Study regarding the physical and psychical recovery of sportsmen and their recuperation

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Abstract: In order to allow maximum performance, fatigue limits have to be constantly removed during sportive activity. Effort and recuperation are interconnected, interdependent and they interrelate. The recovery methods are applied according to their accessibility and efficiency, but also according to the sportive teaching line and type of effort. All these methods are found, to a certain extent, in “recovery schemes” which are created according to the predominant effort. These schemes are formed by field specialists (doctors, psychologists, researchers) and are applied under their directions and guidance [1].
A special category of recovery methods is that of psychological preparation methods, which can create a favorable setting to amplify the effects of the planned physical exercises or to directly intervene on psychical processes and phenomena, in order to activate or restore them.
Used directly in training, the psychological preparation methods lead to psychical optimization, having direct effects on the increase of performance capacity.
All components of sportive training (physical, technical, and tactical) have influence on the psychical area, with the condition to be used as such.

Key words: physical recovery, psychical recovery, recuperation, sportive effort.

1. Introduction
Performance capacity can be considered “the result of operational interaction between biological, psychological and social systems, embodied in acknowledged values and classified according to social and historical criteria. It represents the complex manifestation of individual resources, embodied in objective values or objectified in points, positions, charts, lifted kilograms, earned rights, etc.” [3]
Sportive training is a long term process, conceived in such a way as to create a certain competition behavior, leading therefore to sportive performance. This behavior implies a superior body adjustment to physical and psychical effort. [1]
During the handball game, the sportsman’s body makes not only a physical but also a psychical effort. Generally, the psychical component is considered to be the core of the entire activity, because it activates and regulates the superior functions of the body, creating a proper ground for superior manifestation of motility and techno-tactical craft. Furthermore, sport represents as we all known, a signally competitive activity.
The psychical activity of those playing handball is fully solicited: cognitive functions regarding circumstance perception and choosing the best action methods for attack or defense; determination and its qualities to combat fatigue and negative efforts of emotions; affection tightly connected to practical or imagined situations, concerning both game satisfaction and acquired success, and fear of failure or bitterness towards the opponent’s superiority.
Effort in handball is characterized through efforts of sub maximal intensity, depending on the practical game conditions, with efforts of maximal or medium intensity and even with breaks. During the game, the maximum cardiac activity reaches 170 bpm, with some moments when it increases up to 190 bpm. During moments of medium effort or break, it can decrease to 130-140 bpm. [1] Knowing these aspects of the game, we can estimate that the effort has an anaerobe –aerobe mixed nature, in what the energetic level is concerned. During episodes of maximum effort, the main energetic supplier is represented by the adenosintriphosphoric acid (ATP), mostly produced by the energy provided through creatine phosphate (C.P) discomposure, but also through anaerobe glycolysis. During episodes of medium or low intensity effort and even in those of break, the phosphagen re-synthesis is made with ATP energy, coming from oxygen consumption during the alactacid phase of oxygen supply. A part of the re-synthesized ATP goes directly into the muscles, while other quantity is used to re-synthesize the CP, which goes from the supply directly into the muscles. In addition, the anaerobe glycolysis can provide a certain energy quantity to re-synthesize the CP. The higher the phospogen use, thus the higher the intensity of the effort, the higher the oxygen consumes to produce energy necessary to re-synthesize the phosphagen. These biochemical processes allow continuing the efforts of maximum intensity after the relaxation moment.

It is known that after an effort of maximum intensity, 70% of the consumed ATP is recovered during the first 30 minutes. In order to determine a proper adjustment to these kinds of efforts, sets of maximal effort will be put together during trainings. These kinds of efforts stimulate alactacid re-synthesis of ATP, especially upon the CP decomposition. To stimulate the anaerobe glycolysis too, such efforts will be effectuated at maximum pace, in sets of 30-50 minutes. An essential condition is the increase of the work volume, expressed by the length of the competition period, by increasing the numbers of trainings to weekly cycles and by increasing the length of the training period. The volume increase permits the achievement of superior qualitative indicators of physical training, and detailed study of various aspects regarding the assimilation and perfection of handball technique and tactic.

The increase of effort complexity leads to intensity enhance, this being realized by raising the difficulty level for action methods and for technical-tactical combinations, which are learned by creating more difficult and varied situations which have to be resolved by the sportsmen during trainings and imply using various recovery methods in order to regain the effort capacity. [1]

2. Theoretical background

2.1. Fatigue characteristics

Sportive training creates adjustment to competition effort, through homeostatic adjustment, but also through variations of short and long period adjustment. Fatigue = “represents the transitional state produced by an extended or excessive activity, characterized by the decrease of body’s functional potential and by a specific individual sensation”. [2] Fatigue shatters homeostasis by altering the biochemical processes, allowing the body to pass to a new adjustment state, superior to the previous one. Sportive training comes with fatigue, representing the premise to performance capacity enhancement.

Effort repetition during training leads to fatigue development which produces overcompensation and finally an adjustment state for the body. (Fidenstein and collaborators 1980, quoted by D. Martin). On the other hand, training has to avoid excessive fatigue. [6] Fatigue and recuperation are considered to be the main control values of training. [2] Fatigue can develop in two phases: 1. Latent fatigue (hidden) - this type can be overcome and is characterized through: lack of economy in movement, decreased level of coordination, decreased muscular reactivity. It usually develops in the 2nd part of the activity and it is the typical state of training fatigue. 2. Obvious fatigue (manifested) determines the decrease of effort capacity and is accompanied by the refusal to keep on working. It is also called lesson-system fatigue, because the diminished output and the decrease of the performance capacity (coordination especially) are the result of an entire system of weariness into a certain direction. Overtraining appears when the two phases (latent and obvious one) become deeper and
they can no longer be compensated in the recovery process. Some authors estimated that overtraining represents a “professional disease” specific to high performance sportsmen, and, if not treated in time, it could have negative repercussions equally on the performance capacity and the further life of sportsmen, producing functional and psychical disorders. [2]

2.2. Psychical fatigue
Psychical fatigue (subjective) - can be observed or not, can be real or imaginary – and not only it determines the decrease of the performance capacity, but it is also followed by a definite decline, which can take, at a certain point, pathological shapes, very difficult to treat.

Table 1. Detected conditions of fatigue during sportive games [4]

<table>
<thead>
<tr>
<th>Optimum performance Symptoms</th>
<th>General norms</th>
<th>Fluctuating</th>
<th>Alternating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac function</td>
<td>Recovery for 3-5 minutes</td>
<td>Recovery &gt;5min.</td>
<td>Very high to small effort, irregularity etc.</td>
</tr>
<tr>
<td>Respiratory function</td>
<td>Increased, comes to normal</td>
<td>High – trough nose and mouth</td>
<td>Very high, superficial, gasping</td>
</tr>
<tr>
<td>Transpiration</td>
<td>Normal</td>
<td>Abundant</td>
<td>Highly abundant, on the inferior part</td>
</tr>
<tr>
<td>Teguments</td>
<td>Normal colour</td>
<td>Alight cheek</td>
<td>Whiteness, face cyanosis.</td>
</tr>
<tr>
<td>Motility</td>
<td>Verve, agility</td>
<td>Instability of motility acts</td>
<td>Hard, unsecure moves, lack of ability precision and coordination disorders, strength and speed decrease</td>
</tr>
<tr>
<td>Psycho-motility</td>
<td>Game mood, coordination, precision, creativity</td>
<td>Decrease of speed reaction and precision, delayed readjustment, difficult self control</td>
<td>Perception, optical, space and temporal disorders. Decrease of regulation and self regulation capacity of psycho behavior</td>
</tr>
<tr>
<td>Psycho-physiological</td>
<td>General good mood</td>
<td>Diminished capacity of focus, attention and of tactical thinking</td>
<td>Permanent internal tensions, hyper excitability, exhaustion, limpness</td>
</tr>
<tr>
<td>Recovery time</td>
<td>Under 24 hours</td>
<td>1 – 7 days</td>
<td>7 days – 6 months.</td>
</tr>
</tbody>
</table>

In the specialty literature, the most known theories for fatigue are those of De Marees (1979), of Kuhler (1983) – which makes the difference between central and peripheral fatigue, and the Findeisen’s theory (1980) which states that this differentiation is inadmissible, because there is no peripheral fatigue without central repercussions. [6]

Among the causes that produce such states, Colibaba-Evulet D.and Bota I mentioned [4]:
- Summing up the different states of fatigue, without the necessary recovery;
- Monotonous trainings and competitions;
- Strong, extended emotions;
- Camp and competition stress;
- Rapid increase of effort dynamics;
- Incorrect planning of the instructive-educational process.

To determine fatigue, the training’s structure and the effort conduct are very important. Fatigue conditions have to be permanently observed and identified by trainers, according to some manifested and easily seen symptoms.

Changes appearing in the recuperation period, leading to an increased level of training are developed in two phases:
- Early recuperation (recuperation of vegetative functions) - takes minutes or hours and is developed under the influence of muscular activity;
- Delayed recuperation (cumulative) - structural and functional changes take place in the body –
it is specific to big efforts, which also ensure the needed exercise level to long term adjustment.

2.3. Restoration and rehabilitation

The speed of recuperation processes is determined by the extent, orientation and type of effort and it is taken into consideration for the coherent effort alternation during training. The fatigue effects are removed during the recuperation period, in the course of more phases. [6]

<table>
<thead>
<tr>
<th>Recuperation period</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatigue elimination (%)</td>
<td>60%</td>
<td>30%</td>
<td>10%</td>
</tr>
</tbody>
</table>

An essential aspect which has to be kept in mind by the trainers is the fact that recuperation after a competition is more difficult to reach than the training recuperation.

Both in theory and practice, in what sportive training is concerned, a clear delimitation between de recovery and the recuperation processes has to be made.

Recovery = the establishing phenomenon of the initial homeostatic balance;

Recuperation = is a hyper complex process of rebalancing, reestablishing and reconstruction of the body, after the effort. [6]

The recuperation process depends on the following factors:

- type of the task (recuperation is easier after a dynamic muscular effort, than after a static one)
- task duration (complete depletion of glycogen reserves is made within an hour, for anaerobe efforts, and within 1½ - 2 hours for aeroerobe efforts).
- task intensity (as higher the intensity, as higher the production of anaerobe energy)
- tasks sequence (recuperation intervals between exercises have to be planned judiciously)
- task frequency (is a result of the recuperation time; is determined by the length, intensity and stimuli sequence)
- training level (training optimization allows a better task adjustment, which determines a decreased homeostasis disorder)
- heredity and environmental factors (recuperation capacity differs genetically, from one individual to another, and environment factors can influence it also).

Recuperation “represents a section of the sportive training which uses, in a rational and controlled manner, a series of medical, pedagogical, natural and/or artificial means coming from the external and/or internal environment of the body, with the view to re-establish homeostasis as before the effort and mostly to overcome it through functional overcompensation. [2]

We cannot talk about spontaneous, natural recuperation under the circumstances of today’s trainings for high-performance sportsmen; that is 8-10 hours/day with an intensity of 85-100%. This is why the effort capacity recovery is an essential condition for progress during trainings.

Recovery deficiency can have serious repercussions on sportsmen - overstressing neurosis, overtraining. [3]

Recovery methods are classified according to I Dragan’s taxonomy in [2]:

- specific, medically controlled;
- non specific (pedagogical, hygienical), they can be applied by the trainer and sportsman.

2.4. Recovery methods classification:

According to the effects:

- Neuropsychic (psychotherapy, acupuncture, pressopuncture, oxygenation, negative aero-ionization, passive/active rest, warm hydrotherapy, etc)
- Neuromuscular (sauna, massage, diet, yoga, acupuncture, pressopuncture, pharmacological, etc)
- Endocrine – metabolic (natural or artificial oxygenation, negative aero-ionization, neuromuscular relaxation techniques, massage, electrolytic rebalancing, etc)
- Cardio-respiratory (oxygenation, electrolytic rebalancing, warm hydrotherapy, sauna for 15 minute/week, daily massage, medication –vitamins B, C, E, glucose, P, K, Na, etc)

According to the status of recovery methods:

- Balneo-hydro-physical-therapeutical;
- Psychotherapy;
- Dietetic;
- Pharmacological;
- Active or passive rest (sleep).

There are, however, elements on the subject of recovery methods which have to be known and come useful to all trainers:

- Medication usage: polivitamin S, polimineral S, vitaspol, glucose, vitamin B1, 6, 12. The vitamin intake is recommended to be acquired naturally and only those
vitamins that are not found in adequate quantity in vegetables and fruits, have to be completed through medication;

- Alimentation: the focus is on consuming vegetables, fruits, chicken, fish, beef, and most of all pasta (it is easily digestible, giving a sensation of satiety, high on lipids, low on fats)
- Electrolytic rebalancing: natural fruit juices consumption, still water (not mineral because it determines calcium decrease in the body, leading to anemia), milk, tea with lemon, etc
- For sporting games: shower, sauna, massage, electrolytic rebalancing (at least 300 ml), medication, proper alimentation, sleep - all recommended on a daily basis
- Recovery sessions have to be programmed twice a week, with a length of 60-90 minutes and using all recovery methods.

3. Problem solution

3.1 The purpose and hypothesis of the research

The purpose of the research was to identify the weight of the recovery methods used by sportsmen, intended for the rapid and efficient recuperation during competitions, along to create an informative campaign about the benefits and utilization method for all processes of controlled recovery.

Hypothesis: we assumed that the identification of the controlled recovery processes frequently used by sportmen will contribute to a faster recuperation, after efforts specific to handball game, and by default to the increase of their performance potential.

3.2. Means and tools of research

Research took place during August 2009 and June 2010 and consisted in applying a questionnaire on a number of 160 sportswomen - handball players and components of 8 feminine teams playing in the Romanian Super league. 20 sportswomen from each team filled a questionnaire identical to the below summarizing table, regarding the controlled recovery processes used during competition periods.

Research developed on three phases;

Phase 1 developed during the National Championship, where the initial questionnaire was applied concerning the weight of the used recovery processes.

Phase 2 of informing the sportmen on the methods of controlled recovery specific to sport and their benefits. During this phase, discussions with trainers took place also, and it was decided to diversify the recovery methods for each team, according to possibilities and to the preferences and needs of sportmen.

Phase 3 of final questionnaire application regarding the used recovery processes.

Table 3 Results summary regarding the recovery processes used in competitions

<table>
<thead>
<tr>
<th>No.</th>
<th>Recovery process</th>
<th>Questionnaire 1</th>
<th>%</th>
<th>Questionnaire 2</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hydrotherapy - shower</td>
<td>160</td>
<td>100</td>
<td>160</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>Hydrotherapy - swimming</td>
<td>12</td>
<td>6.25</td>
<td>84</td>
<td>52.5</td>
</tr>
<tr>
<td>3</td>
<td>Sauna</td>
<td>58</td>
<td>36.25</td>
<td>128</td>
<td>80</td>
</tr>
<tr>
<td>4</td>
<td>Massage</td>
<td>80</td>
<td>50</td>
<td>122</td>
<td>76.25</td>
</tr>
<tr>
<td>5</td>
<td>Acupuncture</td>
<td>1</td>
<td>0.6</td>
<td>20</td>
<td>12.5</td>
</tr>
<tr>
<td>6</td>
<td>Pressopuncture</td>
<td>16</td>
<td>10</td>
<td>104</td>
<td>65</td>
</tr>
<tr>
<td>7</td>
<td>Recovery alimentation</td>
<td>60</td>
<td>37.5</td>
<td>145</td>
<td>90.65</td>
</tr>
<tr>
<td>8</td>
<td>Psychotherapy</td>
<td>40</td>
<td>25</td>
<td>110</td>
<td>68.75</td>
</tr>
<tr>
<td>9</td>
<td>Pharmacology</td>
<td>160</td>
<td>100</td>
<td>100</td>
<td>62.5</td>
</tr>
<tr>
<td>10</td>
<td>Active rest</td>
<td>110</td>
<td>68.75</td>
<td>148</td>
<td>92.5</td>
</tr>
</tbody>
</table>

Graphic 1 Graphic representation of initial and final study results

3.5 Result interpretation

Initial study results reveal that sportswomen were not familiar with all the controlled
relaxation methods and were not aware of their benefits. Therefore, initial results show that procedures such as acupuncture, pressopuncture, swimming and psychotherapy were hardly used by sportswomen. After applying the independent variable, they changed their preferences and also their options regarding recovery, becoming aware of their role. Final results are particularly improved as compared to the initial ones, sportswomen using as a consequence more varied relaxation procedures.

4. Conclusions
The research determined a diversified usage of controlled relaxation procedures, as a result of the information campaign on the sportswomen about their benefits and variety. The hypothesis of the research was confirmed, the results were improved as a consequence of creating a more efficient, post effort relaxation and therefore more rapid recuperation. As a conclusion, controlled recovery:
• addresses a healthy body, submitted to sportive effort;
• is a part of sportive training;
• the natural and the controlled one complete each other;
• is influenced by nature of the effort, its duration and intensity;
• can be applied during and after the effort, on a daily, weekly or annual basis.
Using post effort recovery methods includes benefits, only if it is carried out in a cumulative manner, as none of them ensures solely rapid recovery and total recuperation of body functions, with the same values as the pre-effort stage.

References: