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Ice-Hockey Training Process Design Methods

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Abstract

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The purpose of the thesis was to investigate features of ice hockey, the required qualities of its players, main stages of long-term training and then implement the gained knowledge in creating an actual methodology of training for young players. A thoroughly planned and constructed training process allows athletes to achieve maximal results. The primary objective was to study essential steps in constructing a training program.

The theoretical framework comprises the characteristics of ice hockey, physical qualities of players as well as describing the structure of micro-, meso- and macrocycles in detail. The theoretical research was based on careful study of sport and fitness literature. The empirical part focuses on an actual training program for young ice hockey players of 13-14 years and contains the results of its implementation. The method was designed by the author based on his theoretical knowledge and coaching experience.

The result of the thesis was the implementation of an actual training program aimed at improving the speed qualities of young ice hockey players and an analysis of the gained results.

Keywords: ice-hockey, coaching, training programms

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1 Introduction

Modern development of ice hockey places growing demands on training process. Ice hockey is not only one of the quickest sports, but also it is a game with the most complex coordination. In the process of the game a player should calmly respond to the movements of adversaries and actions of partners, apply techniques with a hockey stick, choose power tactics in counter-attacks, quickly change direction of movement, precisely analyze changes in the game's situations as well as correctly move within played tactic strategy. Mistakes in any decisions, incorrect evaluation of situations and nervous technical tactic techniques can result in losing both a certain moment and game in general.

The main idea of the thesis was to investigate in the detail the building of a training process for ice hockey players and to implement gained knowledge in creating the author's own methods for developing the high-speed qualities of young players. The thesis comprises two parts. The theoretical part describes the main features of ice hockey as a team game, the essential requirements for players to successfully perform as well as the crucial stages in building of training process.

The empirical part focuses on implementing author's own methodology for the developing high-speed qualities of 8 players from ice hockey school "Strazh" located in Saint Petersburg. The author describes the building of training process, provides the results before and after the experiment and makes an analysis of the obtained results.

1.1 Aims of the thesis

The primary reason for choosing thesis topic is author's personal interest in ice hockey and particularly in coaching. The author has significant experience in coaching both children and young players as well as he is constantly working on improving of his teaching methods. Therefore, creating methods for developing the high-speed qualities of players of 13-14 years were chosen for the empirical part of the project and the final results will undoubtedly help the author in his further coaching work.

A wide range of disciplines taught during the study at the Kajaani University of Applied Sciences gave the author required knowledge and the project enables to combine and perform accumulated skills.

As it was mentioned before the thesis will consist of theoretical and empirical parts. The aim of theoretical study is to examine features of ice hockey and to explore what kind of physical qualities are decisive for ice hockey players. The study also examines training process, the role of microcycles in sport exercises and stages of long-term training. The aim of empirical part is an implementation of actual training methods that were developed by the author and analyze of gained results.

The research is based on the analysis of literature sources, advanced domestic and foreign works devoted to ice hockey training at initial stages of sport perfection.

The work consists of an introduction, six chapters, a conclusion and a list of used literature.

2 Specificity and features of ice hockey

Ice hockey requires from players ability to perform complex movements and techniques with explosive speeds and intense physical contact.

In this chapter, the author will describe main features and characteristics of ice hockey such as intensity, flexibility, reaction and aerobic/anaerobic performances.

2.1 Intensity performance

Intensity in ice hockey implies that a player should perform at high pace not only during one game but also during the whole championship. Therefore, ice hockey is physiologically demanding, particularly at the professional level. To play successfully at the elite ice hockey level a player should develop anaerobic sprint ability, strength, power as well as endurance. In addition, ice hockey predisposes an athlete to premature and chronic fatigue. (Alwani & Ilyin 2016)

The ice hockey players commonly perform an aggressive play with the exercise intervals at maximal capabilities. Time interval spent by a player on the ice during the game is called shift. The shift comprises skating at various speed, force and intensity, quick movements as well as repetitive intense body contacts. Intensity of game shifts differs from other due to the playing circumstances on the ice during every shift. A shift duration is undefined in advanced, however at the professional level it usually lasts from 30 to 80 seconds. As a rule, one shift does not exceed 90 seconds. (Uryupin & Savostyanov & Alekhnovich 2014)

2.2 Aerobic and anaerobic performance

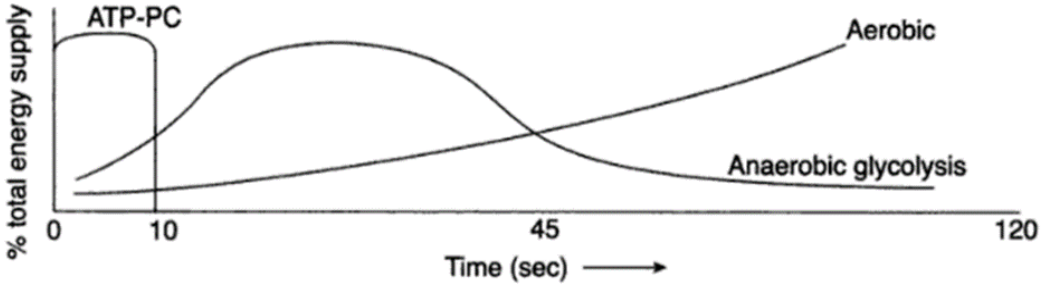
Ice hockey games can last for more than 60 minutes in duration and players have been reported to complete around 1000 changes in activity (approximately once every 4 seconds). Thus, it places great demand on the athletes' energetic systems such as anaerobic and aerobic.

Anaerobic energy system of the athlete's body (alactic and lactic) supports activity with high intensity whereas aerobic system provides low intensity movements. (Hollingdrake, 2015) Table 1 represents approximate contribution of anaerobic and aerobic system during the ice hockey game.

Type of activity	Alactic Anaerobic	Lactic Anaerobic	Aerobic
Five-second burst	85%	10%	5%
Ten seconds of hard skating	60%	30%	10%
Thirty seconds of continuous activity	15%	70%	15%
One-minute shift of intermittent sprint, coasting and stops	10%	60%	30%
Recovery between shift/periods	5%	5%	90%

Table 1. Approximate contribution of anaerobic and aerobic system during the ice hockey game (Donskov 2016, p.46).

Although anaerobic energy systems are the most important source of energy in ice hockey game, all three systems are active for every shift and used at the same time (Graph 1).



Graph 1. Relative contribution of the three energy systems over time (Twist 2007, p.56).

Two anaerobic systems – alactic and lactic – produce energy in response to demands made by the player's body through intensive actions and efforts.

Alactic or ATP-PC system is the main source of immediate energy used by the muscles. It consists of adenosine triphosphate (ATP) and phosphocreatine (PC). Usually the stock of ATP in the muscles can be depleted within 3 seconds. As a compensation PC is used to restore ATP stocks until the PC is completely consumed. In total ATP-PC provides energy for activity with maximal intensity (explosive acceleration, quick shot from the point, power struggle etc.) for 10-15 seconds before it fatigues. (Hewitt, 2014)

As soon as the entire supply of ATP and PC is consumed, the continuation of intense activity depends on second anaerobic energy system – lactic or anaerobic glycolysis. This system uses the glycogen contained in athlete's muscles or blood glucose (carbohydrates) to generate energy. (Hewitt, 2014) Anaerobic glycolysis provides formation of highly substantial energy stocks for ice hockey shifts. This energy may last for 120 seconds, depending on the intensity of the athlete's efforts, however the energy peak falls is between the 30th and 45th seconds. Thus, the change of shifts occurs on average every 45 seconds. If during intense period an athlete stays on the ice longer it would lead to his fatigue, submaximal efforts and decline in game's quality. Fatigue is caused by formation of lactic acid – a by-product of anaerobic glycolysis – which accumulates in muscles and blood. Abrupt stops and starts, sprinting and power struggles require intensive efforts leading to the formation of lactic acid in both the upper and lower parts of the body. As lactic acid accumulates athlete's muscles contract and it leads to decline in their abilities and slower movements. (Twist, 2007)

Aerobic energy system provides only a small part of the energy required for intensive efforts and most of the energy required for moderate-intensity activities. A player highly relies on this system during his recovery between shifts. The more time a player spends on the ice – the longer the shift and the shorter the time spent on the bench – the more important the role of aerobic energy system in restoring an athlete's strength. (Twist 2007)

The level of player's aerobic strength depends on the measure in which the body is able to absorb oxygen from the lungs, transfer it from the lungs to the heart, transport it through the blood to working muscles, extract oxygen from the blood and use it in muscles to form energy. Aerobic strength is expressed by the formula VO2max – maximum amount of oxygen that can be assimilated and used by the body (ml / kg per minute). The more oxygen a player consumes during the minute (VO2max) the more ATP is produced in muscles. Professional ice hockey players' level of VO2max is 57-59 ml/min/kg. The high level of VO2max also helps players recovery more quickly between games. (Twist 2007)

2.3 Flexibility performance

Flexibility of human body implies an ability to perform exercises with large amplitude. Also, flexibility can be defined as full range of motion in a joint or number of joints that is achieved with an instantaneous effort. (Wilson & van Vliet 2017.) For ice hockey players, flexibility of hamstrings and lower back area is crucial. Skating is an activity with bend legs therefore, usually players do not extend their back leg when they are pushing off the ice. Consequently, hamstrings do not stretch to their full length. If muscles are not used to their maximum length they will shorten, and it will lead to back injuries. Enhanced flexibility of the hips, groin, hamstrings and thighs will not only prevent injury but also improve skating speed and agility. (Wilson & van Vliet 2017.) Flexibility is especially essential for goalkeepers since their game position implies that they stretch more than any other players during the game. (Rohan 2015)

2.4 Reaction performance

During the game a player should quickly respond to various types of stimulus (movement of a partner and an opponent, movement of the puck etc.). Therefore, the speed of reactions plays a crucial role. (Sharp 2011)

According to Beashel & Sibson & Taylor (2004) there are two types of reaction: simple reaction and complex reaction. Simple reaction implies the delay between the stimulus and a player's actions. In its turn, complex reaction is divided into choice reaction and reaction to a moving object.

Choice reaction signifies time delay between the stimulus and a player's action when he should make a choice. The time of choice reaction mainly depends on the quality of the options in particular game moment as well as is being determined by the opponent's actions. (Beashel & Sibson & Taylor 2004) For instance, a forward should promptly select the most vulnerable spot in goaltender's position and perform the appropriate technical action.

Reaction to a moving object (RMO) requires from an ice hockey player following actions:

- to notice a moving object (a puck or a player)
- to predict movement of the object
- to choose own action
- to perform the action.

Usually ROM lasts from 0.18 to 1 second while the most part of time requires to notice a moving object. Therefore, an ability to notice an object moving at high velocity plays the most important role in ROM. Thus, an ice hockey player should pay a special attention to develop it. (Beashel & Sibson & Taylor 2004)

3 Development of physical qualities of ice hockey players

During the game an ice hockey player experiences prolonged physical exertion on the entire body, cardiovascular, nervous and musculoskeletal systems. Therefore, the player should be able to adapt to this kind of physical and psycho-emotional stress. It can be achieved during many years of constant training and developing such physical qualities as strength, speed, endurance and coordination.

In this chapter, the author will describe mentioned physical qualities of an ice hockey player, provide optimal periods for their development as well as give an example of training program to increase strength.

3.1 Strength development

An ice hockey player's ability to perform successfully in the game is based on his level of strength skills. According to Matveyev (2010) strength is the Key element in:

- Power: A more powerful athlete can start and stop quicker, hit harder, and dominate opponents.
- Speed: An athlete's potential for speed enhances along with improving of his specific strength.
- Agility: Strong hips and legs allow an athlete to start, stop and change directions quickly.
- Injury prevention: The stability of a joint is enhanced by the strength of the muscle surrounding the joint. Moreover, in case of injury well-trained muscles respond much faster to rehabilitation than less trained ones.

Strength development cannot be achieved without significant muscle tension. Therefore, the fundamental purpose of all training methods and techniques is to create maximal tension on athlete's muscles. (Bach 2014) However, development process of athlete's power capabilities is uneven. It is caused by the peculiarities of skeleton structure, muscular and nervous system, articular-ligamentous apparatus as well as biological features of an athlete's body. (Boucher 2014)

Beginner players have mostly developed large muscles of the trunk, lower limbs and shoulder girdle while abdominal muscles, obliques of the trunk, abductor muscles of the upper limbs, muscles of the back thigh and the adductor muscles of the legs are less developed. This feature should be taken in consideration in developing of training programs in order to prevent negative effects caused by excessive loads on less developed muscle groups. (Boucher 2014)

Besides, according to Gabbett & Georgieff (2007) in creating of strength training program also should be observed following aspects:

- The effectiveness of every strength exercise is determined by the degree of strength increasing of the corresponding muscle groups.
- Maximum power training loads significantly reduce the speed of movements and the ability for explosive acceleration.

- As a competition is approaching diverse and extensive means of strength training should gradually focused on the main muscle groups.

To develop strength Boucher (2014) distinguishes following exercises

- exercises with weights (dumbbells, barbells, expanders)
- exercises with bodyweight (individual or in pairs)
- exercises with parallel bars, rope and on gymnastic wall
- jumping and simulation exercises
- exercises from other sports (tennis, wrestling, rowing, boxing).

It is recommended to use mainly speed-strength dynamic exercises for beginner young players. These exercises may include running, jumping, throwing light objects at a distance and throwing pucks. Also, young players should be taught a variety of exercises that can be later performed with various weights (barbell, dumbbells, expanders, etc.). Strength training exercises should be performed at the end of the workout. (Donskov 2016)

3.2 Speed training

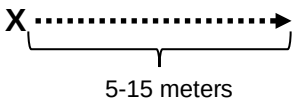
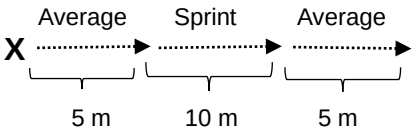
An ice hockey player should quickly start and maneuver on skates, throw the puck and outflank opponents. Besides, he should promptly respond to the actions of team players as well as assess the game situation. To implement all these actions successfully a player should have high speed skills.

Unlike other sports speed in ice hockey does not refer to running speed but to skating speed. However, speed training should be necessarily included in strength program. Enhanced running speed positively influences on skating speed and gives a player the edge over his opponents in defensive and offensive positions. Since skating performance depends mostly on lower part of the body speed training program should be focused on developing explosive capacities of leg musculature. (Jeffreys 2013) Jeffreys (2013, p.136) defines following recommendation for enhancing explosive speed:

- start workout with speed training exercises
- implement all exercises at maximum speed
- in exercises with resistance do not admit decreasing in velocity more than 10 percent

- combine drills with linearly and laterally move
- work-to-rest ratio between repetitions is a one to four.

Speed training exercises can be divided into activities conducted on the ice rink and in the training gym. Drills on the ice rink help to enhance hockey-specific speed whilst exercises in the gym allow to develop decisive physical capabilities that can be turned into more efficient performance in the game. (Jeffreys 2013) Table 2 represents one-ice and off-ice speed training exercises, their aims, athlete's actions, execution scheme as well as technical features of the exercise.

One-ice speed training exercises			
Drill	**Aim**	**Athlete's actions and execution scheme**	**Technical features**
Acceleration speed from a standing start	Development of athlete's ability to speed up over distance range from a standing start	From a standing point the athlete skates at his maximum speed for chosen distance (usually 5-15 meters) 	• Define rapidly the most effective skating posture to speed up • Apply a driving skating action to enhance speed
Acceleration speed from a rolling start	Development of athlete's ability to speed up from a rolling start	An athlete starts to skate 5 meters at an average pace, then rapidly accelerate to a sprint for 10 meters and comes back to the initial pace. 	• Control movements before speeding up • Define rapidly the most effective skating posture to speed up • Apply a driving skating action to enhance speed
Back and forward transition	Development of athlete's ability to rapidly move forward after the player	An athlete moves backward 10 meters then promptly stops and speed up forward 10-15 meters.	• Control movements as skating backward • Implement a skating stop

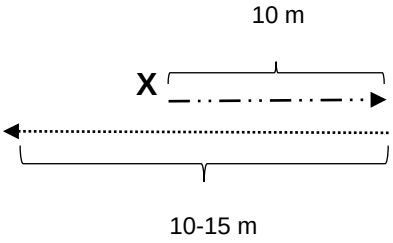
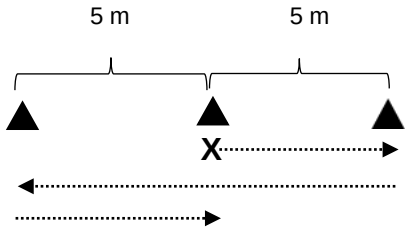
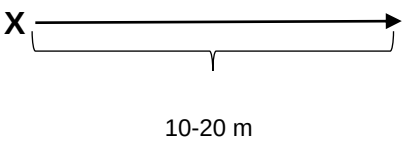
	was moving backward		• Change the body into speed up position • Move forcefully forward for the required distance
5, 10, 5	Development of athlete's ability to speed up, stop and re-speed up	There are set three cones with 5 meters distance between them. An athlete stands at central cone then speed up 5 meters to the end of any side cone. Then he moves to the other side and speeds up 10 meters to the cone at the opposite end. Then he speeds up 5 meters to the central cone and from there he repeats the exercise moving to the opposite direction. 	• Skating starts with forceful movement • Control applicable position • Stop promptly, then speed up rapidly and forceful
Off-ice speed training exercises			
Running sprint	Development of athlete's ability to speed up over distance range from a standing start	From a standing point the athlete runs at his maximum speed for chosen distance (usually 10-20 meters) 	• Choose applicable start position with forceful extension of the rare leg • The lead leg's knee position is forward and up • The drive is supported by powerful arm action

Table 2. On-ice and off-ice speed training exercises (Jeffreys 2013, pp.137-139).

If young players do not have yet enough technical skills it is recommended to develop speed abilities mostly off-ice. Every developed technique should be use for improving speed on ice. Speed training exercises is performed at the beginning of the workout after proper warming-up. (Donskov 2016)

3.3 Endurance training

Endurance is the ability to resist physical exhaustion in the process of muscle activity. In ice hockey endurance can be considered as the process of energy supply. On high level endurance is divided in **general** endurance and **specific** endurance. (Saag 2012.) As it was mentioned in chapter 2.2 ice hockey player's activity during the game is supported by aerobic and anaerobic energy systems. Aerobic performance is usually considered as general endurance whereas anaerobic as specific endurance. (Saag 2012.)

According to Donskov (2016) to increase general endurance it is recommended to use following cyclic activity:

- with moderate intensity: heart rate is in the range of 130-150 beats/min
- with medium intensity: heart rate is 150-160 beats/min. Activity can include running at the stadium, in the forest, along the riverbank, skating, cross-country skiing, swimming or cycling.

The duration of the cyclic activity gradually increases from 10 to 60 minutes depending on the age and physical fitness of an athlete.

Specific endurance in ice hockey implies speed endurance. It may be defined as the ability to fulfill durably physical activity at extreme speed without decrease of effective performance. To increase speed endurance following exercises are used: running for a distance from 200 to 800 meters; running uphill, relay races, obstacle course race, shuttle running on skates and playing exercises. The exercises are characterized by such features as:

- submaximal heart rate (180 and higher beats/min)
- duration from 30 seconds to 2 min
- rest intervals are constant or reduced from 3-5 minutes to 1 minute between repetitions and up to 10 minutes between sets

- the number of repetitions in the set from 3 to 5 whilst the number of sets is 1-3
- rest is passive. (Helmicki 2011)

Endurance development exercises is recommended to performed during the second stage of the workout. (Donskov 2016)

3.4 Coordination training

Coordination and balance are crucial for an ice hockey player since the development of these abilities is directly related to other motor skills and physical qualities. Every new movement that an athlete studies should be based on the previous one. All basic skills gradually become reflexes. The more accurate and diverse motion exercises, the greater the reserve of reflex connections; the greater the number of skills the hockey player possesses, the easier and better he adapts to the conditions and actions arising on the ice. (Pavlis 2007)

Liebenson (2014) defines the most important coordination abilities for an ice hockey player as follows:

- to orientate on the ice rapidly
- to perform high accuracy of movements
- to keep balance
- to respond promptly to the actions of the opponents
- to win a power struggle.

At the initial stage training should be focused on mastering a variety of coordination skills. Complexity of exercises is always considered in close relationship with the level of ice hockey players' physical fitness. As soon as coordination skills are improving, an athlete should be taught how to act in the most appropriate way in different game situations. In this regard, it is necessary to include obstacle course race in the training program of 7-8 years old players. Obstacles are selected based on the athletes' preparedness and tasks should not be very easy (otherwise participants will lose their interest) or too complex. Obstacles should be put in a different order every training session, the order of overcoming them should be changed as well as athletes' actions are complicated by additional tasks. (Liebenson 2014)

It is also recommended to include elements from other sports (gymnastic, acrobatic and track and field athletics) in coordination training of ice hockey players to enhance their ability to rapidly switch from one action to another. (Pavlis 2007)

3.5 Periods of development for athletes' qualities

All the basic athlete's qualities such as parameters of body growth, formation of bones and muscles as well as the basic development of strength and endurance already are formed by the age of 17. They should be maximally developed as a result of the preparatory and basic periods of training.

Using different literature sources, the author designed Table 3 that shows the most optimal periods for the initial preparation and development of all the physical qualities necessary for the active training of adult ice hockey players.

Morpho-physical indicators of physical qualities	**Age (years)**										
	7	8	9	10	11	12	13	14	15	16	17
Muscle mass						+	+	+	+		
Speed	+	+	+	+	+	+	+	+			
Strength						+	+	+	+		
Endurance		+	+	+	+	+	+	+	+	+	
Flexibility	+	+	+	+							
Coordination	+.	+	+	+	+	+					
Balance	+	+	+	+	+	+	+	+			

Table 3. The most favorable periods for development of young ice hockey players' physical qualities.

Muscle mass and Strength

The optimal period to develop muscle strength and mass is the age from 12 to 15 years. During this age, the maximum muscle growth rate is observed. Therefore, it is necessary to introduce additional strength exercises during training, both in

the gym and on the ice. The coach should supervise the correct performance and adjust the load if necessary. (Donskov 2016)

Speed

Speed qualities are closely related to age. The most favorable age period for developing speed is 7 and 14 years. After 14 years the ability to improve speed decreases and even speed targeted training does not lead to significant changes. (Donskov 2016.)

Endurance

8 to 16 years is the optimal period for improving general endurance. Special attention should be paid to the development of this quality during puberty from 13 to 16 years. (Helmicki 2011.)

Flexibility

Development of flexibility should begin at the age of 7-10 years. By this time the child's body is ready for various loads and stretching will be an important addition to the overall set of training exercises. Flexibility development provides an athlete with the ability to better control his body and helps to change the direction of movement without losing speed. Insufficient attention to stretching training may lead to injury or serious damage of a young player. The age of 10 years is the time of maximum development of inherent flexibility. (Donskov 2016)

Coordination and Balance

The main development of neuromuscular motor skills occurs from 7 to 12 years and by the end of this period a person masters up to 90% of their total volume. After 12 years and before puberty coordination of already acquired movements improves. Therefore, the period between 7 and 12 years old is the most favorable period for the development of coordination. For balance development this period lasts until 14 years. (Liebenson 2014)

4 Organization of training process

4.1 Periodization of training process

The training process is the basis for preparing and achieving success in any kind of sport for both a beginner and a professional athlete. It lasts throughout an athlete's sporting life. The training process is based on a certain structure with a relatively balanced order of combined components, their logical relationship to each other and the overall sequence. The coach has a leading role in building and managing this structure. The final result depends on his knowledge and ability to manage. It is important to correctly and successfully combine different means and methods in the training process. (Issurin 2016a)

Usually, the training process is divided into manageable periods – training cycles with their own structure, content and level of loads. This process is called periodization. It allows planning periods of increased loads and easier stages for recovery. It also helps to improve skills of athletes through different phases of training programs. For the first time, the concept of classical periodization was introduced by scientist Lev Matveev (USSR) in 1962. According to the theory there are three types of training cycles:

- A **microcycle** is the shortest training cycle, which usually lasts no more than a week. Microcycle consists of a training session. During a week there can be from 6 to 18 sessions and 1-3 workouts per day.
- A **mesocycle** is the average training cycle, which consists of a series of completed microcycles. These microcycles may have different goals but nonetheless should correspond with the main aim of the mesocycle.
- A **macrocycle** is the longest training cycle since it implies training sessions during a longer period of time, for instance an annual cycle and Olympic cycle. Donskov 2016)

Interconnection between training cycles is represented in Figure 1.

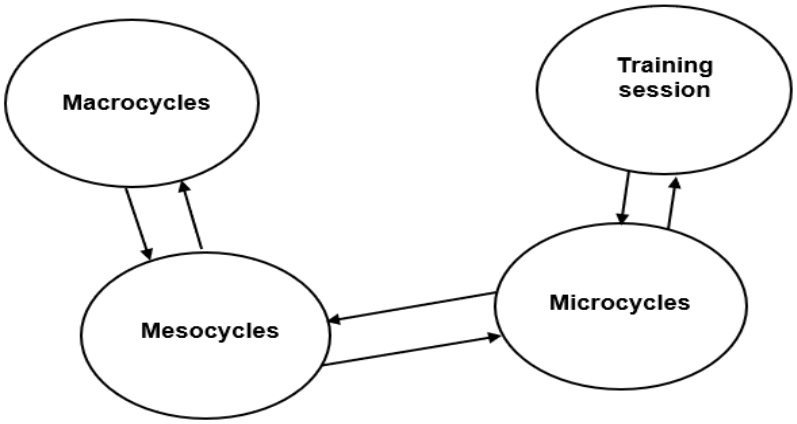


Figure 1. Training cycles (Donskov 2016).

Every mesocycle is aimed at developing a certain quality or skill. The microcycle within the mesocycle helps to work this skill in complex way whereas the macrocycle provides final result of the entire period. Therefore, building a proper structure of annual training year plays the main role. (Donskov 2016)

According to Matveyev the year is divided into 3 parts: preparation, competition and transition. Amount of time each ice hockey player spends in every phase of the training plan is influenced by a seasonal schedule (Figure 2).

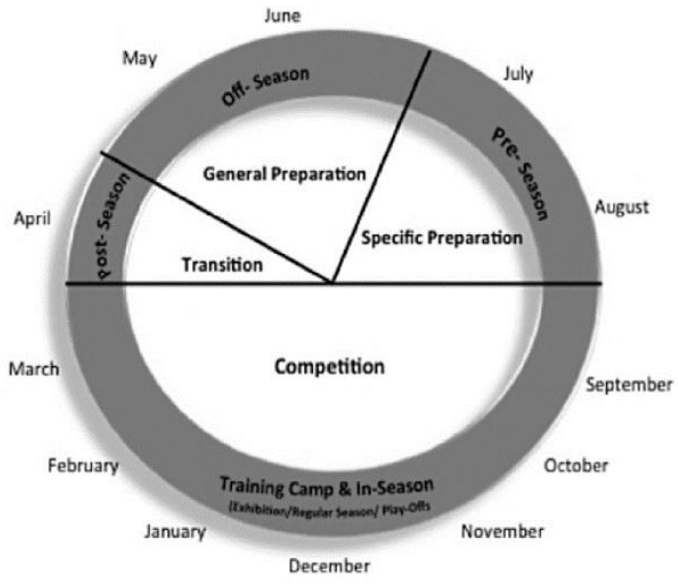


Figure 2. Structure of training year (Donskov 2016, p.52).

General Preparation (Off-season)

- Period: May-June
- Main abilities trained: general physical preparation, aerobic capacity, strength, flexibility.

Specific Preparation (Off-season)

- Period: July-August
- Main abilities trained: maximum strength, endurance, lactate capacity

Competition

- Period: September-March
- Main abilities trained: speed, endurance, flexibility, maintaining gained physical condition, coordination.

Transition

- Period: April
- Main abilities trained: aerobic capacity, general physical qualities.

Stages of macrocycles will be described in detail in chapter 4.4

Proper construction of all three cycles as part of the training process will allow athlete to achieve desirable goals and to remain in perfect shape during competition year.

4.2 Training microcycles

Microcycles are series of exercises providing a comprehensive solution to problems that arise at the stage of preparation. They usually last from 3-4 to 10-14 days. However, the most common is the 7-day microcycle since it corresponds with the calendar week and general mode of athlete's life. A microcycle with another length is usually planned in the competitive period due to the need for regime change activities. (Matveyev 2010)

Microcycle consists of two phases: stimulation (cumulative) and recovery (unloading and rest). These phases are repeated, and the recovery phase coincides with the end of the microcycle. Usually microcycles are denoted by figures reflecting the number of working days and rest days (6 + 1, 3 + 1, 4 + 1, 3 + 0 etc.) (Matveyev 2010)

Microcycles are built based on the peculiarities of the process of fatigue and recovery as a result of the impact of training loads during training sessions. In order to build a microcycle properly, it is crucial to know what impact different loads have on a player, what are the dynamics and duration of the recovery process. This data is crucial since the functional and morphological changes in athlete's body provide an increase in working capacity and take place during the recovery period. The restoration of working capacity after training sessions occurs unevenly, non-simultaneously and at different paces. Initially, recovery proceeds quickly, and then slowly, therefore, more time for rest gives greater results in the stimulation phase and less in the recovery one. (Melnikov 2013)

4.2.1 Types of microcycles

Ozolin (2003) classifies microcycles (MC) depending on their purposes, level of training load and length as following:

- **MC-1 – basic** is usually held in the preparatory period.
- **MC-2 – introductory** is intended for gradually increase of the load and cautious approach to the necessary training values.
- **MC-3 – educational and training**. This microcycle is often taken place in the classroom for less trained athletes and usually held on the second stage of the preparatory period.
- **MC-4 – training** takes the most time in the annual training since it consists of set of tools, techniques and loads aimed at strengthening physical qualities, improving psychological preparedness and sport skills.
- **MC-5 – training (special)** is designed specifically for use in the preparation stage as well as in all cases of intensive development of special components preparedness.
- **MC-6 – training (impact)** is created for the highest sport activities order to cause major changes in chosen kind of sport or in a separate component of preparedness.
- **MC-7 – pre-competition** provides the best conditions and high performance of athletes to the competition day.
- **MC-8 – modeling** in which distribution and training workload by the day of the week, as well as external conditions correspond to what is required in contests.

- **MC-9 – competitive** provides for the appropriate mode of training and participation in competitions.
- **MC-10 – recovery** to recover from significant stress and mental stress by means of leisure.

The mentioned types of microcycles are used mainly to build up training processes for athletes in cyclic sports. Table 4 represents the most appropriate microcycles to construct the training in sports such as ice hockey.

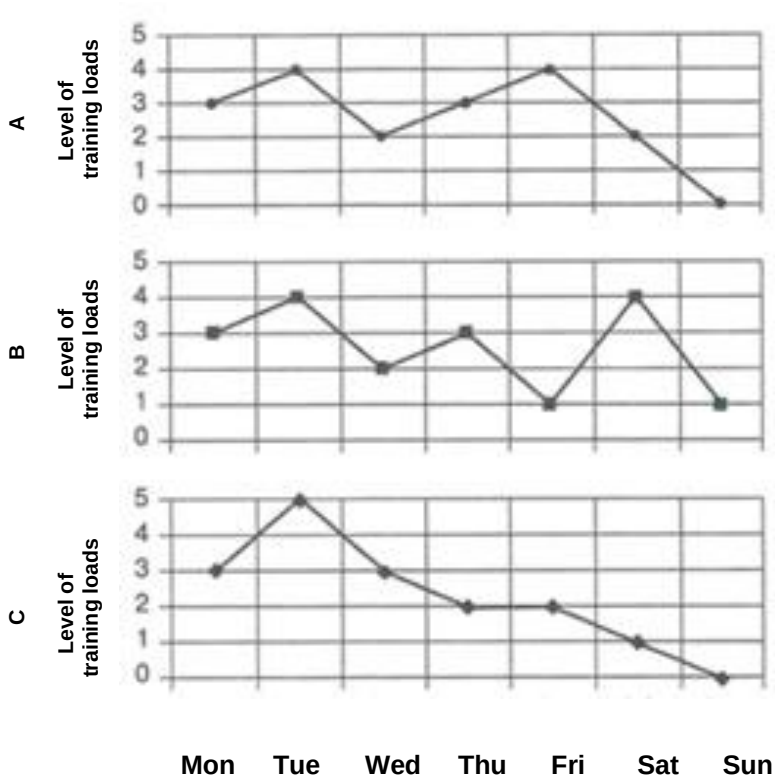
Microcycle types	Characteristics
Introductory	Characterized by low volume and intensity sessions. Apply at the beginning of the preparatory phase before the main competition.
Impact	Characterized by significant (impact) load volume and high intensity. Used mainly in the general and especially the preparatory stages of training players in annual cycle training.
Educational and training	Aimed at players' immediate implementation of training for competitions. Used in the final stage of pre-competition year cycle of training players.
Competitive (renewable and introductory)	Structure and duration of these microcycles depends on the competition calendar. They begin immediately after the game of the day.
Competitive (introductory)	This microcycle differ from competitive (renewable) one thus, it begins at the end of pre-competition stage or after reducing microcycle.
In-competitive (introductory)	Aims to train players in the competitive period when there has been quite a long break between regular competitions (games). Begins after renewable microcycle.
In-competitive (renewable and supporting)	Differ from in-competitive (introductory) microcycles in less significant volumes of training loads. Usually such microcycle begins immediately after the game.
Recovery	Conducted after the impact microcycles and used in the transition year cycle of preparation of ice hockey players.

Table 4. Types of microcycles in ice hockey (Ozolin 2003, p.97).

The method of constructing microcycles depends on such factors as general mode of ice hockey players' life (accommodation, meals, travel to the place of training or competitions etc.), age, level of preparedness as well as place of the microcycle in the general system of the annual cycle. (Matveyev 2010)

4.2.2 Training loads in microcycles

Changing of training loads is essential feature of any type of microcycles. Graph 2 represents planning of microcycles with one, two and three peaks of training loads. There is one training session each day of a week-microcycle. Scale with five levels allows to formalize changes of training loads in presented microcycles.



Graph 2. Planning of microcycles with one, two and three peaks of training loads (Issurin 2016b).

Microcycles with two or three peaks of training loads are used most widely, since it allows athletes to perform quite a large amount of weekly training loads with reduced risk of excessive accumulation of fatigue. Decreasing levels of training loads (three or two respectively) enable athlete's recovery and enhances his readiness to effectively perform following intense training sessions. In this case all training sessions are focused on the most essential training loads corresponding with a certain type of microcycle. (Issurin 2016b)

Microcycles with one training peak are used to perform a few developmental training sessions in order to improve specific skills. All the following sessions with medium or low loads will be based on that skill simultaneously with gradual

athlete's recovery. One peak training loads are recommended only for professional players. (Issurin 2016b)

4.3 Training mesocycles

As was mentioned, a mesocycle consists of sets of repeated microcycles (usually 3-6) and lasts from 2 to 6 weeks. Mesocycles allow the coach to build a training process in accordance with the main aims of the stage of preparation, to ensure optimal level of training loads, desirable combination of various means and training methods as well as to achieve efficient development in the athlete's various qualities and skills.

Mesocycles change depending on the training aims, periods and stages of the annual cycle, the duration of the competition calendar, recovery conditions and many other factors. Issurin (2016a) defines following types of mesocycles and their main features:

- **Introductory mesocycle** begins an annual training cycle and includes most often 2-3 microcycles completed by the recovery microcycle. The training loads are not intensive however, their volume can reach a significant level. The number of this type of mesocycles depends primarily on athlete's general state before the beginning of annual training cycle, his individual adaptation capabilities as well as features of a previous training stage. If there were no extraordinary circumstances (diseases, injuries etc.) there is only one introductory mesocycle.
- **Basic mesocycle** is main type of mesocycles during preparatory period of training. During this mesocycle main training work is carried out to form new and transform previously developed skills, training loads are highly intense and aimed at enhancing the functional capabilities of the body. Basic mesocycle consists of training microcycles in various combinations. Overall number of these mesocycles depends on how much time an athlete has before competitions begin.
- **Preparatory mesocycle** is transitional stage from basic mesocycles to competitive ones. During this mesocycle training sessions are combined with athlete's participation in minor competitions that subordinated to the tasks of preparation for the main competitions. Preparatory mesocycle

may consist of two training and two competitive microcycles. In this case training microcycles will be aimed at further improving skills and qualities that were considered as not enough developed during control competitions.

- **Precompetitive mesocycle** allows to fully simulate the mode of the upcoming competitions and to ensure adaptation to its specific conditions. If in the annual cycle there is not one but two or more equally important competitions, then a pre-competition mesocycle may be introduced before each of them with changes resulting from the particular conditions of the competition (for example, if it takes place in unusual climatic or geographical conditions, pre-competition preparation is held in similar conditions).
- **Competitive mesocycle** is the main cycle during competition periods. Usually this mesocycle includes one training and one competitive microcycle or in some cases training, competitive and recovery microcycles.
- **Recovery-preparatory mesocycle** is similar to basic one, however includes an additional number of recovery microcycles (for instance, two recovery and two training ones).

All mentioned types of mesocycles are building blocks that make up stages and periods macrocycles. The number of mesocycles and order of their combination in the structure of macrocycles depend primarily on the specific conditions of training year construction.

4.4 Macrocycles

One of the most important issues of effective management of the training process is to find rational forms of planning training loads in multi-year training in any sport. As it was mentioned in chapter 4.1 annual training cycle in ice hockey is divided into the following: preparatory, competitive (first and second), recovery and transitional stages. These periods differ in the task's ratio of training volume and intensity of training effects. The boundaries between periods are conditional.

4.4.1 Preparatory stage

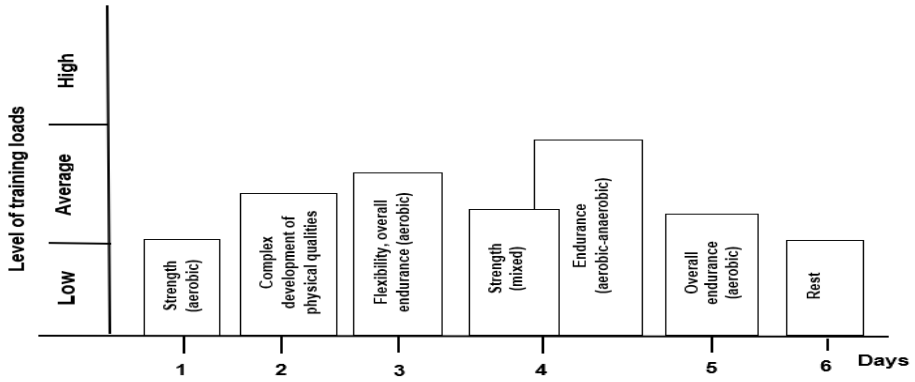
The purpose of preparatory stage is significant increase of the overall functionality of an athlete as well as improvement of his skills and abilities. In ice-hockey this period lasts for 8 weeks. The main tasks of training in this period is development of physical qualities that make the most efficient impact on improving techniques and tactics in the game as well as raising psychological readiness for upcoming competitions. In ice hockey for better planning of educational and training work preparatory period is divided into two phases: **general preparatory** and **special training preparation**. (Savin 2003)

According to Savin (2003) the main tasks of **general preparatory phase** are:

- increasing overall physical and functional athlete's fitness
- restoration and development of motor abilities and skills
- improving athlete's level of psychological and theoretical readiness.

This phase includes two mesocycles: *introductory* and *basic*.

Introductory mesocycle consists of 4-6 days microcycles. Its duration, structure and content are highly defined by team's state at the moment, its tasks and calendar of competitions. During introductory mesocycle training loads are gradually increased in volume whereas their intensity stays quite low. They are mainly aerobic with a wide range of different means aimed at strengthening athlete's motor apparatus. Major focus of training sessions is on development of general endurance, strength and flexibility. (Savin 2003) Graph 3 represents example of 6-days introductory microcycle in general preparatory phase in ice hockey.

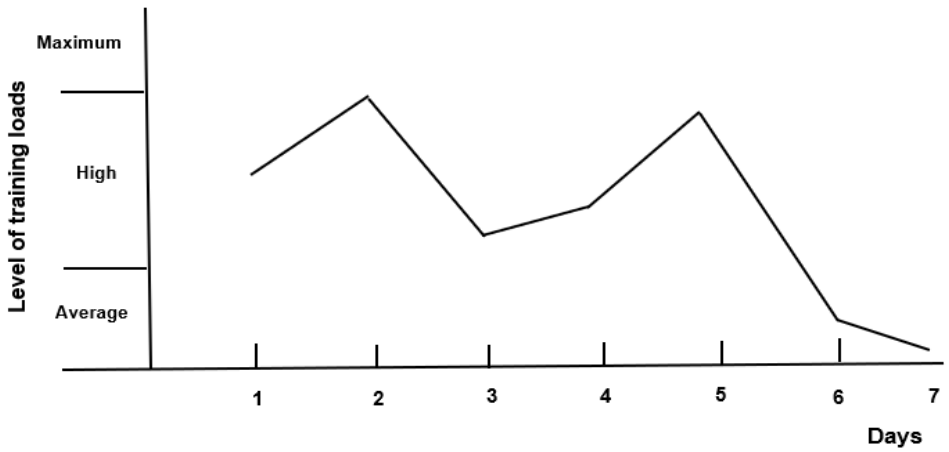


Graph 3. Example of 6-days introductory microcycle in introductory mesocycle of general preparatory phase in ice hockey (Savin 2003, p.80).

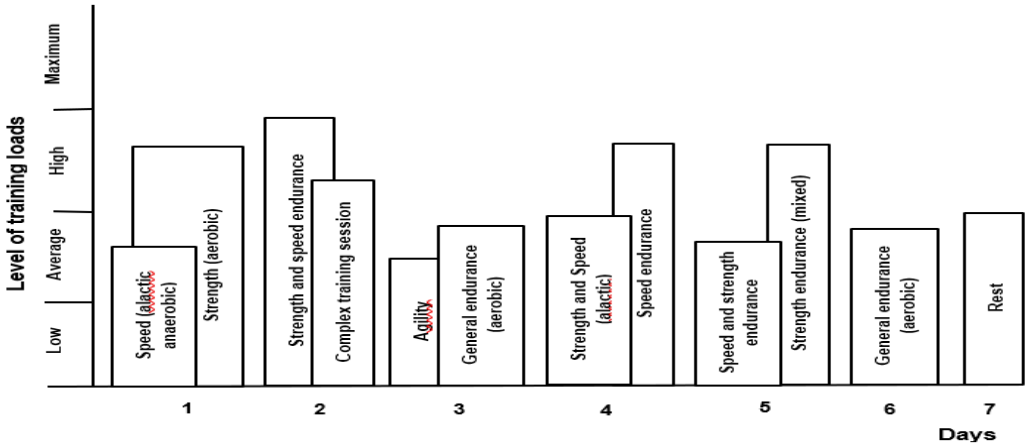
This microcycle has 1-2 training sessions per day mainly with aerobic orientation: training of general endurance, strength and complex development of physical qualities. The training method includes a large number of repetitions with small and medium weights. Speed and speed-strength exercises are not yet recommended as players are not ready for strong muscle tension. Dynamic of the training loads in this microcycle is smooth with one peak on forth day. During first four days there is a noticeable increase in volume and a slight increase in intensity. At the end of the microcycle on the fifth day there is a reducing of loads and transition to active rest. Therefore, morning exercises are carried out in aerobic mode with small loads (jogging, general exercises for the main muscle groups, etc.). (Savin 2003)

Basic mesocycle during general preparatory phase is defined by further increase in volume and intensity of training loads. Microcycles in this mesocycle have 2 or 3 training sessions per day. Graph 4a, b represents example of 7 days microcycle in basic mesocycle of general preparatory phase.

a



b



Graph 4a, b. Example of 7 days microcycle in basic mesocycle of general preparatory phase (Savin 2003, p.82).

Training loads in these microcycles are high in both volume and intensity. Dynamic is with two peaks on second and fifth days and decrease occurs on third and sixth days. Such dynamic enables the use of highly intensive loads and helps athletes to adapt more easily. (Issurin 2016a)

It is recommended that training sessions be implemented to develop strength, speed and balance at the beginning of the training day and microcycle, since their effectiveness would be much higher due to low level of fatigue. First training session of the day has higher loads than others. The focus of training day is defined by the main training session since this session is aimed to solve essential tasks of the day. Training load in this session is higher. The rest sessions during the day increase the training effect or contribute to a more rapid recovery after intensive loads of the main session. (Savin 2003)

Issurin (2016a) defines the main training purposes during the second phase (**special training**) of preparation stage as the following:

- rise of the level of special physical training
- improvement of competitive technique and tactical skills
- increase of the level of psychological and theoretical training
- enhancement of athlete's special qualities and skills.

Second training phase consists of *preparatory* and *precompetitive* mesocycles. These mesocycle includes 7-9 microcycles. (Issurin 2016a)

During *preparatory* mesocycle training sessions are carried out on ice and off ice in proportion 1:4. The main attention is paid to technical and tactical training in the form of dynamic and adaptation training tasks along with special physical training. Training sessions off ice are small in volume but quite intensive. They are aimed at development of speed and strength qualities as well as special endurance in the mode resembling competitive activity. On ice sessions are focused on improving technical skills, speed and tactics of the game in attack and defense. (Savin 2003)

In the third week of the special preparatory stage competitive training sessions are carried out in the form of training games. The main task during these games is further improvement of technical skills and testing of different tactical options in both attack and defense. Ratio of training and competitive loads play crucial role in this phase. On average competitive load is approximately 30% of total amount of training sessions. (Savin 2003)

Precompetitive mesocycle is carried out in the end of special training preparation and lasts for 3 weeks. According to Issurin (2016a) during this mesocycle athletes continue to improve their general physical fitness, psychological readiness as well as technical and tactical skills. Most of training sessions are carried out on ice and only morning exercises are conducted off ice. A lot of attention is paid to the improvement of tactical options in attack and defense, enhancement of various tactical combinations, and mutual understanding between players during the game For this purpose, test games with a team playing in a different tactical way are conducted.

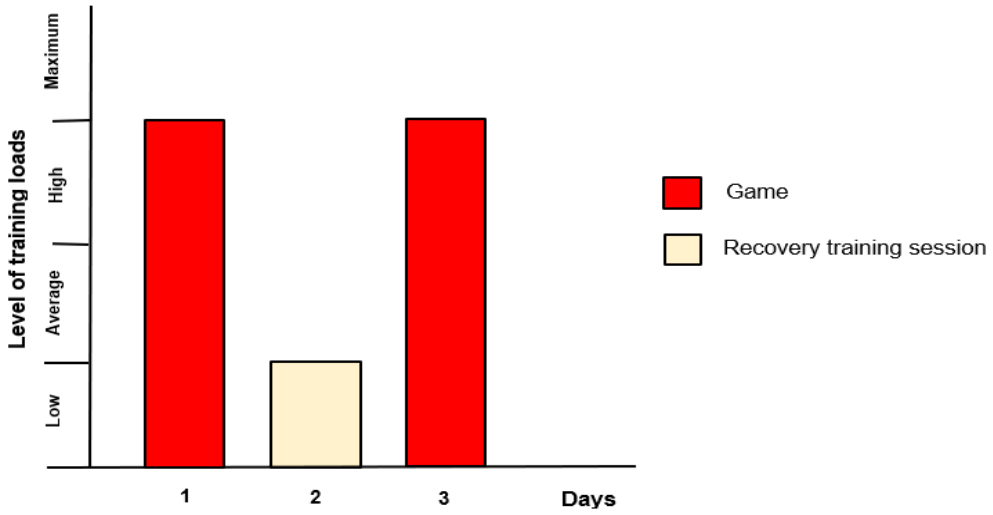
4.4.2 Competitive stage

Competitive period is the longest in ice hockey and lasts 7 months. Its structure is defined mainly by the calendar of official competitions within the country and international (world championship, Olympic games).

Competitive period includes two or three competitive and one or two intermediate phases. The main objective of this period is preservation and maintenance of players' physical fitness. During this period training loads significantly decrease

since game intervals usually are 1-2 days and recovery period is too short. Building of training process at competitive stages should be based on cycles between games. In ice hockey these cycles are usually from 1 to 4 days.

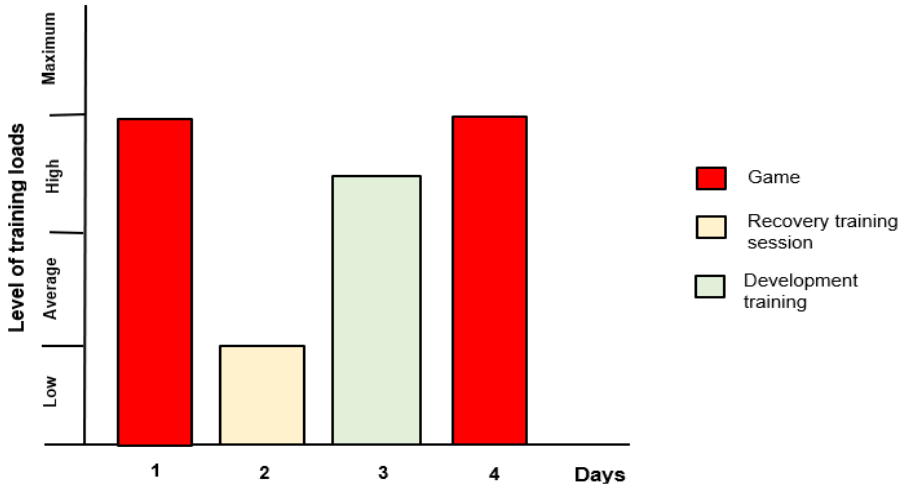
Cycle with one day between games implies that recovery training session is carried out the next day after the match (Graph 5).



Graph 5. Cycle with one day between games at competitive stage (Savin 2003, p. 83).

First session is intended for faster recovery after large competitive loads. Depending on the state of the team and importance of the upcoming game this session includes technical and tactical or general physical training with small or average loads in aerobic and aerobic-anaerobic modes.

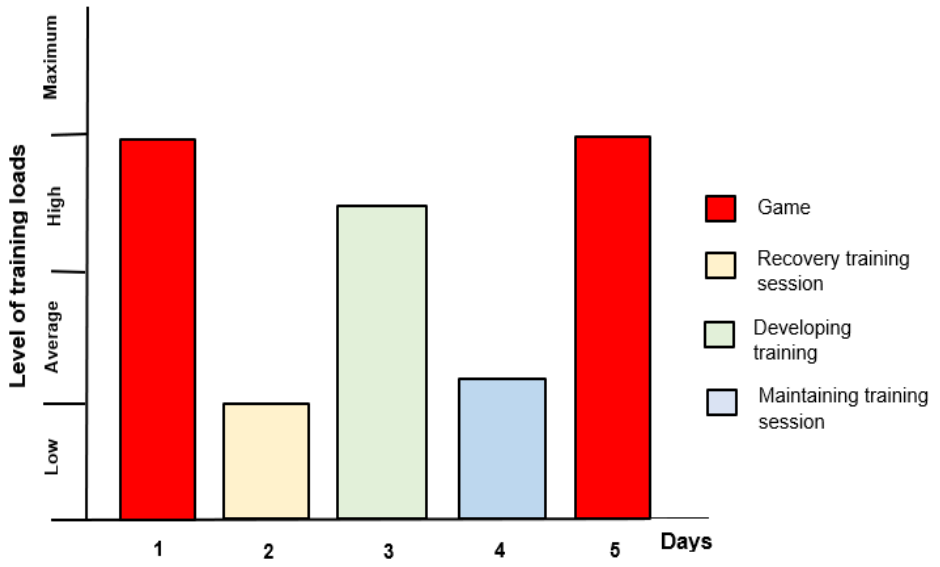
In cycle with two days between games there are two training sessions: recovery and maintenance (Graph 6).



Graph 6. Cycle with two days between games at competitive stage (Savin 2003, p. 83).

Maintenance training session is aimed at supporting achieved level of athlete's physical fitness and improving technical and tactical skills. Training loads are average with intensity of 70-80% of the maximum for 90-100 minutes.

Cycle with three days between games includes four training sessions and one of them is development session (Graph 7).

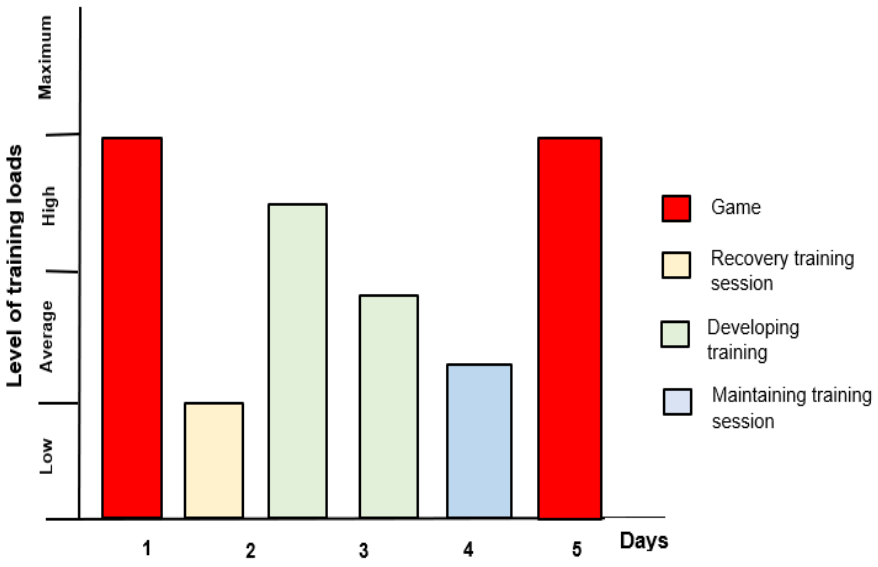


Graph 7. Cycle with three days between games at competitive stage (Savin 2003, p. 83).

On the day after the game recovery session is carried out, on the second day – development and maintenance or recovery sessions and on third – maintenance session.

The main task of developing training session is to increase special physical and psychological level of preparation and improve technical skills and tactical. This session is conducted with maximal intensity in anaerobic and mixed mode for 90-110 minutes.

Cycle with four days between games is similar in structure and content to three days cycle (Graph 8).



Graph 8. Cycle with four days between games at competitive stage (Savin 2003, p. 83).

It includes 5 or 6 training sessions: one is recovery, two – maintaining and two – developing.

Among described cycles three and four-day cycles between games are optimal since they include developing training sessions and enable athletes to recover fully and conduct training process consistently.

4.4.3 Transitional stage

Sport season is finished by transitional stage. During this period the main training goals are:

- improving and expanding physical and functional level of preparation
- strengthen weaknesses in the athletes' performance
- learning and testing new technical and tactical methods.

Transitional stage in ice hockey usually lasts two months and consists of two periods. First period (one month) includes recovery-preparatory mesocycle with 4-5 weeks of microcycles. In first microcycle training sessions are carried out in aerobic mode with average volume and quite low intensity, for instance running, swimming, rowing, etc. In second microcycle training loads rise slightly and sessions on ice begin. In third and fifth microcycles training sessions on and off ice are carried out in the mode of mixed exercises with versatile impact. Training sessions off ice are aimed mainly at developing strength, speed, coordination and general endurance. Whereas on ice sessions focus on improving technical skills and learning new tactical methods in attack and defense. Training loads are primarily aerobic-anaerobic mixed mode with average volume and intensity. Their dynamic is characterized by a smooth wave-like curve with one peak. Training sessions are built up with individual features of every athlete in the team and combined with various kinds of restorative, therapeutic and preventive measures. (Issurin 2016a)

Second part of transitional stage is vacation. In this period an ice hockey player continues training loads according to his individual plan along with active rest.

5 Implementation of the methodology for developing high-speed qualities of young ice hockey players of 13-14 years

After analysis of the scientific and methodological literature the author found that the problem of the development of high-speed qualities of young ice hockey players is poorly understood nowadays. In author's opinion the main reason is that the features of developing special speed abilities of athletes have not been sufficiently studied. In most works the proposed means and methods of development are given without considering the individual characteristics of the person conditioned by the specific nature of the sport.

In the author's opinion the most effective method of increasing the intensity of motor training is the option of circuit training which was not yet widely applied in the work with young ice hockey players of 13-14 years. Therefore, the author developed his own methodology to apply it in an experiment with a group of participants included in the team of the ice hockey school ''Strazh'' from Saint Petersburg and as result to prove its efficiency.

School "Strazh" was established in 2008. The school offers various types of training such as skating training, amateur hockey, team and group training as well as power skating. Training sessions are carried out on five ice rinks in different parts of the city. Coaches of the school provide modern methods of training helping to reveal players' talents and improve their individual skills.

5.1 Building the training process

For the experiment, the author selected 8 athletes of 13-14 years. They had different physical shape and skills. This selection guaranteed more reliable results. All participants were tested in general exercises before the experiment. Only 6 from 8 players demonstrated good physical shape and could do all exercises with proper rhythm and technique.

The participants had their own timetable and plan for the year. Therefore, the author tried to avoid any breaks and changes in their training process. The author described only the main changes in the training process. The participants were responsible for their warm-up and cool-down exercises.

For the development of physical qualities and technical preparedness the author compiled complexes of physical exercises, the models of which have been developed and tested. In addition, the author proposed a model of circuit training developed by himself with a primary focus on the development of high-speed qualities. Circuit training should be built and conducted considering the impact on the main muscle groups involved in performing the basic movements of the young ice hockey player in the game.

Table 5 represents circuit training program constructed by the author for the experiment.

Training days	Load	Exercises on the ice rink	Exercises in the training gym
Monday	75%	Change every week: • Dribbling • Puck control • Shooting trainings • Skating techniques	During the training was used: • Weights • Rubbers • Own weight • Barriers
Tuesday	100%	•Body check trainings •Power struggle	•Flexibility •Gymnastics •Athletics
Wednesday	100%	•Tug of war using stick or rope •Games 1x1; 2x2;3x3	Circuit training with 5-10 stations, Working limit is 50-70-30 seconds Rest is 3-4 min. All muscle groups are included
Thursday		Day off	Day off
Friday	100%	•Tactical training •Out from zone •Middle zone •Attack zone	•15 minutes of running with 140-160 bpm •Stretching
Saturday	50%	Tactical training 5x4; 5x3; 4x3; 6x5	•Video observation of the games •Tactical education
Sunday	150%	Game day	•Running •Cycling •Walking •Stretching

Table 5. Circuit training program constructed by the author for the experiment.

The author planned training load in every day taking in consideration different aspects. Monday was always the day when the athletes came back to work after the rest/ Thus, the load was lower to prevent any injuries. Tuesday was focused on strength, balance, coordination and speed exercises. If a player has a lot of strength, then his speed is higher. Wednesday trainings were aimed at improving strength, skate control and balance. Friday and Saturday were days before the game thus, players should have recovered after the trainings and focused on the game elements.

The provided training plan was not followed strictly during the experiment. Changes could be caused by many factors such as the group's emotional behavior, games' timetable or obvious weaknesses of participants.

The dosage of the load in the circuit is carried out in the following way: the maximum possible number of repetitions of the exercise is predetermined for the given subject, which makes it possible to individually dose the load. Each training

session gives a certain percentage of the maximum repetition at the stations. In some complexes of circuit training exercises repeated with increasing number of repetitions at the same time, in others - the time was reduced with a constant number of repetitions. Performance and changes were made simultaneously by all athletes at a given signal. In author's model of circuit training 4 stations were used. At each station there were two people which increased competitivity allowed the athletes to compare results at the end of the experiment. Each set of exercises had its own temporary mode of operation and rest at the stations.

Speed training in the hall or on the sports ground was carried out using technical means and methods, however, with a greater emphasis on performing exercises that meet the specifics of ice hockey. Speed training on ice was conducted using the special means of complex impact: set of exercises were used, simultaneously affecting the speed of motor reaction, and the development of starting speed. Then, special attention was paid to the speed with which technical and tactical actions were carried out, games and game exercises were predominantly used in the appropriate mode, providing an increase in acceleration qualities.

To increase speed-related abilities, a high emotional background is very important. For this purpose, exercises of a competitive nature were used. It should be taken into consideration that the teams selected were equal in speed and in the pairs one athlete was stronger than another. Thus, the strong player was in the role of leader and the weak one followed him.

Speed exercises performed by athletes in the first half of the classes were from 20 to 40 minutes. In the competitive period systematic training work on the education of high-speed quality was difficult. In this regard, high-speed training in the amount of 12-15% was carried out mainly in the form of complex exercises, which contemplate the simultaneous solution of the tasks of high-speed and technical-tactical training.

In the intermediate stages, the volume of rapid training is about the same as in the preparatory period, and the first two weeks of the intermediate stage (rehabilitation and preparatory exercises) corresponded to a similar volume in the general preparatory stage. In the following weeks (3, 4, 5, 6), speed training was conducted in the same way as in the special preparatory stage of the preparatory period.

At the general preparatory stage, speed training takes 5-7% of the total time allocated for physical training. Its main tasks at this stage are to create prerequisites for the successful increase of special high-speed qualities and increase the capacity and capacity of the energy supply.

Since high-speed training refers to working at maximum power, and high-speed exercises require extreme muscular strain, mesocycle should not be done without the appropriate preliminary preparation of the musculoskeletal system of hockey players. At this stage, the following main means are used: running uphill, relay races, game exercises, basketball, football, handball, rugby, tennis.

5.2 Execution methods

The experiment was carried out in a European standard ice ring for 6 months. To determine the effectiveness of the developed methodology the initial speed data of each hockey player was recorded before the beginning of the experiment. In order to determine the effectiveness of the developed experimental methodology repeated testing was performed six months later and a comparative analysis of results was carried out. Throughout the observation period training sessions were conducted six times a week for two hours per day. They were mainly focused on the development of speed qualities using specially selected sets of exercises. To define the level of speed qualities and technical preparation at the beginning and at the end of the experiment the following tests were used:

- skating forward (36 m)
- running on skates backward (36 m)
- shuttle run on skates (18 × 12 m)
- slalom without a puck
- slalom with a puck (three attempts).

5.3 Results

The speed measurements were made using a manual stopwatch and later analyzed by applying computer software – Microsoft Excel. The training effect depended not only on the organization of the exercising load, but also on their

correct distribution over time, the order of the combination as well as the separation of intervals.

Table below represents the gained results in five test exercises at the beginning of the experiment.

Name of player	Test				
	Skating forward (sec)	**Skating backward (sec)**	**Shuttle run on skates (sec)**	**Slalom with a puck (sec)**	**Slalom without a puck (sec)**
Player 1	5.9	8.3	58.5	31.1	22.1
Player 2	6.7	8.8	59.6	30.1	23.4
Player 3	6.4	9.7	57.8	30.0	23.8
Player 4	6.7	9.1	60.0	32.4	26.1
Player 5	7.1	9.9	58.9	31.8	23.5
Player 6	7.0	10.0	63.3	32.2	24.6
Player 7	6.5	9.1	61.3	30.4	24.2
Player 8	7.1	9.0	58.6	31.9	25.1
Average	**6.7**	**9.2**	**59.7**	**31.2**	**24.1**

Table 6. Results of the athletes at the beginning of the experiment.

The author compared these results to results of the experiment in each test separately.

Table 7 represents skating forward (36 m) results comparison.

Name of player	Initial results (sec)	Final results (sec)	Difference (sec)
Player 1	5.9	5.5	0.4
Player 2	6.7	6.3	0.4
Player 3	6.4	6.2	0.2
Player 4	6.7	6.4	0.3
Player 5	7.1	6.6	0.5
Player 6	7.0	6.8	0.2
Player 7	6.5	6.0	0.5
Player 8	7.1	6.4	0.7
Average	**6.7**	**6.3**	**0.4**

Table 7. Skating forward (36 m) results comparison.

Player 5 and Player 8 showed the best results (6.6 and 6.4 seconds respectively) whereas their initial results were the worst among the rest – 7.1 seconds. Overall improvement of speed in skating forward for the whole team is 0.4 seconds.
Team improvement in running on skates backward (36 m) is slightly better – 0.7 seconds as shown in Table 8.

Name of player	Initial results (sec)	Final results (sec)	Difference (sec)
Player 1	8.3	8.1	0.2
Player 2	8.8	8.6	0.2
Player 3	9.7	8.8	0.9
Player 4	9.1	8.1	1.0
Player 5	9.9	8.8	1.1
Player 6	10.0	9.3	0.7
Player 7	9.1	8.7	0.4
Player 8	9.0	8.0	1.0
Average	**9.2**	**8.5**	**0.7**

Table 8. Skating backward (36 m) results comparison.

However, personal results of Players 3, 4, 5 and 8 are significant taking in consideration that their initial results were the lowest among others.
Overall team results in shuttle run on skates showed significant improvement – 2.5 seconds (Table 9).

Name of player	Initial results (sec)	Final results (sec)	Difference (sec)
Player 1	58.5	54.8	3.7
Player 2	59.6	55.4	4.2
Player 3	57.8	57.1	0.7
Player 4	60.0	59.1	0.9
Player 5	58.9	56.2	2.7
Player 6	63.3	60.7	2.6
Player 7	61.3	57.5	3.8
Player 8	58.6	57.2	1.4
Average	**59.7**	**57.2**	**2.5**

Table 9. Results comparison in shuttle run on skates.

Player 1 and Player 7 showed impressive progress in experimental results: 3.7 and 3.8 seconds of improvement respectively.

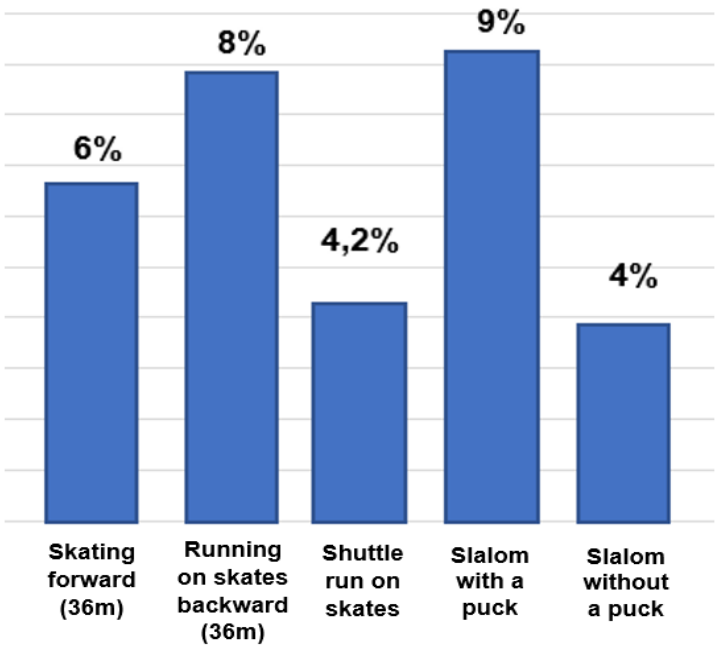
Table 10 represents comparison of results in slalom with and without a puck.

	Slalom with a puck			**Slalom without a puck**		
Name of player	**Initial results (sec)**	**Final results (sec)**	**Difference (sec)**	**Initial results (sec)**	**Final results (sec)**	**Difference (sec)**
Player 1	31.1	29.1	2.0	22.1	21.1	1.0
Player 2	30.1	29.3	0.8	23.4	22.1	1.3
Player 3	30.0	28.7	1.3	23.8	23.0	0.8
Player 4	32.4	29.2	3.2	26.1	25.4	0.7
Player 5	31.8	27	4.8	23.5	22.8	0.7
Player 6	32.2	27.8	4.4	24.6	23.2	1.4
Player 7	30.4	28.6	1.8	24.2	23.4	0.8
Player 8	31.9	28.6	3.3	25.1	23.9	1.2
Average	**31.2**	**28.5**	**2.7**	**24.1**	**23.1**	**1.0**

Table 10. Result comparison in slalom with and without a puck.

Team showed significant improvement in slalom with a puck – 2.7 seconds whereas in slalom without a puck result was not as significant – 1.0 seconds. Player 5 and Player 6 achieved the best improvement among others in slalom with a puck – 4.8 seconds and 4.4 seconds respectively. Moreover, Player 6 showed the best improvement in slalom without a puck – 1.4 seconds.

Based on gained results the author assumes that his methodology improved the players' results in all tests (Graph 9).



Graph 9. Percentage increase of players' results after applied methodology.

According to Figure 6 the main improvement was achieved in slalom with a puck, running on skates backward and skating forward: 9%, 8% and 6% respectively. Whereas results in shuttle run on skates and slalom without puck increased only by 4,2% and 4% respectively. However, positive change occurred in all tests of the experiment.

6 Conclusion

The main purpose of this thesis was to investigate the essential stages and features of the training process in ice hockey, to define the crucial qualities of the players influencing the success in the game and then implement obtained knowledge to create a methodology developing high-speed qualities of young ice hockey players of 13-14 years. The aims of the project justifying the importance of carefully building a training process, analysis of ice hockey features and the study of the crucial qualities of the players were met.

The idea of choosing specific topic was based on the author's desire to become a professional ice-hockey coach in his future. However, the idea for the practical part of the thesis was not so obvious at the beginning. The author defined it during his second professional training in ice hockey school "Strazh" in Saint Petersburg.

During the placement, the author worked with players of different ages. The placement supervisor suggested to focus on the players of 13-14 years since the author had some work experience with this age group. The main feature of this group is the highest growth rate of speed qualities compared with other ages.

The hockey player should be able to perform everything quickly: to start and to run on skates, to slow down, to maneuver, to pass and to take the puck, to throw the puck into the goal as well as to stop the opponent with the force. Moreover, he should quickly respond to the actions of his rivals and partners, evaluate situation in the game, make correct tactical decisions and immediately execute them. To successfully accomplish this, an ice hockey player should have high-speed abilities. Therefore, the author decided to design his own methodology aimed at enhancing speed qualities of 13-14 years players. Furthermore, changes in speed skills are easier to evaluate compared to other qualities.

At the beginning of his research the author obtained solid theoretical framework about features of ice hockey and the required physical qualities for the players. Building of any training program should take in consideration physical loads that a player will experience in the game. After that it is easier to define which physical qualities he will need to perform successfully. However, development of those qualities should be carefully planned according to player's age. If a player begins to develop any of those skills later than it should be, it will adversely affect his game in the future.

The author began practical part of the research with creating his training methodology. It was based on the circuit training exercises such as:

- exercises to increase the body's strengths
- exercises aimed at developing the technique of movements
- exercises to increase the aerobic capacity of the players
- game and competitive methods.

When the program was ready the author selected 8 participants for his experiment. In author's opinion this number was suitable to perform experiment successfully as well as to gain reliable results. The supervisor of placement and other coaches of school provided the author with great support in participants' selection since they were aware of physical conditions and skills of every player.

Therefore, the author used given recommendations in the selection process. Moreover, he conducted set of exercises to select participants with different level of skills to determine the effectiveness of designed methodology more accurately.

During the work with athletes the author faced some challenges. He connected them with the features inherent to this age category. Age of 13-14 years is the period of hormonal changes, overreacting as well as aggression. Unfortunately, not all schools in Russia have their own psychologists, thus it made author's work harder when some conflicts between players aroused. It is also should be taking in consideration that some players are growing faster and some slower. All these factors the author tried to observe in his work.

Before the experiment began the speed tests of 5 different skills were taken to compare them with final results. Gained outcomes of training sessions according to the developed program demonstrated significant improvement of athletes' speed qualities, especially in such tests as skating forward, running on skates backward and slalom with a puck. Moreover, players' agility enhanced positively because of increased speed movements and ability to combine them with special skills.

The author considers his methodology to be a helpful tool in coaching young hockey players aged of 13-14 years. It can be used as a template for designing training programs for other age groups. However, the features of certain age group should be taken in consideration.

The thesis was perfect opportunity to apply the author's knowledge in practice. The process of developing and applying author's methodology was challengeable but at the same time very exciting. The author will use his designed program in his professional life as a coach.

The thesis commissioner ice hockey school "Strazh" made valuable contribution in research work. The author believes that his designed methodology will be helpful tool for the school.

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