DEVELOPING ENDURANCE SPECIFIC TO EARLY AGE BASKETBALL GAME

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Abstract

Specialists concerns for athletes' early training aren't new and the field of modern sport has brought in the previous years many controversies regarding children and junior training.

We see a part of these controversies in young basketball players training too when it comes to developing endurance.

Keywords: *endurance, effort, children*

JEL classification: ***I0, I10***

Introduction

On the first years, the long and cyclical endurance ability doesn't show in children. Children move a lot, they can play from morning to evening and their effort is interrupted by shorter or longer breaks that they take themselves.

Children don't spare efforts, this being due to the lack of motion coordination that involves a considerable volume of energy generating exhaustion even in moments of cyclical effort. Between 4-7 years old, coordination development makes moves become more economic and less tiring, which leads to the possibility of making prolonged efforts.

A gradual training between 3-5 years leads to 80% progresses for boys and 50% for girls of the adult age maximum possibilities. It's obvious that the psychological possibilities at this age exclude endurance efforts but these increases are a piece of evidence in favour of the body ability to adapt even from an early age.

Up to the age of 12, endurance development occurs simultaneously almost at the same values both in boys and girls. Later, after this age, boys stay at the same value for about 1.5 years while girls after 2 years of stability start a visible regression that seems connected to the appearance of secondary sexual characters: menstruation, weight gain, adipose tissue-muscle tissue variety etc.

Years before, aerobic endurance training was limited to the age of 10 years old. Today, modern studies prove that at the age of childhood aerobic capacity can be educated. Under the age of 8 years old the heart muscle volume change is explained by means of the increase in the systolic and filling capacity.

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The heart morphological and anatomic feature influences the result of the athlete. The heart muscle, whose number of fibers is fixed, thickens increasing even the internal cavity volume. It's important to remember that the maximum O2V rises together with the heart volume and the relative heart volumes (in ml./kg) seen in trained children has similar values to the ones of adults. Up to the age of 10-11, O2 maximum consumption does not show a relevant difference between boys and girls. Reported to body weight (ml./Kg./min.) oxygen consumption presents extremely high values for this age being among the highest one recorded during a lifetime. After 12 years old there is a slight decrease of these indicators (according R. Manno 1996).

Research has resulted in the following: maximum breathing capacity is genetically determined by 93,4% while maximum aerobic capacity is genetically determined by 81,4%. But to what extent can children be trained to develop endurance? J. Keul (1982) answers there is a 50% improvement for the aerobic capacity.

Teenage is the most complex age period preceding youth, which is the fulfillment of human personality.

Teenage is the extension of childhood and it stretches from 12 to 18-20 years, having as first substage or puberty teenage (12-16 years old) and as secondary stage juvenile teenage (16-18 years old)

In boys the first signs of the growing up process appear at the age of 11-12 years old when the characteristic sexual signs start to appear. Strength and endurance are perfectible since the age of 10, having a rising evolution and maximum perfection possibilities after the body maturation. There is no lower age limit to start developing movement qualities. There are only adequate ways and methods to this more intense and relative stagnation period. According to G. Mitra and A. Mogoş 1980 the motion qualities development chart looks like in figure 1.

According to some longitudinal research carried out by Grosser, the evolution of motion qualities development in relation to age differences is illustrated like in figure number 2. One can notice in this figure that aerobic endurance can be carefully educated starting with the age of 8-10, speed endurance since 10-12, while the strength and anaerobic ones start with the age of 12-14 years old.

MOTIVE QUALITIES	AGE (years) 11 12 13 14 15 16 17 18 19 20
SPEED	
STRENGTH	
ABILITY	
ENDURANCE	

Fig 1. The motion qualities development chart according to age differences (according to G. Mitra and Mogoş 1980)

The charts show that at 13-14 we can carefully start educating all forms of endurance expression, especially aerobic one.

PHYSICAL FITNESS	AGE IN YEARS (♂ - boys; ♀ - girls)						
ELEMENTS	5-8	8-10	10-12	12-14	14-16	16-18	18-20
MAXIMUM STRENGTH				+♀	+♂ ++♀	++♂ +++♀	+++♂ →
STRENGTH-SPEED			+♀	+♂ ++♀	++♂ +++♀	+++♂	
ENDURANCE-STRENTH				+♀	+♂ ++♀	++♂ +++♀	+++♂ →
AEROBIC ENDURANCE		+♂ +♀	+♂ +♀	++♂ ++♀	++♂ ++♀	+++♂ +++♀	→
ANAEROBIC ENDURANCE				+♀	+♂ ++♀	++♂ +++♀	+++♂ →
REACTION SPEED		+♂♀	+♂♀	++♂♀	++♂♀	+++♂♀	→
MAXIMUM ACYCLICAL SPEED			+♀	+♂ ++♀	++♂ ++♀	+++♂ +++♀	→
MAXIMUM CYCLICAL SPEED			+♀	+♂ ++♀	++♂ ++♀	+++♂ +++♀	→

Legend:
+ Cautious beginnings (1-2X a week)
++ Constant training (2-5X a week)
+++ Performance training
→ Charging continuation

Fig. 2. The best age for training motive qualities and planning the training load (according to Grosser) different authors (Ericson, Benji – quoted by Weineck) it's very unlikely for maximum lactic acid capacity to develop in children, similar to the production of enzymes involved in the anaerobic and lactic acid elimination process. It's both valid for catecholamine production, which under lactic acid effort is uncoupled in relation to its basic value. Due to this, lactic acid capacity training is far from being recommended in this age category or it would rather not be recommended, being a source of long term fatigue and stress hormone overproduction. When it comes to its positive effects, the latter are insignificant in relation to the effort made, leading (in some authors) to the decrease of natural testosterone.

In order to establish the endurance capacity dimensions or physical and psychological demands parameters specific to basketball we would have to start from the structure of the game per se. On the current stage the basketball player has

to be endowed with features and possibilities indispensable to gaining performances. As such, one should easily run at different paces, different distances, with constant direction and rhythm changes, be able to make one leg take off jumps, or both legs, to keep the fundamental defense and attack position, to dribble, to pass the ball or throw from different distances a game object weighing 567-650 grams, to move, to fight under body contact conditions in tight game spaces etc. The main basketball feature is that the abovementioned motion structures are continuously repeated during 4 x 10 minute halves, being interrupted due to the game rules by very short recovery breaks. Generally, the 40 minute effort is interrupted by:

- ***the rules*** - fouls, technical errors, the ball going out of the field, one on ones etc that lead

to almost 5-15 sec. time-outs

- 1-2 and 3-4 halves intervals = 2min.
- 2 and 3 halves intervals = 15min.

- ***the referees***: free throws after fouls (20 sec. length), 30-60 sec. eliminations off the court,

time-out = 60sec., other 60 sec. situations

- ***the trainers***: time-out –each team gets a time-out minute for the first three halves and 2 minutes for the 4th half , other situations: 20 sec.

It's necessary for the players to benefit form a proper training for the motive effort together with the abovementioned breaks.

Teodora Predescu (1994) shows that a good indicator in order to establish the effort specific to the basketball game is the heart beat that can reach the following values:

- when the heart beat is higher than 180 beats/min. the effort is entirely anaerobic (with a great oxygen shortage)
- when the heart beat is 160-180 beats/min. the effort lies in the transfer area between the aerobic and anaerobic (mixed)
- when the heart beat is 140-150 beats/min., we are dealing with the aerobic endurance effort, mainly used by athletes aged between 14-16 years old in the maintenance trainings of the functional capacity of the cardio-vascular and respiratory system.

Many sport doctors have also been concerned with characterizing the effort pattern specific to basketball. For example: **Jacques Sapin** shows that 'basketball specific endurance is closely connected to the features of the game constraints. In basketball there are very high demands in jumps and delimitations, of limited length and recovery, while in full effort and disregarding the opponent's position. During the game, fatigue depending on the muscle mass engaged appears (local, namely 1/3 of the muscle mass and general, over 2/3 of the muscle mass involved).

Starting from the premises that the game pattern determines and is determined by the training method, **D. Colibaba** (1998) presents under the form of

parameters the four fundamental dimensions of the effort dynamics of the current times basketball: volume, intensity, density and complexity.

In agreement with the table the author presents parameters for the following dimensions of the game:

1.- Effort duration (E.D.U.)
2.- Interruption number (I.N..)
3.- Interruption duration (I.D.)
4.- Actual match duration (M.D.)
5.- Match effort global duration (GD.ME.D)

Crt. No.	DIMENSIONS	VOLUME INDICATORS (BASKETBALL EXAMPLES)
0	1	2
1.	EFFORT DURATION (E.DU) E.DU=timed work time, overtime in case of a tie	E.DU=2x20 min.= 40` (2400 sec.) timed +"n" overtime x 5 min. until a winner is selected
2.	INTERRUPTION NUMBER (N.I.) caused by players, referees (fouls, free kicks, game eliminations, time-out) and by the coaches (time-out, player changes)	-I.N.= 150 times
3.	INTERRUPTION DURATION (I.D.) I.D = Σ interruptions	short ones up to 15 sec; 20-30 sec.; -Time-outs (20", 60", 150"), overtimes; 10 minute break, etc. I.D. = 30 min.± 8 min.
4.	ACTUAL MATCH DURATION (M.D.) M.D.= E.DU.+G.D..	E.DU. = 40'(20'+20'); ID = 34'20" therefore MD = 40' + 34'20" = 74'20"
5.	GLOBAL MATCH EFFORT DENSITY (GMED) GMED = E.DU/MD	GMED = 40'/74'20" = 2400 sec/4460 sec = 0,54; the higher with c\t DM the smaller is DEGEM - in percentage GMED = (E.DU./M.D.)x100=2400x100/4460=53,8%
6.	SEQUENTIAL TRAINING EFFORT DENSITY (STED) STED=ACTUAL WORK LENGTH/TOTAL LE NGTH	Example: In a 5' interval (300sec) a player works 2'30" (150sec.) and rests 2'30" therefore STED=150sec./300sec.=0,5(in digits) or =(150/300)x100=50% (in percentages) - in a 24sec. interval-a player works 6sec.and rests 18sec; STED = 6/24sec.=0,25 or (6/24)x100=25% of the allocated time
7.	TRAINING DENSITY (TD) TD=ACTUAL WORK TIME/PLANNED TIME	TD= 60'/120' = 0,5 (digits) TD = (60/120)x100=50% (percentages)

Crt. No.	DIMENSIONS	VOLUME INDICATORS (BASKETBALL EXAMPLES)
8.	GAME SPECIFIC MOTIVE ABILITIES VALUE	Is recorded with the help of manual actograph or on computer, run meters, jumps number, stops, sprints, passes, throws, scores, eventually including how they are done
9.	COMPETITIVE CHARGE (CC) - is established at the same time as setting the planning dates	- see 'Planning documents'
10.	TRAINING CHARGE (TC)	- see 'Planning documents' chapter
11.	QUANTITY AND QUALITY PARAMETRES OF THE GAME PATTERN	- see 'The game pattern'
12.	USED ENERGY (UE) - tested under lab conditions	US= Kg F m or 1 Joule= 1 Newton/sec.

The effort volume in the basketball game according to D. Colibaba, 1998

1. Sequential effort density (S.E. DE.)
2. Training percentage (T.P.)
3. Game specific motive abilities percentage.
4. Competitive charge (C.C.)
5. Training charge (T.C.)
6. Quantity and quality game pattern parametres.
7. The energy used under lab conditions

(D. Colibaba 1998 p. 253)

The same author researches the effort intensity dynamics during the game concluding that:

Ist half
- minute 1-15 medium intensity constant actions and maximum alternation, namely 110-160 beats/minute and 160-180 beats/minute
- minute 16-20 the aerobic capacity level reduces to 160-165 beats/minute

IInd half
- minute 21-25 maximum intensity actions and submaximum intensity
- minute 26 decreases progressively every 5 minutes.

Conclusions

Referring to the forms of expression of the endurance specific to the basketball game we can state the following:

In basketball the dominant motive quality is endurance seen under the form of speed, springiness and coordinating abilities. Correlating this dominant motive quality of the specific effort, the latter is characterized from the point of view of:

- *intensity:* submaximal efforts, alternating with maximal intensity stages.
- *length* (volume), variable intensity and length efforts with short interruptions.

- *complexity:* complex and diverse efforts seen in motive abilities and training factors, namely endurance seen in speed, springiness, technique, tactics and psychological tension.
- metabolic energy release processes: aerobic effort mixed with anaerobic moments' (Predescu Teodora,1999),

Educating the forms of expressing early age endurance must be done without exhausting and, at the same time, without overprotecting the training process subjects. At the same time, at the age of 13-14 years old, children are in the prebuperty biological maturation stage-period characterized by spectacular processes accompanied by major glandular and morpho-functional changes.

Training children and junior teams follows too much the senior training teams. The training strategy addressed to educating the forms of endurance fits in the same context. In this case it's worth signaling the difference between the general forms of endurance expression (specific to multilateral training:-anaerobic functional, segmented endurance-abdomen, arms, upper body, legs, etc.) and the forms of expression of endurance specific to basketball (endurance under the form of arms and legs dribbling, speed rezistance, jump rezistance, overtime game endurance, etc.). Its only logical to believe that without a training that aims at developing the general forms of developing endurance we cannot get special improvements in educating the forms of expression of specific endurance. This correlation focuses on cyclical exercises to educate endurance able to ensure the functional basis on which the other motive qualities are built.

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