# STUDY ON THE DEVELOPMENT OF THE ENDURANCE SPECIFIC TO THE UNIVERSITY FEMALE BASKETBALL

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**Abstract**

*In order to develop the endurance in the university women's basketball, we watched for two years the U. P. B representative women's basketball team. The investigation of the endurance capacity was performed by applying the 800m endurance trial. The initial testing was carried out during the preparatory period of the first academic year (which was followed) and pointed to a weak endurance, which required the need to intervene in the preparation of the female players with appropriate methods and means. The systematical practicing of basketball ensures an optimal functional level determined by the degree of training that is obtained and then maintained if the activity does not interrupt.*

*The basketball game also requires and develops the entire biomotor complex, due to its rich motor content and the great variety of moves it asks for.*

*In basketball the specific effort is characterized as being maximal and submaximal; variable in intensity and duration, with short interruptions; very complex and diverse in manifesting motor qualities and performance factors, namely endurance under speed, detente, technique, tactics and mental tension; mixed, aerobic with anaerobic moments. Thus, this paper is a contribution to achieving performance at university level. The female students on which the experiment was conducted form a homogeneous and representative sample for the university basketball. An athlete may be in a good physical condition but is not prepared to play basketball and this is the premise of the specific training.*

**Keywords**: *raining, basketball, experiment, endurance, female students.*

**JEL classification:** I20, I23

## 1. Introduction

The systematic practice of the basketball ensures an optimum functional level determined by the amount of training that is obtained and then maintained if the activity is not interrupted.

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The basketball game requires and develops equally the whole biomotor complex, due to its rich motor content and wide variety of movements that it requires.

In basketball the specific effort it is characterized as maximal and submaximal; variable in intensity and duration with short interruptions; very complex and diverse in manifesting motor qualities and performance factors, namely endurance under speed, detente, technique, tactics and mental tension; mixed, aerobic with anaerobic moments (Teodorescu L., 1984, p.89).

Although the psychological factors (motivational, emotional, etc.) have an important role in influencing endurance, however, the biological components are considered crucial. Their assessment is done indirectly by means of some variables whose level of correlation with the human endurance to effort has proved great: the maximum oxygen consumption, anaerobic threshold, lactic acid accumulation and the relative time needed to eliminate it, maximum lactacid power, heart rate during work and respiratory rate (Bota C.& Djamo O, 1999, p.103).

## 2. Materials and Methods

The research objectives consisted in:

-establishing the optimal operational structures for the development of endurance and their inclusion in training programs;

- Experimental verification of the effectiveness of the programs developed.

- In order to obtain outstanding performance in university female basketball, there is a constant concern for the development of endurance throughout the game.

Thus, through this paper we will try to bring a small contribution to achieving performance. The female students on which the experiment was conducted form a homogeneous and representative sample for the university basketball. An athlete may be in a good physical condition but is not prepared to play basketball and this is the premise of the specific training.

### 2.1. Research Hypotheses

1. If in organizing the training we will intervene with variations of intensity, workload and technique then we will reach a maximum effect of the training at the highest level of performance.

2. If we will rationalize the trainings specific to endurance development, a rationalization which involves the accurate determination of the quantitative and qualitative indicators, and also the assessment of the intermediate effectiveness of the preparatory process given by the tests data, then we reach a maximum development of endurance in female university basketball.

### 2.2. Research Methods

The bibliographic documentation and field method, modeling method, experimental method, mathematical and statistical method.

### 2.3. Research Instruments Used

Endurance running over a distance of 800m.

## 3. Research Content

To develop endurance in female university basketball, we followed over two years the UPB representative women's basketball team. The endurance investigation test consisted of endurance running of 800 m. The first test was performed in the preparatory period of the first academic year (which was followed) and we noticed a low endurance, which required to intervene in the players training with adequate methods and resources.

Endurance capacity development has been studied by numerous authors but the different methods are experimental in a large number of disciplines. These methods can be classified into three main groups:

- continuous work methods;
- work methods with intervals;
- work methods with repetitions.

The first group includes exercises with constant speed, with changes in rhythm and tempo at certain times or with off the rhythm changes on different distances. They are used in various forms by specialists in various endurance subjects, but also in other sports during the preparatory periods.

The second group consists of work phases alternating with recovery phases, the duration of which is such as to bring heart rate to 120-140 beats / minute. For the duration of work time there are chosen, generally, three guidelines:15”-2”; 2”-8”; 8”-15”.

The third group is a set of methods based on a full recovery. The intensities are high and repetitions are reduced, especially when the lactacid anaerobic mechanism is solicited.

**The Continuous Method**

It consists of exercises performed at a constant speed, with variable intensity and duration. We have at least three types, depending on the nature of the work done:

- continuous and long duration work (minimum 1 hour); the most important indicator is the heart rate, whose values can be between 100 and 120 beats / min, depending on the objectives and individuals. In fact, as Coconi has shown, it is one of the few means available to

measure the internal load which can be applied to different subjects, since motor loads performed with unequal speeds can be an identical effort, if the heart rate remains the same. But this method should be used with caution. Dal Monte has shown that at an equal energy consumption a load does not have the same effect, this depending on the way it is executed by means of the arms or legs;

- intermediate duration work (40-60") and high heart rate (150-170 b/min.); unlike the long work type whose regime is entirely aerobic, the intermediate type is characterized by growing intervention of the anaerobic process because the exercises it consists of have an intensity close to the anaerobic threshold;
- short duration work (or rapid), between 20-30" with high heart rate (170 b/min.); the aerobic threshold is often exceeded and the lactacid process is used extensively. (Manno, R., 1996, pp.371-374).

**Interval Training**

This method can have as clear the nature of the following aspects: intensive or extensive, depending on the duration of the work phases. The main points that must be taken into account to structure the work with intervals are the following:

- distances and / or intensity;
- number of repetitions and intervals;
- the duration of the resting interval;
- the level of activity at rest;
- the weekly frequency of the training sessions.

This method has been widely studied by the School of Friburg and is based on a recovery time with a maximum duration of 45 "-90", which prevents too great a drop in the level of functions activity. As a general rule, the heart rate should never drop below 120 b / min.

When using this method, also called the Active Break Method (Rezindell - Roskmann - Gerscheler) because of the significant changes in diastolic blood pressure at the end of the exercise, the filling volume of the heart increases, which is considered to be one of the causes of the cardiac chambers increase, which according to some authors can reach up to 220 cm3 in a few weeks. What mainly distinguishes this method of the method with intensive intervals is its aerobic type specificity.

If the work with intensive intervals exceeds 90% of the max. VO2 and 30% of the muscle tension, then the white fibers are also solicited. After Fox & Mathews this is the most effective method for increasing the max. VO2. (Manno, R., 1996, pp.371-374).

**The Repetitions Method**

The difference between this method and the method with intervals is the fact that recovery is almost complete after each exercise.

The work is performed mainly on short distances with high intensity and full recovery, which strongly solicits the FT(fast)fibers. This method is suitable for the athletes specializing in subjects whose trials have a short duration.

**The Competition Method**

This method, whose limits are difficult to define, is used in particular in preparing high performance athletes, especially during the pre-competitive period. It is based on executing the official competitions trials, and - especially - trials with lower or higher duration than these or on distance portions at the same pace.

The main methodical procedures, for developing the motor capacity of the endurance after (Tudor, V. 1999, p.73) are the following:

1. Methodical procedures based on the change in the effort volume:

- the uniform efforts procedure consisting of: constant intensity during exercising and the volume varies in the growth direction, in the same activity or from one activity to another.
- the repeated efforts procedure, which is also based on the volume change, the intensity of the effort remaining constant. With this procedure there will be used a standard effort that throughout the lesson will be repeated several times. The number of repeats can increase either in the same training session or from training to another.

2. Methodical procedures based on varying effort intensity.

These are based on changes in the intensity during efforts while the volume remains constant. The intensity may be increased gradually or may increase or decrease during the same exercise. Depending on these possibilities of intensity variation, we have two different methodical procedures:

- the variable efforts procedure - in this methodical procedure, the intensity increases and decreases during the same unit of effort (during the exercise);
- the progressive efforts procedure - when the intensity increases gradually during the course of the effort unit and when the effort unit of consists of several repetitions and several halves, the intensity can be increased from a repetition to the next, from one half to another.

3. The methodical procedure based on varying both the volume and the intensity (the procedure with "intervals")

Endurance assessment, which is certainly the most studied, is an issue which has long fascinated researchers and specialists. Despite all efforts to this end, we now have no means of exhaustive assessment, even under laboratory conditions, of the endurance capacity.

However considerable progress was registered, due to the use of specific ergometers devised by Professor Dal Monte, from the Institute of Science of Sports of Coni and, especially, due to the remote registering by means of telemetry transmissions of the measurable, physiological and biomechanical parameters. All these lead to a real knowledge of the "field" situations, yet, this means has its limits, because not all parameters can be assessed by telemetry.

There is no denying, however, that this failure is offset by the perfect current, biologically and mechanically, between the effort recording and the conditions in which this is performed since it is about the competition conditions in its natural environment.

A fact which became classic in assessing long endurance trials is that of Coconi. This test consists in recording the heart rate during a trial with increasing load (in running and cycling) administered according to a particular protocol. Load increasing leads to a point of inflection of the heart rate curve with respect to speed.

Endurance training is influenced by the major physiological functions that have a significant intervention in all forms of long duration effort. These interventions, however, are very different in sports and human actions that have variable limiting factors. (National Basketball Conditioning Coaches Association - NBA, 1997, p.237).

For the formation of a specific endurance training it is necessary to take into account the following:

- execution duration in long duration sports;
- running speed against maximum speed to go;
- the intensity of the effort;
- muscles mobilized;
- muscle tension necessary to the execution;
- lactic acid accumulation at the end of the effort;
- average value of the maximum oxygen consumption for the elite athletes in the respective trial;
- the number and intensity of trials;
- the average duration of the recovery intervals;
- recovery regularity

Matveev suggests a certain number of procedures aimed to make more specific the endurance acquired by the direct transfer of the general endurance to the competitive exercises. To facilitate this transfer, however, it is necessary to have a multi-purpose preparation, due to the multiplicity of the factors conditioning the endurance (Netolitzchi, M., 2002,pp.50-60).

These procedures are the following:

- -summation of fractional loads with limited effect. It is about exercises whose total duration is superior to that of the competitive exercise;
- an intensity similar to that of competitive effort, with variations of the order of 5-10% more or less;

- a duration that depends on the level of specific training: the more the preparation improves, the more the times are closer to that of the competition;
- selected intervals to allow significant functional changes, without reaching levels of fatigue able to affect the performance of the motor technique and without harming the quality of movement;
- total work sum can significantly exceed the competition duration.

Later, the intervals duration can be reduced to increase the intensity of work. It is also possible to accentuate the development of the specific endurance by exercises with a duration greater than that of the competition exercise.

For a long time, basketball has not taken systematic forms of training outside of a technical and more intense competition activity, which somewhat incidentally, improved the physical training and produced a state of relative form of the players.

Lately, a particular interest for the general physical training has been observed. Subsequently increasingly numerous personalities appeared among athletics instructors, having a rich baggage of general knowledge, while coaches in collective sports possessed particularly technical and tactical skills and their personal authority to act as coaches and ensure the team psychological conduct, which is not always enough to correlate the physical training requirements with those of the technical and tactical training based on schemes, strategies and optimal use of the athletes in the team.

Very recently the researchers tried to find out that the endurance training from basketball, which is distinguished by a great motor variability based on starts and on short and repeated actions may have specific characteristics. With this purpose data have been highlighted to promote a new direction, which is even more related to the specific conditions of the competition. Otherwise, the aerobic training by working with a constant speed or lengthy intervals, considered by many authors as important, continues to be the subject of special attention. In short, we can say that if we tend to have shorter work phases with short and very short intervals on one hand, on the other hand, for the start of the preparation, a prolonged work is reserved for exclusively general objectives (such as basic endurance or body weight loss) (Manno, R. – 1992, pp. 371-374).

Endurance running to keep fit 1-2 weeks will be performed for 20-225" while the pulse will have to rise to 120-140 b/min. To improve endurance, we will work for 2-3 weeks, for 20-40" while the pulse will rise to 160 b/min. or we will perform rapid running on 50 m + 50 m of slow running; 8 x (50 m + 50 m) = 2 stadium tours; 5-10 series; 3" recovery between series, pulse 160 b/min.; 6-8 weeks.

- Specific Endurance – work on intervals
- 15" work + 15" comeback;
- heart rate - 90% of the maximum;
- each exercise = 5" + 1' recovery between exercises;

- 4-8 exercises (24 – 48") for 2 times a week in a cycle of 8 weeks.

Examples of exercises:

- game 1x1 to a panel starting from the 3 points line; an attack each; passes in two on all the field, without adversary, with throwing to the other panel; comeback in light running on the side, we alternate the game part 1x1;
- running, panel jump, footwork; recovery 10" and recovery 220";
- running, panel jump, footwork, recovery 30";
- little marathon in running; 30"; 13 x 6 m = excellent;
- little marathon in dribbling;
- dribbling with direction changes, between obstacles; 2x9 m; 5x5";
- lateral movement or running in circle on diameter; 30"; we must increase the number of lines crossed;
- jumps over the ball; 30; between 55-60 jumps = excellent;
- jumps over the line; 30"; maximum 120 jumps;
- rope jumps; 30"; the number of repetitions is recorded (F.R.B. - 2000).

We performed three more tests (the competitional period, the preparation period, the competitional period, Table no1).

## 4. Results and discussions

All these led to the following results:

**Table 1.** Endurance running - 800m

| TESTINGS | | INITIAL TESTING | CONTROL TESTING | CONTROL TESTING | FINAL TESTING |
|---|---|---|---|---|---|
| | | PREPARATORY PERIOD | COMPETITIONAL PERIOD | PREPARATORY PERIOD | COMPETITIONAL PERIOD |
| | **Full-backs/Defenders** | | | | |
| 1 | P.N. | **2'45"0** | **2'43"0** | **2'43"0** | **2'41"0** |
| 2 | P. G. | **2'50"0** | **2'50"0** | **2'49"0** | **2'47"0** |
| 3 | Ş.C. | **2'47"0** | **2'45"0** | **2'45"0** | **2'40"0** |
| 4 | T. A. | **2'43"0** | **2'41"0** | **2'43"0** | **2'40"0** |
| | **Extremes** | | | | |
| 5 | M. I. | **3'05"0** | **3'03"0** | **3'03"0** | **3'01"0** |
| 6 | K. A. | **2'59"0** | **3'02"0** | **2'57"0** | **2'56"0** |
| **7** | C. 0. | **3'01"0** | **3'00"0** | **2'55"0** | **2'55"0** |
| 8 | R. C. | **2'49"0** | **2'50"0** | **2'47"0** | **2'45"0** |
| | **Pivots** | | | | |
| 9 | **L. C.** | **3'18"0** | **3'15"0** | **3'15"0** | **3'15"0** |
| 10 | **C. D.** | **2'58"0** | **2'55"0** | **2'55"0** | **2'57"0** |
| 11 | **G.** A. | **3'15"0** | **3'15"0** | **3'12"0** | **3'11"0** |
| 12 | **N.** A-M. | **3'20"0** | **3'20"0** | **3'18"0** | **3'18"0** |

- The endurance running - 800m was tested on an athletics stadium with normal dimensions.
- The sportswomen were not trained especially for this test.
- Two sportswomen, K.A. and R.C. obtained at the second testing from the first competitional year sensibly weaker results than at the first testing of the same competitional year.
- Three sportswomen, S.C., G.A. and N.A-M. obtained in the first competitional year, at testings one and two, respectively, identical results.
- At the third testing all the sportswomen obtained better results compared to the first testing, except for sportswoman T.A. who had an identical result with the one from the first testing.
- All sportswomen obtained better results at the last testing compared to the initial testing.
- The best result was obtained by sportswomen S.C. and T.A. - 2'40". The lowest result was obtained by sportswoman N.A-M. - 3' 18"

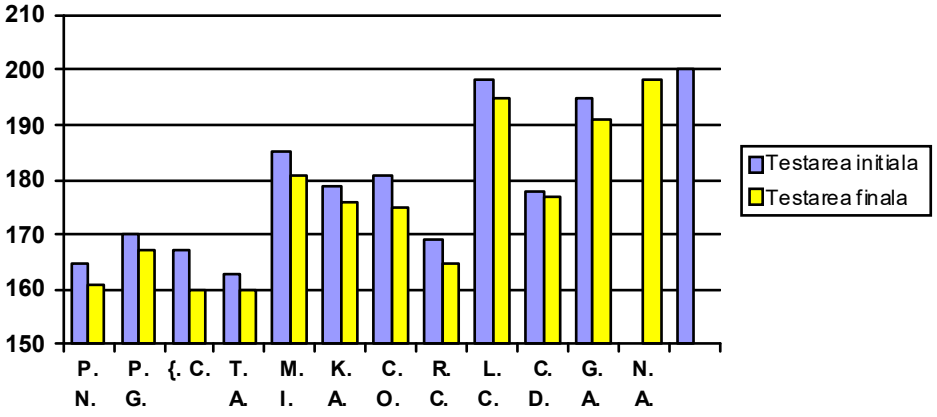
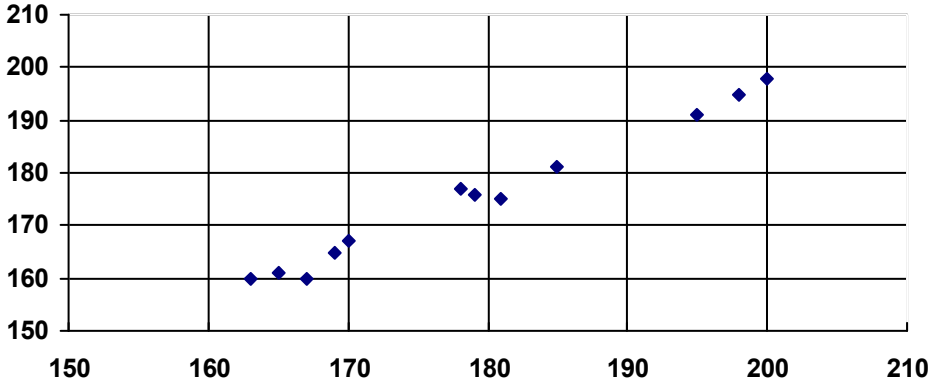



**Figure 1**: Endurance running (800m)




**Correlogram 1.** Endurance running - Correlogram (X-Y)

**Table 2. Statistical interpretation of the resultats endurance running - 800m**

| Arithmetic Mean | | Standard Deviation | | Coeff. of variability | | Student Test | Coeff. of correlation |
|---|---|---|---|---|---|---|---|
| Initial | final | initial | final | initial | final | 7,87 | 0,99 |
| 179,17 | 175,50 | 12,40 | 10,88 | 6,92 | 6,20 | | |

The motor running endurance test, measured during the preparatory period of the 1999-2000 competition year (1) correlated with the same test measured during the competitive period of the 2000-2001 competition year (4) shows that:

- The arithmetic mean is of 179,17", the standard deviation of 12,40 "for the initial test and for the final test the arithmetic mean is of 175,50" and the standard deviation is of 10,88";

- The coefficient of variability in the first case is of 6,92%, and for the second is of 6,20%. This shows us that this collective is homogenous, the variability being lower than10%;

- By calculating the student test "t", to verify the null hypothesis, we find that the value of "t" is of 7,87. By comparing it with the value from the Fisher table, for a 0,01 signification threshold and frequency n-1 of the selected sample, we find that the calculated "t" has a higher value than the table "t".

We can say that the difference is significant, so the null hypothesis is rejected. The coefficient of correlation is of 0,99. The sum of the initial test is of 2150,0" and for the final test of 2106,0". We can find better results, the variations occur in the same sense, so the correlation is direct, significant, and the coefficient is positive. (Gagea, A., 1996, p.34).

## 5. Conclusions

Through a systematic training regimen that was done through training variations and a high level of performance, following the experiment, the results showed that most female players improved their strength.

By applying methods and means specific to basketball, individual features could be distinguished and the application of optimal solutions for the development and improvement of the endurance, as well as for the subsequent evolution of each sportswoman.

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