Effects of Recuperat-*ion* in the recovering period after intensive efforts

Balius R.[1], Estruch A.[1], Parra J.[2], Rodas G.[1,2]

[1]Competitive Sports Efficiency Studies Centre, (CEARE), Direcció General de l'Esport,

Generalitat de Catalunya

Barcelona, Spain

[2]Cardedeu Health Department (GSC), Cardedeu, Barcelona, Spain

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Abstract

The objective of this study was to evaluate the effect of the "**Recuperat-ion**" beverage (Prec) on the sports efficiency as well as on the different physiologic parameters of a group of volunteers undergoing an intensive effort test. This study followed a double blind test, with two other beverages, made up of a solution of salts in concentrations different from **Recuperat-ion** (Pas) and an aqueous solution without salts (Pss), with the same sweeteners.

A group of 14 moderately active volunteers took the assigned beverage in two doses of 250 ml per day during one week and after 6 days they underwent an effort test on a static jogging machine (3 min at 16 km/h, and afterwards an increase of 1 km/h each minute until voluntary cessation). During the test the gases were monitored, assessing the oxygen consumption and the respiratory quotient. Once the test was ended, a subjective valuation of fatigue according to Borg's Scale was asked and lactate samples were taken at 3, 5, 7 and 10 minutes of resting.

The results did not show any significant differences either in the efficiency at the effort test shown as an increase of the maximum speed reached, or in the Borg's Scale score. On the other hand, in the lactate concentration in blood a distinguishing behaviour was observed between the beverages used, so that the **Recuperat-ion** beverage provoked lower values than the other beverages all along the curve. A decline of lactate could be related to an increase of the muscular fiber stability and would prevent injuries.

Introduction

Physical activity generates several organic alterations; most of them allow the skeletal muscle to generate the required mechanic work.

The efficiency achieved by the muscle depends directly on its condition before the effort. This is why the ionic balance of the muscular fiber is so important.

This study tries to assess the effect of a new product (**Recuperat-ion**), taken as a beverage and made of a mixture of salts, on the sports efficiency and the recuperation, in anaerobic and aerobic efforts.

Materials and Methods

Methodology

In order to analyse the effect of the product, a study was elaborated in which **Recuperat-ion** and two other products were tested at the same time, so that the volunteers did not know which sample they were taking. This ensured that there was no interference with the physiological tests due to predisposition.

Protocol

A group of volunteers took the samples assigned during three weeks and also passed a series of physiological tests. The protocol followed in this study is shown in the graphic below:

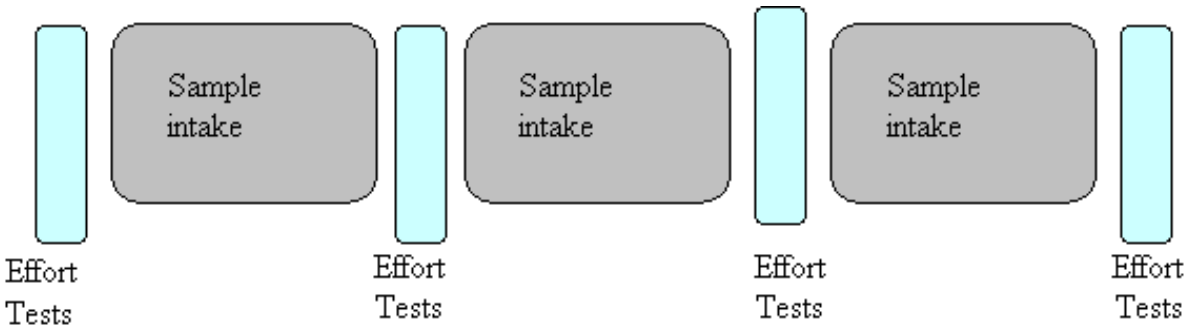

Figure 1: The study's structure

The pattern of the product intake was the following:

-One dose at morning and one at night during five consecutive days and a last dose the morning the day the tests were passed

-After the tests, two days of rest were left before the next dose

-The doses were a small bottle (stored in refrigerator)

The samples

The samples consisted of:

Product **Recuperat-ion** (Prec): aqueous solution of **Recuperat-ion** at the concentration established by the manufacturer

Product with salts (Pas): aqueous solution with salts at a concentration different from **Recuperat-ion**

Product without salts (Pss): aqueous solution with sweeteners

All three samples had the same characteristics of colour, aspect and flavour. To help the volunteers take the products, they were presented in twelve small bottles of 250 ml, which corresponded to each of the samples assigned, properly labelled and in dark plastic. This way the volunteer could take the sample and would not skip any intake.

Volunteers

In this study 14 volunteers participated with an average value of age, weight and height of 25,1 ± 3,2 years, 72,3 ± 4,5 kg and 176,9 ± 7,8 cm respectively. The volunteers were duly informed about the objective, methodology and possible risks, and so they gave their written consent to participate.

Physiological assessment of the volunteers

The tests were carried out in a properly equipped laboratory with the following characteristics: 125 m above the sea level, temperatures from 22 to 24 ºC and a humidity from 55% to 65%.

Test on a jogging machine

The test was performed on a jogging machine (Power jog) following a progressive test without slope that consisted in three minutes walking, three minutes at 16 km/h and afterwards the speed was increased by one km/h each minute until the volunteer stopped. At this moment the maximum speed reached was noted and the time during which it was maintained too. When finished, the cardiac frequency was also noted, as well as the Borg Scale score according to their subjective perception of fatigue and in reference to a list of values and definitions.

For the assessment of the gases and the respiratory parameters, an automatic breathing-to-breathing analyser was used (model CPX II, Medgraphics) equipped with a pneumotocograf (Hans Rudolph model). Before each test, the equipment was calibrated, by volume and by flow, with a mixture of gases obtained from a tank (containing 5% CO_2, 12% O_2 balanced with N_2) and atmospheric air (aired room). The respiratory parameters assessed were: Oxygen volume (VO_2, ml·min^{-1} STPD), Oxygen volume per kilogram of body weight (VO_2/kg, ml·min^{-1}·kg^{-1} STPD), Respiratory quotient (RER=VCO_2/VO_2), Exhaled volume (VE, L·min^{-1} BTPS), Dioxide carbon volume (VCO_2, ml·min^{-1}·kg^{-1} STPD).

Lactate assessment

A miniphotomer plus LP20 (V 1.3 of Dr. Bruno Lange GmbhCo) was used to calculate the lactate levels in blood. The samples from the volunteers were analysed, moments before the effort test (basal level) and at 3, 5, 7 and 10 minutes after finishing the test. Blood samples were obtained by puncture in the ear lobe and were immediately processed.

Follow-up survey

In order to assure the maximum control of all the factors that could affect the development of the study, a follow-up survey was carried out about the sensations and the general physical condition during the week.

Each volunteer participated in this survey on the day they underwent the physiological tests, by the end of the week they had been taking their respective samples.

Statistics

The results are expressed as medians ± standard deviations.

To study the possibility of learning or improvement, a comparative study was made with regression of the increases of each parameter for each volunteer.

In order to study the efficiency, each value was normalized according to the basal values and the standard treatment of the percent obtained.

To study the recovery from fatigue, as well as the lactate, the variation percentage was calculated for each testing day and afterwards they were compared to basal values.

Results

Volunteer's basal values uniformity

The group of volunteers showed homogeneous basal values and physiological responses. Regarding the effort test, the values corresponding to the VO_2 max/kg (46,5 ± 4,6 $ml \cdot min^{-1} \cdot kg^{-1}$) confirm that the group of volunteers was moderately active (recreational activity).

The effect of learning or improvement

The samples of the three products tested were distributed to the volunteers in a random way in order to reduce the possible effect of learning or improvement.

The possibility of there being any type of improvement as a consequence of learning the methodology followed or of physiological adaptation was analysed. The statistical study rules out there being an improvement (either physiological or due to learning) over the values of the different parameters.

Effects on the sports efficiency and the period after the effort

In order to assess the effect of the three samples on the sports efficiency a test on a jogging machine was passed according to the protocol described in the methodology. From the parameters assessed we must underline in a significant way the volunteers' oxygen consumption and the maximum speed reached. Both values allow the resolution of the volunteers' sports efficiency.

The results of the maximum speed achieved in the effort test are shown in Table 1. Even if there are small variations, none of them are significant enough. These results seem to indicate that none of the products affect the maximum speed reached in the test.

	Maximum speed variation (%)
Prec	+ 1,66 (±1,71)
Pas	- 0,17 (±0,89)
Pss	+ 1,45 (±0,93)

Table 1. Percental variation of the maximum speed

Reached in the effort test, after on week of taking the samples.

Medians (Stand. Dev.).

The maximum speed reached in an effort test like the one designed depends on a great number of factors, from the most biochemical ones (muscle glycogen reserve), physiological ones (oxygen consumption) to the biomechanical ones (racing technique).

Among the respiratory parameters, the oxygen consumption per kilogram of body weight and the respiratory quotient (RER) stand out due to their significance in the interpretation of the volunteer's effort.

	VO_2max/kg (ml O2·kg^{-1}·min^{-1})	RER
Prec	+ 3,03 (± 2,76)	+ 0,98 (± 1,85)
Pas	+ 2,10 (± 2,83)	- 1,08 (± 1,91)
Pss	+ 1,02 (± 2,03)	+ 1,68 (± 1,41)

Table 2. Percental variation (%) of the Oxygen consumption per kilogram and of the respiratory quotient reached in the effort test, after a web of taking the samples. Medians (±Stand. Dev.).

As shown in Table 2, with **Recuperat-ion** there was an increase of the volunteers' oxygen consumption, although not sufficient to be statistically significant. The other parameters assessed did not have any differences to stand out.

Lactate assessment in blood has shown significant differences depending on the beverage used, as seen in Figure 2. While the beverage without salts or the one with some salts produced a slight increase in the lactate concentration in blood after the effort test (not significant), the **Recuperat-ion** beverage induced a decrease in the lactate concentration in blood. This decrease was over 10% of the value at 7 minutes after the effort.

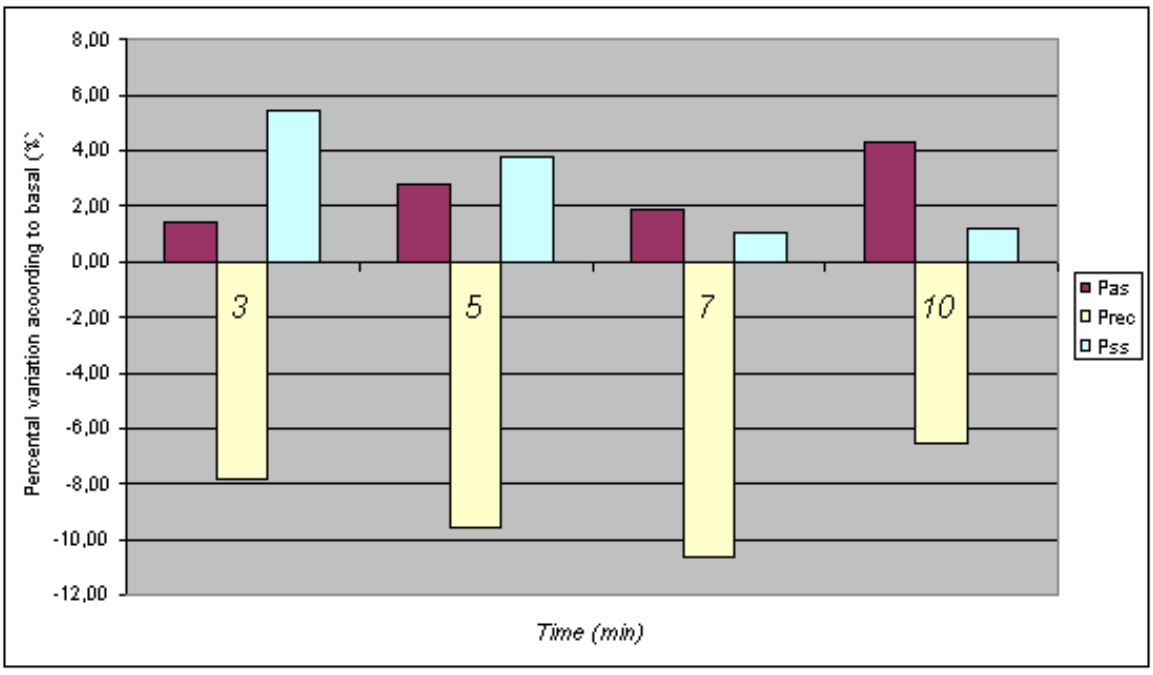

Figure 2: Percent variations of the lactate level in blood at different timings (3, 5, 7 and 10 minutes) after the effort in comparison to the basal test. The score of the light coloured column (Prec) is the value of the Time axis (min).

The Borg's Scale score did not show significant differences depending on the beverage taken.

Subjective assessment on fatigue and beverage

During the project a survey was carried out, repeatedly, in which the fatigue and the volunteers muscular perceptions were assessed.

Summarising, the results of these surveys are shown in Tables 3 and 4. Table 3 shows the results of the follow-up on the volunteers' muscular problems sensations after undergoing the tests each day.

	None	The same day	Days after
Prec	41,7	33,3	25,0
Pas	42,9	28,6	28,6
Pss	33,3	46,7	20,0

Table 3. Muscular problems and the time they last according to the beverage taken (value is the percent of volunteers).

It looks like the beverages that most avoid muscular problems are those containing salts. This fact could be related to the response in the tests during the testing days.

The purpose of this survey was to assess the volunteers' sensations during the week they took the studied beverage. The sensations expressed in Table 4 are a compilation of the subjective volunteers' sensations either while resting or while doing any daily physical activity.

	Good	Normal	Bad
Prec	21,4	64,3	14,3
Pas	0,0	92,9	7,1
Pss	13,3	66,7	20,0

Table 4. Volunteers' sensations during the web they took the beverage (value is percent of volunteers).

Conclusions

According to the results of this research, a beneficial effect of the salts on the muscular fatigue is observed. In the particular case of **Recuperat-ion**, the variation of the lactate concentration observed in blood suggests that this beverage is capable of decreasing the blood lactate levels. In any case, it is difficult to justify the mechanisms, because lactate is a metabolite generated during an effort in the muscle, and with the parameters studied in this research we cannot conclude if there has increased the production of lactate or if it has not been carried into to the blood stream, or any other mechanism.

Further studies will have to determine the mechanisms for which a lower concentration of lactate in blood is found and the possible effects of **Recuperat-ion** on the efficiency and stability of the muscular fiber.