Influence of the fat of the diet on the body composition, VO_2max and plasma biochemical parameters in endurance athletes

Influencia de la grasa de la dieta sobre la composición corporal, VO_2max y parámetros bioquímicos plasmáticos en atletas de resistencia

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RESUMEN

Este trabajo se ha llevado a cabo con 40 atletas de resistencia distribuidos en tres grupos experimentales, que consumieron respectivamente aceite de oliva virgen, aceite de oliva refinado y aceite de girasol como única grasa dietética durante 40 días, disminuyendo la ingesta total de grasa saturada todos ellos. Desarrollaron un test de ejercicio máximo antes y tras el período de adaptación a las respectivas dietas. Los resultados previos parecen mostrar un aumento estadísticamente significativo del VO_2max tras los 40 días experimentales. Este VO_2max no se correlaciona con la duración del entrenamiento diario de cada atleta, lo cual sugiere una influencia de la manipulación dietética. Finalmente, los resultados de los parámetros bioquímicos muestran un efecto beneficioso sobre la salud de la relación dieta-deporte y un aumento en la resistencia como consecuencia de la mayor tolerancia al lactato en el grupo de oliva virgen.

Palabras clave: Grasa dietética, VO_2max, lactato, ejercicio aeróbico.

ABSTRACT

This work was carried out with 40 endurance athletes distributed in three experimental groups, who respectively consumed virgin olive oil, refined olive oil and sunflower oil as main dietetic fat for 40 days, decreasing the total intake of saturated fat in all of them. They performed a maximal exercise test before and after the period of adaptation to the diet they followed, getting samples of blood before, at the end and half an hour after the test. The previus results seem to show a statistically significant increase of VO_2max after the 40 experimental days. This VO_2max does not correlate to the duration of the daily training of each athlete, which suggests an influence of this dietetic manipulation. Finally, the results of biochemical parameters show a beneficial

effect on health of the diet-sport relationship and an improvement in the endurance capacity as a consequence of higher tolerance to lactate in the virgin olive group.
Key words: dietary fat, VO_2max, lactate, aerobic exercise.

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INTRODUCTION

Nowadays the importance that nutrition has on the athlete's performance does not come up for discussion. That is why, during the last years, the research about the influence of nutritional factors on the sports performance has increased significantly. Every day new elements are looked for in the athlete's diet to make him excel himself and break his records. That may be the reason why diverse ergogenic substances which are consumed by the athletes as a panacea to win proliferate in the market lately. We have studied the influence that the quality of the dietary fat may exert on the performance of the endurance athlete and on different and biochemical parameters measured in plasma.

MATERIAL AND METHODS

We have studied 40 endurance athletes, all of then males of ages between 18-25 and with a mean daily training of 139 minutes. They were calculated, among other tests:

Body composition, by means of the division of their body weight into 4 components (muscular, fatty, osseous and residual), in accordance with the **De Rose and Guimaraes** strategy (1).

Maximun oxygen consumption: all the athletes performed a maximal exercise test in accordance with the **Mader** protocol for men and on a treadmill, calculating the maximun oxygen consumption using the following formula: $\mathbf{VO_2max = (13.162 * V) - 3.99}$ where **V** is the speed expressed in metres per minute.

Biochemical parameters: 10 ml of venous blood were extracted to all the athletes before the exercise test and 10 ml immediately after it, introducing the blood in heparinized tubes and centrifuging it immediately at 3.000 rpm.

to separate the plasma. All the blood extractions were carried out with the athletes fasting. The following biochemical parameters were measured in the laboratory : glucose, total cholesterol, HDL-cholesterol, triglycerides and lactate.Besides the aterogenic index (AI) was calculated in accordance with **Glueck** (2). The whole analytic was carried out with commercial kits (Boehringer Manheim). After the tests, the athletes were redistributed among three experimental groups so that they consumed virgin olive oil (VO), olive oil (OO) and sunflower oil (SO) as main dietary fat for 40 days, decreasing the intake of saturated fat in all of them to the utmost. The statistical treatment of the results was carried out with the computer programme SPSS-PC (3). A basic descriptive statistic (mean and standard error of the mean), an analysis of the simple variant (one way) to try to identify the possible differences among groups, a test of homogeneity of the variant (**Levene test**) and a **Duncan test** to identify the differences among groups individually were carried out for all the parameters. Significant differences to the values of $p<0.05$ were considered in all the cases.

RESULTS AND DISCUSSION

The results obtained in our experimental conditions show the following: A significant increase of the maximun oxygen consumption values in the three groups (table 1, figure 2) takes place after the 40 days of the specific dietary manipulation. On the other hand, when we compared the maximun oxygen consumption values obtained in each group we did not find significant differences which show us a higher suitability of any of the studied fats. Therefore, these changes could be explained by the reduction of the consumption of saturated fat and its replacement by mono or polyunsaturated one during

Table 1.—Oxygen consumption, pertentual body fat, weight and training time of athletes. Values are means ± SEM. A=Before diet; VO=Virgin olive oil diet; SO=Sunflower oil diet; OO=Olive oil. Means within files not followed by the same superscript letter are significantly different at $P<0.05$ or less

	A (n=40)	VO (n=16)	SO (n=14)	OO (n=10)
VO2 max. (ml/Kg/min.)	60.8 ± 0.6^a	65.3 ± 1.1^b	63.3 ± 1.05^b	66.6 ± 0.56^b
%Grasa	10.8 ± 0.12^a	10.6 ± 0.29^a	10.4 ± 0.15^a	10.5 ± 0.15^a
Peso (Kg)	64.6 ± 0.5^a	63.2 ± 1.04^a	64.8 ± 0.85^a	64.9 ± 0.7^a
T ent.(min.)	120.4 ± 4.73^a	125 ± 8^a	111.3 ± 5.9^a	125 ± 11.4^a

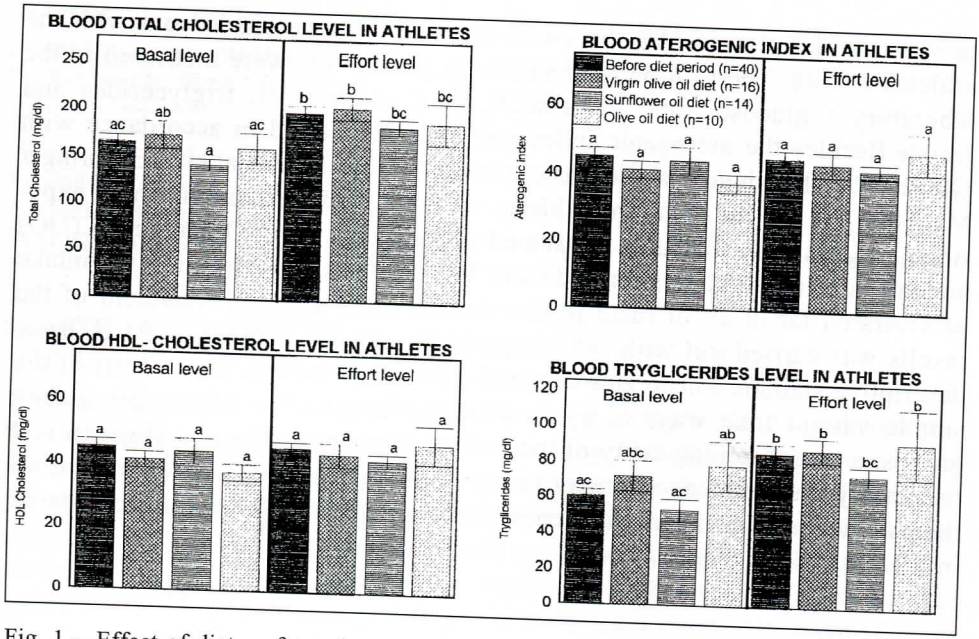

Fig. 1.—Effect of dietary fat and exercise on Total cholesterol, HDL-cholesterol, Aterogenic Index and Triglycerides in plasma of athletes. Values are means ± SEM. Means of values not followed by the same letter are significantly different at $P<0.05$ or less.

the experimental period. In fact, the experimental works (4) show that a diet rich in saturated fatty acids causes a lesser sensitivity in the adipose tissue to the stimulating action of the catecholamines, mobilizing, consistently, less fatty acids during the exercise. In the same way, an increase in the consumption of unsaturated fat exerts a beneficial effect on the functional character of the membrane of the erythrocyte (5), which would also justify the increase in the aerobic capacity observed in all the studied athletes. A significant increase in the glycemia takes place in the experimental groups at the maximal effort as a response of the hormonal mechanisms, such as the glucocorticoids and their glucogenolitic action at a maximal effort and of relative short duration (the longest exercise test lasted 21 minutes) (figure 2). The differences existing in the tolerance to high levels of lactate in the virgin olive oil group (VO) as opposed to the olive oil (OO) stand out of the obtained lactic acid values because of its significance. This could be due to the difference with regard to the saponifiable fraction of these two types of fat. With regard to the total cholesterol and triglycerides levels (figure 1) there were significant differences for the athletes only on the basal levels and at maximal effort before the diet. We observed an increase of plasma cholesterol at maximal effort although we could not explain it since, on the other hand, it disappeared when the groups were distributed in their respective diets. Moreover, not only the HDL-

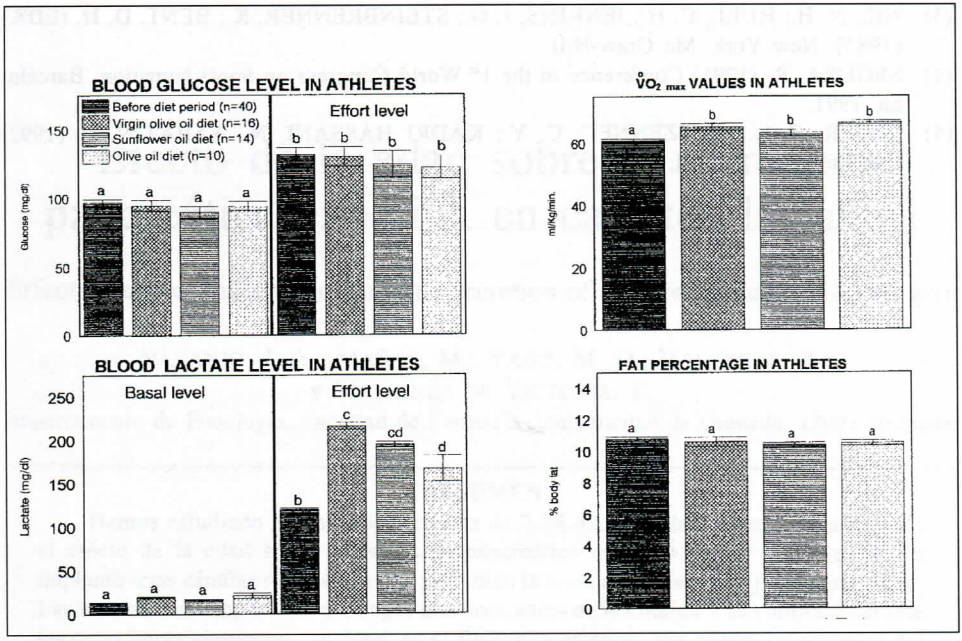

Fig. 2.—Plasma Glucose and Lactate levels, Oxygen consumption values and Fat percentage of athletes. Values are means ± SEM, Means of values not followed by the same letter are significantly different at $P<0.05$ or less.

cholesterol levels but also the aterogenic index did not show differences among the groups.

These results seem to suggest that the decrease of the saturated fat content in the diet and its replacement by mono and polyunsaturated fat may affect positively physical performance in long duration sports by two ways: the increase in the aerobic capacity and a greater use of the fatty acids.

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