THE RELATION BETWEEN FATIGUE STATE, THE
RECOVERY PROCESS AND THE EFFORT’S CAPACITY
OF AN ATHLETE

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Abstract
The sport performance represents a very complex variable in the actual context of
the sport’s development. As we know, between the different individuals there are notable
differences in what concerns the corporal constitution, the aptitudes, attitudes etc, with all
these there are certain “concepts” that are universally valid, no matter the individuals’
particularities, one of them being the connection between the sport performance capacity,
fatigue and recovery, between them existing a close relation. This paper puts accent on the
recovery’s importance in the performance sport, the recovery process being one of the very
important variables in the athletes’ training, the superior results being conditioned also by
their increase and correct understanding. The relation between the fatigue state, the
recovery process and the effort capacity of an athlete is a special relation, being actually
the foundation on which a high performance athlete increases.

Keywords: relation, effort’s capacity, fatigue, recovery


1. Introduction

As we know, between the fatigue state, the recovery process and the
effort’s capacity of an athlete, there is a close relation (direct or indirect), relation
that will be debated in this paper, that has as main purpose the awareness of the
recovery importance in any sport training, knowing that this is a very important
variable of progress in sport. It is considered that without a complete recovery we
cannot realize maximum intensities and high volumes during the specific training,
these having an important role in the continuous increase of the performance
capacity.

In this paper, beside the general presentation of the fatigue types, there are
also shortly presented the main recovery means used in sport performance.

2. Content
The relation between the fatigue state, the recovery process and the effort capacity of an athlete is a special relation, being actually the base, the foundation on which a high performance athlete rises, and not only.

It must be said that, the higher the shown fatigue after the effort is, the higher also are the secondary effects, among these we enumerate only a few one and that is: the weak rate of recovery, the weak coordination, the low power of muscular contractions, the low speed etc.

Fatigue is defined as “the reversible diminution of the physical and/or physical performance capacity; unlike exhaustion though, this fatigue allows still to continue the effort, but with the price of a considerable energetic over cost and of a lowering of the motor precision” after Weineck, J., (1992, pg. 207).

Fatigue, in general, can be divided into: acute peripherical fatigue and acute central fatigue (that influence each other and are strongly connected between them) and local chronic and general fatigues (the so-called – over practice).

In the large majority of cases, the peripherical acute fatigue and the central one are strongly connected between them.

Weineck, J., (1992 pg. 208-210) considers that the main causes of the appearance of acute peripherical fatigue are the following: the changing of the physical-chemical state, the gathering of intermediary and final products of the metabolism, the fatigue connected with the neurotransmitters, the exhaustion of the energy supply and delivery processes.

If we refer to acute central fatigue we must understand actually a lowering of the capacity to realize different coordinate actions with the same precision that the athlete had had in the rest estate.

One of the synthesizing of the central fatigue characteristics was realized by Stegemann (1971) and Findeisen-Linke-Pickenhain (1980) being processed and interpreted by Weineck, J., (1992, pg. 211-213), these characteristics being the following: the diminishing of the command and control functions, the diminishing of the seasonal performance capacities, extending the reaction time, the diminishing of the coordination capacity, attention, concentration and thinking disorders.

![Figure 1. Forms of fatigue after Bota, C. (2000, pg.237)](image-url)
Local and general chronic fatigue is a special type of fatigue, being known also under the name of over-practice, and that has a special importance in the high performance sport. The causes of the appearance of over-practice are multiple, not being a diversity of them, a bad administration of the recovery processes, a quick increase of the volume or of the practice intensity, learning the procedures or the different technical aspects specific to the respective sport in a too fast rhythm (it is referred especially to the difficult movements) etc.

Bota, C. (2000, pg. 236) divides fatigue as physiological and pathological, differentiating the physiological fatigue of exhaustion that is considered of quantitative nature.

Bompa, T. (2002, pg. 78) mentioned the fact that recovery has a vital role besides the others variables of the sport training, considering that “a good recovery quickens the return rate between the practice lessons, makes to decrease the fatigue, to increase the over-compensation and facilitates the use of high charges at practice. It can even determine a decrease of the number and frequency of injuries, because fatigue hinders the coordination and concentration, leading to a weak control of the movements”.

The correct alternation of effort with recovery has a high role in the training process, being made by synchronizing the biological adjustment to the training requirements. Bompa, T. (2002, pg. 78-79) considers that recovery is a multidimensional process being conditioned by a series of intrinsic and extrinsic factors, among which I mention: sex, age, the type of muscular fiber, the environment factors, the time differences, the movement amplitude, the existence and re-feeding with micronutrients, the solving of the acute local traumatisms and of over-practice, the psychological factors, the exercise type and the energetic system type, the efficient energy transfer and removing the residual products.

Table 1. Types of recovery practiced after an exhaustive effort (competition etc), Cazoria (1993) quoted by Bota, C. (2000, pg. 270)

<table>
<thead>
<tr>
<th>The duration of the made effort with maximum individual possibilities</th>
<th>Recovery</th>
<th>The type of used recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Incomplete of 60%</td>
<td>Complete</td>
</tr>
<tr>
<td>10 seconds</td>
<td>30 seconds</td>
<td>2 minutes</td>
</tr>
<tr>
<td>20 seconds</td>
<td>60 seconds</td>
<td>2-3 minutes</td>
</tr>
<tr>
<td></td>
<td>Mixed passive active + passive</td>
<td></td>
</tr>
<tr>
<td>30 seconds to 1 minute (glycogen in anaerobic)</td>
<td>10 minutes</td>
<td>50 to 60 minutes</td>
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<tr>
<td></td>
<td>Active: accelerates lactate removal in 20-30 minute</td>
<td></td>
</tr>
<tr>
<td>1 to 3 minutes (glycogen - anaerobiosis)</td>
<td>15 minutes</td>
<td>60 minutes</td>
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<tr>
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<td>idem</td>
<td></td>
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<tr>
<td>3 to 9 minutes (glycogen – anaerobe +aerobe)</td>
<td>10 minutes</td>
<td>1-2 hours</td>
</tr>
<tr>
<td></td>
<td>mixed passive + active</td>
<td></td>
</tr>
<tr>
<td>1 to 2 ore (glycogen and lipids in aerobiosis)</td>
<td>3 to 6 hours</td>
<td>24 to 48 hours</td>
</tr>
<tr>
<td></td>
<td>passive</td>
<td></td>
</tr>
</tbody>
</table>
Bota, C. (2000, pg. 260-264) classifies the recovery in: spontaneous recovery (natural) that is achieved by passive rest and that is based on anabolic component of cellular metabolism, being caused in a phasic way and directed recovery, which complements the first one, being necessary in the cases when effort's intensity is very high, and between the repetitions the breaks are insufficient. The same author reminded the fact that the recovery uses different natural, artificial or physiologic means, through which it is realized the acceleration of the recovery process, having as finality the re-establishment of the homeostasis.

The recovery is realized nonlinear, but under a curve form, in the first third being realized approximately 70% from the recovery process (so the most consistent), in the second third approximately 20% and in the last third 10%. The time needed from the first third to the last one varies from a few minutes to more months, this variation is based on the implied energetic system and the fatigue type (the recovery is made after the fatigue on short term or exhaustion/over-practice on long term).

Dragnea, A. et al. (2006, pg. 248) consider that “the recovery is subdue to certain physiological legalities of practice and, as such, must be trained, at which we add the fact that the recovery is addressed to certain mechanisms integer from a morphological or functional point of view; the directed recovery is not subdue to the natural, physiological recovery, but completes it, strengthens and accelerates it; the efficiency of both recovery forms is conditioned by the integrator role, coordinator of the neuro-endocrine-vegetative system; recovery, such as effort, has an individual character, taking into account age, sex, training level, environmental conditions, sport branch, stress state, nature and effort duration, the level of sport majesty, the application moment in the macro-, mezzo- or microstructures frame etc.”.

Also, Bompa, T. (2002) pointed out the fact that the recovery of different parameters and biological substances from the human organism has a sequential place, noticing the fact that the recovery of the glycogen requires from 10 till 48 hours after an aerobe effort and between 5 and 24 hours after an intermittent anaerobe activity, and the cardiac frequency and the arterial pressure go back to normal at approximately 20-40 minutes after the effort. Also, the vitamins, the fat and the enzymes need over 24 hours to recover and the proteins from 12 till 24 hours. The same author reminded also that ignoring an adequate regeneration can have a negative influence over the supra-compensation, making it late or even destroying it.

The reminded earlier experts consider that the means through which recovery can be made are multiple, in this chapter we treat the most frequently used means and that is: the natural recovery means, the physiotherapeutic recovery means, the psychological recovery means.

The means of natural recovery are some of the methods widely used by athletes and do not require any special procedures or equipment. The most
important of these means are considered the active and passive rest, the lifestyle
directly affecting the recovery rate, the psychologist's role being very important for
solving the emotional issues that have an effect over the development of will and a
strong character.

Bompa, T. (2002, pg. 85-91) selects the from the recovery physiotherapeutic means are: reflex-therapy, vagal reflex therapy, massage, chemo-
therapy, alternative baths, heat (thermo-therapy), cold (crio-therapy), practice at
altitude, oxygen therapy and aero therapy.

After we know, the regeneration of the nervous cells is seven times slower
than of the cells form the muscles, that is why the appearance of fatigue at the level
of the central nervous system coordination and concentration decrease, the subject
reacts slower and with a low strength to the internal and external stimulus, skills
are made less correctly, the effort’s capacity being lowered.

The psychological means of recovery have an important role in the general
recovery process, in this type of recovery the sport psychologists being very useful,
the used means in treating the fatigue being the coach’s suggestions, autosuggestion and the psychotic practice. Between the physical stress and the
psychological one there is a connection, being considered that the athletes with a
good physical shape cope more easily with the psychological stress.

Dragnea, A. et al. (2006, pg. 248) considers that the psychological training
means are chosen from “the psychotherapy and psycho hygiene techniques and
methods, with the consultation and the support of the sport psychologists
(relaxation, concentration, autosuggestion, suggestion techniques)”.

Also, the psychological training means assure a favorable premise to
amplifying the effects of the programmed physical exercises.

Combating the psychological stress factors is made through different
specific techniques, taking into account that the answers will vary from subject to
subject, depending on the perception of each athlete.

The reminded experts consider that among the used relaxation techniques
we can mention the training of stress inoculation, biofeedback, yoga, breathing
control, psychological counseling, the relaxation answer, the progressive muscular
relaxation, auto hypnosis for a deep relaxation of the muscles, transcendental
meditation, visual representation etc.

Another classification of the recovery means is presented by Dragnea, A.
et al. (2006, pg. 248-249), classification that is synthesized depending on the
exerted effects or after the affiliation of the recovery means as it follows:

After the exerted effects:
1. cardio-respiratory: being oxygenized (naturally, artificially), massage
   (daily), active-passive rest, autogenic training, diet (alkaline, with glucose, with
   vitamins), sauna (15min/week), hydro – electrolytic re-equilibration, warm
   hydrotherapy, medication (P, Na, K, Mg, Ca, glucose, B, C, E vitamins, tyrosine).
2. neuro-psychic: psycho-therapy (conversations, yoga, suggestion etc.),
   active-passive rest, negative aero-ionization (natural or artificial), medication,
warm hydrotherapy, massage, acupuncture, press puncture, being oxygenized (natural or artificial).

3. endocrine-metabolic: neuro-muscular relaxation techniques, acupuncture, being oxygenized (natural or artificial) and negative aero-ionization, medication (piracetam, pirovitan, vitamins etc), hydro – electrolytic re-equilibration, massage.

4. neuromuscular: warm hydrotherapy, acupuncture, press puncture, pharmacology (glucose, glycine, Na, K, P, Mg, vitamin B), active-passive rest, massage, yoga, sauna, autogen training, diet (alkaline, hydro-glycemic, mineralized, with vitamins).

After the affiliation of the recovery means:
5. balneal – physic – hydro-therapies;
6. psycho therapeutically;
7. active rest, passive rest (sleep);
8. dietetic;
9. pharmacologic.

At the end of this paper we can say that the different energetic deposits that were used in the training process have a specific dynamic of recovery, these varying depending of the different factors presented above.

3. Conclusions

From the things said above we can conclude the followings:

Generally, fatigue is a reversible physiological state that is characterized through the decrease of the functional potential of the organism, being removed by the restoration of the potential reminded on natural way, through rest, rehydration, etc.

The directed recovery of the body after an effort represents a very important variable in the performance sport, the sport training treating this component with a special attention.

Fatigue, being a training process consequence, follows in general lines its characteristics on a methodological plan, but also on a physiologic one, etc., of course adding certain features depending on the effort's specific of the respective sport branch.

The recovery realized after scientific criteria has as result the accelerating of the natural recovery, being addressed mainly to those parts that have undergone effort and that can be restored also on a natural way but in a higher period of time.

Fatigue, the recovery process and effort capacity of an athlete are some of the main variables of the training process, between them being an inter-conditioning relationship, reaching superior results being conditioned by correctly knowing and understanding the recovery process, being one of the very important variables in athletes training and not only.
REFERENCES