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Unbalanced intake of fats and minerals associated with risk hypertension by young ciclists

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Abstract

The *objective* of the present work was to determine whether the young cyclists follows the optimal fats and minerals intake, based on the recommended dietary guidelines. The appropriate intake of Fats, Fibre, and minerals (Sodium, Calcium, Magnesium, Potassium) in their diets; may reduce the risk to develop hypertension and cardiovascular diseases, in the long term. The correct rehydration is essential in cycling during summer.

***Methods:* Nutrients intake questionnaire of 7 consecutive days, applied to 34 young cyclists. The evaluation results are compared with the enKid study of Spanish young people. The diet has been evaluated at the beginning of the cyclist season. The cyclists belong to the cyclist club Enypesa Lambea (http://www.echozas.com).**

***Results:* A percentage of cyclists in the present study, consum excessive quantities of cholesterol (94% of cyclists), saturated fats (74%), and Sodium (47%); while they do not consume the recommended quantities of unsaturated fats (100%); fibre (67%), Calcium (29%), Magnesium (10%) and potassium (44%). Similar pattern is found in the homologous Spanish young people of the enKID study.**

***Conclusion:* This work contributes to the knowledge of the diets followed by very active young people. Their diets show nutritional unbalances; therefore the need to educate the cyclists, their parents and coaches, to follow diets based on the Mediterranean diet; rich in vegetable, fruits, fish, nuts, and olive oil, in order to increase the intake of MUFA, PUFA and minerals, that will protect them against possible risk of Cardiovascular diseases.**

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Key words: *Hypertension. Active adolescents. Cardiovascular diseases (CVD). Index of quality of the Diet (ICD).*

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CONSUMO DE DIETAS DESEQUILIBRADAS EN GRASA Y MINERALES, ASOCIADOS CON RIESGO DE HIPERTENSIÓN, POR CICLISTAS JÓVENES

Resumen

El *objetivo* de este trabajo ha sido determinar si los jóvenes ciclistas no profesionales siguen una dieta óptima en consumo de grasas y de minerales, acorde con las pautas recomendadas. El consumo equilibrado de Grasas, Fibra y Minerales (Sodio, Calcio, Magnesio y Potasio) reduce el riesgo de desarrollar hipertensión arterial y a la larga previene las enfermedades crónicas. Además en el ciclismo la correcta hidratación es esencial en verano.

***Método:* Cuestionario de Ingesta de alimentos durante 7 días consecutivos aplicado a 34 ciclistas de los equipos Juvenil y Sub23 del club ciclista Enypesa Lambea (http://www.echozas.com). Los resultados se comparan con los del estudio en KID sobre los jóvenes españoles.**

***Resultados:* Un porcentaje de los ciclistas estudiados consumo cantidades excesivas de Colesterol (94% de los ciclistas), Grasas saturadas (74%), y sodio (47%); mientras que no consumen las cantidades recomendadas de Grasas insaturadas (100% de las ciclistas); fibra (67%), Calcio (29%), Magnesio (10%) y Potasio (44%). Esta misma tendencia se ha observado en la población general de jóvenes españoles del estudio EnKid.**

***Conclusión:* Este trabajo ha contribuido a un mejor conocimiento de la dieta que siguen jóvenes que son muy activos físicamente y que en verano tienen grandes pérdidas de electrolitos por el sudor, que deben reponer. Las dietas que siguen presentan desequilibrios nutricionales, que se deben corregir educando no solamente a los ciclistas, sino también a los padres y entrenadores. Se debe hacer una correcta rehidratación (sobre todo en verano) y fomentar la Dieta Mediterránea rica en vegetales, frutos, pescado, y aceite de oliva que proporcionan la cantidad adecuada de Grasas Mono y Poli-insaturadas que protegen el sistema cardiovascular.**

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Palabras clave: *Hipertensión arterial. Adolescentes activos. Enfermedad cardiovascular (ECV). Índice de calidad de la Dieta (ICD).*

Introduction

For the young people practising cycling, the success not only depends on a suitable training but, it is as well the consequence, of a correct feeding, healthful habits of life, and psychological aptitudes; that are developed by a complex emotional learning.

Specific nutritional aspects of cycling

The *correct diet* is the one that provides the sufficient energy and the suitable nutrients (carbohydrates, proteins, fats, vitamins, minerals and water) for the sportsman according to its age, gender, weight, and sport activity.[1]

High consumption of sugars and fat by elite athletes was not associated with overweight or excess body fat. Although recommended diets are usually built around complex carbohydrates, dietetics professionals can address the increased energy needs of elite athletes by recommending energy-dense foods. Sugars and fats are efficient sources of energy per unit volume.[2]

For many endurance events, the habitual consumption of a high-carbohydrate diet, with supplemental carbohydrate before and during exercise, is appropriate for many athletes. However Diets relatively higher in fat than is currently recommended, may be beneficial for exercise in which energy expenditure is high and time for recovery is limited. The choice of diet for optimal physical performance depends on several factors, including type and duration of exercise, total energy expenditure, time for recovery, dietary preference of the athlete.[3]

The above statements recommending diets high in sugars and fats, may be in contradiction with Heart healthy diets advice aiming to diminish the intake of certain types of nutrients such a saturated fats, MUFA-trans fatty acids and cholesterol; and at the same time to increase the intake of Calcium, Potassium and Magnesium.

Cycling is both intensive and endurance exercise. The cyclist tours (France, Italy, Spain) composed of multiple stages are, may be, one of the more demanding sports, in terms of physiological and psychological requirements. The group of sportsmen is one of the most motivated to follow a correct diet; but for a long time it has been one of the groups that commit the greater errors, and believe in myths with respect to which it is a correct feeding.

Recent longitudinal studies (Women heath initiative, february 2006),[4] seem to demonstrate that a dietary intervention that reduced total fat intake and increased intakes of vegetables, fruits, and grains did not significantly reduce the risk of CHD, stroke, or CVD; in postmenopausal women and achieved only modest effects on CVD risk factors.

But there are already some concerns about the validity of the conclusions raised in that Women heath initiative of february 2006. It seems that the intervention did not test current dietary guidelines, which focus less on total fat intake, and more on saturated fats, cholesterol, sodium, and weight maintenance. Dietary changes have been shown to improve CVD risk-factor profiles, although only when part of comprehensive lifestyle changes (see Journal Watch Cardiology Mar 2, 2001). Still, Women heath initiative CVD outcomes data on dietary interventions are not yet firm. Non-pharmacological approaches to blood-pressure control tend not to get the attention they deserve. One effective strategy is the Dietary Approaches to Stop Hypertension (DASH) diet, which emphasizes fruits, vegetables, and low-fat dairy products and is low in saturated and total fat (see *JWC* Jun 1997, p. 47, accession number 970505002, and *N Engl J Med* 1997; 336:1117). Reducing the amount of sodium chloride in typical diets also can lower Blood pressure (BP).[5]

Moreover, although there is new interest in the recovery of intramuscular triglyceride stores between training sessions, there is no evidence that diets which are high in fat and restricted in carbohydrate, enhance training.[6]

Given that reducing the amount of sodium chloride in typical diets (as recommended by DASH), may not be practical for many people, it is as well recommended to increase the intake of Potassium, Calcium and Magnesium to achieve an significant reduction of the BP.[7]

We have considered interesting to evaluate the intake by young cyclists, of the nutrients mentioned above; which may in the long term, be associated with risk of hypertension, atherosclerosis, dyslipidemias, and in general with cardiovascular diseases (CVD). The diet has been evaluated at the beginning of the cyclist season (another evaluation will be done at the end of the sport season, to determine the evolution in the considered parameters. Education in healthy and comprehensive lifestyle is essential for the prevention of CVD and the cheapest way to contribute to the people heath.

Methods

Thirty four *young cyclists* pertaining to the *junior team* (of 15 to 17 years) and to *the Sub23* team (of 18 to 23 years). (http://www.echozas.com/), have participated in the nutritional study.

The cyclists have a regular program of training with technical Directors and trainers; the cyclist were training about six days a week. Along the year they participate in about 12 competitions in the community of Madrid (Spain) and other six Spanish national competitions. They run more than 25,000 km per year.

The nutritional and psychological evaluations are mandatory for the Juniors team; and optional for the Sub-23 team. All cyclists have made a medical examination to participate in the cycling club. They combine their studies with practices of cycling, and their goal is to become professional cyclists.

Table I
Anthropometric data of the cyclists teams (n = 34)

	Age (Y)	*Weight (kg)*	*Height (M)*	*BMI (kg/m²)*	*FM (%)*	*Activity factor*
Means	20	67	176	21.92	15	2.34
SD	2	5	7	1.53	2	0.2

BMI: body mass index. FM: body fat mass. SD: standard deviation.
Note: The quantities showed in the all tables have been rounded to the units value (unless otherwise mentioned), no comma and decimals were used, because the readability is improved, while the accuracy is kept (i.e.: if the means of age the cyclist teams were 20.1 years, in the table it is put 20 y).

All are healthy, without disease. They have signed an informed voluntary consent, together with their parents or tutors, if they are under 18 years of age.

Antropometric data and energy requirement

The information required for the evaluation, is provided by cyclists in the "Questionnaire of *nutritional habits and physical activity"* such as anthropometric data, as well as the amount and intensity of the physical activity that every individual cyclist make.

The Body fat mass (FM) was assessed by bio-impedance measurements, INBODY520 body fat analyzer. Other methods, like skin folds thickness have been used but only with some of the cyclists, and the errors are of similar level.

The *anthropometric results* are shown in the table I It presents the average and the standard deviation of several parameters like age, weight, height, and Body Mass Index (BMI), percentage of body fat mass (FM), and physical activity factor.

To calculate the physical *activity factor* the DIAL program is used. All the details on how to calculate those data are in a precedent article[8]. DIAL uses an equation with the weighted daily activity duration; on the basis of values of WHO.[9]

It appears that the Average of intake of Calories (means ± sd = 3,842 ± 615 kcal./d) by the cyclist teams are, slightly lower than the energy required by them according to their activity factor (means ± sd = 4,122 ± 413 kcal./d). The activity factor is higher during the cyclist season, but the nutritional lifestyle remains unchanged, therefore the body fat of the cyclists goes from 15% ± 2 down to about 7% along the sport season.

The intake of macronutrients in their diets, is presented in table II.

Statistical method

The results are expressed in MEANS ± SD. To determine the statistical significance, independent sample *t*-tests were used to evaluate differences between groups of the same team. Values of $p < 0.05$ are considered statistically significant.

Linear correlation method has been used to analyse possible associations between nutritional variables and sport achievement variables (using Microsoft Excel).

Informatic tools

PC informatics tools of the Department of Nutrición and Bromatología I of the Faculty of Pharmacy UCM. Madrid (Spain), have been used.

The DIAL program, using a Table with the composition of foods,[10] calculates the *energy consumed* and the *Nutrients* (macro nutrients, minerals and vitamins) contained in the daily food ingestion. The information of the ingested food is extracted from the "Questionnaires of Record of food consumption of 7 consecutive days.

In addition the DIAL program uses equations to calculate the *energy required,* based on the anthropometric data and the hours of physical activity (total energy spent is equal to Resting energy multiplied by the physi-

Table II
Ingested macronutrients and caloric profile, cyclists and spanish young people

Intake	*Energy (kcal/day)*	*Proteins (g/day)*	*Carbohydrates (g/day)*	*Fats (g/day)*	*% energy of proteins*	*% energy of carbohydrates*	*% energy of fats*
Cyclists (n = 34) means	3,842	162	443	149	16.3	45	38.7
Spanish males (18-24 y)	2,482	107	264	107	18,0	41.5	40.1

(n = 436 means).
Note: The quantities showed in *the all tables* have been rounded to the units value.

Table III
Groups of foods groups consumed by cyclist of the Junior and Sub23 teams (n = 34)

Food group intake	*Cereals & legumes (servings/d)*	*Vegetables (servings/d)*	*Fruits (servings/d)*	*Dairy (servings/d)*	*Meat, fish, eggs (servings/d)*	*% e. from fats*	*% e. from saturated fats*	*Cholesterol (mg/d)*	*Sodium (mg/d)*	*variety of food types in diet*
Means	11.1	6.3	2.7	3.3	7.3	38.70	13.4	669	5,758	18
sd	4.3	2.7	1.2	1.2	2.6	3.5	2.00	210	3,763	4.4
recommended	12	6	4	4	3	< 30	< 10	< 300	< 4,800	> 16

Note: The quantities showed in *this table* have been rounded to one decimal value.

cal activity factor). The serving sizes are based on information provided by the University of Leon, Spain.[11]

The Microsoft Excel and SIGMA 2.0 programs have been used for the statistical analysis, statistical significance and linear correlation.[12]

Evaluation of the index of quality of the diet (ICD)

Every cyclist participating in the study fill up several questionnaires:

- Questionnaire of *nutritional habits and physical activity:* where it is recorded the frequency of intake of different groups of foods, some anthropometric data, as well as the amount and intensity of the physical activity performed by the cyclist.
- Questionnaire of *Record of food consumption during* of 7 consecutive days. This record list all the foods and drinks ingested and its quantities; including supplements, appetizers and snacks; Other useful information are as well included, such as lunch start/end time, the place where they eat, etc.

The Questionnaires data are input into the DIAL program, which after processing it outputs a Result Report detailing the Energy intake, nutrient and the Quality of the Diet, the later based on the recommendations applicable to the studied population group.[10] The results of the cyclist nutritional evaluation are used to determine the diet unbalances; which in the present study have been compared with the data of the Spanish young population of the enKid study.[13]

The index of quality of the Diet (ICD), allows to classify the Diets as, poor diet (< 50 points), diet which needs to be improved (51-80 points), and excellent diet (80-100 points).[14]

The ICD is calculated analysing the variety and quantity of groups of food consumed by comparison with the recommendations (CRD). The CRD are determined taking into account the anthropometric data and the energy requirements of the cyclist.[1]

Ten criteria are evaluated corresponding to groups of food in the food pyramid. Each criteria may have from 0 till 10 points. The ICD evaluation therefore has a range from 0 till 100 points.

The intake of different groups of foods by the cyclist team is shown in the table III.

Note: the serving sizes are based on information provided by the Univesity of Leon, Spain.[11]

The resulting index of quality of the diet of the cyclists teams (as calculated by the DIAL program), expressed as MEANS ± SD; is *ICD = 67 ± 11 points over 100 points;* which as average *it is a good diet, but needs to be improved* in some groups of foods.

The cyclists of the present study consumes as average excessive quantities of meat, eggs, cholesterol and sodium. At the same time they consume less quantities of fruits than the recommended ones, The intake of cereals and legumes is slightly under the recommended quantities.

As part of the nutritional intervention, individual diets have recommended to the cyclist to correct those unbalances. Those fat and sodium unbalances may jeopardise their health as they are considered risk factors for hypertension and cardiovascular diseases, in the long term.[15] One published study stated that women who consumed five or more servings of red meat per week also had a significantly increased risk of forearm fracture compared with women who ate red meat less than once per week. Recall of teenage diet did not reveal any increased risk of forearm fracture for women with higher consumption of animal protein or red meat during this earlier period of life.[16]

Evaluation of the intake of fats

The intake of different types of fats by the cyclist team is shown in the table IV.The cyclists are very active young people, therefore the intake of calories is about 1.55 times the intake of the homologous Spanish males of the enKid study.[13] The extra energy needed should be taken from ingestion of higher quantities of carbohydrates, but instead of it the cyclists consume as well proportionally increased quantities of fats (they consume diets with slightly lower density of calories than the general young male population), as it is showed in table IV in the column of the density

Table IV
Average intake of fats and minerals in diets of cyclist and spanish young people

Daily intake	*Cyclists (n = 34) daily/per 1,000 kc*		*Enkid[i] 18 a 24 years (n = 436) daily/per 1,000 kc*		*Rel. Cyc/Enkid*	*% cyclists which do not follow recommended guidelines*
Calories (kcal/d)	3,842	1,000	2,482	1,000	1,55	–
Fats (g/d)	149	39	107	43	1,40	82
Cholesterol (mg/d)	669	174	489	197	1,37	94
SFA (g/d)	49	13	34	14	1,43	74
PUFA (g/d)	18	5	14	6	1,33	100
Na (mg/d)	5,323	1,385	2,851	1,149	1,87	47
K (mg/d)	5,651	1,471	3,151	1,270	1,79	44
Ca (mg/d)	1,585	413	994	400	1,60	29
Mg (mg/d)	532	138	314	127	1,69	10

Note: The quantities showed in *the all tables* have been rounded to the units value, no comma and decimals used.

of nutrients per 1,000 kcal. The intake, by the cyclists, of fats and cholesterol is high, although in less in proportion than the energy. By contrary the intake of PUFA is bellow the recommended value, in a similar way to the homologous young people. The PUFA of long chain omega 3 from fish are involved in the control of hypertension.[17] The intake of fish is bellow the recommended guidelines.

Evaluation of the intake of minerals

According to the table IV the cyclists take 1.87 times more of sodium than the homologous young males. It is recognised that cyclists have increased needs of salt due to losses by transpiration. The American Institute of Medicine[18] recommends the intake of less than 3.8 g/d of salt (1.5 g/d of sodium and 2.3 g/d of chloride) for general people; and the intake 5.8 g/d of salt (2.3 g/d of sodium and 3.8 g/d of chloride) for sportsmen with high losses of liquids (because of sweating). It is recognised that this is a stringent recommendation difficult to follow (the average intake in the USA is 8 g/d; and in Spain is 9 g/d); therefore we have considered as acceptable the intake of less than 4.8 g/d for the cyclists. For potassium, Calcium and Magnesium the official recommendations for young people are more than 4,700 mg/d, 1,300 mg/d, and 400 mg/d respectively,without any increase for sportsmen.

Evaluation of the intake of sodium

The intake of sodium by cyclists exceeds as average the recommended value, as presented in the table V. When we classify the cyclists into two groups according to their intake of sodium; group S (47% of cyclists) take equal/more than 4.8 g/d; and group M (53% of cyclists) take less than 4.8 g/d. The group M has a better quality of the diet (69 ± 11) than the group S (65 ± 10), and the difference of intakes by the groups have statistical significance. The high intake of sodium is, in the long term, a risk factor of hypertension and other diseases.[7]

Table V
Intake of sodium by cyclists (n = 34)

Intake		*Diet quality (0 a 100)*	*Sodium (mg/d)*
Group M (53%)	Means	69	3,938*
	SD	11	780
Group S (47%)	Means	65	6,880
	SD	10	2,799
Team (100%)	Means	67	5,322
	SD	11	2,469

Statistical significance between groups: * $p < 0.001$.

Table VI
Intake of potassium by cyclists (n = 34)

Intake		*Diet quality (0 a 100)*	*Potassium (mg/d)*
Group A (66%)	Means	70	6,614*
	SD	10	1,775
Group B (44%)	Means	63	4,275
	SD	10	201
Team (100%)	Means	67	5,651
	SD	11	1,788

Statistical significance between groups: * $p < 0.01$.

Evaluation of the intake of potassium

The intake of potassium by cyclists is presented in the table VI. When we classify the cyclists into two groups according to their intake of potassium; group A (66% of cyclists) take equal/more than 4.7 g/d; and group B (44% of cyclists) take less than 4.7 g/d. The group A has a better quality of the diet (70 ± 10) than the group B (63 ± 10), and the difference of intakes by the groups have statistical significance. The low intake of potassium by the group B do not protect them from the high intake of sodium and therefore from hypertension and other diseases.[7]

Evaluation of the intake of calcium

The intake of calcium by cyclists is presented in the table VII. When we classify the cyclists into two groups according to their intake of calcium; group X (71% of cyclists) take equal/more than 1,300 mg/d; and group Y (29% of cyclists) take less than 1,300 mg/d. The group X has a better quality of the diet (68 ± 10) than the group B (64 ± 12), and the difference of intakes by the groups have statistical significance. The low intake of calcium by the group B do not protect them from the high intake of sodium and therefore from hypertension and other diseases.[7] Additionally the intake of calcium is essential for the construction of bones, from the early stages of life till maturity, therefore the group Y which has deficit in the intake of calcium may, in the long term, have risk of osteoporosis, and periodontal diseases.[19]

The ratio Phosphorus/Calcium of the cyclist intake is, as average, acceptable (means ± SD = 1.7 ± 0.55), however it is excusive (more than 2:1) for 21% of the cyclists indicating for them, increased bone demineralisation by resorption (because the high level of phosphorus compared with the level of calcium, activates the parathyroid hormone (PTH).

Evaluation of the intake of magnesium

The intake of magnesium by cyclists is presented in the table VIII. When we classify the cyclists into two groups according to their intake of magnesium; group V (90% of cyclists) take equal/more than 400 mg/d; and group W (10% of cyclists) take less than 400 mg/d. The group V has a better quality of the diet (68 ± 10) than the group W (54 ± 5), and the difference (quantity of magnesium and the quality of the diets) between the groups have statistical significance. The low intake of magnesium by the group W do not protect them from

Table VII
Intake of calcium by cyclists (n = 34)

Intake		*Diet quality (0 a 100)*	*Calcium (mg/d)*
Group X (71%)	Means	68	1,812*
	SD	10	521
Group Y (29%)	Means	64	1,039
	SD	12	136
Team (100%)	Means	67	1,585
	SD	11	568

Statistical significance between groups: * $p < 0.001$.

Table VIII
Intake of magnesium by cyclists (n = 34)

Intake		*Diet quality (0 a 100)*	*Calcium (mg/d)*
Group V (90%)	Means	68*	506**
	SD	10	65
Group W (10%)	Means	54	339
	SD	5	18
Team (100%)	Means	67	532
	SD	11	138

Statistical significance between groups: * $p < 0.01$; ** $p < 0.001$.

the high intake of sodium and therefore from hypertension an other diseases.[7]

Discusion and conclusions

As a *summary the percentage of cyclists with unbalances* in the intake of fats and minerals is presented in the figure 1. They unbalances are similar, although less severe than the ones observed in the homologous Spanish young males of *the enKid study,*[13] that are presented in figure 2 (in the later only the major deficits in minerals, Magnesium and Calcium, are shown).

Several cyclists present unbalances in their diets, namely:

A percentage of the cyclists have taken *excessive amounts of saturated Fats and cholesterol,* while they have no taken *enough quantities of PUFA* (mainly from nuts and fish), in the long term, it may be a factor of risk of hypertension, atherosclerosis, dyslipidaemias, and in general with cardiovascular diseases (CVD).[15]

Also a percentage of the cyclists take an *excessive amount of Proteins,* that in the long term it will probably be a factor of risk of the liver and kidney and cardiovascular diseases. The excretion of the protein nitrogen implies the lost of increased quantities of Calcium, which together with low intake of calcium in the diets, in the long term, may be a factor of risk of osteopenia, bighead, and periodontal diseases.[19]

Additionally a percentage of the cyclists take excessive quantities of sodium, that, in the long term, a risk factor for hypertension an other diseases.[18]

The low intake of calcium, potassium and magnesium by some of the cyclists do not protect them from the high intake of sodium and therefore from hypertension and other diseases.[7] The ratio Calcium *versus* phosphorus of the cyclist intake ratio is not appropriate for 21% of the cyclists, indicating that the absorption of calcium is not the optimal one.

Education in healthy and comprehensive lifestyle is essential for the prevention of Cardiovascular diseases and it is the cheapest way to contribute to the people heath. When the sportsmen stop the practice of the exercise, they have to be careful to change accordingly their diets to avoid obesity and the related cardiovascular diseases.[20]

We have designed individual diets to correct their nutritional unbalances found during the evaluation

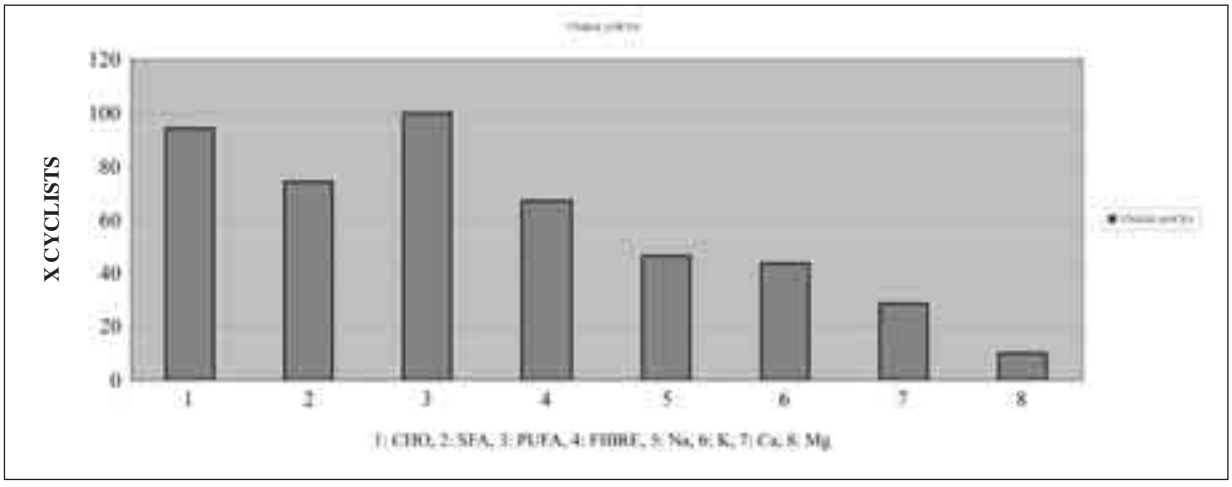

Fig. 1.—Percentage of cyclists with unbalances in their diets.

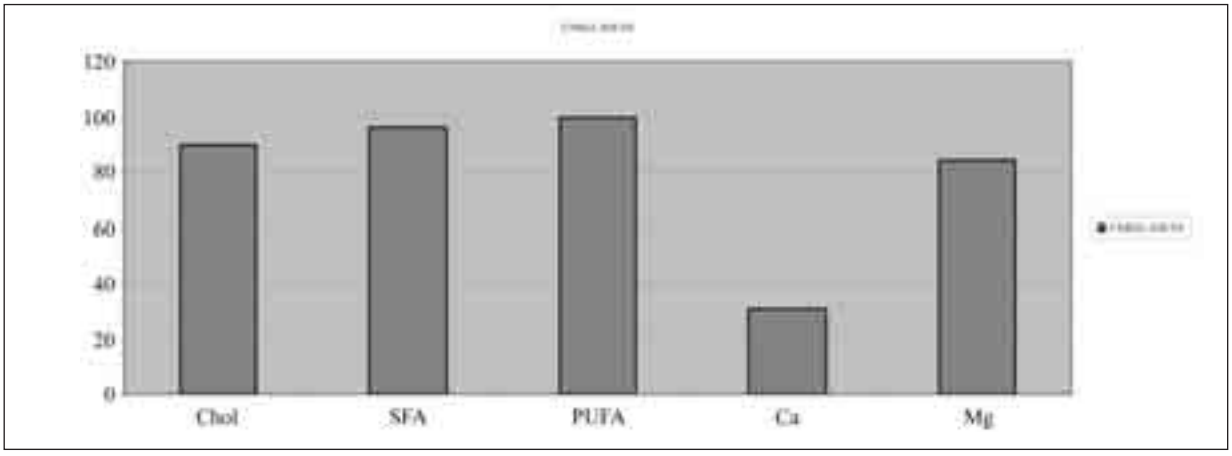

Fig. 2.—Percentage of spanish youngsters enKID study, with mayor deficits in their diets.

(reducing the proteins, fats and cholesterol in their diets; while increasing the whole cereals, nuts, fish, and carbohydrates); and we are performing *nutritional education* to inform the cyclists, their parents and their sport couches of the suitable nutritional habits.

We are providing psychological advice and support, to develop emotional shelf-control skills of the cyclist team.

The results of the mentioned interventions will be the subject of a future work to be published at the end of the year, when the present cyclist season has ended.

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