

DEVELOPMENT OF COORDINATION MOTOR ABILITIES (CMA) IN THE SYSTEM OF LONG-TERM PREPARATION OF ATHLETES

Development of coordination abilities

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Abstract

The article attempts to summarize the current knowledge on the preparation of coordination in combat sports and team games. It has been discussed: the basic principles of CMA training, complexity of coordination exercises, the duration of load and rest breaks, the systematic use of special exercises creating the most important CMA and factor of sensitivity and lateralisation in the development of CMA. The directions for further researches have been marked out.

Key words: single combats, sports games, training

Introduction

Nowadays there have been published numerous works concerning various aspects of CMA [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12]. Today we have quite complete information about the notion and significance of CMA in physical education and sport, their structure, dynamics of the development and training throughout the ontogenesis, especially during the period from 3-4 till 18-19 years old. There are experimental materials about the relationship between different CMA and the physical development, conditioning abilities, the level of psycho-physiological function development, speed and quality of teaching motor skills, etc. It was found that high level of CMA promotes the quality and speed of mastering a new motor functions, but the development of these capabilities is poorly associated with different somatic and conditional parameters [13].

However, at the same time, there are some aspects of CMA that have just been addressed recently [2, 14, 15, 16, 17]. These are as follows: the concepts and variants of their training, the CMA structure in athletes engaged in different sports events or the place of general and special coordination preparation in the system of long-term training. In the present study it has been endeavoured to introduce the reader to these issues based on existing literature.

The concepts of coordination preparation in sports games and single combats

Ljach [2] and Ljach and Sadowski [14] distinguish five coordinating training concepts in these two sports (Fig. 1).

The authors believe that coordination training should be considered as a separate chapter in the long-term system of training athletes. In the same way German trainers approached this issue [2] (Fig. 2).

The objectives and place of coordination preparation in the system of long-term training

The main objectives of coordination preparation in sports games and single combats are presented on Figure 3 [2]. The first three objectives are suggested to plan in sections of general and special coordination preparation; the solution of the fourth and the fifth ones should be envisaged in the sections of coordination, technical and tactical preparation. Our observations [2] show that only the first objective is more or less successfully applied by coaches, whereas the other ones are realized at empirical level or are not planned at all.

Approximate distribution of time for general and special coordination preparation among other types of preparation of athletes of playing sports events and single combats were shown in Table 1 [2, 12, 14, 15, 18, 19].

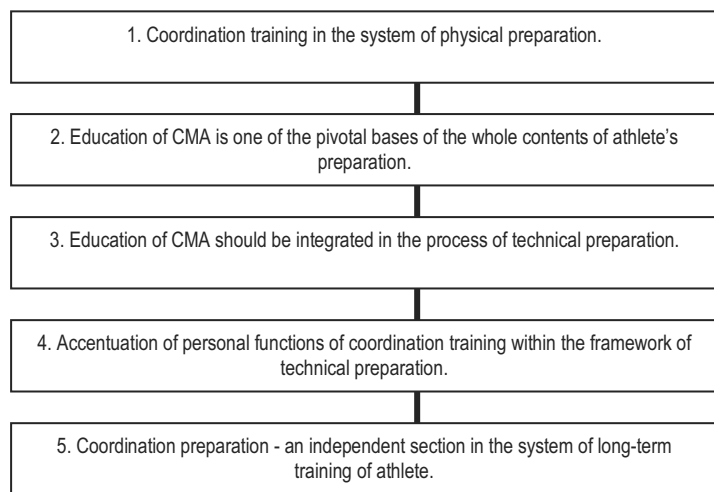


Figure 1. Concepts of coordination training in sport [14]

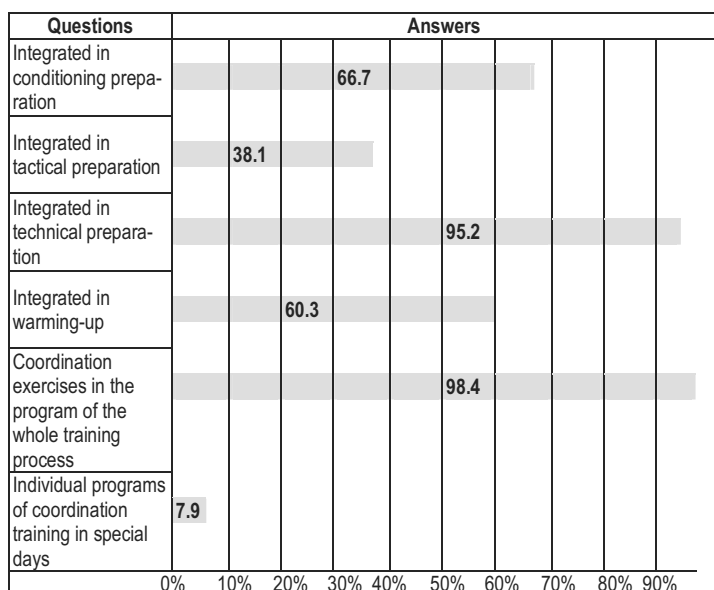


Figure 2. Distribution (%) of answers of German basketball coaches (n=115) to question concerning their way of realizing coordination perfection in training process [2]

Table 1. Suggested allotment of time for general and special coordination preparation in the system of training of young athletes of playing sports events and single combats, % [2, 12, 14, 15, 18, 19]

AGE (years)	TYPES OF PREPARATION					
	Coordination		Conditioning		Technical	Tactical
	General	Special	General	Special		
8-10	25	5	25	5	30	10
11-12	15	5	20	10	35	15
13-14	10	10	15	10	35	20
15-16	5	15	10	15	30	25
17-18	5	10	10	15	30	30

The major provisions of CMA training in sport

CMA training should be outlined and organized as an independent part of training and performed for 15-45 minutes. The intervals between these types of training should be the same as during "strength" and "endurance" training. In practice, however,

these conditions are not always applied; there are observed long intervals that have a negative effect on the level of individual CMA. It has been demonstrated that coordination loads exceeding 45 min during a single training session do not lead to expected effects [16].

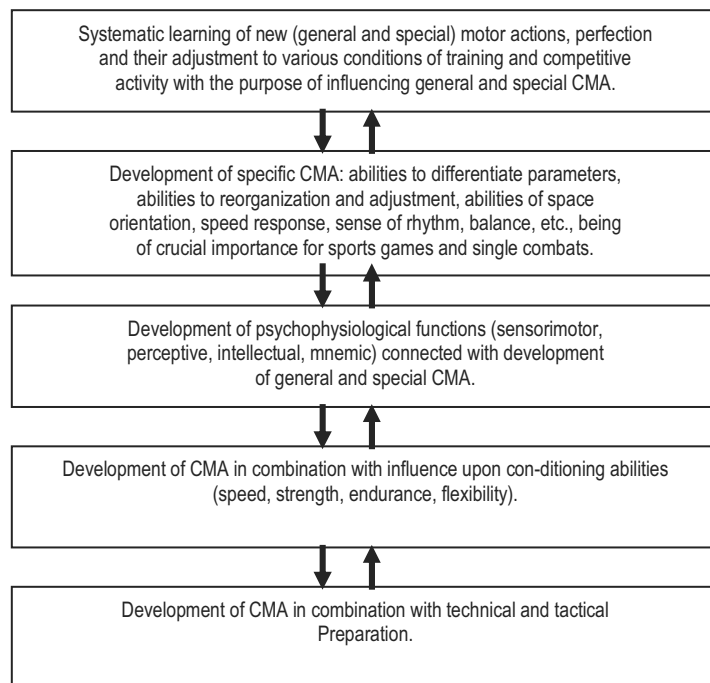


Figure 3. Objectives of coordination preparation in sports games and single combats [2]

Figure 4 illustrates possible variants of coordination training in sport. The first and the second variant looks more suitable for athletes of relatively low skills, whereas the third-fifth – for skilled ones. The efficiency of the above variants has been confirmed during experimental studies on basketball players [20, 21], handball players [18], footballers of both sex [12, 22, 23] as well as kickboxers, taekwon-do players, Greco-Roman and free-style wrestlers [15, 19]. Meanwhile, further research is needed to determine the significance of mentioned variants of coordination training in the system of long-term preparation of athletes.

1. Even impact by means and methods during the whole of macro- or mesocycle.
2. Accentuated impact on the leading CMA during preparatory, competitive or transitional period.
3. Directed training of these or those CMA in the course of 2-6 microcycles.
4. Utilization of exercises of increased coordination complexity.
5. Utilization of special "coordination devices" (stands).

Figure 4. Variants of CMA training in sport [2]

Training of sports specific CMA results in their increase only when the selected physical exercises reflect typical competitive conditions.

The sequence in CMA training

It is well-known that success, especially in sport games and single combats, depends on many CMA. From practical point of view one should answer the question – which ability should start the training process in order to provide the basis for other CMA,

and what sequence should be used? Figure 5 illustrates the model of CAM training sequence. As it appears, the ability for reorganization and adjustment should be improved as the last when other CMA have already been developed sufficiently. Ability for reorganization and adjustment is characterized by movements which require precision and execution speed in variable conditions. However, taking into consideration the fact that individual profile of CMA in elite athletes may be different [15], the sequence in CMA training as well as other parameters of load (volume, intensity, coordination complexity) influencing the above abilities may differ as well.

The physical exercises used for CMA training should be thought and executed correctly from technical point of view. This is particularly important while training of CMA in children and young. The selection of the utilized physical exercises should be aimed preferentially at improvement of one CMA despite the fact that in reality CMA are never manifested isolated. In training practice during improvement of the level of different CMA, the selected and utilized exercises should make higher demands of athlete in regards to precision, speed and coordination complexity.

Easier exercises from the angle of coordination are recommended to combine with more complex ones – this is the essence and the efficiency of contrast method of CMA training. According to Hartmann [16], this rule should be especially accounted for when an athlete is performing more and more complex exercises but fails to perform them “purely” any more. The coordination training at this stage should be terminated and the athlete should return one or several steps back.

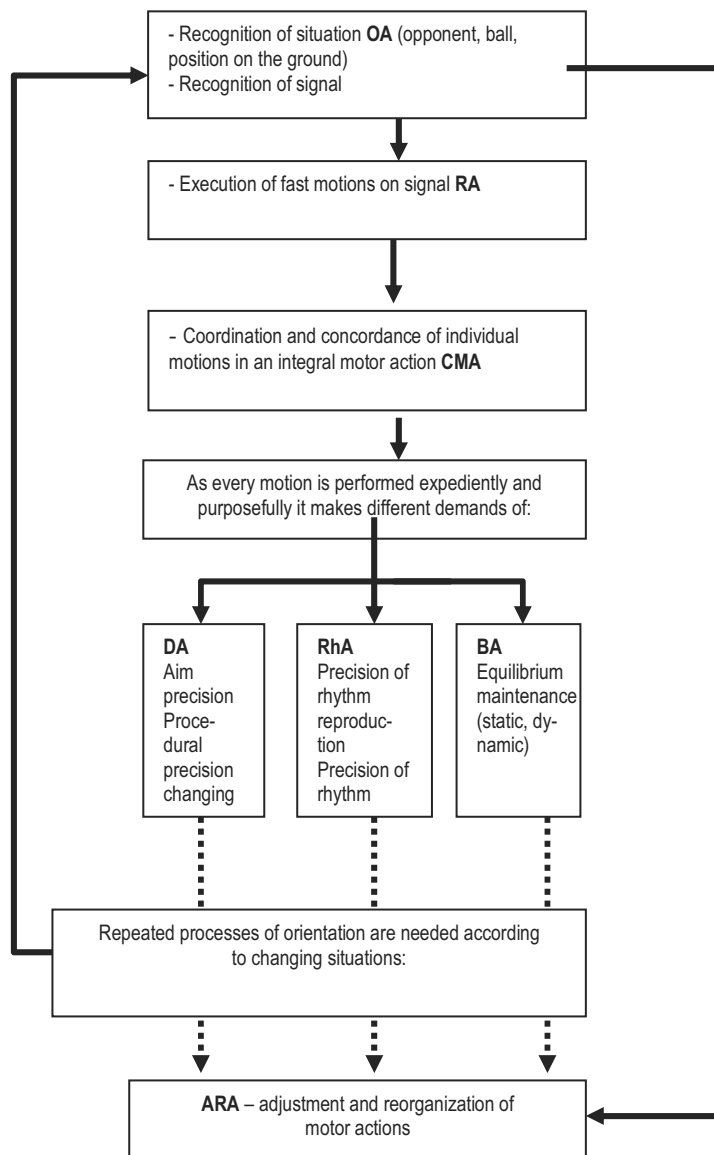
Coordination complexity of exercises

The optimum training effect is achieved when coordination complexity of exercises gradually increases from one exercise to another. Unfortunately, the analysis of training session plans of young and skilled basketball players [20], Greco-Roman and free-style wrestlers [19], kickboxers [15] have shown that in the majority of cases the coaches fail to keep to the principle of gradual increase of coordination complexity of exercises; necessary ratios between exercises of different coordination complexity are not established during transition from one stage of preparation to the subsequent higher stage of sports mastery. As a rule, too many tasks of low and moderate coordination complexity are utilized which may be considered appropriate in preparation of young athletes but skilled masters.

According to Platonov and Bułatova [24], the process of different CMA perfection proceeds most efficiently in the case when the complexity of motions varies in the range of 75-90% of maximum level. The tasks of relatively low (40-60% of maximum level) and moderate (60-70% of maximum level) coordination complexity are rather efficient in preparation of young athletes. They may be used for highly skilled athletes at the beginning of training season as well as during warming up in sessions with low loads of recovery character.

Previous observations [2] concerning the use of exercises (tasks) of different coordination complexity have allowed to determine their approximate ratios in training of athletes (Tab. 2).

The data show that along with increase of athlete's qualification the volume of exercises of low and moderate coordination complexity decreases respectively from 30-40% and 35-45% at the age of 10-12 to 5-10% and 30-40% in the group of skilled athletes of playing sports events at the age of 19-30 and older. The percentage of tasks of high and maximum complexity increases accordingly from 10-20% and 0-5% to 40-50% and 15-20%.



Key: OA – orientation ability; RA – response ability; CA – concordance ability; DA – differentiation ability; RhA – rhythm ability, BA – balance ability; ARA – adjustment and reorganization ability.

Figure 5. Sequence in training of coordination abilities [16]

Table 2. Suggested ratio of exercises of different coordination complexity in training of athletes of playing sports events, % [2]

Age (years)	Exercises of low coordination complexity (1 point)	Exercises of moderate coordination complexity (2-3 points)	Exercises of high coordination complexity (3-4 points)	Exercises of submaximum and maximum coordination complexity (4-5 points)
10-12	30-40	35-45	10-20	0-5
13-14	20-30	45-55	15-25	0-5
15-16	15-20	40-50	25-35	5-10
17-18	10-15	35-45	30-40	10-15
19-30	5-10	30-40	40-50	15-20

The duration of loads and rest intervals during performance of coordination exercises

The duration of loads and rest intervals during performance of coordination exercises depends on the level of athlete's technical skills, conditioning and tactical preparation, actual CMA which improves due to given exercise, way of conjugated development of coordination and conditioning abilities as well as upon the number of players participating in exercise, their degree of resistance, number of balls and other factors. Duration of work without the rest interval during utilization of a given exercise varies in a wide range from fraction part of a second to several minutes. For instance, the exercises aimed at training the ability to differentiate motion parameters, to orientate and respond last from fraction part of a second to several seconds, whereas those influencing the abilities to concordance or effecting simultaneous development of CMA and special endurance may last from fraction part of a second to several minutes [2].

The intensity of coordination exercises at earlier stages of training when the reserve of technical-tactical skills is the lowest is mainly low and moderate. In the group of skilled athletes the intensity of these exercises should constitute 75-90% of maximum. This provides efficient control for the quality of their execution as well as creates favorable conditions for optimum regulation of motor activity. The rest intervals during transition from one coordination exercise to another may be absent at all; they may be rather short (several seconds), such as in the case of developing of speed of responsiveness or may last until complete recovery (e.g. if the CMA is shaped in conjunction with the improvement of fitness abilities). The load and rest components during execution of coordination exercises by basketball players of different age are listed in Table 3.

Table 3. Load and rest components during coordination exercise performance by basketball players of different age [2]

Age (years)	Load and rest intervals components					
	Exercise duration	Exercise intensity	Duration of rest intervals between exercises	Character of rest intervals	Number of Exercise repetition	Exercise coordination complexity
8-10-13-14	from fraction part of a second to several minutes	From low to sub-maximum	From several seconds to complete recovery	Any (passive, active)	From 8 to 40 in series, number of series 2-6	low, moderate
15-16-17-18	from fraction part of a sec to several minutes	From moderate to maximum	From several seconds to complete recovery	Any (passive, active)	From 8 to 40 in series, number of series 2-6	moderate, increased
19 and above	from fraction part of a second to several minutes	From moderate to maximum	From several seconds to complete recovery	Any (passive, active)	From 8 to 40 in series, number of series 2-6	moderate, increased, submaximum, maximum

Numerous studies [2, 14, 15, 22] have resulted in determination of the group of CMA which conditions the efficiency of competitive activity of athletes. It should be mentioned, however, that opinions of experts and specialists about significance of individual CMA in basketball, football, handball [2] as well as single combats [15, 19] did not coincide and sometimes were opposite. These estimations not always coincided with experi-

mental studies aimed at determination of the leading coordination factors in the given sport games.

In the course of training of athletes especially of the top level one should envisage the time for influencing psychophysiological functions related with development of CMA. The question is about the influence upon perceptive, mnemonic, sensorimotor and intellectual components of these functions: speed of information reception and processing, speed and precision of response, anticipation, operative memory, speed and quality of operative thought, sense of time, space and degree of muscle efforts [5, 25]. One of the major methodical problem of coordination training consists in optimum combination (conjugated impact) of coordination exercises aimed at CMA development with those influencing various conditioning and complex abilities (speed, strength, endurance, flexibility and their combinations). As a matter of fact, scientists and coaches have to develop such exercises.

From the point of view of CMA training strategy, especially with regard to children and youth, it is very important to know sensitive (the most favorable) periods of development of these abilities as well as age and individual peculiarities of their formation. Studies of Ljach [13] and the results of other scientists [1, 5] demonstrate that the most favorable period for purposeful development of various CMA is 5 to 7 years of age. Purposeful training from 7 to 11-12 years of age provides the second in significance effect, whereas developing CMA from 14-15 to 17-18 and 12-13 to 14-15 years of age, the effect of impact appears to be lower as compared to the first two time periods. There are no grounds to claim that above 17-18 years of age the process of CMA improvement, at least most of them, terminates. It is just important to know and make the best use of appropriate means and methods of training of these abilities.

The other most important theoretical-methodical provisions of CMA training is their development with account for lateralization. The previous studies [12, 15, 23, 25, 26] indicate that it is symmetrical preparation of athlete of playing sports events (both hands, legs and body sides) which we consider as widening of coordination abilities along with technical and technical-tactical skills of an athlete. Such approach is also the reserve for sports preparation improvement. However, the issue of symmetrical or asymmetrical (coordination) training of athlete at different stages of athletic preparation and in various sports events requires further discussion and investigation.

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