NEEDS AND POSSIBILITIES OF MINIMIZING OF MECHANICAL EXERTING OF LOWER EXTREMITIES DURING LANDING IN RECREATIONAL SPORTS

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INTRODUCTION
Many people prefer sport games to individual activities such as running or swimming because of emotionality and higher possibility of socializing. However, positives joint together with performing them are sometimes accompanied by problems - frequent injuries and pains of motion apparatus. The reason of this phenomenon has mechanical origin - inadequate claims on motion apparatus. Jumping and landing occurs frequently at these activities. Vertical jumping is a fundamental aspect of performance in a variety of athletic activities. Impact forces in landing from jumps utilized in volleyball can exceed the elastic limits of the cartilage (Stacoff, 1986). Good jumping mechanics is important not only with respect to performance success but in preventing and minimizing both traumatic and overuse injuries (Ridgway, 1990).

The objectives of our research were:
1. To record and to evaluate the reaction force of ground (RFG) during landing after vertical jump.
2. To find out the influence of warming-up to dynamic parameters of landing.

METHODOLOGY
Investigated subjects (total number 27) were divided into two groups. The first one consisted of athletes who develop mainly the strength of extensors of lower extremities (volleyball players), the second one of athletes whose sport specialization is not focused on strength abilities (endurance athletes).

Registration of time parameters of RFG was done by dynamographic platform KISTLER. Landings after the vertical jump with arm swing (JWAS), without arm swing (JWOAS), and landings after the jump-down from 0.6 m height without previous warming-up (JDWOW) and with previous warming-up (JDWW) were recorded and elaborated by computer.

RESULTS AND DISCUSSION
We have selected the following results from our findings:

Table 1: Magnitude of overload expressed by multiplier of an acceleration of gravity (g):

<table>
<thead>
<tr>
<th>Landing Type</th>
<th>Multiplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landing after the JWAS</td>
<td>4.88 g</td>
</tr>
<tr>
<td>Landing after the JWOAS</td>
<td>4.28 g</td>
</tr>
<tr>
<td>Landing after the JDWOW</td>
<td>3.97 g</td>
</tr>
<tr>
<td>Landing after the JDWW</td>
<td>3.66 g</td>
</tr>
</tbody>
</table>

Table 2: Maximal Force During Landing

<table>
<thead>
<tr>
<th></th>
<th>JWAS</th>
<th>JWOAS</th>
<th>JDWOW</th>
<th>LDWW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>M 3559</td>
<td>3528</td>
<td>3264</td>
<td>3264</td>
</tr>
<tr>
<td>SD</td>
<td>1431</td>
<td>1264</td>
<td>1106</td>
<td>1368</td>
</tr>
</tbody>
</table>
M - arithmetic mean  SD - standard deviation
Group I. - volleyball players
Group II. - endurance athletes

These values represent the average magnitude of overload. However, there were
subjects in the investigated groups with overload 9 times higher than acceleration of
gravity. It is noticable, that higher magnitudes of maximal force during landing - it
means higher overload - were measured during landing after previous jump, although
height of the level of jump-down was higher than the height of the jumps. Explanation
reside probably in better psychic concentration and better readiness of muscles for
attenuation of landing after the jump-down than after the jump.
RFG and time of amortisation of kinetic energy during landing after the JDWOW and
the JDWW was observed to judge the influence of short warming-up. The differences
confirm better attenuation of landing with previous warming-up. The RFG is lower - it
means lower overload is attained during landing after previous warming-up.

CONCLUSIONS
1. Higher overload is attained when some activity (take-off) precedes landing. This is
usual for most landings.
2. More complicated is activity, which precedes landing, higher overload is attained.
This is also usual for most athletic activities, jump with arm swing and with additional
movements is more frequent than simple jump without arm swing and other
movements.
3. Warming-up contributes to ability of athlete to decrease the overload during
landing.

REFERENCES
Ridgway, M. (1990). A kinematic comparison of the block jump and a training jump as
performed by elite college and recreational female volleyball players. In Proceedings of the
VIIIth International Symposium of the Society of Biomechanics in Sports, Prague, 163-169.