DEVELOPMENT OF JUMPING ABILITY IN HIGH-POWERED HANDBALL PLAYERS THROUGH A PLYOMETRIC METHOD

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Development of jumping ability is an important prerequisite for achieving high sport results in handball since it is crucial for throws at goal with a jump and for blocking the ball by the defence.

Most often, handball players must rebound powerfully in a vertical or horizontal direction in implementing the relevant motor actions.

A characteristic of jumping ability is the priority manifestation of speed and power based on the maximum power of movements. In other words, power may be considered as a product of speed and velocity i.e.:

\[ N = \frac{A}{t} = \frac{F \times s}{t} = F \left( \frac{s}{t} \right) = F \times V \]

The implementation of rebound itself can be provisionally divided into two phases: amortization and thrust.

Depending on the impact on these phases, explosive power can be developed through various methods and tools. A number of authors have carried out research in this field, among others: H. Yurdakul, D. Dasheva (2002); M. Bachvarov, V. Filyov C. (2005); D. Dobrev (2005); JC Radcliffe, R.C. Farentinos (2003).

What is specific about plyometrics is that the active force of muscle is preceded by a pre-stretch.

Using kinetic energy from the free fall of the athlete’s body will produce the following effects:

- provide a sharp transition of the muscle to active status at the time of amortization;
- boost the speed of the work force whose maximum is inversely proportional to the time of support;
- creates considerable tension potential in the muscle, which increases the power of the next movement and favours a rapid switch from an eccentric action to a concentric one.

The aim of this article is to examine the impact of plyometric training on the explosive power of the lower extremities in high-powered handball players.

Method

Fourteen competitors from the male handball team of the Bulgarian National
Sports Academy, a First Republican League team, were tested. During the experiment 12 training sessions were conducted in the second half of the preparatory period, with two sessions held in the micro cycles on Monday and Wednesday (see Table 1).

The exercises took place in the following order:

1. A preparatory part of 25 minutes with the performance of a series of stretches with a focus on the lower extremities.

2. In the weight room athletes performed exercises the explosive type with a weighted bar on their lower limbs of 5 to 6 series:
   - half squat in combination with 3 – 5 jumps:
     60%; 60%; 70%; 70%; 60%; 60%.
     
     10 8 6 6 6 6
   - jumps over logs with a gradual increase in height according to individual abilities of players up to 120 cm tall with a follow up reduction to 70 cm
   - plyometric jumps on logs 70 cm and 90 cm high

**Table 1**

Sample training session for explosive power of lower limbs in the special preparatory phase

<table>
<thead>
<tr>
<th>Mesocycle</th>
<th>Special preparatory phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microcycle</td>
<td>1</td>
</tr>
<tr>
<td>Day</td>
<td>Mon</td>
</tr>
<tr>
<td>half squat in combination with 3 – 5 jumps: (%)</td>
<td>60</td>
</tr>
<tr>
<td>jumps over logs with increase and decrease in height from 120 cm to 170 cm</td>
<td>10</td>
</tr>
<tr>
<td>plyometric jumps on logs 70 cm and 90 cm high</td>
<td>30</td>
</tr>
</tbody>
</table>

The third jump is measured, the unit of measurement employed is centimeters (the third jump is a standing two-leg jump) (see Fig. 1).
Each competitor performs 5 to 6 series, each one consisting of 6 jumps on Monday and 8 on Wednesday with a 2 minute break between the series.

At the beginning and end of the experiment athletes were tested through a standing two-leg jump test.

The results obtained from the experiment were then compared to a second experiment characterised by intense power input without plyometric jumps; the number of training sessions has been kept the same.

The data were processed using a variational analysis based on Student’s $t$ criterion for dependent and independent samples.

**Analysis of results**

Table 1 presents a model for planning the exercises in the experiment. Their purpose is to impact the explosive power of the lower extremities. The order of exercises is the following: initially explosive power exercises with a weighted bar are performed, followed by jumping on logs of varying height and finally plyometric jumps are carried out.

The analysis of the data in table 2 show that at the beginning of the experiment the measured length of standing two-leg jump is $\bar{x} = 269.07$ cm, whereas at the end of the experiment it is $x = 274.86$ cm. The comparative analysis (Table 3) findings show that there is a significant growth $- t_{emp} > 2.15$.

**Table 2**

Variational and comparative analysis of achievement measured in standing two-leg jump test after plyometric jumps
Initial testing | Final testing | $\Delta$ | $T_{\text{emp}}$ | $P_t$
--- | --- | --- | --- | ---
$x,\bar{}$ | 269.07 | 274.86 | -5.79 | 26.99 | +
S | 15.43 | 15.39 | | | |
V | 5.73 | 5.66 | | | |

| Indicators | $\Delta_1$ | $\Delta_2$ | $d$ | $T_{\text{emp}}$ | $P_t$
--- | --- | --- | --- | --- | ---
Standing two-leg jump | 5.79 | 3.46 | 2.25 | 7.69 | +

Note: $\Delta_1$ Experiment involving plyometric jumps
$\Delta_2$ Experiment involving intense power exercises with weights.

The differences in growth between the first and second experiment are presented in Table 3.

When analyzing the results using the average growth rate ($\bar{d}$) and the difference in the growth rate between the first ($\Delta_1$) and second experiment ($\Delta_2$) – $d$, it can be noted that $T_{\text{emp}} > 2.05$. This shows a significant difference in growth in favour of the experiment involving plyometric jumps, with a guarantee of over 95%

**Conclusions**

1. The above pedagogical experiment could serve as the basis of a new methodological set-up on how to apply the content, volume and structure of training resources related to the development of jumping ability in handball.

2. In the first stage of the preparatory period, coaches are recommended to focus on integrated power capabilities of handball players so as to encourage the preliminary preparation of their locomotor apparatus using plyometric jumps.

3. In the weekly micro cycle of the special preparatory phase, it is advisable to carry out 2 training sessions of 30 to 48 jumps each, divided into 5-6-series following explosive power exercises with a weighted bar. The recommended break between sets is 2 minutes.

**Bibliography:**


2. Dobrev D., Plyometric methods to develop strength in different sports (sample sets of exercises), Sport i Nauka, issue No. 2, Sofia, 2005.

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