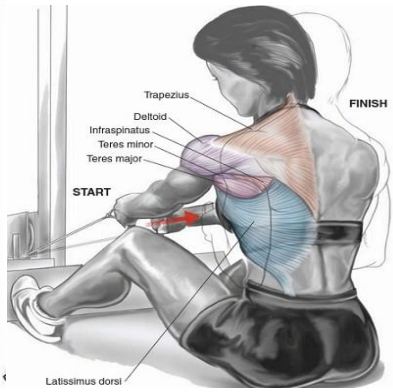
15 and more repetitions=40-80% of 1RM = development of strength endurance

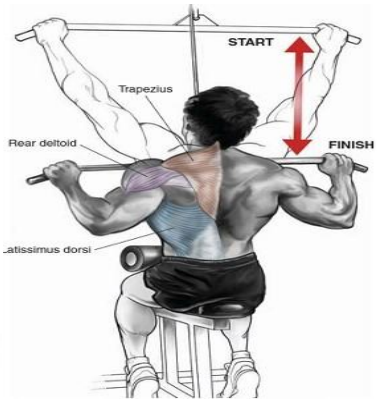
9.1.7 Strength exercises for the whole body

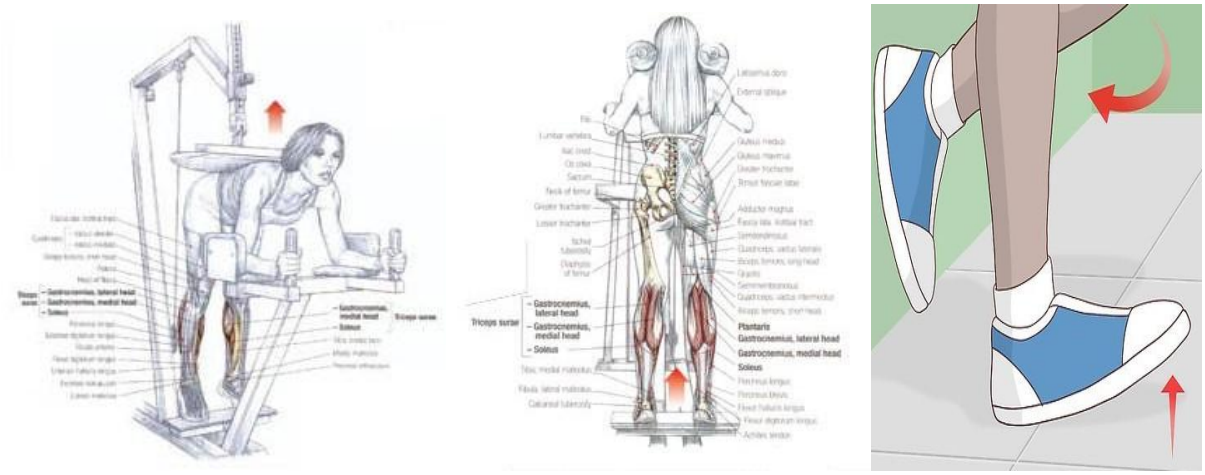
It is self-evident for the athletes that in between they also do strength training on machines, barbells, or dumbbells.

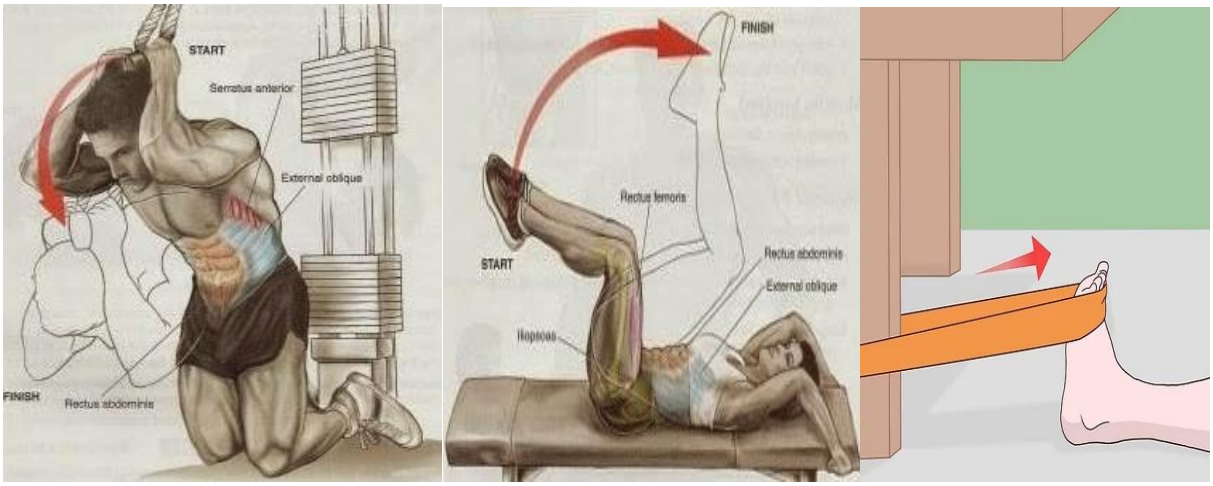
These examples show what kind of exercises (there are many more possibilities and combinations).

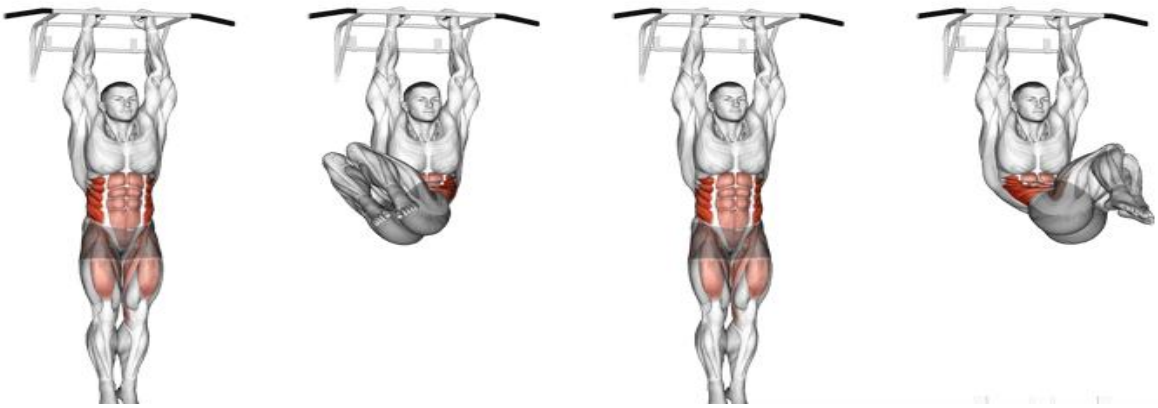


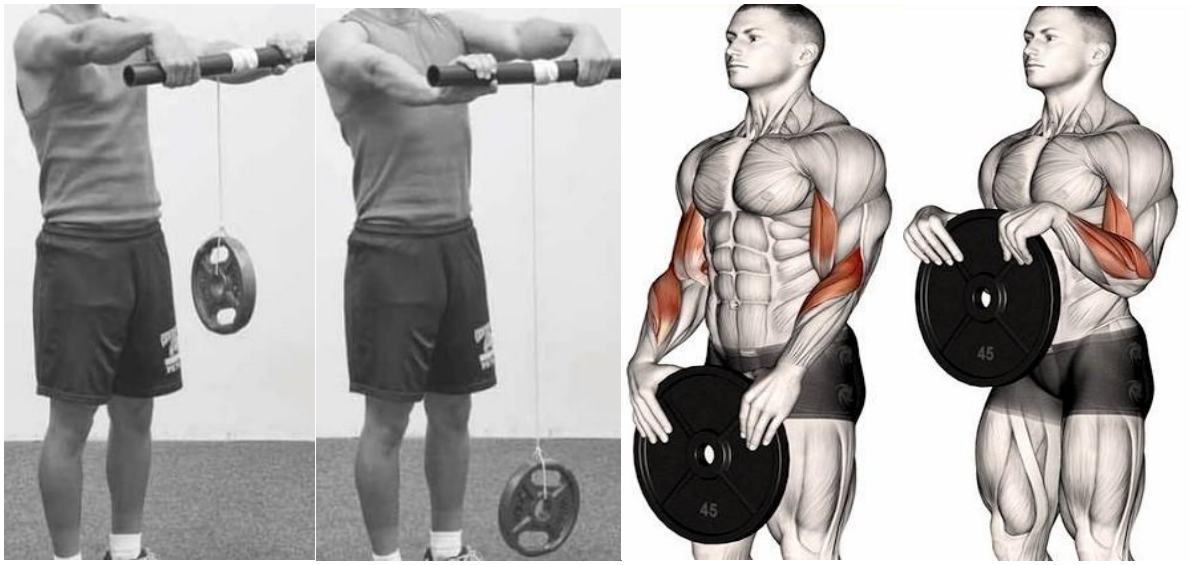


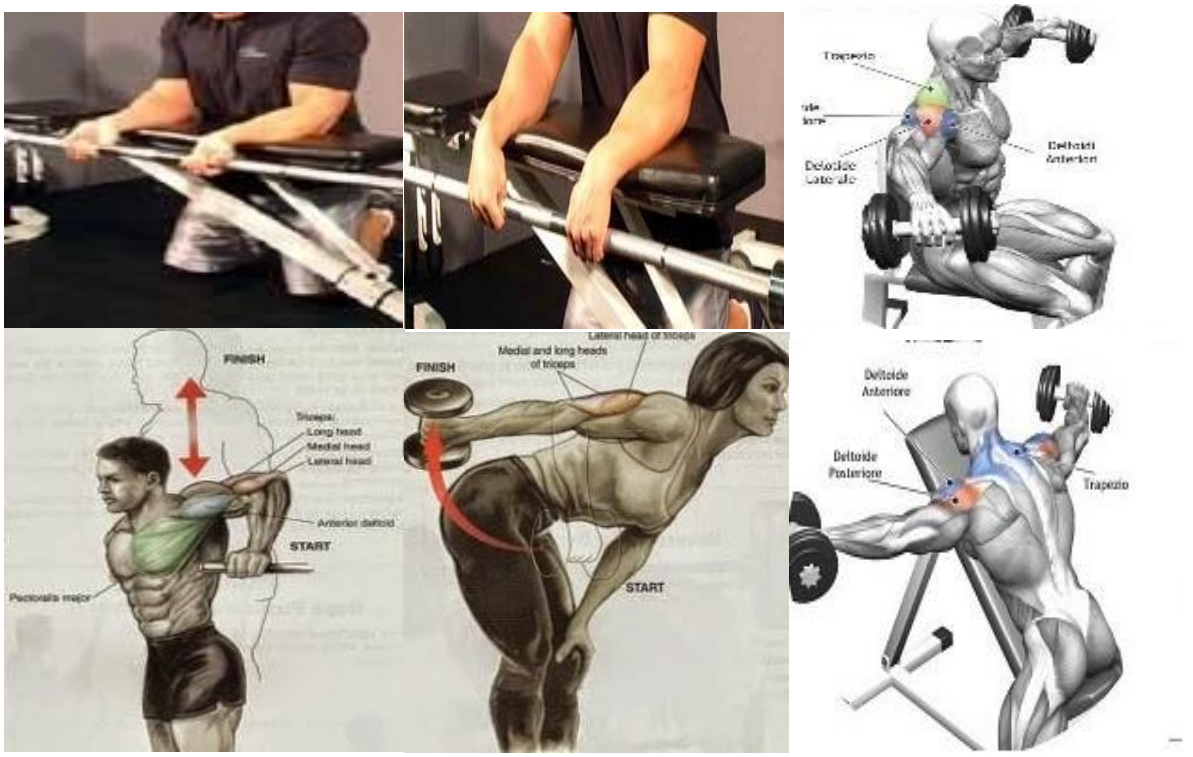



Gastrocnemius, lateral head
Gastrocnemius, medial head
Soleus
Triceps surae
Plantaris


START
Serratus anterior
External oblique
FINISH
Rectus abdominis
FINISH
Rectus femoris
START
Iliopsoas
Rectus abdominis
External oblique






FINISH
Triceps:
Long head
Medial head
Lateral head
Anterior deltoid
START
Pectoralis major
FINISH
Medial and long heads of triceps
START
Deltoide Anteriore
Deltoide Posteriore
Trapezio

9.1.8 Speed in Tug of War

In Tug of War, the reaction speed comes into play in the start phase (pull). it is used with verbal commands from the coach or athletes etc. The aim here is to get into a more advantageous position than the opponent as quickly as possible (the eight athletes).

trainable in competition start simulation, in games and relay races and other reaction games.

The repetition numbers that are applied are important, so that the processes are memorised. The processes can be combined in visual and verbal form.

The action speed, this variant can be used after the pull phase or during the fight in the case of attacks or defensive = attack blocking. These special workouts should be done in different variations. Otherwise, the movement patterns are too one-sided and are very difficult to change in old age.

10 Training of coordinative skills

In contrast to the conditional abilities - in which the processes of energy provision and energy transfer predominate - coordinative abilities represent performance prerequisites across all skills, which primarily concern processes of movement control.

They enable the athlete to master motor actions in predictable (stereotype) and unpredictable (adaptation) situations safely and economically and to learn sporting movements relatively quickly.

10.1 Most important components

Balance ability

Orientation ability

Differentiation ability

Rhythm ability

Reactivity

Ability to change

Coupling ability

10.1.1 Definitions of the components

Balance ability	The ability to keep the entire body in a state of equilibrium or to maintain or restore this state during and after extensive body displacements. During the Tug of War: Finding a foothold/balance again when a foot slip.
Orientation ability	is understood as the ability to determine and change the position and movements of the body in space and time, in relation to a defined field of action and / or a moving object. In the Tug of War: a subordinate role
Differentiation ability	is understood to be the ability to make finely tuned and measured movements and partial body movements, which is expressed in great accuracy of movement and economy of movement. Tug of War: To feel the pressure on the rope and to classify and act accordingly.
Rhythm ability	is understood as the ability to grasp an externally given rhythm and to reproduce it motorically as well as to realise the ¨internalised¨ rhythm of a movement existing in one's own imagination in one's own movement activity. Tug of War: After triggering an attack, get into a rhythmic (flowing) kick = power walk.
Reactivity	is the ability to quickly initiate and execute appropriate short-term motor actions in response to a signal. It is important to react at the appropriate time and at a speed appropriate to the task, whereby the maximum fast reaction is usually the optimum. On the one hand, the ability to react represents an independent coordinative ability, on the other hand, it is important as a subcomponent of the conditional characteristic ¨speed¨. Tug of War: Counter an opponent's quick start, block an attack, etc.

Ability to change	The ability to adapt the action programme to the new circumstances or to continue the action in a completely different way during the execution of the action due to perceived or anticipated changes in the situation. Note: Reaction and changeover skills are not sufficiently trained in some sports. For example, the gymnast does not have to adjust to a disruptive opponent, which does little to support the development of these coordinative skills. It is therefore important that in this and comparable sports, team games are included in the training as a supplement (warm-up or as a conclusion). Tug of War: Tournament weather changes from dry to rain, ground gets slippery, rope gets wet, etc.
Coupling ability	The ability to coordinate partial body movements of the extremities, the trunk, and the head in relation to each other and in relation to the overall body movement directed towards a specific action goal. Tug of War: Block the attack, quickly shift the centre of gravity of the hips downwards and slow down with the torso muscles.

Coordinative skills are inconceivable without the physical performance factors of strength, speed, endurance and agility and their complex interplay during movement realisation. Accordingly, they only become effective in sporting performance in conjunction with these conditional abilities. Conversely, the coordinative abilities are indispensable for the development of physical abilities, as they enable the acquisition of the sporting skills necessary in the process of physical education (=expansion of the training content).

The more an athlete is able to analyse his movements and the environmental situation, the better he will be able to adapt to changing conditions and solve them motorically within the scope of his individual possibilities.

10.2 Training of coordinative skills in childhood and adolescence

For the long-term training process, the following applies in principle:

coordination training before conditioning training!

In childhood, the fulminant development of the brain and a high plasticity and adaptability provide particularly favourable conditions for the optimisation of coordinative abilities. At no other time in life is coordinative training so successful and occurs so quickly and comprehensively. Because of the age-specific urge to move, the child is active in coordinative learning ¨all day long¨ if the environment is appropriately stimulating and the opportunities for movement are not too severely restricted, and if the child is educated and taught accordingly.

10.2.1 Training of coordinative skills at pre-school age

There is no such thing as too early in the training of coordinative skills, but only inadequate methods and content, i.e., methods and content that are not yet sufficiently adapted to the developmental level of the children.

For targeted expansion of the range of movement, a versatile and varied task with a sufficiently high frequency of practice is of great importance.

It is already possible to learn perfect movement sequences in childhood, which is why importance should be attached to learning motor skills correctly right from the start. Later, the use of an incorrectly learned motor stereotype - movement loop - via so-called relearning requires a disproportionately higher energy consumption and increased nervous substance than the acquisition of a movement skill that has been learned exactly from the beginning.

10.2.2 Training of coordinative skills in the early school years

The early school age (7 - 10 years) can be described as an intensive developmental age for the completion of athletic responsiveness, the ability for high-frequency movements, spatial differentiation ability, coordination under time pressure (for girls and boys), balance ability and dexterity (girls). It must therefore be the task of a targeted training (school, club) to train these special abilities at this age.

It is important to remember that this good motor learning age is mainly for learning simple movement skills, but not for skills with targeted, fast, peripheral use coordination.

10.2.3 Training of coordinative skills in late school age

The high plasticity of the cerebral cortex and the improved ability to perceive and process information enable children to learn new movement skills extraordinarily quickly.

An important role is also played by the favourable power-to-leverage ratio at this age - the musculature of the upper extremity has a ratio of 27:38 to that of the lower extremity; in adults the ratio is 28:54 - and the low body weight.

The more finely, precisely, and versatilely the children have been able to develop their movement skills, i.e., the greater the wealth of movement skills they have acquired up to that point, the more pronounced the learning at first go.

Consequences for the training of coordinative skills:

- Versatile athletic training with targeted expansion of the range of movement
- Increased learning of basic sporting techniques
- Variable design of exercise requirements
- Sufficient deepening of learning

10.2.4 Training of coordinative skills in pubescence

During pubescence, the second shape change takes place with an annual increase in height of eight to ten centimetres. Due to the change in proportions, the training of coordinative abilities - depending on whether the adolescent is involved in a sports training process or does not receive any coordinative training - can experience an individually more or less pronounced impairment. In untrained adolescents, especially movements that require greater accuracy and corresponding fine control suffer a loss of quality. Simple, regularly practised and already confidently mastered movements, however, remain unaffected.

With increasing age, the ability to learn new movements faster and better increases in childhood and adolescence!

10.2.5 Training of coordinative skills in adolescence

In this developmental phase, there is a general stabilisation of movement control, an improvement in motor control, adaptation, and adjustment as well as in the ability to combine movements. Overall, adolescence is once again a period of good motor learning ability - it is more pronounced in male adolescents than in females - which enables unrestricted coordinative training in all sports.

The differentiated development of individual coordinative abilities in the various age groups requires the use of intensive development phases: The demands must be adapted to the developmental profile.

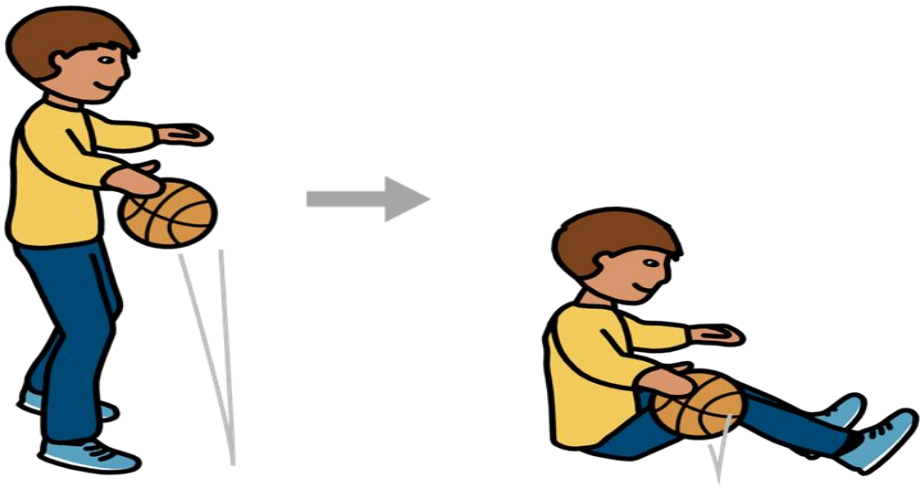
A varied movement experience shortens the learning process in the development of new movement skills or sporting techniques: Great importance should therefore be attached to the development of a comprehensive set of movement skills.

The training of coordinative skills cannot be started early enough, as this is the respective prerequisite for an increased motor learning ability in the following age groups.

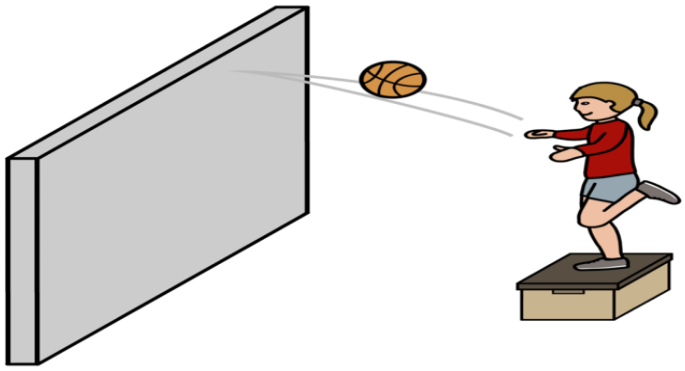
Coordinative skills can only be developed from the point of view of complexity, variability, and continuity; emphasis should be placed on age-appropriate training, especially with the inclusion of small games.

10.3 Exercise variants

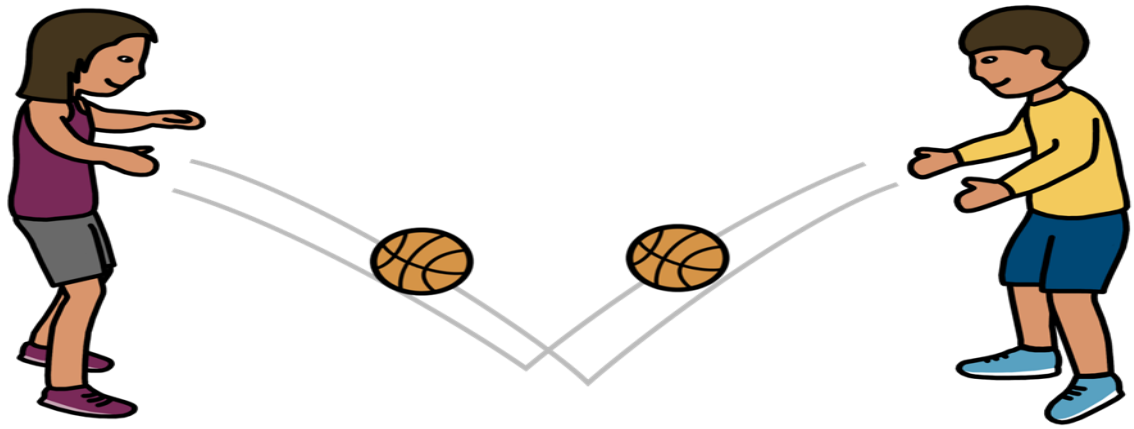
Balance on the wobble board (medicine ball) and swing a hoop around your arm. Increase the level of difficulty with several hoops.



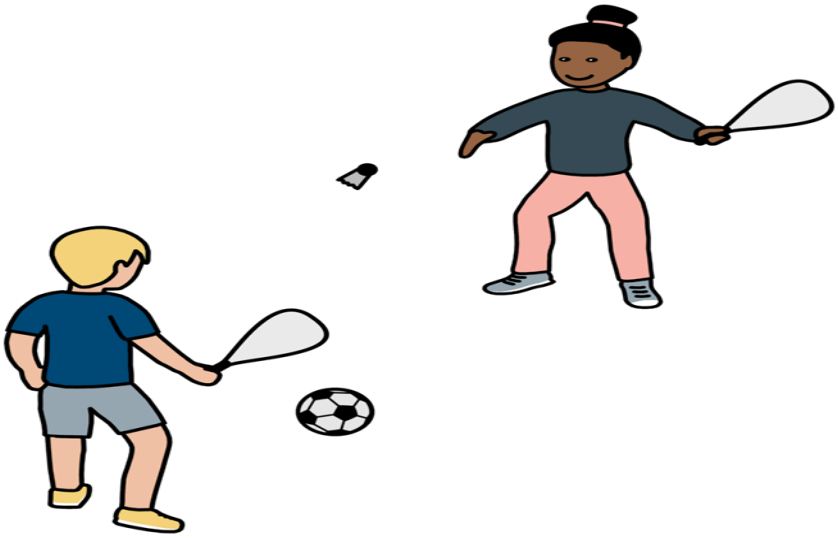
Bounce the ball while sitting down. Stand up again after 3 seconds. The bounce is continuous.



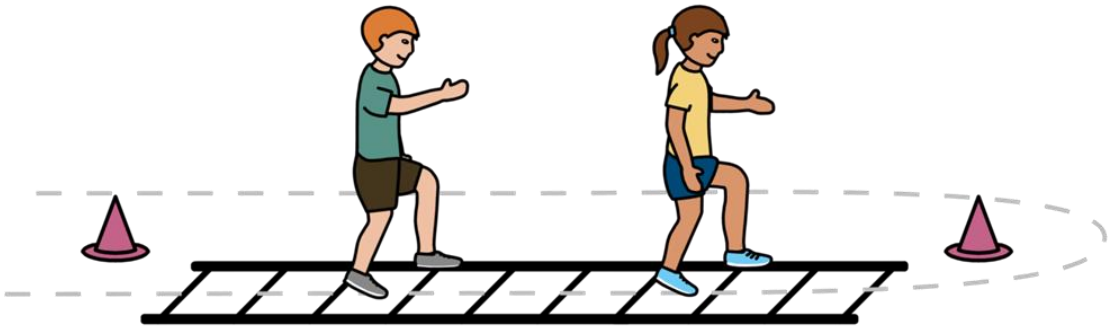
Stand on the box with one leg, throw the ball against the wall and catch it again.



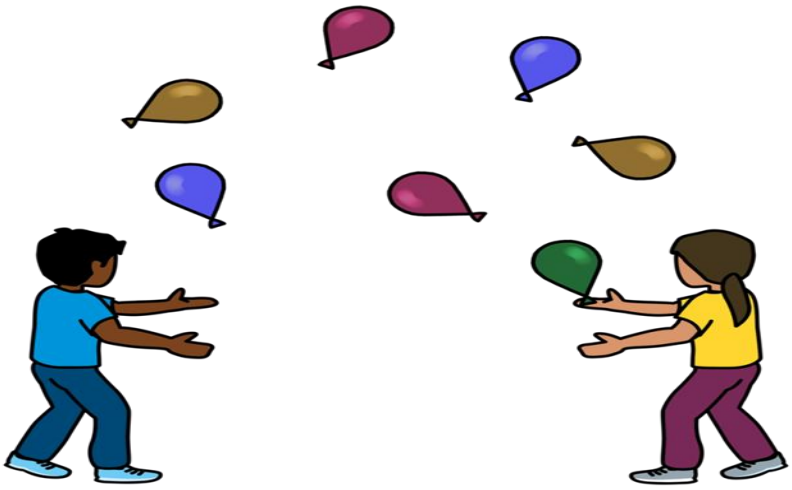
Bounces both balls back and forth at the same time.



Passes the badminton ball and the football back and forth at the same time.



Run over the coordination ladder one after the other. the person in front specifies the form of movement (backwards, forwards, sideways, etc.) and the number of steps per rung.



Try to keep seven balloons in the air for as long as possible.

These exercises are intended to stimulate ideas. There are many more such variations. Have fun with it.

10.3.1 Methodical measures

Methodical measures	**Examples**
Variations of the movement execution	Jumps with crouching, straddling or instep of the legs. Opposite Performances of the Physical Exercise Exercises with tempo or rhythm changes
Change in external conditional skills	Exercises in modified terrain with equipment or partners Reduction or increase of the support area.

Combining agility skills	Combining different gymnastic or sport elements Game combinations
Exercises under time pressure	Reaction training exercises Obstacle courses according to time
Variation of information intake	Balancing with eyes up, head tilted or blindfolded. Exercises in front of the mirror Precision movements with additional objective information
Exercise after preload	Performing complicated movements at the end of a training session Balance exercises after several fast rolls
Exercise under psychological pressure	Competition, qualification, spectator pressure Risk conditions, e.g., balancing at a greater height.
Exercise under pressure conditions	e.g., time, precision, successive or simultaneous pressure

11 Technique and tactics training

11.1 Technical training

Sporting technique is the process, usually developed in practice, of solving a specific movement task in the most expedient and ecological way possible.

Technique training differs from coordination training in that it is movement-, sport- and situation-specific.

Coordination training, on the other hand, is generally cross-skill and thus situation- and movement-unspecific.

Therefore, the following applies: For younger athletes who are inexperienced in movement and at the beginning of a technique training process, coordination training should have a higher proportion than at a later point in time (with higher movement experience).

However, coordination training should always be an integral part of technique training. However, with increasing age and skill level, there should be a shift in favour of specific training content.

In the Tug of war, an economical sequence of movements leads to an improved realisation of the physical performance potential in relation to the athletic work. the special technique can be a decisive factor in the diversity of the ground conditions. Thus, both economic and special technique play an important role in the Tug of war.

<table>
<tr><th colspan="5">Sporting technique</th></tr>
<tr><td colspan="5">based on</td></tr>
<tr><td>Coordinative skills</td><td>Physical abilities</td><td>Movement treasure</td><td>Movement experience</td><td>Analytical skills</td></tr>
<tr><td colspan="5">and manifests itself in</td></tr>
<tr><td colspan="2">Mastery of sporting techniques</td><td>Enhanced tactical action competence.</td><td colspan="2">Abilities to exploit the psycho-physical potential</td></tr>
</table>

11.1.1 Technique training methods

The following distinction is made here:

Holistic method it is particularly suitable for simple movement sequences and proves to be advantageous especially at the ¨best learning age¨ (learning at first go at the age of approx.12 to 15 years).

In the **dissection method**, difficult and/or complex movement sequences are broken down into individual functional components - usually in the form of a methodical series of exercises - and progressively led from the simple to the difficult to the whole.

Massive learning means intensive, uninterrupted learning. **Distributed learning** method means learning that is interrupted several times.

Further methods of technique training, which are particularly suitable for special technique training, are the methods of active and passive differentiated practice.

In **active differentiated** practice, the improvement or stabilisation of the special technique is practised through constant active repetition or practice of the entire technique or its individual components.

Passive differentiated practice focuses on mental training, observational training, verbal information, and comparable forms of training. In the case of observational training, video recordings, instructional films, demonstrations, instructional picture series, etc. form the training content. In the case of verbal information, the focus is on describing movements, explaining movements, and instructing movements. In mental training, the ideomotor idea of movement can be intensified and improved by additional accompanying texts.

Despite all the advantages of the various psychological methods, active learning, carried out in practice, has the highest learning effectiveness.

Receptivity

Listen 20% - Seeing 30% - Seeing & hearing 40% - Saying it yourself 75% - Do it yourself 90%

11.1.2 Technique training pre-school age to adolescence

Important methodological measures for the technical learning process are of enormous importance, especially in the youth sector. As with many sports, there is the question of specialisation and versatility. How should this take place, when, how much, to what extent and when?

Children's training, whether at school or in a club, is versatility training. Children who, because of their urge to move, their curiosity and their need for variety, accept all new opportunities for movement with enthusiasm. Children can only concentrate on one thing for a short time and their enthusiasm quickly wanes. A varied training programme is necessary. The growing organism of a child or young person needs a variety of stimuli to develop the different organ systems (muscles, bones, cartilage, vision, ligaments, cardiovascular system, metabolism, and hormone system) harmoniously.

Parents and coaches who restrict their children to one type of sport too early and deprive them of this necessary versatility are acting short-sightedly and irresponsibly.

Tug of war is the right load of the whole-body structure it is important to balance the left side.

From a medical point of view, the unfavourable effects of one-sided loading, especially on the spine, make it necessary to train on many sides, especially at a growing age.

One speaks of cross-training when other sports are included as a supplement and balance to a main sport. To avoid one-sided, deficient development or sport-specific muscular imbalance.

Cross-training is especially recommended for young competitive athletes.

Ensure comprehensive athletic training that increases the general resilience of the musculoskeletal system and develops skills that are neglected in specialisation.

Increasing athletic performance through combined training units.

Versatile coordinative and technical training, which is not possible in the special discipline.

Avoidance of overload through one-sided specialised training.

Other emotional experiences in disciplines or sports.

Cross training not only compensates for sport-specific deficits but also serves to mitigate burn-out syndromes in a single sport practised over many years.

What is particularly important for competitive athletes is the increase in sporting performance and general resilience and ability to recover.

All the advantages of versatility notwithstanding, specialisation in the technique: in this case Tug of War, must be learned and mastered properly.

11.1.3 Methodical principles for technique training

- A special technique requires special training measures.
- A special technique must be preceded by special conditional preparations, e.g., sufficient strengthening of the back, leg, and abdominal muscles.
- Recognizing movement details for learning an athletic technique, observation skills and knowledge of the technique must be included in the learning process.
- the speed of the technical learning process depends on knowledge, sub-processes, control and video analysis and control.

- the technical learning process should be completed without long interruptions between training sessions, otherwise the effectiveness of the training will be reduced.

- Technical training should be carried out in a recovered state. The number of exercise repetitions must be adapted to the conditional requirements. an overtired central nervous system does not allow optimal coordination.

- Early participation in a competition with insufficient technique can have a negative effect on the movement process due to the stress of competition.

11.2 Tug of War technique: Outdoor

Tug of War has changed over the decades and the technique has evolved through the competitions. We have experienced in competitions that different techniques can lead to victory. Whether it is the stretched open posture (upper body turned away from the rope) or the closed posture with the rope leading from the hip to the armpit or more the bent posture (angle at the hip). These different positions on the rope are part of the whole team. What has a much more decisive effect on the team is whether seven or eight athletes are doing the same thing at the same time.

In addition, the ground conditions (wet, hard, dry, or deep) also require adaptability in technique and tactics. This requires the team to be able to adapt quickly.

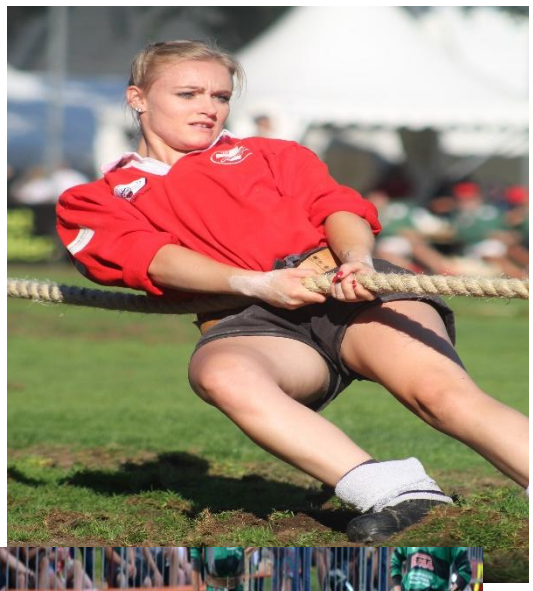
This is where the versatility of the athletes comes into play. This increases the possible room for manoeuvre and the ability to react flexibly to rapid changes during the competition.

The factors of strength, endurance, physical conditions, tactical considerations, external influences with all their interactions ultimately lead to which technique the team uses.

In the outdoor, the posture and movement sequences are divided into two groups. In tug of war, there is a constant interplay between the offensive and defensive positioning of the athletes. This is also how they are presented here.

In indoor tug of war, the positioning is compulsory. Due to the constant pressure on the athlete, the position is given from the pull to the whistle. It does not allow any abrupt change of position, as the pressure drop is too high.

11.2.1 Basic position



The pictures above illustrate the different positions in the basic stance.

It is easy to see that the rope is guided at the level above the hip bone.

This is considered to be the ideal line. From this position, the defence (blocking) can be initiated or the body can be turned in and the pressure increased for the attack.

The hand position is central in the front of the puller. In the open position the arms are extended. When the body is turned in, the arms are slightly bent.

11.2.2 Faults in the Basic Position

In the past, the rope was led much higher and the puller literally hung in the rope. These positions can still be seen on teams and pullers today. It is not really efficient because the puller feels enormous pressure on his hands, but he cannot bring it to the ground because the position is not right. **See Basic Position.**



11.2.3 Procedure at the start of a pull

The next step in the learning process of the pulling techniques is the start.

The team is lined up on the competition area. the first athlete stands at the marking of the rope. the distance of each athlete is about one arm's length to have enough space during the fight.

the judge asks the coach (team)

Team are you ready?

the coach gives the sign with his hand; we are ready.

The judge then gives the command: **Pick up the rope.**

The team lifts the rope with their foot, takes it in their hands and makes a single hole in the ground with the heel of their shoe.

After the command: **take the strain**,

the upper body is shifted backwards with the left leg extended to slightly bent. The right leg is already bent and tensed for the catapult movement backwards.

In this position the judge corrects the centre line (red) with his hands left or right until it is centred.

after this scenario, the command following: **Pull!!!**

In the case of an explosive start, the factors act:

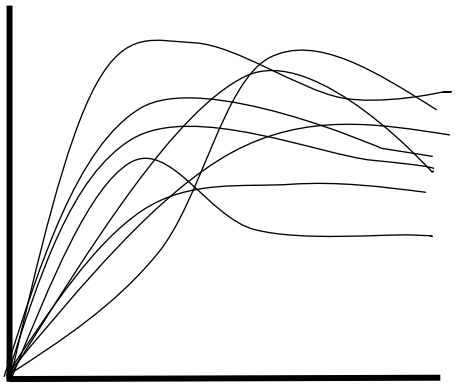
the kinetic energy of the ¨**falling body**¨,

and the **explosive stretching of the legs and torso muscles.**

These sequences must be trained again and again. The best way to do this is on a trestle with weight, during sparring pull in your own team.

To visualise the sequences, videos are helpful for analysis. Acoustics and concentration skills with the help of commands are also helpful.

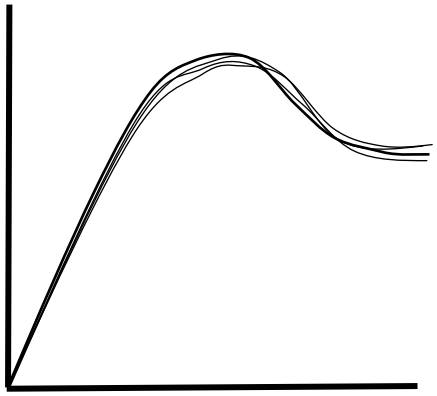
max. Power



Time

uncontrolled start with 8 athletes

max. Power



Time

Controlled start, all 8 athletes apply power to the rope at the same time.

These two diagrams show how important it is that the athletes are prepared for the pull, physically, psychologically, and mentally with all senses awake and ready for anything.

11.2.4 Foot positions

this foot position is used for walking or pressure chamfering with the body turned sideways to the right.

This foot position is relatively narrow, and in case of missteps or slipping, disbalance can throw the athlete or even the team off balance.

This active foot position enables a quick conversion from defensive to offensive.

This foot position is used for the defensive, i.e., the body is open and straight in the rope from a light to a bent position.

This passive posture increases the load on joints and tendons.

11.2.5 Hand position

These are hand positions with the body turned to the right side of the rope. The left arm is extended, and the right arm is slightly to strongly bent, depending on the pressure on the rope.

The bent arm can lead to a small congestion of blood (hyperacidity).

These hand positions are mostly used in open body positions, waiting periods or defensive work.

The straight hand position results in better blood circulation.

This hand position also results in a more stable posture.

By turning the right-hand outwards, is a danger that the upper body will turn outwards, resulting in an unfavourable body position, the so-called right pressure is created. This means that the rear and front pullers must compensate for this so that no disbalance occurs. This results in a loss of power and thrust to the rear.

It is essential to pay attention to these points during training.

11.2.6 Attack position

The posture and movement structures are basically divided into two main groups. these experience a constant alternation between offensive and defensive positions in a combat situation.

- **Open pull position**

Scope pulls: loose and deep soils

Partly for pressure soils

Pros : Load on the back is distributed over both muscle groups along the spine

The arms are relatively stretched, thus less blood congestion

Cons : A better attack can be triggered by the opponent.

This position can cause a certain instability in young athletes.

- **Closed pulling position**

Scope pulls: is mainly used for hard floors.

Pros: Apply stable posture especially in the youth sector

Enables enormous high-pressure generation.

Cons: tend to have a large one-sided physical load

the reaction to an enemy offensive requires high rope awareness.

- **stooped posture**

Scope pulls: Application area on wet and slippery ground.

Pros: this position reduces the risk of slipping. due to the changed foot/floor angle.

Cons: extremely high load on the back muscles at max. power level. Risk of right pressure due to this position.

11.2.7 Defence position

- **tensed body**



Scope pulls: For soils that allow high pressure generation.

Pros: Strain on the spine, more strain on the muscles due to the straight posture.

Chances of the opponent initiating an attack are rather small.

Cons: High effort for the whole body

- **open body position**



Scope pulls: is used for very deep soils (lower pressure generation)

Pros: Energy-saving bridging of a zero-phase hot low pressure on the rope.

Cons: Greater stress on the spine and its soft tissues, which can lead to a hunchback. In the case of an opponent's pressure attack, it is almost impossible to block.

- **sideways pulling position**

Scope pulls: Application specifically for pressure soils.

Take place during interplay of attack and defence.

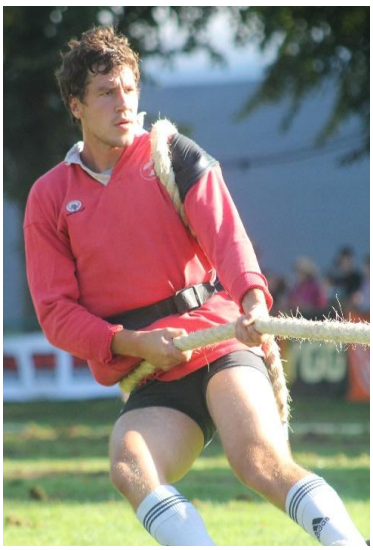
Pros: Quickly convert to defensive or continue in attack position,

Compact posture with little pressure loss in the transition phase attack-blocking.

Cons: can tend to cause right-sided pressure loss

right-hand pressure possible during conversion to the defensive position

- **anchor positions**



The anchor is a challenging position. Because the stability of the athlete must be produced by himself. His task is to stabilise against the front, to be sure not to slip and not to lose momentum in case of an attack or defensive work.

This position is used with many anchors when there is a resting phase on the rope, a less than ideal hole.

This position is not ideal for the following reasons: in the event of a counterattack, the anchor is levered out of the hole and there is a loss of pressure. it can slip and endanger stability.

If your team launches an attack, there is also a loss of pressure because the anchor falls.

the three pictures above illustrate the possibilities of good anchor positions.

11.3 Practical training options

The sport of tug of war is constantly evolving, so it is important that trainers, coaches, and athletes are open to new developments in technical training. The old tried and tested is combined with new modifications.

A good technique depends on various factors. The trained eye of the trainer, coach and athlete, the use of appropriate tools such as videos, photos, and competition analyses from top teams. These tools contribute greatly to the improvement of technique, with the willingness to improve and the ability to criticise making a huge contribution to progress or stagnation.

For the coach and athlete, there are many different forms of training, especially in tug of war, to learn the technique as a whole or step by step. here are some possibilities as input.

Different ground conditions improve technique, tactics, foot positions and train the instinct on the rope.

11.3.1 Learning blocking Offensive- defensive

There are various possibilities for this. two teams can pull each other around a wheel. two springer athletes are used to increase the pressure on one side. In this way, an attack can be simulated. One of the teams is forced to take up a defensive position. In the defensive phase, the two jumpers from the team that attacked will leave.

They will then move to the other team. The defending team pushes itself back into the starting position. as it was started. This exercise requires a lot of skill and intuition.

Coaches, trainers, athletes, and video analysis are used for correction and assistance.

With a team using a strong spring or an elastic band (bungee jump rope), a constant and increasing pressure can be applied to the athletes. With this exercise the whole process of blocking to attack can be practised. Refines, improves the movements of the coordination system. due to the constant muscle tension, this variation achieves an additional physical increase in the athlete's performance.

For the entire process, it is important that the whole team, which also competes together, repeats this repeatedly on the gantry. It is especially important to have a instinct for the whole team and everyone.

Under point 11.1.1 the methods are mentioned which are needed for successful learning and implementation.

11.4 Tug of war technique: Indoor

As the name Indoor implies, it is played in a gym or arena. Indoor uses a mat as a base. In Europe, the Dunlop mat is the most used. These are joined together as a plate element and connected to each other in this way. In Asia, the Japanese mat is used, it is thinner and is rolled up. The mats are cleaned periodically according to the time and degree of contamination. This ensures the risk of slipping and the adhesion of the shoes.

Unlike in the outdoors, running shoes with a special sole are used. They are protected from dirt with overshoes during the breaks and when entering the arena.

Shoe covers

indoor shoes there are different types.

11.4.1 Basic Position

compared to outdoors where several positions are possible. The hand position indoors is the right hand in front and the left hand behind. Whereas in outdoor the left hand is in front and the right hand behind.

The reason for this is that the open stance is drawn indoors and is supported by the hand position. By changing the hand position, the shoulder belt and hips are at the right angle to the rope. The advantage of this is that the legs and feet are loaded evenly.

The posture, the shoulder girdle is pushed back, and the chest is pushed forward. this gives the upper body a tension. this results in an optimal hand position.

11.4.2 Faults in the Basic Position

this foot position puts extreme strain on the joint and ligaments and is not recommended.

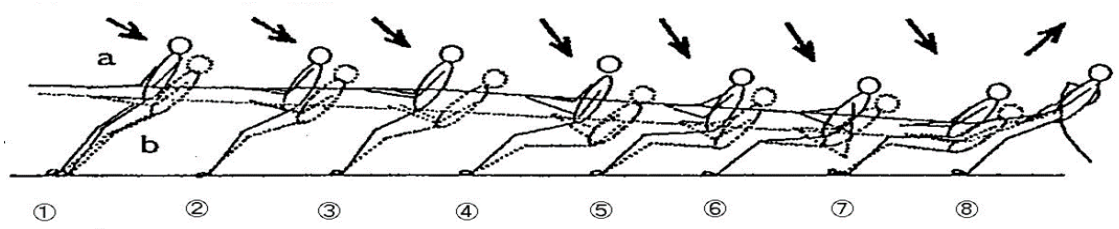
11.4.3 Procedure at the start of a pull

The pull command scenario is the same as in the outdoor. The pull on the mat is a little different. The position is open and is maintained until the end of the whistle. Here are the pictures of the phase from the command take the strain.

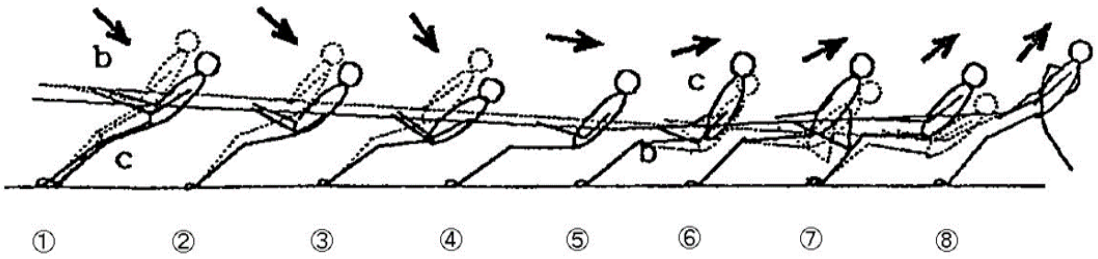
Take the strain

Steady

Pull



Pull situation Team



Team situation after pull

this process is also called the drop phase.

Here, as in the outdoor, it is important to have an explosive start with all eight athletes.

A mistake has a more extreme effect indoors because it is very difficult to correct it. As the pressure generated on the mat is higher than in the outdoor.

11.4.4 Foot positions

This foot position is the optimal position to aim for. the load is straight to the ankle and does not twist the joint sideways.

11.4.5 Hand position

Here you can see the hand position well, in the first picture the hands are firmly together. The left hand forms a kind of block so that the right hand remains stable.

In the second picture, the hands are a small distance apart. It is easy to see that the hands anchor the rope in the centre of the hips.

There are athletes who use the hand position from the outdoor as well as the indoor.

11.4.6 Attack Position

Drive phase: means that the pressure is exerted on the opponent with a low body position.

With alternating small, powerful kicks, one tries to pull the opponent to one's own side.

The width of the feet is between the width of the hips and the width of the shoulders, depending on the technique being played.

11.4.7 Block Position

The block or hold phase is used when the opposing team attempts an attack.

low position of the feet between the hips and the width of the shoulders. the whole body is tense to slow down the opponent until he is tired or makes a mistake, from which an attack can be made.

11.4.8 Anchor Position

Here you can see the different varied movements from defensive to attack to hold position. The anchor is an important team support.

If he makes a misstep, this can lead to a counterattack or throw the team off balance.

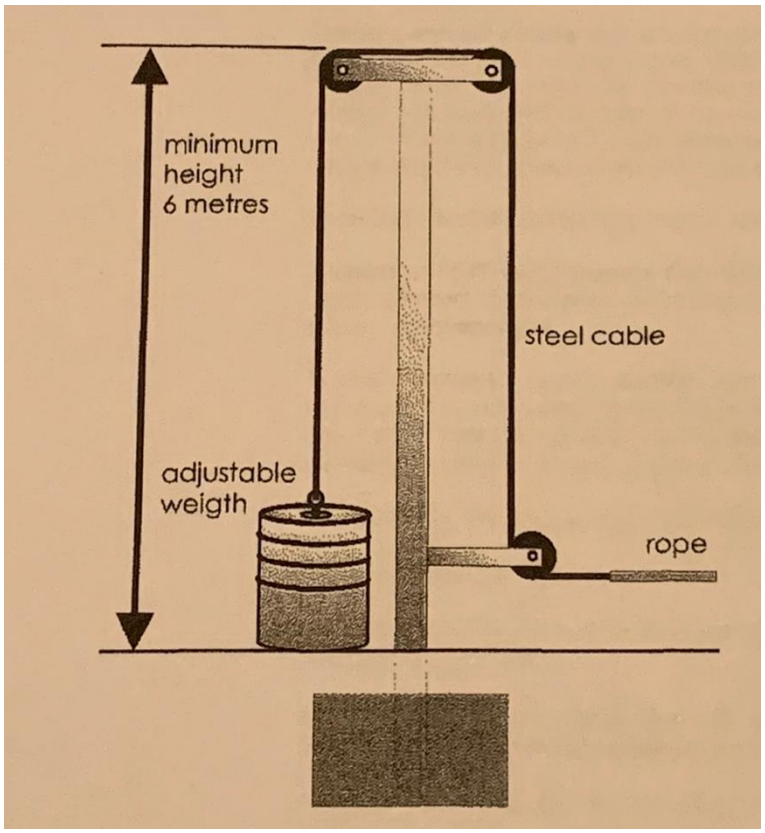
11.4.9 Get back into position after sitting.

- reset the setting of upper body as soon as possible.
- put the legs and feet in the ready position.
- wait the hint or sing of the coach.
- push up, then push or defence.
- never do it alone, or in hurry.

11.5 Exercise equipment In-Outdoor

Most Teams will train twice a week, maybe more often a week or two before an important competition.

As in getting fit, learning to pull on the rope must be accomplished gradually.



Getting the right stance and position on the rope, and being tested on the gantry, with other pullers at modest weights, initially will be best. Learning how to establish a rhythm in pulling in unison with other pullers is vital. Some teams learn this by all chanting together. Such as ¨one two, one two, one two¨. Moving first the right leg then left leg, or by chanting ¨yes¨ together, as them puts in a heave. Indeed, some teams carry this thought to competition.

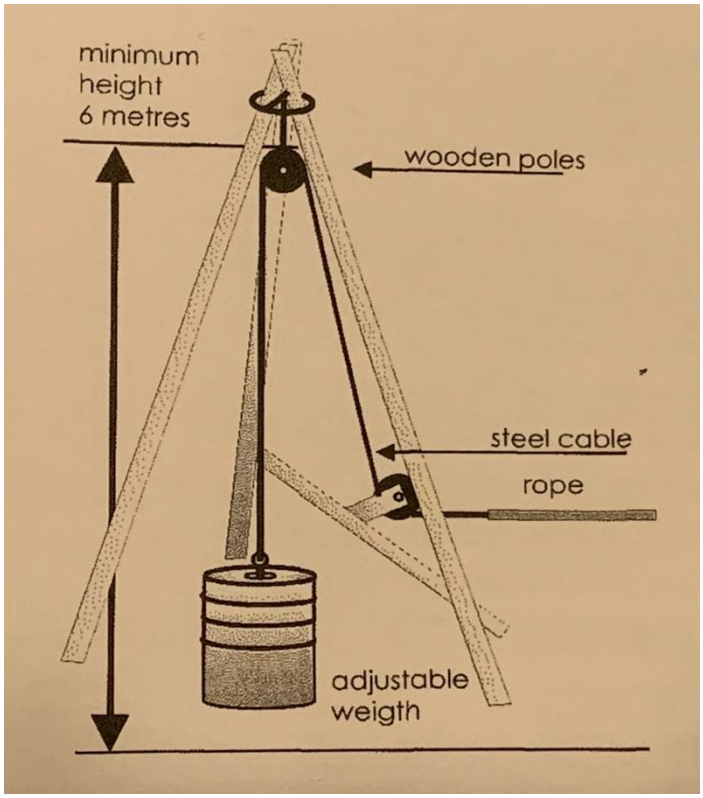
When a coach is satisfied that his pullers are improving with training, he will increase the weight being lifted on the gantry, and then instructing the team to hold the weight at that point. Firstly, for short periods, then for longer ones. This will equate to keeping an opposing team under pressure. Eventually as training progresses, pullers will be taught to lower the weight on the gantry, and suddenly be told to stop the downward moving by digging in their feet. This equates to check where an opposing team is taking you forward.

Where more sophisticated equipment is available, it may be possible to test pullers individually, at raising a given weight on the gantry, but no puller should be tested to his limit, individually, as this cause injury.

Rope training should be interspersed with short runs and simple exercises, so as vary an evening's programme.

However, much training is carried out on the gantry, ¨live¨ pulling gives every puller a chance to ¨feel¨ the rope. Splitting those pullers present at training into two teams, as equal in weight as possible will be of great benefit. Pulling against each other as if in competition. If there is another team, not too distant, arranging an evening ¨live¨ pulling, at the beginning of the season, would be greatly beneficial.

The following two diagrams show methods of rigging a gantry (derrick) for carrying out trainings work.



In some cases, a Tug of War club may be fortunate in having a large tree close to its training area which would be obviate the necessity of a gantry. A branch may be found strong enough to be able to take a length of steel cable capable of supporting the weight being pulled up by the team training. In all cases a normal Tug of War rope is used and will be secured to the end of the steel cable at ground level.

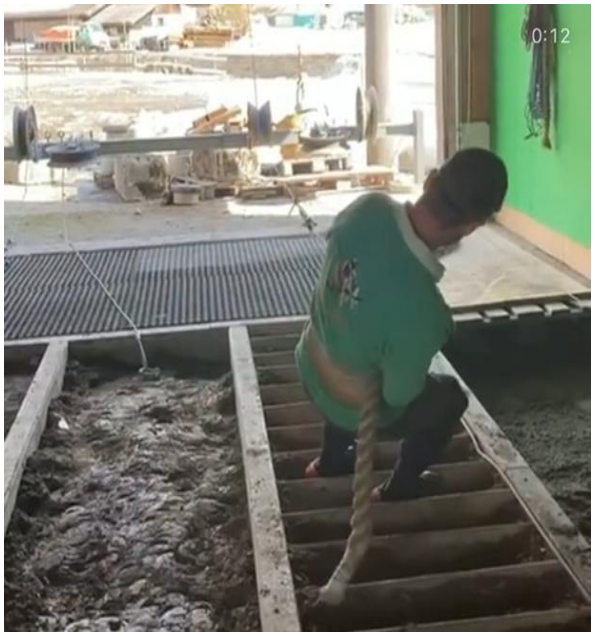
Strengthening legs may be obtained by digging a small trench and fixing wooden slats into the ground, so that it takes one the appearance of a ladder. The distance between the slats should be not too wide, but just enough to make the required steps under pressure. By placing pullers along the trench, pulling a rope, with other pullers trying to pull them out of the trench, pulling them against the slats in the ground, this will assist the leg strengthening. It will also approximate to the pullers trying to move those in the trench, to trying to move an opposing team that has become well ¨dug in¨.

The use of an ¨inner tube¨ from a large van or lorry is favoured by teams in training. If secured to a pole or small tree, the elasticity of the tube gives a ¨spring¨ against those pulling against it. Care should be taken to ensure that a tube is in good condition before use.

There are many trainings methods favoured by countries and clubs worldwide, too numerous to list in this manual, which only seeks to suggest some basic methods. But invention is the mother of innovation, as an old proverb relates!

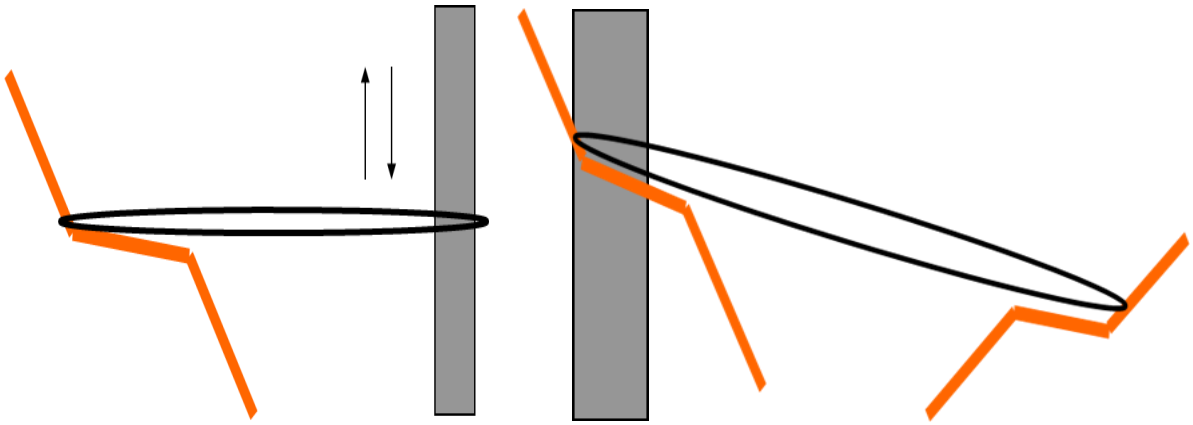
11.5.1 Individual training

Single Gantry for use of In- and Outdoor training



Individual and team training facility

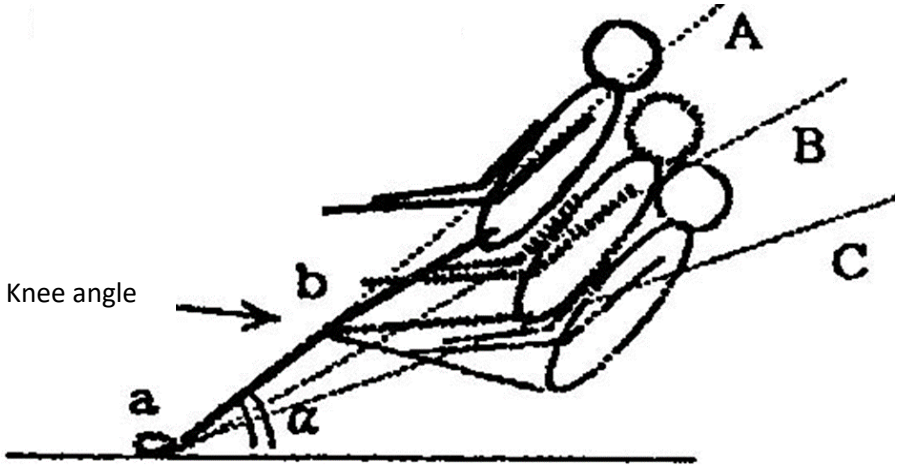
Indoor practice



Indoor training and feel the pressure

Indoor posture how to train

- The sense of gravity



Knee angle

- **practice the sense of gravity**.

❖ **Pull evenly**	to practice the sense of force from feet up to gravity.
❖ **Pull acclivitous**	avoid lying the rope too much.
❖ **swing up and down**	to sense the change of force change and space.
❖ **Put strength forth**	to sense the change of the space and falling of gravity.
❖ **tug/pull the tire**	react / defence the various force.

12 Tactics training

In general, tactics are understood to be the planned behaviour in an individual or team competition, based on one's own and the opponent's performance and the external circumstances.

In tactics, a distinction is made between general and special tactics, as well as individual, group, and team tactics.

General tactics refers to general rules and laws of tactical action.

Special tactics, on the other hand, are sport-specific and require appropriate training.

Optimal competition behaviour requires an optimal tactical attitude on the part of the athlete (team).

It is often overlooked that sporting performance is also tied to cognitive (mental), emotional and volitive (willpower), which must be optimised just as much as the physical prerequisite for the purpose of improving performance.

The maintenance of the inner drive and control abilities requires the so-called control abilities.

Sporting tactics

based on

Cognitive skills	Technical skills	Psychological skills

and aims at

Optimal competition behaviour using all individual abilities and skills.

The components of the tactical action structure.

The cognitive-tactical performance prerequisites are indispensable for successful competition decisions and form the most important determinants in the regulation of action.

Control skills:

Will	Ability to consciously overcome subjectively experienced difficulties and obstacles.
Determination	Abilities to make decisions and to realise them in motor actions.
Self-control	Ability to keep emerging emotions and spontaneous impulses under cognitive control.
Courage	Abilities to consciously cope with dangers and overcome fears.
Perseverance	Abilities to strive towards a goal over a longer period even in the face of failures and delays.
Concentration	Abilities to record a limited section of the field of perception with the highest brightness of consciousness and at the same time to eliminate other stimulus influences.
Stamina of concentration	Ability to consistently focus attention on a selected field of consciousness over an extended period.

The control skills are needed to overcome the:

To control internal difficulties such as state of excitement, emotions, fatigue, states of weakness, permanent stress, and conflicts.

The external obstacles such as difficult training and competition conditions, spectators, unknown environment, complex tasks, and difficult tasks.

12.1 The Tug of War tactic

Tactics play an important role in tug of war. the different ground conditions must be considered, even within a competition. One is owning strengths and weaknesses are influenced by the physical abilities of the team.

The draw for the competition, the referees, the competition rules, etc.

12.1.1 Tasks of tactical training

It forms an integral part of the training process and is closely related to technical and psychological skills. Tactical training can be divided into theoretical and practical training.

Theoretical training:

It includes the training of the intellectual skills that the athlete needs to compete successfully in sport.

- The training of the learning ability: It serves the acquisition, classification and updating of sport-specific knowledge (knowledge of the competition regulations or rules of the game, organisation, and management of the sporting competition).

- The training of sport-related thinking skills (e.g., game intelligence): This should enable logical, flexible, original, and evaluative thinking, which ensures the optimal use of tactical skills and enables independent changes of action when circumstances change.

- Training anticipation skills: The aim is to programme in advance and thus prepare potential trading alternatives.

- The training of emotional-volitive characteristics: self-control, perseverance and decisiveness can have a decisive influence on tactical ability to act; their development is therefore important for the optimisation of tactical action.

- Training information intake and processing by directing and sharpening attention: On the one hand, successful acting and reacting requires that as many signals as possible that are important for the course of the competition are taken in; on the other hand, a search-preparedness for essential points of the competition management makes it possible to avoid information overload, which often leads to wrong actions by beginners.

Practical training:

It involves the acquisition of tactical skills and behaviour. The repeated execution of certain tactical behaviours (e.g., defensive defence/counterattack) leads to an automation of subcomponents of conscious action. The athlete's attention can thus be directed to other elements of the complex action. The practical training also serves to train the athlete's correct self-assessment, which enables him to recognise his individual possibilities and limits and to use the available forces in the team accordingly.

12.1.2 Methodical principles for tactics training

- Tactics play an important role in tug of war, and it is essential to include them in the training of young talents in the context of technical training.
- Technical and tactical training must be developed in parallel.
- Tactical training is closely interrelated between theory and practice.
- Tactical behaviour is trained and consolidated under increasing difficulty - from the easy to the difficult and from the simple to the complex.
- The tactical knowledge of the trainer and coach should already be passed on to the team during training.
- The development of the ability to observe - centrally and peripherally - strongly influences the tactical ability to act. (Video analysis)

12.1.3 Activate awareness.

It is a must to deal intensively with the tactical possibilities and their relationships.

Reminder for the training preparation:

- Current competition rules, what leeway do they allow?
- Mixing the team to create a competitive situation.
- Competition field, ground conditions, uneven tracks. Can I create similar training conditions?
- Emotions, home tournament significance? Loud fans and other special circumstances?

Reminders for the competition:

- Tournament list, when which opponent, consider different tactics from coach/trainer?
- Weather hot/cold, placement of competition tent, clothing, ground conditions, possible technical changes, choice of resin, etc.
- Judges, what do they penalise, what don't they penalise?

12.1.4 Tactics training in childhood and adolescence

Tactical training should be started as early as possible, and always in conjunction with the teaching of technical skills. The motor learning age of early and late schoolchildren is particularly suitable for a versatile technical-tactical basic training with the acquisition of an extensive repertoire.

In addition to comprehensive, versatile general motor training, attention should be paid to practising sport-specific movement skills at an early stage, which make appropriate tactical action possible immediately or subsequently.

Football, basketball, handball, or hockey, each with different technical requirements (foot or hand games, games with different balls, without and with a stick), make timely and early sport-specific training indispensable for successful tactics training. Tactics modules that are important in every game, such as running free, offering oneself, etc., are trained. In addition, the child/youth benefits from the variety and variability of the different requirements of the individual games (different court and space dimensions, different movement speeds, different demands on speed of action, running, passing, throwing, shooting and hitting speeds) and thus improves factors relevant to sports games such as perception, decision-making and reaction speed.

Children between the ages of 8 and 13 improve significantly in the different components of attention. In addition, the tactical-technical training process should be closely coupled with intellectual training, even in children and adolescents, since highly reliable correlations can be established between the mental performance and challenge level and the complex sporting performance capacity.

Each activity is like a melody that involves its own peculiar combination and sequence of musical notes, sensory, motoric, and cognition.

Parker/McKinney 1999

13 Psychological training to improve athletic performance.

Today, psychological training is part of the toolbox of sports training in many ways. Success in sport depends not only on a strong body, but also on an equally strong mind.

Similarly, the various forms of psychological training can be used not only to optimise performance, but also to improve tactical learning processes, to optimise pre- and post-performance processing in the sense of an optimal pre-start condition, a consolidated winner mentality and rapid recovery after stress.

13.1 Relaxation and recovery after sporting exertion

13.1.1 Autogenic training (AT)

AT is a concentration self-relaxation that leads to a state of lowered consciousness with optimal muscle relaxation through autosuggestion.

AT plays a role in the recovery and restoration of the athlete's mental and physical potential, who is exposed to extreme stress situations in competition and is forced to eliminate physical states of exhaustion and mental states of overexcitement as quickly as possible.

To enable the process of complete relaxation in AT, the practitioner must completely free himself of performance expectations and gain distance from the environment through concentrative mental relaxation.

The learning time for the AT is about two to three months, the daily practice time should not exceed ten minutes at the beginning.

If AT is mastered, physical fatigue is eliminated or reduced, and emotional tension is relieved in a short time. A five-minute recovery with AT has a greater impact on the restoration of mental functions than a one-hour recovery without AT.

AT does not necessarily lead to success for every athlete, as the learning time can be relatively long depending on individual characteristics. AT that is only imperfectly mastered, learned under pressure to perform or practised only sporadically is often ineffective.

Related forms of the AT:

Deep muscle relaxation (DMR): is relatively quick to learn, in contrast to the AT. Two hours are sufficient to convey the basic knowledge. After that, a few short repetitions are sufficient.

The DMR duration is about ten minutes. DMR training has the following physical and psychological effects eliminates or reduces difficulties in falling asleep, reduces or eliminates

existing pain by increasing the pain threshold, reduces or eliminates mood swings (anxiety, etc.), increases tolerance to stress, reduces blood pressure and heart rate. nervous calming effect as with AT, increases blood flow to the entire muscular system.

Psych regulative training (PRT): consists of a calming and an activating part, the focus of which depends on the athlete's personality traits as well as the tasks ahead.

In PRT, the same reactions occur during the relaxing part as in AT, i.e., a switch to a trophological (recovery-oriented) phase, which is accompanied by a reduction in heart rate, blood pressure and muscle tone. In the mobilisation phase, there is an increase in sympathetic tonus and thus an increase in the willingness to perform.

The effects of PRT are, accelerated recovery processes after athletic stress, reduction of performance decline during static and dynamic stress through the application of PRT, improvement of mental performance, e.g., reduction of error rates and recovery of attention, desensitisation of mental disturbance factors, elimination of sleep disturbances, elimination of states of over-excitement and apathy before and after competition, assurance of stable competitive performance.

Relaxation Activation Method and Active Therapy (ATP): with the help of which the athlete can free himself from the excessive stress of psychological strain, but without suffering any loss in his performance dynamics.

The methods consist of a combination of relaxing exercises and targeted tensioning exercises for the competition. The exercise programme is divided into three phases: relaxation (AT sub-stage), transition and activation through formulary resolution, swing gymnastics. This leads to an economical functioning of the central nervous system and improved control behaviour of the circulatory system.

13.2 Psychological training as a skill

Psychological training is the systematic optimisation of the psychological prerequisites for action with the help of psychological methods. As with physical training, this involves purposeful, planned, repeated, and controlled measures.

13.2.1 Mental training (MT)

In the process, ideas of an optimal execution of a certain movement or action are activated and mentally reproduced several times and trained in this way, without realising the movement or action.

MT is therefore used when learning new movements/techniques, when optimising and stabilising individual movements or sequences of movements or at the time of an injury break to maintain a movement technique.

Basically, as with all training methods, optimal learning conditions optimise the training effects. Thus, internal, and external factors have a decisive influence on the effectiveness of MT.

Internal conditions: A positive attitude, the promotion of the athlete's motivation and the following concentrated thought processes are essential for the success of the MT.

Excessive ambition and any kind of compulsion must be eliminated. The willingness to imagine and thus the success of the exercise is increased in a relaxed state.

In addition to psych regulative methods such as AT and progressive muscle relaxation, relaxation can be initiated by playing calm music beforehand. Breathing and swing gymnastics for relaxing intervention before the actual MT begins. Additional meditation, massage and floating baths further promote the effect.

The exact idea of the athlete's optimal set point. This can be created by verbal description, series of pictures, video films, etc. Since the coach cannot intervene in the exercise process during MT, the athlete must be used to working independently to ensure optimal exercise success.

External conditions: The mental exerciser must be protected from loud noise, bright light, sweating or freezing, etc. Studies have shown that the posture adopted is a decisive criterion for the effectiveness of MT: Only when standing does the electrographic image of the relevant musculature during the imagined movement correspond to the real execution.

Limits of the MT: The effect of MT depends on movement experience and clear movement knowledge; it is hardly usable before the age of twelve.

Due to the high concentrative fatigue, MT can only be used for a limited period, about two to three minutes per training session. Over the day, however, mental training can be repeated, whereby mainly movement details that are difficult to grasp should be practised more ideomotorically.

If MT is performed exclusively or for too long, faulty movement sequences can develop and become ingrained due to a lack of control under real-life conditions.

MT can be used in Tug of War to support various movements.

Through image series and video documentation, the pull phases can be learned in multiple mental trainings in a shorter time.

The attack release with lowering phase, pressure increase and body rotation gain stability with mental exercises.

Incorrect movement sequences can be effectively corrected with mental training.

13.2.2 Related forms of mental training

Observational training (OT):

Presentation methods for OT are demonstration (teacher or student demonstration) film, picture series, calculation, etc. According to research, the use of picture series seems to be more effective than a ring film. This is emphasised the viewing time is longer and can be better memorised. Each demonstration must be preceded by verbal information in order not to leave perception to chance, but to trigger a sensory perception in the pupils.

Observational training involves the planned, repeated and targeted observation of other people's practice.

Verbal Training (VT):

The possibilities of VT are applied according to the situation and level of ability, with particular emphasis on self-command.

Forms in VT are:

Communication with other persons (athletes/trainers/coaches)

Talking along with the preparation and execution and movement

Talking to oneself.

Verbal training is a planned repeated targeted verbal communication about the sequence of sensorimotor skills to be learned.

The selection of verbal information and the number of corrections given should be based on the learner's level of development and training and the complexity of the movements.

With increasing skill level, the amount of verbal information should be reduced, since the skilled person is able to define the target value of a movement on the basis of his or her own movement experience.

13.2.3 Mental strength

Currently, the top Tug of War teams are roughly equal in technical physical potential. To this end, in competition it is important through mental strength to use one's own strengths and the team's skills to one's advantage over the opponent.

There are many ways to divide mental strength into sub-areas. In practice, one concept has proven to be useful and realistic, which we call HPT (Human Potential Training). HPT distinguishes between eight different mental performance factors:

Motivation:	To work towards a high goal with joy, commitment and enthusiasm in training and competition.
Regeneration:	Switch off (e.g., from work) and start with recharged batteries.
Concentration:	Being fully engaged in the task without being distracted.
Self-confidence :	Believing in one self and one's own possibilities - regardless of the situation or the opposition.
Mind control:	Trying to make the best of every situation. Set yourself up for success and do not dwell on possible failures.
Emotion control:	Putting away anger and frustration (e.g., about mistakes and defeats).
Activation control:	Find the right mix between inner calm and aggressiveness, especially in the phase directly before the start.
Organisational control:	Preparation procedures under control from A-Z - from the week before to the super start.

How important the individual factors are for an athlete depends on the person and the situation. While some get annoyed about little things, others almost always stay cool - and perform well.

How can I work mentally?

You already work mentally.

Since you have certainly adjusted to the competition in some way so far, you also bring the potential for optimising your mental strength with you. You can basically improve yourself by

Expand your mental repertoire, use individual strategies more consciously or more regularly.

Of course, you can also count on the fact that you are one of the few talents (teams) that reach the (world) top even without conscious work in the mental area.

However, only a very, very, small percentage of the population brings these optimal mental prerequisites with them (by having acquired them unconsciously during their careers).

Only take a chance if you have always performed well, even in the most important competition.

Less is usually more!

However, instead of trying to put all ten of the following tips into practice immediately, you should set a **maximum of three priorities.**

Then apply this "technique" consistently - and have some patience.

Mental strength grows - just as continuously as strength and endurance - in three steps.

1. "Suddenly" a (slightly) better performance succeeds. You have improved your **mental performance.**

2. you can regularly put into practice what you have just learned. You have achieved **mental stability.**

3. you manage to perform well even when it matters. Now you are **mentally strong under pressure**. Bravo!

The following tips should help you to become stronger in the mental area, regardless of your sport or level of performance.

Of course, not every person (team) has the same strengths and weaknesses.

Therefore, choose the techniques that seem particularly important and interesting to you.

I want to do my best!

What is your goal before or at an important competition?

- Win?
- Deliver a super performance?
- Set a personal record?

You are probably making things more difficult for yourself than necessary. The successful top athletes (teams) have a much simpler solution.

They usually say before a competition:

I simply want to do my best. We will see how far that goes!

We are by no means talking about an overly casual attitude, as we assume that top athletes always want to perform well.

The danger of overactivation (nervousness), especially in important competitions, is therefore rather greater than that of under activation.

So, the above objective only helps to reduce the risk of being too nervous. Moreover, it prays the advantage that it can also be applied in training.

The athletic training thus becomes "mental" training in addition.

Tip 1: **Goal: You want to perform well, give your best!**

Forecasts - no thanks!

Top athletes are often asked before a competition what result they would expect. Experience shows that two types of behaviour indicate a subsequent average or weak performance:

- a very **bold prediction** such as "I'm in top form at the moment and can win against any opponent!"

- **a cautious forecast** such as "It will be very difficult against this opponent."

The reason for this is probably that both forecasts point to overconfidence or a lack of self-confidence. Neither is an ideal basis for good performance. Successful athletes assess themselves realistically, know that they are not always in the same "mood" and remember tip no. 1.

So, forget about what if.... Forget all speculations and forecasts: **but go forward step by step - towards success!**

Tip 2: **Do not make any predictions about the outcome of the competition. You only put yourself under unnecessary pressure.**

Desire for the competition

They prepare long and intensively for the competition.

Over the course of months and years, this can also become a bit monotonous or boring. At the competition itself you then "want" to give everything, but it just does not work out for you - and you can't find an explanation for it!

But: **If you are more motivated, you have more "power".** So, before the next competition, ask yourself whether it would not be better to take a few days off, do little or no training - and do something completely different.

Goal: **They should be really "keen" on competing again, really looking forward to stepping onto the competition field.** this extra energy should more than outweigh any minimal deficiencies in the technical area or even the fear of "losing form".

Tip 3: Make sure you really feel like the next competition!

Here and Now

Do you already see yourself on the winners' podium in your mind, or do you still think back to previous competitions before the start?

A targeted reminder of good performances can be just as performance-enhancing as presenting a successful competition.

However, you should **rather use** these mental training techniques in the **weeks and days before the competition.**

On competition (day) itself, it is much more important to **focus only on what is important in the here and now.**

Leave the past behind for a few hours, start from scratch. Also "the future comes all by itself", without you are doing anything. Concentrate exclusively on what you can do now to make the competition successful. This can be e.g., running in, preparing the material, repeating tactics, recalling mental strategies, etc. Nothing else!

Tip 4: Consciously direct your thoughts to the here and now. What happened before and what will happen afterwards will only interest you after the competition.

Everything as always

A particularly important competition often tempts you to want to prepare especially well - after all, you want to do particularly well.

But you are only making things unnecessarily difficult for yourself!

The whole preparation gets mixed up, the well-rehearsed procedures are no longer correct, etc.

So: **Prepare for "unimportant" and "important" competitions alike.**

Leave as much as possible as it is, because a lot will still be different at the competition itself.

With systematic preparation, you don't need to be afraid of limitations: **A consciously planned preparation ritual should not be a constraint, but a help so that you have a clear head at the competition for the things for which you could not prepare.**

Tip 5: Build "your preparation ritual" into your systematic competition preparation.

Everything under control

One of the most important objectives from a mental point of view is to **have the best possible grip on any opponents, the situation and yourself.**

This sounds much easier than it really is. Because: if you want to control the opponent and the situation, you must first learn to control yourself!

We recommend that you aim for three main points:

- **Keep talking positively to yourself, e.g.,** with words like "keep at it" or "come on, keep fighting..." or similar.

Tip 6: **Prepare consciously for what is coming up in the competition. Be in control of the situation, your opponent and yourself always!**

Comparison with others

Unless you have been undefeated in your sport for a few years, **there should always be better athletes.**

If you are concerned with what others can do better than you, this negative comparison will attack your self-confidence in the medium term (only a small proportion of athletes react to this with even more effort).

If you want to compare yourself directly, then make sure that you use your strengths as a yardstick and your weaknesses only as a suggestion for even more commitment in the relevant areas.

But it seems even safer to us not to compare ourselves so much with others.

Go "your way", play "your game", do it "your way". The successful ones determine their own path.

Tip 7: **If you compare yourself with others, only do it positively. Put your strengths in the foreground and determine your own path.**

The ¨Turbo Package¨

This "power package" has no fixed content but is designed to help you regularly and safely get into the ideal performance state before the "starting gun". The "turbo-package" is a kind of 10 - 30 seconds - programme, which should bring you directly into the ideal performance state.

You can put together your package from these, among other things:

- **Mini - activation exercises** like jumping, hopping, sprinting, etc.
- Gestures that express strength, like the "Boris Becker fist".

- Repetition of the **three most important** memorisation points (e.g., tactics, task, combat strength etc.)
- **Last refreshment** with water, drinks, etc.

The key is to find out early on and react to which offer you need to take from your individual "turbo package" for the current situation - under the existing conditions.

Tip 8: **Get yourself into the ideal performance state with the most suitable method for you personally.**

But that is enough!

Especially after an unsatisfactory competition, you should take this rule to heart:

Set yourself a time limit after which the processing of the previous competition is over, and you start to prepare for the next competition.

If you still fall back after this "dead-line", do not fight against these thoughts, but say to yourself nicely - but firmly - "Come on, let us drop this now" and deal with the **solutions** that you have drawn as a consequence of the previous competition.

These solutions can involve four levels:

- Your **everyday life** (personality, job, private life)
- the **training**
- the **preparation for the competition**
- the **competition** itself.

Tip 9: **Mental processing of a competition is necessary. However, it should be clearly limited in time so that you can clear your head for new challenges.**

I am good!

Stand in front of the mirror and say to yourself: **"I am good".**

Arrogant? Not at all, because you should be able to tell yourself that you are capable of good performance.

The language here is not one of "overconfidence", after all you have not shouted to yourself "I am the best" or expressed the other way round: "The others are bad".

The others are good - but so are you.

Tell yourself this during training, even for small, seemingly self-evident things.

With every little "internal pat on the back" you build up self-confidence, which you can then draw on for a long time.

Tip 10: **Self-confidence can be built up in a targeted way. Make sure that you consciously incorporate positive mnemonic sentences / self-talk into your training.**

14 The importance of warm up and cool down in sport.

14.1 Warm up

Warming up is understood to mean all measures that serve to create an optimal mental and coordinative-kinaesthetic state of preparation as well as injury prevention before a sporting activity - whether for training or competition.

Through the redistribution of blood to the working muscles with parallel capillarisation and enzymatic increase in activity, the muscles can provide maximum metabolic performance. However, it must be gradually prepared for this performance: An increasing increase in load and approaching the target performance via the load chain ¨**activate - preload - utilisation**¨ represent the basic prerequisite of a correct special warm-up programme.

There should never be a change in warm-up method, intensity, or volume before a competition, as this could result in over- or under-dosing with a corresponding reduction in performance. The correct warm-up should be based on the experience of training and competition practice and should be optimised and fixed in a long-term development process according to individual needs.

General and specific warm-up can be supported by appropriate clothing (training suit, gloves, etc.).

Especially in international Tug of War competitions, where there can always be longer breaks, it is important to ensure that the muscles and circulation are activated. So that the top performance can be called up with every pull.

Warming up is understood to be the task of preparing the entire organism, which is set to a normal performance before training or competition, for a higher readiness to work and perform.

Forms	Volume/Intensity	Procedure
• Versatile exercises with alternating load on all muscles (synergists and antagonists) and sufficient stretching exercises. • General and specific physical exercises • Specific and non-specific movement elements	• Depending on the training condition of the athlete • Depending on the type of nerve: -Phlegmatic type= intense -Nervous type= low, but extended in time • Familiarisation time: optimal -Competition: 20-40 min -Training: 15-30 min • Closing: 5-10 min before the start of the competition • Halting effect: 20-30 min • When interrupting the competition: keep warm passively and use a shortened active programme to prepare for the start.	• Start with gradually increasing whole-body exercises, low intensity. • Special technique exercises follow: Gymnastics, run-in, warm-up. • Intensity gradually increases. • The main parts of the programme must be oriented towards the specific structure of the movement.

Effect of warming up.

Physiological reactions	Motor tuning	Psychological attunements	Reduction of susceptibility to injury
Muscles: • Loosening and stretching • Releasing tension	• Familiarisation with the special movement sequence (coordination skills)	Bringing about a combative willingness to perform with	• Through improved elasticity of muscles,

• Increase muscle elasticity. **Connective and supporting tissue:** • Better perfusion of the otherwise poorly perfused or not perfused tissue • Improved elasticity and mobility **Cardiovascular:** • Increase stroke and minute volume. • Mobilisation of the blood depot • Opening of the capillaries • Elimination of the dead centre **Breathing**: • Increased lung ventilation (respiratory frequency and depth) • Remove/dissolve arteriovenous short circuit connection. **Metabolism:** • Increase in body temperature. • Improved energy supply • Improved removal of waste products	• Achieving optimal responsiveness • Increase receptor responsiveness. • Decrease the significance of the nerve stimulus	attention to the nervous type. • Establishing an optimal state of arousal • Concentration on the main task	tendons, and ligamentous apparatus • Through increased mobility in the joints • Through increased responsiveness
Higher performance/better load compatibility			

14.1.1 Tug of War specific warm up

The special warm-up is discipline-specific and in Tug of War specifically needs the forearm muscles, back, shoulder girdle and leg parts. Care should be taken to ensure that it is a warm-up and not a strength training or endurance block and through partner exercises or direct rope work the muscle groups can be addressed directly.

The final preparations are performed on the rope. Pull in on both sides, left and right. With running in on the rope, with different pressure grips for a short moment.

Finally, pull exercises with short intervals are initiated.

14.2 Cool down.

These are all measures that bring the organism back into a state of relief, relaxation and rest after stress, strain, and performance, and in this way make an important contribution to the mental regeneration of the athlete.

Depending on the accompanying factors and different framework conditions, the cool-down process is given a corresponding target orientation.

Stretching after exercise should make an additional contribution to muscle relaxation (lowering muscle tone). It should be noted that after intensive lactic stress, no ¨tough¨ or long stretching is required, but intermittent short stretching. The stretching exercises should be related to the stressed musculature of the respective sport. Each muscle group should be stretched three to four times for about 10 seconds - preferably passively. Mental relaxation at the same time can further support the positive effects.

Subsequently, different physiotherapeutic and dietary measures are used, which finally optimise the recovery processes.

In general, enough time should also be devoted to loosening up exercises such as: Shake out the legs in a candle stand, or actively loosen the muscles with the help of a partner in the supine position by elevating the legs and supporting venous return.

15 Recovery and restoration after sporting exertion

The energetic-metabolic, neuromuscular, cardiovascular, cardiopulmonary, and psychological stress profile and the resulting recovery or restoration needs show significant differences between training and competition stress.

The need for regeneration also differs between the different types of stress (pure endurance, strength and speed-oriented or complex game sport stress) and the respective athletes with their individually different recovery capacities.

Regenerative measures serve to optimise and accelerate compensatory recovery processes, training tolerance in the case of high training density or accelerated recovery after competitive stress.

15.1 Physical recovery

Training design	Physical measures	Dietary measures
Warm down / Run out. Easy running 5-15 minutes	**Massages**	**Sufficient fluid and mineral intake** Replenishing energy stores as quickly as possible
Stretching 3-4 times 10 seconds per muscle group	**Heat baths / bubble bath** 36-38 degrees water temperature optimal 15-20 minutes	**Adequate nutrition** A balanced food supply must be ensured
Regenerative training Low to medium intensity endurance training approx. 30 -60 minutes	**Sauna** Air temperature up to 39 degrees Passage limited to approx. 10-15 minutes. about 2 minutes cold water application Relaxing and strengthens the immune system, reduces colds. **Cold applications** Water temperature 5-8 degrees Interval application about 5x2 minutes water temperature 10-15 degrees 10-20 minutes continuous application Venous return improved decongestant anti-inflammatory effect	
Useful training planning	**Sleep** Sleep and relaxation are essential for the regeneration of the organism and co-determinants of physical and	

	mental performance.	

15.2 Mental regeneration

Resource building	Psych regulatory measures	Avoid monotony
Positive sense content	**Relaxation techniques**	**Varied training content**
Entertainment (joy/fun)	**Positive self-talk**	**Motivating training**
Diversion	**Relaxation music**	**Optimal alternation of tension and relaxation**
Alternative programme	**Special forms of visualisation**	**Different intensities**
	Chill-out Darkened quiet room during competition breaks	

16 Tug of War injuries and rehabilitation

16.1 Injuries

Tug of war itself is a low-injury sport. But it can happen from time to time that injuries occur. Be it blisters on the hands, bruises from a missed pull, or small cuts from falling on the edges of the steel plates on the shoes. Muscle cramps can occur with insufficient fluid intake.

Some muscle strains in the leg muscles, back or shoulder muscles. The possibility of severe injuries cannot be ruled out.

Nowadays, physios are part of the coaching staff of the top teams and influence the fast recovery process.

Medical personnel are now required on the showgrounds to provide immediate assistance and first aid in the event of minor accidents.

16.2 Rehabilitation process

The goal of the therapy of a sports injury is clear: The sporting "forced break" should be as short as possible. Sporting activities should be able to be resumed at an early stage with normal function so that the athlete is again fully able to perform in everyday life and at work. Rehabilitation after an injury is of crucial importance here.

Only after the respective complaints have subsided should a gentle increase in load with initially only low intensity take place. Only when the symptoms are completely gone can you train without restrictions, whereby the training programme should be analysed exactly and changed if necessary, to avoid mistakes and thus renewed problems.

Various professional groups are involved in rehabilitation, depending on the need, including, for example, doctors, physiotherapists, sports scientists, or psychologists. Depending on the injury or illness, rehabilitation is carried out either on an outpatient basis or as part of a hospital stay.

A wide variety of measures - often combined - are used for rehabilitation after sports injuries. An important pillar of rehabilitation is physical medicine or therapy. This includes, for example, physiotherapy, ergotherapy, manual therapy, thermotherapy (heat or cold applications), massage, electrotherapy, applications on a naturopathic basis, e.g., pot compresses and bath therapy.

The role of the trainer is of central importance, he can positively influence the course of rehabilitation through this important information and thus provides a sound basis for a natural integration into the team.

17 Nutrition of the athlete

In principle, sports nutrition consists of a balanced, healthy diet that is specifically adapted for the athlete. The essential cornerstones of sports nutrition are the amount of training in hours, the training frequency, the training times, and the corresponding training goals. Thus, it is possible to compose the nutrition individually. Of course, the type of sport, the personal parameters of the athletes and the environment must also be considered. Accordingly, there cannot be one perfect sports nutrition for everyone.

Depending on age, gender, training volume, recovery time and climatic conditions, it is important to try to balance energy, macronutrient, and fluid intake. This can minimise the occurrence of severely performance-limiting factors such as hypoglycaemia (low blood sugar), dehydration, glycogen depletion (depleted glycogen stores).

In summary, a distinction is made between nutrition before exercise, nutrition during exercise and nutrition after exercise.

The essential prerequisite for making progress in training is to train sufficiently and sensibly. Sleep and nutrition are essential for regeneration. Nutrition serves the purpose of supplying the necessary energy after training (energy balance). If the athlete eats the wrong food, too little or too much, the body cannot regenerate optimally. Thus, the athlete must document the amount of training, the training intensity, and the time of training.

Supplements are often used to improve performance in sports. However, with a balanced and coordinated diet, the needs of the Tug-of-War athlete can be largely covered.

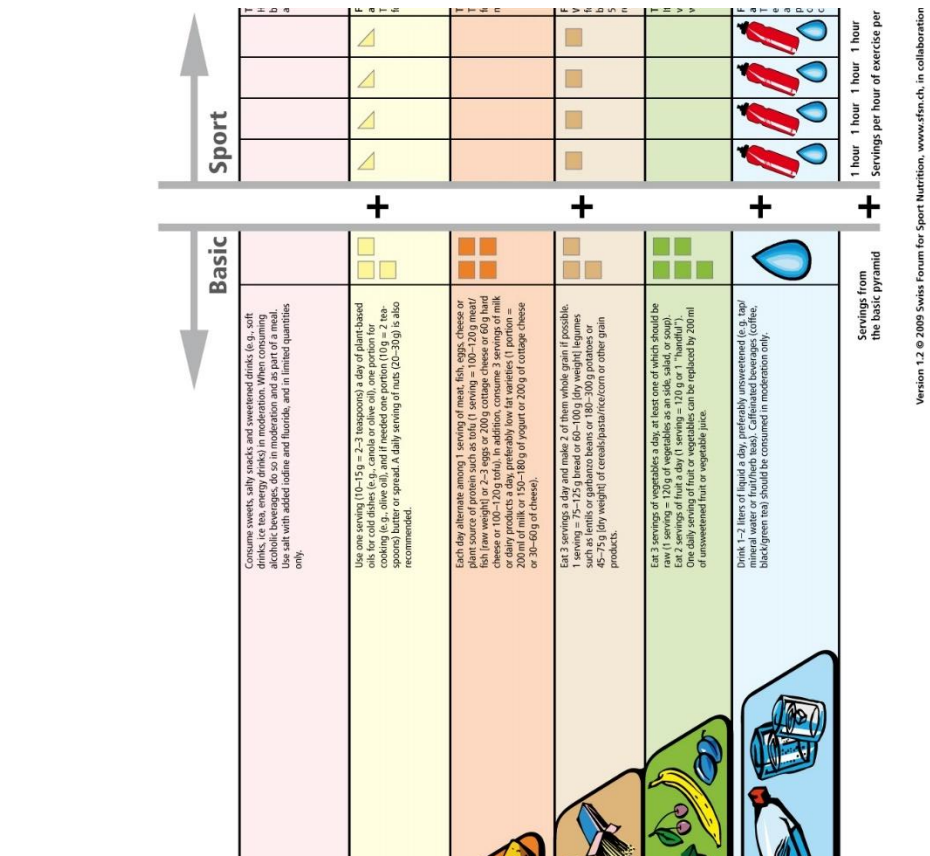
Before you think about supplements:

Supplements are ubiquitous in sport, but it takes some expertise and time to assess them properly. Despite their tempting promises, a handful of basic considerations should always be made before using any supplements. These considerations are part of any professional approach to supplements.

Supplements should only be used:

- adapted to the individual situation.
- in consultation with a specialist
- as a supplement and not as a substitute for basic nutrition.
-

The diet should be based on the Swiss food pyramid.



Nutrition before exercise (preparation for high-intensity exercise)

3-5 h before: last (normal-sized, easily digestible) main meal

2-3 h before: small meal or easily digestible snacks

1-2 h before: in the last 1-3 h before the type of exercise, small snacks such as rolls/sandwiches, bars, bananas, etc. can be used as a supplement if necessary.

Food selection before exercise:

Food selection before high-intensity exercise aims at easy digestibility. I.e., mainly carbohydrate-rich foods (bread, pasta, rice, potatoes, corn). Meals and snacks should be rather low in fat and protein. At most in small quantities: Anything high in fat, meat, fish, eggs, vegetables, and fruits (exception: ripe bananas).

Nutrition during exercise (performance support) The two most important factors are fluids (replace fluid deficits, quench thirst, performance optimisation) and carbohydrates (energy supply from carbohydrates, performance optimisation). They are regularly supplied in smaller quantities, e.g., in the form of sports drinks (commercial or homemade), gels (always take with fluid), bars, etc.

Important aspects to consider for regeneration:

- fluid deficits should be compensated. As a rule of thumb, the necessary amount of fluid is approx. 120-150% of the fluid deficit. Especially if the deficit is not exceptionally large, you can also drink according to thirst. It is important to start drinking actively and consciously as soon as you stop exercising.
- Carbohydrate intake: Energy stores must be replenished. The amount of energy or carbohydrates needed must be adjusted to the daily training needs so that regeneration is ensured when the need is high, but conversely not too much is eaten when the need is low.
- Protein fulfils two important functions. On the one hand, it supports muscle growth. On the other hand, it helps to regenerate faster.
-

If it is not possible to eat immediately after the end of the effort, which is often the case, it makes sense to organise mobile food so that regeneration can begin immediately after the end of the effort. It is important to ensure that the intake of fluids, carbohydrates and protein is adapted to the circumstances.

The nutritional goals for regeneration can be summarised with the "3R rule": Rehydrate + Refuel + Rebuild:

Make up for fluid losses: Drink enough after training and during the rest of the day (according to losses). Depending on sweat loss, salty snacks and/or a salty meal are recommended to compensate for salt loss.

Replenish energy stores, especially the carbohydrate stores in the muscles and liver (glycogen). Recommendation: 1-1.2g glucose / kg / hour (for max. 4 hours or until the next main meal). For woman endurance (58 kg) this corresponds to an intake of approx. 60 to 70 g carbohydrates per hour.

Support of repair processes, (re)construction and adaptations in muscles and other tissues. Recommendation: 20-25 g protein per meal. Adequate carbohydrate intake is a prerequisite, otherwise proteins are used as energy sources.

The snacks or main meals consumed after the effort should therefore contain carbohydrates, proteins, and water. Depending on the time between the end of the race, the snack, if any, and the main meal, different foods are recommended. In the case of Ms. Endurance, the stages end each day around 3 pm. After that, she still must take care of the equipment, shower and return to the hotel. Dinner is planned for around 7 pm.

This regeneration period can be divided into three phases:

Phase 1: within 30 minutes after the effort: Intake of fluids, carbohydrates, and proteins.

Phase 2: in the time between phase 1 and 3: additional carbohydrate and fluid intake

Phase 3: balanced, well-tolerated meal.

Examples Phase 1: 15h30

5 dl chocolate milk, ideal if you are not that hungry after the race.

Protein bar (~50 g) and 5 dl sports drink, handy to take with you.

1 portion of regeneration drink, practical as you can prepare it on the spot.

Sandwich: 2 pieces of smoked bread + 50g de ham/dry meat + sports drink (3dl), if you are hungry.

These examples provide about 60-70g of carbohydrates, 20g of protein and 3-5 dl of liquid.

Examples phase 2: at about 17h

1 sultana roll and 3 dl apple juice

1 apple, 75g Biberli or Linzertörtchen, 3 dl water

These examples provide 60-70g carbohydrates and 3 dl liquid.

Phase 3: Dinner 19:00

This meal should be balanced with 20-25 grams of protein (up to twice that amount if it is purely vegetable protein), carbohydrates and vegetables (example: chicken schnitzel, saffron rice, ratatouille).

In order to have the necessary snacks from phases 1 and 2 with you, it is necessary to plan in advance. It is also important to consider where these snacks will be eaten, how they will be taken and where they will be stored. Practical phase three main meals for on the go are a large sandwich, pasta/ebly/rice salad with, for example, egg, (cottage) cheese, dried meat, Birchermüesli.

In addition to nutrition, other regeneration measures such as sufficient sleep, massages, ice baths are helpful.

17.1 Five energy balances

Nutrition keeps five energy balances in equilibrium: Calorie, nutrient, mineral, vitamin, and fluid balance.

17.1.1 Calorie balance

Carbohydrates and fats are of primary importance for energy metabolism, and proteins are of particular importance for building metabolism.

The calorie balance includes the energy consumption through the burning of carbohydrates, fats, and proteins (proteins) as well as their recovery through food intake.

The energy loss of digestion is approx. 10%. For the breakdown and conversion of nutrients: protein approx. 22%, carbohydrates 8%, and fats 4%. in a mixed diet approx. 10%. The basal metabolic rate is 60% for heat production to maintain body temperature, and the power metabolic rate is the energy requirement for physical performance that exceeds the basal metabolic rate.

The basal metabolic rate for men is about 4.2 kJ or 1 kcal per hour and per kilogram of body weight. Women need about 5-10% less.

17.1.2 Nutrient balance

For a normal mixed diet in everyday life and in health sports, a nutrient distribution of about 60% carbohydrates, 25% fats and 15% protein are recommended.

For competitive athletes, there are different nutrient compositions and divergent energy requirements depending on the type of sport (endurance or strength sports and games) and the time (pre-competition phase, before, during and after the competition).

Carbohydrates are the most important source of energy. The central nervous system and the red blood cells are dependent on the supply of glucose. **The glycaemic index** (sugar content) is used less during physical inactivity and more during intense performance foods with low or higher sugar content.

OOD	Glycemic index (glucose = 100)	Serving size grams	Glycemic load per serving	OOD	Glycemic index (glucose = 100)	Serving size grams	Glycemic load per serving
BAKERY PRODUCTS AND BREADS				**FRUITS**			
Banana cake, made with sugar	47	60	14	Apple, average	36	120	5
Banana cake, made without sugar	55	60	12	Banana, raw, average	48	120	11
Sponge cake, plain	46	63	17	Dates, dried, average	42	60	18
Vanilla cake made from packet mix with vanilla frosting (Betty Crocker)	42	111	24	Grapefruit	25	120	3
Apple muffin, made with rolled oats and sugar	44	60	13	Grapes, black	59	120	11
Apple muffin, made with rolled oats and without sugar	48	60	9	Oranges, raw, average	45	120	5
Waffles, Aunt Jemima®	76	35	10	Peach, average	42	120	5
Bagel, white, frozen	72	70	25	Peach, canned in light syrup	52	120	9
Baguette, white, plain	95	30	14	Pear, raw, average	38	120	4
Coarse barley bread, 80% kernels	34	30	7	Pear, canned in pear juice	44	120	5
Hamburger bun	61	30	9	Prunes, pitted	29	60	10
Kaiser roll	73	30	12	Raisins	64	60	28
Pumpernickel bread	56	30	7	Watermelon	72	120	4
50% cracked wheat kernel bread	58	30	12	**BEANS AND NUTS**			
White wheat flour bread, average	75	30	11	Baked beans	40	150	6
Wonder® bread, average	73	30	10	Black-eyed peas	50	150	15
Whole wheat bread, average	69	30	9	Black beans	30	150	7
100% Whole Grain® bread (Natural Ovens)	51	30	7	Chickpeas	10	150	3
Pita bread, white	68	30	10	Chickpeas, canned in brine	42	150	9
Corn tortilla	52	50	12	Navy beans, average	39	150	12
Wheat tortilla	30	50	8	Kidney beans, average	34	150	9
BEVERAGES				Lentils	28	150	5
Coca Cola® (US formula)	63	250 mL	16	Soy beans, average	15	150	1
Fanta®, orange soft drink	68	250 mL	23	Cashews, salted	22	50	3
Lucozade®, original (sparkling glucose drink)	95	250 mL	40	Peanuts	13	50	1
Apple juice, unsweetened	41	250 mL	12	**PASTA and NOODLES**			
Cranberry juice cocktail (Ocean Spray®)	68	250 mL	24	Fettucini	32	180	15
Gatorade, orange flavor (US formula)	89	250 mL	13	Macaroni, average	50	180	24
Orange juice, unsweetened, average	50	250 mL	12	Macaroni and Cheese (Kraft®)	64	180	33
Tomato juice, canned, no sugar added	38	250 mL	4	Spaghetti, white, boiled, average	46	180	22
BREAKFAST CEREALS AND RELATED PRODUCTS				Spaghetti, white, boiled 20 min	58	180	26
All-Bran®, average	44	30	9	Spaghetti, whole-grain, boiled	42	180	17
Coco Pops®, average	77	30	20	**SNACK FOODS**			
Cornflakes®, average	81	30	20	Corn chips, plain, salted	42	50	11
Cream of Wheat®	66	250	17	Fruit Roll-Ups®	99	30	24
Cream of Wheat®, Instant	74	250	22	M & M's®, peanut	33	30	6
Grape-Nuts®	75	30	16	Microwave popcorn, plain, average	65	20	7
Muesli, average	56	30	10	Potato chips, average	56	50	12
Oatmeal, average	55	250	13	Pretzels, oven-baked	83	30	16
Instant oatmeal, average	79	250	21	Snickers Bar®, average	51	60	18
Puffed wheat cereal	80	30	17	**VEGETABLES**			
Raisin Bran®	61	30	12	Green peas	54	80	4
Special K® (US formula)	69	30	14	Carrots, average	39	80	2
GRAINS				Parsnips	52	80	4
Pearled barley, average	25	150	11	Baked russet potato	111	150	33
Sweet corn on the cob	48	60	14	Boiled white potato, average	82	150	21
Couscous	65	150	9	Instant mashed potato, average	87	150	17
Quinoa	53	150	13	Sweet potato, average	70	150	22
White rice, boiled, type non-specified	72	150	29	Yam, average	54	150	20
Quick cooking white basmati	63	150	26	**MISCELLANEOUS**			
Brown rice, steamed	50	150	16	Hummus (chickpea salad dip)	6	30	0
Parboiled Converted white rice (Uncle Ben's®)	38	150	14	Chicken nuggets, frozen, reheated in microwave oven 5 min	46	100	7
Whole wheat kernels, average	45	50	15	Pizza, plain baked dough, served with parmesan cheese and tomato sauce	80	100	22
Bulgur, average	47	150	12	Pizza, Super Supreme (Pizza Hut®)	36	100	9
COOKIES AND CRACKERS				Honey, average	61	25	12
Graham crackers	74	25	13	**DAIRY PRODUCTS AND ALTERNATIVES**			
Vanilla wafers	77	25	14	Ice cream, regular, average	62	50	8
Shortbread	64	25	10	Ice cream, premium (Sara Lee®)	38	50	3
Rice cakes, average	82	25	17	Milk, full-fat, average	31	250 mL	4
Rye crisps, average	64	25	11	Milk, skim, average	31	250 mL	4
Soda crackers	74	25	12	Reduced-fat yogurt with fruit, average	33	200	11

Fats:

For healthy adults with low physical activity, values of maximum 20 to 25 % of the total energy intake are still frequently recommended. This corresponds to a daily intake of about 1 g per kg of body mass. This amount ensures a sufficient intake of the essential fatty acids that are necessary for life. The prerequisite is a reasonably balanced diet.

Fatty acids and fat perform many functions in the body. The best known are those as an energy reserve in the form of fatty tissue and as an energy supplier, e.g., in the muscles. Fatty acids are components of every cell wall in our body. In addition, they perform countless functions in energy and immune metabolism.

In contrast to carbohydrates, fats can be stored in almost unlimited quantities. In addition to depot fat, there is also so-called organ fat, which serves to cushion and fix the organs. Fat is also a carrier of fat-soluble vitamins A, D, E and K. Flavour and aroma substances are also often fat-soluble. Fat therefore makes food tasty. Depot fat, which serves as a storage medium, is subject to constant breakdown and reconstruction. Before dietary fat can be converted into depot fat, it must be broken down and rebuilt several times.

The build-up of depot fat requires a corresponding metabolic state, which is particularly present after the intake of carbohydrates. In the period after carbohydrate intake, the breakdown of body fat is also reduced, and the burning of fatty acids is also lowered. Therefore, the assumption that dietary fat alone leads to a direct accumulation of depot fat is far too simplistic and does not consider essential metabolic processes. The depot fat tissue is considered an active organ with glandular function. It produces substances (e.g., leptin) that are necessary to control healthy metabolism, as well as those that promote the risk of disease (inflammatory substances).

Too little fat in the body is therefore just as unfavourable for health as too much. The general assessment of fats and fatty acids solely based on their origin (vegetable or animal) or their fatty acids (saturated or unsaturated) is at best of limited use for estimating the effects on metabolism.

Two different foods with the same fat content and the same distribution of fatty acids can have different effects on the metabolism.

Saturated fatty acids		
Palmitic acid	C16:0	Component of all-natural fats of vegetable and animal origin.
Stearic acid	C18:0	Main component of many animal fats, in vegetable fats
Monounsaturated fatty acids		
Oleic acid	C18:1(n-9)	In all-natural fats, most common unsaturated fatty acid (e.g., olive oil).
Polyunsaturated fatty acids		
Linoleic acid*	C18:2(n-6)	In vegetable oils, abundant in linseed, hemp and cottonseed oil, in the de-pot fat of animals.
α-linolenic acid*	C18:3(n-3)	In vegetable oils (linseed oil, rapeseed oil) and phosphatides of animal fats
Arachidonic acid	C20:4(n-6)	Phosphatides of animal fats (e.g., liver)
Eicosapentaenoic acid (=EPA)	C20:5(n-3)	In fish oils and phosphatides
Docosahexaenoic acid (=DHA)	C22:6(n-3)	In fish oils and phosphatides

Selection of the most important fatty acids. * = essential fatty acids, n-3 is the chemically correct designation for the colloquial term omega 3 fatty acid, corresponding to n-6 = omega 6. C18:3(n-3) means that the fatty acid consists of 18 C atoms, is 3-fold unsaturated and the double bonds are arranged in such a way that it is an n-3 fatty acid.

Since weight limits must be fought in Tug-of-War, a low-fat diet is often chosen. It should be noted that too little fat intake can lead to various health problems. As mentioned above, the fat-soluble vitamins should be mentioned.

Proteins:

Proteins are many different substances with a similar structure. They consist of building blocks linked together like chains, the amino acids, and are colloquially called "proteins". Twenty amino acids are important for proteins in the human body. Theoretically, an infinite number of proteins can be formed by combining them in any way.

In the human genome, however, there are "only" blueprints for the formation of about 30,000 different proteins. This enormous number alone gives us an idea of the many functions that proteins perform in the body. With 17 kJ/g (4 kcal/g), the energy content of proteins corresponds to that of carbohydrates. In contrast to carbohydrates, however, their main function is not to supply energy.

Amino acids are the building blocks of proteins. As soon as amino acids are linked together, they are called peptides (e.g., 2 amino acids → dipeptide). Dietary and body proteins consist of many linked amino acids and the recommendations for athletes are 1.2 to 2.0 g per kg for both strength and endurance sports.

The body needs various 20 amino acids for the formation of body protein. However, it can only produce some of them itself, the non-essential amino acids. The amino acids that the body cannot produce in sufficient quantities are called essential amino acids. There are a total of 8 essential amino acids, including the three branched-chain amino acids, which are often listed in the marketing of corresponding preparations with their English name BCAA (branched-chain amino acids).

Essential amino acids		
Isoleucine*	Methionine	Tryptophan
Leucine*	Phenylalanine	Valine*
Lysine	Threonine	
Conditionally essential amino acids		
Histidine (only essential for infants)		
Cysteine (methionine is needed for synthesis)		
Tyrosine (phenylalanine is needed for synthesis)		
Non-essential amino acids		
Alanine	Aspartic acid	Glycine
Arginine	Glutamine	Proline
Aspartic	Glutamic acid	Serine

The 20 amino acids found in body and dietary protein. * Branched-chain amino acids.

Selected foods sorted by their protein content. The information is taken from various sources and serves as a guide. The nutrient content of a food always varies somewhat, depending on the production, preparation, or brand, among other things.

Per 100 g	Ch	Fat	Protein
Protein concentrate	0	0	92
Dried meat	1	5	39
Emmental cheese	0	30	29
Chicken breast, raw	0	1	26
Peanut	19	49	26
Salami	0	35	25
Smoked salmon	0	8	23
Minced beef, raw	0	8	22
Ham	0	4	20
Fish fingers	26	1	23
Hazelnut	35	60	15
Tofu	3	7	15
Pasta, raw	75	1	13
Egg	1	10	12
Low-fat quark, natural	4	1	11
Brown bread	49	1	11
Pea, green, raw	18	1	6
Yoghurt, natural	5	3	4
Whole milk	5	4	4
Potato	17	0	2
Banana	23	<1	1
Water	0	0	0

17.1.3 Fluid balance

Keeping the water balance and the closely related electrolyte balance constant is of utmost importance, as water must fulfil a multitude of important functions for the organism.

Water is a structural component of macromolecules. Serves as a solvent for low-molecular substances. Plays an important role in thermoregulation and is required for many enzymatic reactions.

Fluid intake always depends on the extent of fluid loss. In healthy adults, this amounts to about 2 to 3 litres per day (without sweating) and the total fluid intake should be correspondingly high. Since a balanced diet includes just under one litre of solid food and a good 400 g of water is produced in the metabolism during the breakdown of carbohydrates, fats, and proteins (=oxidation water), the recommendations for drinking are always lower than those for total fluid intake. High drinking recommendations are often because the drinking requirement is confused with the fluid requirement.

The usual losses through the skin and lungs are hardly noticeable and are called imperceptible losses. They amount to about 0.5 litres per day in mild environmental conditions and low physical activity. In cold temperatures and/or low humidity and coupled with large, all-day physical activity such as snow hiking, these losses alone can reach 2 to 3 litres per day. A healthy person can lose a lot of fluid, especially through sweat. In sports, values between 0.3 and 5.7 litres per hour have been measured, but during normal training, values between 0.5 and 1.5 litres per hour are much more the rule.

For training practice, the following balance sequence is recommended after training: fluid and electrolyte replacement, replenishment of depleted energy stores and supply of proteins to build up structure.

Water plays a central role in the regulation of the heat balance (= thermoregulation) and this is especially important for physical activities. All muscle work requires energy, and this comes from the two nutrients carbohydrates and fats. However, the conversion of energy from nutrients into kinetic energy for muscle work is not highly effective. Only about 20 to 25 % of the nutrient energy can be converted into muscle work. Heat is generated from the remaining 75 to 80 % (thus the more intense and longer the activity, the more heat is generated). The body must release this heat, otherwise it would overheat. An effective way of releasing this heat is through sweating and the subsequent evaporation of sweat. Sweating can be seen as a preparation for the cooling of the body. For it is only during the subsequent evaporation of the sweat from the surface of the skin that heat is extracted from the body (=cooling of the body). Accordingly, the body is only cooled when the sweat also evaporates. Sweat that drips off, on the other hand, has no cooling effect.

17.1.4 Mineral metabolism balance

Minerals in sport Minerals, together with vitamins, are very frequently used supplements.

Physical activity leads to a higher metabolic turnover and greater energy consumption. As with vitamins, the following questions are therefore obvious for minerals:

- Is the need for minerals increased in sport because of the increased metabolic rate?
- If the demand is increased, is this additional demand automatically covered by the higher intake of energy or food?
- Is it sensible or even necessary to supplement minerals during sport?

There are many statements on the internet that the mineral requirement is really increased in sports and that supplementation is necessary. However, these statements are not well-founded, because there are practically no studies that show that minerals or vitamins must be supplemented in sports.

On the contrary, it is assumed that a healthy and varied diet, which also covers energy requirements, provides sufficient vitamins and minerals for athletes.

For this reason, experts in sports nutrition focus primarily on sufficient energy intake and a sensible selection of foods.

However, this also means that if the energy intake is insufficient or the choice of food is not balanced or varied, an undersupply of individual minerals - or vitamins - cannot be ruled out.

Before long-term supplementation with minerals - or vitamins - advice from a specialist is more than advisable, as otherwise there is a risk of oversupply.

Minerals in sports drinks According to the current state of knowledge, only the quantity element sodium has a justified place in sports drinks. From a scientific point of view, there is no need to add any other minerals or electrolytes to sports drinks.

Sodium and **chloride** in sport increases the sodium requirement due to sodium losses with sweat. However, the extent to which it is necessary to deliberately add salt to sports drinks depends on the individual intake through food (and on how the saltshaker is used). Sodium is the only mineral that, according to current knowledge, should be added to a sports drink.

With a balanced diet, **magnesium** supplements are not expected to improve performance in sports. In addition, sporting or muscle activity does not cause any consumption of magnesium, so that no increased requirement would result from this. The same applies to magnesium losses through perspiration, as these can be classified as low at less than 10 mg-L-1 and can be easily compensated for through the normal diet.

A higher potassium intake is not considered necessary in principle for sport. Sweat losses range from 40 to 160 mg/L and are therefore not considered a sufficient reason for a higher intake in sport.

A higher **potassium** intake is not considered necessary in principle for sport. Sweat losses range from 40 to 160 mg/L and are therefore not considered sufficient reason for a higher intake in sport.

There are no indications that the **calcium** requirement is significantly increased by high physical activity. With a balanced diet with sufficient energy intake, there is therefore no need for a general supplementation with calcium, even in sports.

17.1.5 Vitamin balance

Vitamins are one of the most widely used supplements worldwide, and this should be no different in sports. Physical activity leads to an increased turnover in the energy metabolism and to greater energy consumption.

The following questions are therefore obvious:

- Does the increased metabolic activity in sport increase the vitamin requirement?
- If the need is increased, will this additional requirement be covered by the additional energy or food intake that is necessary anyway?
- Is it sensible or even necessary to supplement vitamins during sport?

Even though these three questions are often answered in the affirmative, this is by no means scientifically proven. In principle, however, it is assumed that a healthy and varied diet, which also covers energy requirements, also provides sufficient vitamins and minerals during sport. Therefore, there is no fundamental need for a general and chronic supplementation with vitamins in sport.

Basically, vitamins are divided into fat-soluble vitamins, A, D, E, K, and water-soluble vitamins B1, B2, B6, B12, folic acid, biotin, C. However, this does not say anything about their importance, nor does it indicate whether a high intake of a vitamin is problem-free or not.

17.1.6 Sports nutrition for young athletes

Nutrition plays a special role for young athletes. In addition to school and training, there is a growth spurt and new structures are formed. These complex processes require energy but also specific nutrients. Children and adolescents therefore have a higher energy requirement per kilogram of body weight than adults. This demand increases even more during intensive sporting activity.

An individual consideration of the different components (e.g., age, stage of development) is indispensable to optimally care for and support the individual young athletes. The eating behaviour acquired during this period can shape and influence the whole life. For this reason, the teaching of healthy eating and general behaviour patterns is crucial.

Supplements A Canadian study investigated the prevalence of and reasons for supplement use among adolescents. The results show that 98% of young athletes take supplements in the form of energy drinks, protein powders or bars, amino acid or multivitamin supplements. The reasons given were health promotion, performance-enhancing effect, or influence from third parties. Less than half of the participants in the study had consulted a nutritionist on the subject.

Scientists agree that vitamin or micronutrient supplements are only useful in the case of a laboratory-confirmed deficiency. In addition, young athletes already cover their protein needs through food, so supplementation is unnecessary. The main source of information for young people is their coaches or their environment. For this reason, it makes sense to provide these people and the athletes with sufficient specialist knowledge to make them aware of the risks and possible benefits of supplements. In summary, supplements are not necessary for young athletes. In case of reduced performance, the basic nutrition should be checked and adapted to the training.

The right diet can make the difference between winning and losing. Conversely, no one will win just because of their diet and some people even become world champions despite their diet and not because of it. This is something that many athletes, especially young ones, forget when they try to emulate their role models. Everyone has their own potential range of performance that can be exhausted, and nutrition is just one factor among many others. Only a few people have the potential to become national champions or even world champions.

Acknowledging and realistically assessing one's own possibilities is the basis for practising sport or even competitive sport for a long time, with motivation and pleasure. If we think about all the factors that can influence performance - such as genetics, talent, training effort - nutrition is the surest to manage. Proper nutrition will not make a mediocre athlete a champion. But certainly a few bad nutrition choices can turn a champion into a mediocre athlete.

How can a sports nutritionist help? The goal of a sports nutritionist is to understand and assess the individual sports situation to make a tailor-made recommendation for sports nutrition. However, without in-depth knowledge of sports physiology and training science, it is hardly possible to develop an individually adapted solution for sports nutrition. The individual measures can then be - Increase energy levels - Promote good health - Help optimise weight or body composition - Improve concentration - Support growth in youth athletes - Improve regeneration.

17.1.7 Nutritional supplements and doping infractions

Nutritional supplements can be a source of positive doping cases as some supplements contain prohibited substances without showing this on their label. This problem has existed for some time and has been extensively studied in the past 8 years.

The sport of tennis has played a particular role in this problem because of some peculiar doping cases within its community. This article focuses on this doping problem, explaining the background and reviewing the available literature. It presents the first 3 years of experience within the Netherlands Security System Nutritional Supplements Elite Sports ("Nederlands Zekerheidssysteem Voedingssupplementen Topsport" or NZVT) and explains the most extensive system established to combat this doping problem.

The NZVT experience has shown that paper-based quality systems are still prone to possible contaminations, which leads to the conclusion that the best possible solution for athletes who wish to use nutritional supplements must include laboratory-based analysis for doping substances, preferably repeated for every new batch.

The most important educational message, however, is to use a nutritional supplement only if it is deemed of benefit by a nutritional expert.

17.2 Sports with weight class division

The short-term reduction of body weight is often practised in sports with different weight classes to enable a start in a lighter weight class with supposedly greater chances of success. The sometimes-dramatic interventions in the fluid balance can lead to considerable health risks and even sudden deaths, especially from heat stroke due to reduced thermoregulation. In addition, excessive weight loss also reduces performance. A short-term weight loss of up to 3 % of body weight within three to five days before a competition still seems acceptable. To prevent excessive weight gain, it seems sensible to carry out the weighing procedure immediately before the competition and to prohibit parenteral fluid intake after weighing to replenish the reduced fluid balance. In children and adolescents, weighing should generally be rejected.

In sports with different weight categories, "weight making" is a common and widespread procedure for short-term reduction of body weight in the days and hours before the weigh-in. This is supposed to make it possible to start in a lower weight class, which is supposedly associated with greater chances of success. In fact, success in sports with weight classes, such as wrestling, judo, weightlifting, Tug-of-War, lightweight rowing, and galloping, often depends decisively on whether one's own body weight can be brought under control or kept as low as possible during the competition period within the weight limits. However, this can lead to considerable health complications, even fatalities, as well as to loss of performance, which will be discussed in more detail below.

The most common methods for short-term weight loss, apart from almost complete fluid restriction, are induced sweating through extreme sauna applications or endurance exercise in winter clothing (e.g., in non-breathable thermal clothing, rain jackets over tracksuits including woollen hats and gloves) as well as the intake of diuretics and laxatives. Paradoxically, in some sports it is sufficient to reach a minimum body weight once at the time of weight control. Immediately after the official weighing, rapid rehydration can then be attempted through parenteral fluid intake (sometimes including macronutrients such as carbohydrates and protein) or orally administered mineral and carbohydrate-rich drinks to quickly restore physiological normal conditions within a few hours. This can also lead to a considerable increase in body weight. However, it is not possible to regain full performance capacity within a few hours.

Acute weight manipulation in sports with weight classes leads to a variety of changes that can not only impair physical performance but also have considerable health effects. In the USA, but also in Germany, several deaths have been described in recent years among athletes who suffered heatstroke while sweating it out in front of the scales in the sauna, while riding an exercise bike or while running in extreme heat in thermal clothing. Heatstroke is one of the most common causes of sudden death in sport. However, heat stroke can be prevented through targeted education and appropriate preventive measures. Short-term weight loss can only be achieved through considerable intervention in the body's fluid balance. The resulting reduction in plasma volume and circulating blood volume leads to:

1. drop in blood pressure

2. increase in resting and exertion heart rate

3. Decrease in stroke volume

4. release of catecholamines

5. reduced blood flow to the kidneys with the risk of temporary kidney dysfunction

6. Reduced blood flow to the muscles with a decrease in performance.

7. Reduced thermoregulation with the risk of heart damage.

The additional use of diuretics - prohibited by anti-doping regulations - accelerates the loss of fluids and can also lead to electrolyte losses, which can result in increased muscular excitability (cramps) and cardiac arrhythmias. Even with a relatively low body weight reduction or stabilisation at a relatively low level, clear deficits in the macro- and micronutrient supply (e.g., fluid, protein, sodium, potassium, magnesium, zinc, iron, and B vitamins) have already been described in high performance athletes on the days before the competition. The question of a permanent developmental deficit due to more frequent body weight reduction measures in combination with competitive sports training currently remains unanswered.

The phenomenon of weight reduction is still a common procedure in sports with weight classes, although it has been shown several times that short-term manipulation of body weight via the water balance can have considerable negative effects on physical performance. In sports where the rules allow a time interval of many hours between the scales and the competition (e.g., wrestling, Tug-of-War), experience has shown that at least a "moderate" weight loss of 2-3 kg shortly before the competition with the possibility of replenishment is beneficial. However, a weight loss of approx. 5-6 % of the body weight within three days due to fluid restriction leads to a decrease in maximum strength, which is still detectable after 16 hours even after compensation of the fluid deficit. In contrast, a weight loss of approx. 1.3 kg through food restriction over a period of approx. two weeks seems to be possible without loss of body strength. In light-weight rowers, after a short-term weight reduction of 5% of the body weight within 24 hours and subsequent rehydration of 1.5 l in 2 hours (time from scales to start), a clear drop in performance of 5% was measured; this correlated with the drop in plasma volume and was accompanied by a lower glycogen charge of the muscles by about one third.

Based on a currently prepared statement by the Competitive Sports Section of the German Society for Sports Medicine and Prevention, the following recommendations are made. 1:

- A thorough education of coaches and athletes in sports with weight categories should make the health risks and performance-physiological consequences of weight manipulation transparent.
- Based on body weight and body fat measurements, a realistic weight reduction target should be set jointly and early in the season to avoid excessive weight fluctuations and thus the need for large weight reductions before a competition. In sports with weight categories, athletes and coaches should make more use of nutritional advice to avoid deficits in nutrient density.
- In sports with weight categories, body weight changes of no more than 3% of body weight, spread over a period of five to seven days prior to competition, are considered acceptable.
- The rules and regulations in the sports concerned should be changed - if they have not already been done - so that weighing takes place as soon as possible immediately before (and ideally also after) the competition and, in the case of competitions lasting several days, daily weighing becomes obligatory. In this way, excessive dehydration of the body can no longer be applied because of the considerable impairment of performance that this entails. In boxing and lightweight rowing, weighing shall be carried out no more than 2 hours before the competition.
- Parenteral hydration after weighing should generally be prohibited. In the case of children and adolescents, weight reduction should be dispensed with altogether.

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