F. Pasqui[2], M. Baldini[1], A. Lorenzini[1], A. Bordoni[1], M. Malaguti[1], M. Di Carlo[3], R. Miroi[4], M. Maranesi[1]

Evaluation of some nutritional and sport aspects in sedentary and active adolescents: analysis in Italian and Romanian school

Progress in Nutrition
Vol. 11, N. 1, 47-56, 2009

Titolo
Valutazione di alcuni parametri nutrizionali e sportivi in adolescenti sedentari e non: analisi in una scuola Italiana e Rumena

Key words
Physical activity, dietary intake, adolescents, Romania, Italy

Parole chiave
Attività fisica, abitudini nutrizionali, adolescenti, Romania, Italia

[1] Nutrtion Reearch Center, Department of Biochemistry "G. Moruzzi" University of Bologna, Bologna, Italy
[2] Department of Internal Medicine and Gastroenterology. Polo Murri, Policlinico S. Orsola - Malpighi, Bologna, Italy
[3] Faculty of Exercise and Sport Science, University of Bologna, Bologna, Italy
[4] Kinesitherapy Faculty, National Academy of Physical Education and Sport, Department of Special Courses, Bucharest, Rumania

Indirizzo per corrispondenza:
Dott.ssa Marta Baldini,
Nutrition Research Center, Department of Biochemistry "G. Moruzzi", University of Bologna, Via Irnerio 48,
40126 Bologna, Italy
Tel./Fax 0039-0513091235
E-mail: marta.baldini4@unibo.it

Summary
The aim was to investigate the nutritional behaviour and level of physical activity in Italian and Romanian adolescents. The survey was carried out on 1050 healthy adolescents students, aged 13-14 years, from two different European regions: Tuscany (Italy) and Giurgiu (Romania). They were subdivided in two groups about their lifestyles: sedentary (525) and active students (non competitive sports-525) depending on their answers to a specific questionnaire. Sex, weight, nationality, daily activities and dietary habits of students were all collected by questionnaires. Our data show differences in the student's lifestyles: Italian groups spend less hours engaged in physical activity than Romanian ones; the survey reveals also that for active Romanian adolescents a large percentage of their caloric intake comes from lipids. Data of this study show an incorrect dietary and lifestyle habits in both Italian and Romanian children respect to International Guidelines. It is important to design a global strategy to improve dietary habits of the young European population according to the gastronomic traditions of each country. This study will be helpful to plan corrective nutritional and behavioural programs.

Riassunto
La ricerca si propone di valutare alcuni parametri nutrizionali in adolescenti appartenenti a due realtà differenti: Italia e Romania. L'indagine è stata condotta su un campione di 1050 ragazzi, maschi e femmine, tra i 13 e 14 anni, Italiani e Rumeni a cui è stato somministrato un questionario relativo alla pratica sportiva e alle abitudini alimentari. È stato valutato il dispendio energetico giornaliero, l'apporto calorico totale e la suddivisione percentuale tra i principi nutritivi attraverso un programma computerizzato (Winfood; Medimatica Srl, Martinsicuro, Italy). I dati ottenuti hanno evidenziato una diversa frequenza settimanale dell'attività fisica (2-3 volte in media nel campione italiano v.s. 5-6 volte in quello rumeno) con conseguente diverso dispendio energetico medio. La suddivisione calorica tra i principi nutritivi è risultata corretta nel campione italiano, mentre nel campione rumeno si è riscontrata un'eccedenza nella quota lipidica (~ 40% delle kcal. totali) a scapito di quella glucidica. I dati riscontrati indicano abitudini nutrizionali e sportive non idonee alla fascia di età analizzata, per cui è necessario intervenire con programmi nutrizionali e comportamentali per migliorare, nel rispetto delle tradizioni locali, gli abituali stili di vita.

Introduction

The spreading of obesity and overweight across the world notwithstanding the well documented negative implications on health is an ongoing problem (1-4). Particularly worrisome are data regarding adolescents and young adults (5-7). It is known, in fact, that an obese or overweight adolescent has a higher probability to be an obese or overweight adult (8-10). Changes in obesity and overweight rates during the last two decades have been well documented in east European countries both for children and adults (11-14). Ulijaszek and Koziel have analyzed the availability of dietary energy in eastern European countries after the collapse of communism. They report that there has been no significant changes in overall dietary energy availability between 1990 and 2005, and the increased incidence of overweight parallel a gradual decline of physical activity, concluding that the most plausible macro-level explanation for the increased incidence of obesity is in fact the decline in physical activity (15).

Physical activity is a key component of overall health status and it is associated independently from diet with cardiovascular health (16-18). A large study that surveyed leisure-time physical activity in 19.298 university students from 23 countries across the world found primarily that leisure-time physical activity is in average below recommended levels but also that the observed differences across countries are related to their specific cultural factors and to their stages of economic development (19). 16 of the 23 countries analyzed in this study were European countries so this analysis can be used to observe physical activity habits in young adult across Europe. The Authors report for the groups that include United States and 7 western European countries (Belgium, England, France, Germany, Iceland, Ireland and Netherlands) a prevalence of inactivity of 23%, for the group of Central and Eastern European countries (Bulgaria, Hungary, Poland, Romania and Slovakia) 30%, and for the group of Mediterranean countries (Greece, Italy, Portugal and Spain) 39%. So in Europe, for leisure-time physical activity the countries that have the most recommendable dietary tradition have also the worst score (20). In recent years with the widening of the European community to many east European countries and the consequent increased exchange in goods and cultural habits one will hope that a good dietary habit as the Mediterranean diet and a healthy life style rich in physical activity will be the goals toward which each country will aim to (21, 22). With the intent to be able to forecast the actual direction toward which the young European population is moving to, we have chosen to analyze dietary energy intake and energy expenditure of adolescent students of an Italian and a Romanian school. The young boys and girls were recruited in the study so to have similar numbers of Italian and Romanian boys and girls in the different groups classified as sedentary or active. We also analysed if there is an influence of the socio-economical and educational level of the family in determining the nutritional and life style habits of the young.

We choose Italy and Romania as representative respectively of the Mediterranean group (expected to reveal healthier dietary habits) and of the East Europe (expected to have healthier life style in regard to physical activity).

Methods

Subjects

The survey was carried out on 1050 healthy adolescent students, aged 13-14 years, from two different regions: Tuscany (Italy) and Giurgiu (Romania). Students were invited to participate to the study during the lessons by their own teachers, who explained them the

aim of the study; inclusion criteria were similar socio-economic status (middle class) and a good healthy state at the anamnesis. During a period of 4 weeks, about 2000 students were contacted and, based on inclusion/exclusion criteria, 1050 were enrolled and gave oral consent to enter the study. They were subdivided in two groups: sedentary (525) and active students (non competitive sports-525) according to the answers to a questionnaire about their personal lifestyle. Every group has been subdivided according to sex, weight and nationality (Table 1). Body Mass Index (BMI) of each subject was calculated by measuring weight and height using a precision balance and stadiometer. According to the BMI values, subjects were subdivided into weight classes using the cut off values: 90° percentile for overweight and 3° percentile for underweight (23). Daily activities and dietary habits of students were collected by questionnaires. All questionnaires were completed during Autumn-early Spring.

Food frequency questionnaire

Nutrient and food intake was measured using the Willett Food Frequency Questionnaire (FFQ) (for detailed description see (24, 25). Full instructions to complete the questionnaire were given, together with a list of 120 different foods in which each food was characterized by a full description of usual serving size. Food preparation was taken into account by asking to each subject to include all the ingredients used on a separate list provided together with the questionnaire, allowing him/her to extrapolate the amount of each ingredient used in each preparation and to insert the correct amount of all ingredients in the FFQ. Each participant was asked to keep a detailed record of food consumption, starting from breakfast and ending at bedtime. They were also required to record the amount of food consumed and the methods of food processing. To estimate the portion size each participant was provided with a pictorial copy of standard meal/food

Table 1 - Number (Num.) and percentage (%) of girls and boys subdivided in weight classes, nationality and physical activity level

	Italian Sport		Romanian Sport		Italian Sedentary		Romanian Sedentary	
	Num.	%	Num.	%	Num.	%	Num.	%
Female								
nw	100	71,9	99	72,7	98	72,6	100	70,4
ow	25	18,1	12	8,9	25	18,6	16	11,2
uw	14	10	25	18,4	12	8,8	26	18,4
TOT	**139**	100	**136**	**100**	**135**	100	**142**	100
Male								
nw	98	76	100	83	88	70,4	90	73
ow	20	15,5	16	13,2	28	22,4	27	22
uw	10	8,5	5	3,8	9	7,2	6	5
TOT	**129**	100	**121**	100	**125**	100	**123**	100

nw: normalweight; ow: overweight; uw: underweight

sizes. The time frame of FFQ completion was over the past month. All completed questionnaires were checked by a nutritionist for accuracy and completeness. Questionnaire data were evaluated using a database for nutritional analysis (Winfood; Medimatica Srl, Martinsicuro, Italy).
The FFQ were completed by students in the classroom in the presence of their teachers who were trained regarding the correct use of the FFQ forms. To provide information about lifestyle all participants completed an International Physical Activity Questionnaire (IPAQ) (26, 27) with different sections: occupational asses (transportation to and from work), household chores, sports, sedentary leisure time, recreational activity and time of sleep. For each activity reported in the questionnaire, the frequency and duration were indicated.

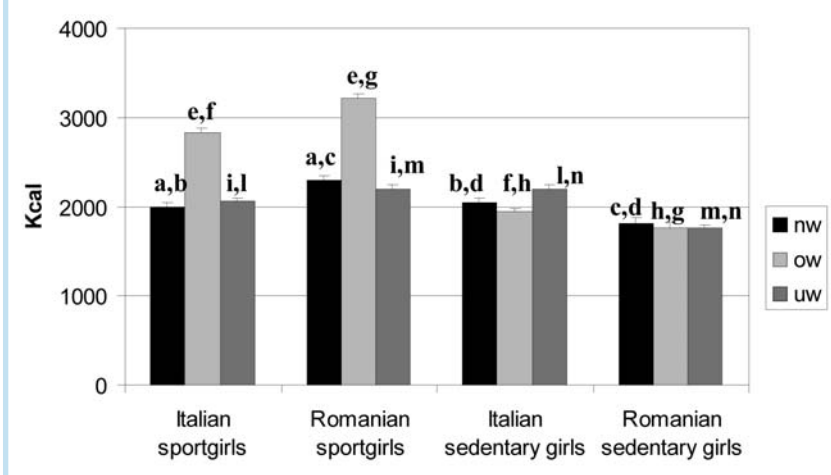
Statistical analysis

Data are presented as means and standard deviations. The Student–Newman–Kuels test after ANOVA was conducted to compare the significance of differences between the two groups using the GraphPad Prism 4 statistical software package (GraphPad Software Inc., San Diego, CA, USA). P<0.05 was considered to indicate statistical significance.

Results

Subdivision of subjects in weight classes showed high percentages of overweight. Among Italian active and sedentary students: sportgirls: 18.1%; sedentary girls: 18.6%- sportboys: 15.5%; sedentary boys: 22.4%. Among Romanian sportgirls: 8.9%; sedentary girls: 11.2% sportboys: 13.2%; sedentary boys: 22.4%.
Among Romanian girls students underweight status was higher than in Italian ones: sportgirls (18.4%) and sedentary girls (18.4%). Among Italian girls: sportgirls (10.0%) and sedentary girls (8.8%).
Daily total caloric expenditure in Italian and Romanian students is reported in figures 1 and 2. Energy expenditure, as measured by IPAQ, was higher in Romanian than in Italian active students, while in sedentary groups the energy expenditure is similar in both countries.
In particular, Italian and Romanian normal weight students have a different frequency of non competitive sport; the hours/day given

Figure 1 - Mean ± sd. of daily total caloric expenditure (total kcal) in girl groups subdivided in weight classes.
nw = normal weight; ow= overweight; uw= underweight
I. SPORT = Italian sport girl; R. SPORT = Romanian sport girl; I. SED. = Italian sedentary girl; R. SED. = Romanian sedentary girl.
Statistical analysis was by Student-Newman-Kuels test after ANOVA comparing each group to all other groups and assuming p<0.05 as statistically significant. Similar letters indicate statistical significance between the two groups

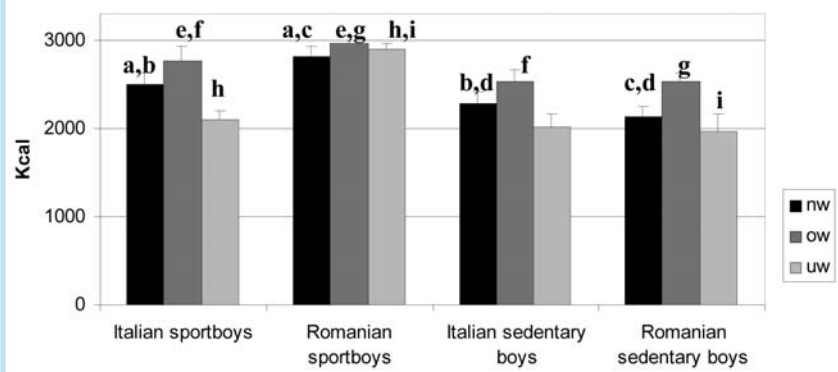


to physical exercise are about one in Italy and two or three in Romania. On the contrary Italian overweight girls are more active than Romanians. In underweight groups the frequency of sport activity is higher for girls and lower for boys in Italy compared to Romania. In active students of the two countries these different habits influence the daily caloric expenditure, but also in sedentary students the caloric expenditure was different in Italy and Romania. Figures 3 and 4 report caloric intake in the Italian and Romanian students. In figure 3 only Romanian sportgirls overweight and Romanian sedentary overweight have higher intake ($p<0.05$) than the corresponding Italian groups. In fact caloric intake of sedentary Romanian girls is generally higher than that one of Italian girls. In figure 4 it possible to observe that the only significant difference among caloric intake of boys is the Italian sport boys have a higher intake then corresponding Romanians.

Overall, energy intake in Italian students appeared correctly subdivided in macronutrients, substantially corresponding to Mediterranean diet, while in Romanian students was observed a low carbohydrate intake and a high fat intake (Tables 2, 3).

Familial characteristics, such as maternal job and education, which can influence dietary habits and lifestyle of students, were considered in relation to sporting or sedentary activities; it seems there is not a direct relation between maternal job and lifestyle of the girls and boys (Fig. 5). Specifically in the Italian groups the majority of active girls have a mother who is a housewife and half of the sedentary girls have an employed mother, while as far as boys are concerned the percentages are practically reversed. In Romanian groups the highest percentage of sedentary girls has an employed mother, while the boys' percentages are more heterogeneous. Additionally no significant trends were found in relation with mother educational level (Fig. 6).

Figure 2 - Mean ± sd. of daily total caloric expenditure (total kcal) in boys groups subdivided in weight classes.
nw = normal weight; ow= overweight; uw= underweight
I. SPORT = Italian sport boy; R.SPORT = Romanian sport boy; I. SED. = Italian sedentary boy; R. SED. = Romanian sedentary boy.
Statistical analysis was by Student-Newman-Kuels test after ANOVA comparing each group to all other groups and assuming $p<0.05$ as statistically significant. Similar letters indicate statistical significance between the two groups



Discussion

Since 1992 east Europe is undergoing a gradual economic and social transformation responsible for a concomitant change in nutritional and lifestyle habits, this, obviously, can have and significant impact on its citizens health (15).

In this study we compared physical activity and dietary habits of

Figure 3 - Mean ± sd. of daily caloric intake in girl groups subdivided in weight classes.
nw = normal weight; ow = overweight; uw = underweight
Statistical analysis was by Student-Newman-Kuels test after ANOVA comparing each group to all other groups and assuming $p<0.05$ as statistically significant. Similar letters indicate statistical significance between the two groups

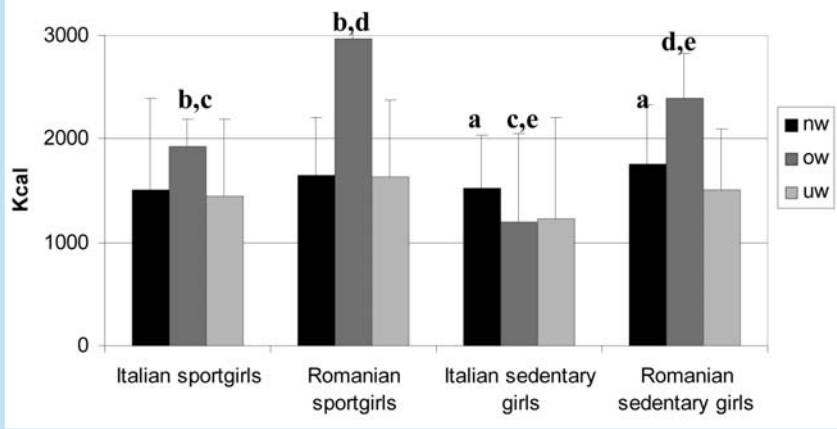
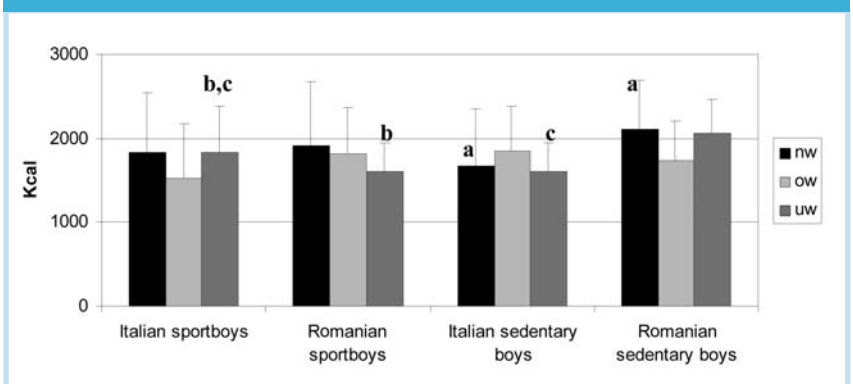


Figure 4 - Mean ± sd. of daily caloric intake in boy groups subdivided in weight classes.
nw = normal weight; ow = overweight; uw = underweight
Statistical analysis was by Student-Newman-Kuels test after ANOVA comparing each group to all other groups and assuming $p<0.05$ as statistically significant. Similar letters indicate statistical significance between the two groups



two groups of Italian and Romanian adolescent. Our findings confirm that considerable differences are present in dietary habits and especially in the frequency of sport activity between an east European country and a west European one. The comparison between hours of performed sporting activities in students of the two countries reveals in Romanian a tendency to a physical activity two or three time higher then that of Italians. The situation is different in overweight students: Italian girls show a higher level of physical activity, while in boys this does not occur.

Gender differences in physical activity participation were analyzed in a previous study (28) where boys were shown to be nearly twice as active then girls, Our study does not confirm these findings, on the contrary, we observe that Romanian girls spend more hours in sporting activity than Romanian or Italian boys. Partially this may be due to their higher sensibility to and idea of beauty closely connected to a certain idea of thinness, so widespread in the young generations. In normal weight subjects of both countries caloric intake is similar in active and sedentary groups and generally it is lower than the Italian recommended daily caloric intake (29, 30). Only normal weight and underweight Romanian sedentary

Table 2 - Macronutrient intake was calculated in normal weight (nw), overweight (ow) and underweight (uw) girls as percentage of the daily energy intake

	Female					
	Italian sportgirls			Romanian sportgirls		
	% Protein (sd)	% Fat (sd)	% Carbohydrate (sd)	% Protein (sd)	%fat (sd)	% Carbohydrate (sd)
nw	18.12 (6.8)	30.25 (2.5)[c]	51.63 (6.3)[d]	18.20 (4.5)[a]	37.90 (3.2)[c]	43.90 (7.2)[d,e]
ow	17.52 (6.1)	30.81 (3.2)	51.67 (5.1)[i]	12.94 (2.1)	27.04 (4.9)[h]	60.02 (1.8)[i,l]
uw	17.21 (6.5)	34.03 (3.1)[o]	49.07 (4.3)[q]	18.11 (3.2)	38.40 (5.5)[p]	43.49 (6.7)[q,r]
	Italian sedentary			Romanian sedentary		
	%Protein (sd)	%fat (sd)	%Carbohydrate (sd)	%Protein (sd)	%fat (sd)	%Carbohydrate (sd)
nw	17.15 (4.5)[b]	33.03 (3.5)[c]	49.82 (6.2)	15.31 (4.9)[a,b]	33.93 (7.6)	50.76 (2.4)[e]
ow	18.56 (5.6)	30.97 (8.6)[g]	50.47 (2.3)[n]	16.75 (6.9)	35.04 (5.7)[h,g]	48.21 (5.0)[l,n]
uw	17.48 (7.5)	32.09 (5.9)[o]	50.43 (4.6)[s]	17.34 (4.9)	35.54 (4.6)[p]	47.12 (1.1)[r,s]

Statistical analysis was by Student-Newman-Kuels test after ANOVA comparing each group to all other groups and assuming $p<0.05$ as statistically significant. Similar letters indicate statistical significance between the two groups.
nw: normal weight; ow: overweight; uw: underweight

Table 3 - Macronutrient intake was calculated in normal weight (nw), overweight (ow) and underweight (uw) boys as percentage of the daily energy intake

	Male					
	Italian sportboys			Romanian sportboys		
	% Protein (sd)	% Fat (sd)	% Carbohydrate (sd)	% Protein (sd)	% fat (sd)	% Carbohydrate (sd)
nw	17.83 (7.8)	31.34 (6.9)[c,d]	50.83 (1.0)[f,g]	18.46 (6.3)[b]	36.84 (2.4)[d,e]	44.70 (2.4)[g,i]
ow	15.84 (6.8)	32.66 (6.1)	51.51 (3.8)	16.93 (9.4)	37.54 (7.5)	45.53 (7.6)
uw	16.06 (5.5)	35.19 (2.4)[l]	48.75 (9.6)	21.53 (4.3)	41.20 (6.3)[l]	37.27 (2.9)
	Italian sedentary			Romanian sedentary		
	% Protein (sd)	% Fat (sd)	% Carbohydrate (sd)	% Protein (sd)	% fat (sd)	% Carbohydrate (sd)
nw	17.79 (7.9)[a]	34.92 (1.2)[c]	47.29 (7.6)[f,h]	15.16 (2.9)[a,b]	34.18 (5.6)[e]	50.66 (6.3)[h,i]
ow	18.37 (4.9)	31.60 (2.5)	50.03 (6.4)	16.89 (7.0)	35.91 (11)	47.20 (9.6)
uw	15.27 (3.8)	34.10 (5.6)	50.63 (4.5)	18.37 (7.1)	39.43 (2.6)	42.20 (12.0)

Statistical analysis was by Student-Newman-Kuels test after ANOVA comparing each group to all other groups and assuming $p<0.05$ as statistically significant. Similar letters indicate statistical significance between the two groups.
nw: normal weight; ow: overweight; uw: underweight

Figure 5 - Percentage of normal weight (nw), overweight (ow) and underweight (uw) Italian and Romanian girls and boys in relation to mother's job. nw = normal weight; ow = overweight; uw = underweight
Statistical analysis was by Student-Newman-Kuels test after ANOVA comparing each group to all other groups and assuming $p<0.05$ as statistically significant. Similar letters indicate statistical significance between the two groups

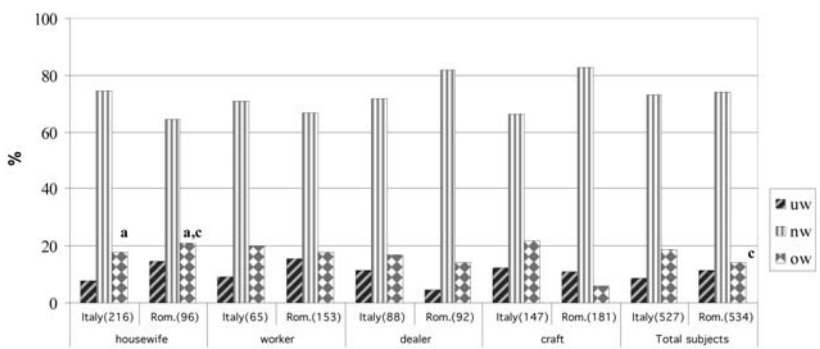
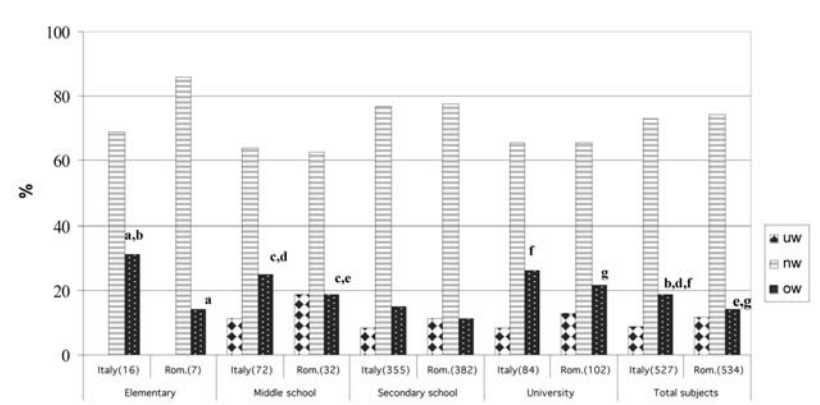


Figure 6 - Percentage of normal weight (nw), overweight (ow) and underweight (uw) Italian and Romanian girls and boys in relation to mother's education level. nw = normal weight; ow = overweight; uw = underweight
Statistical analysis was by Student-Newman-Kuels test after ANOVA comparing each group to all other groups and assuming $p<0.05$ as statistically significant. Similar letters indicate statistical significance between the two groups



boys have a caloric intake corresponding to their energy expenditure, while the groups of active students generally display a low intake compared to expenditure. Even the overweight adolescents indicate in the food frequency questionnaires, a low dietary intake; this inconsistency led us to think that the compilation of questionnaire's data underestimate the amount of food intake. The problem of food intake under valuation has been highlighted in Italy by the National Institute of Research on Food and Nutrition (31). The data of Italian groups show that, contrary to expectations, the caloric expenditure exceeds intake also in sedentary students and consequently their physical activity seems to be adequate; but doubt about the accuracy of the food frequency questionnaires (32, 33) and the importance of sport especially in adolescence suggests that one should try improve dietary intake measurement methodologies and encourage physical activity. In Romanian groups, active boys and girls, where physical activity is more frequent and intensive, should pay more attention to an adequate food intake, in order to provide the required energy without damaging their physical development.

The qualitative aspects of diets, indicated by the percentages of

macronutrients, should be carefully evaluated: the protein need is always satisfied in all subjects, even if the value of proteins in the diet of overweight Romanian active girls is slightly too low and the one of underweight Romanian active boys is slightly too high. The lipid percentage is generally too high at the expense of carbohydrates, especially in Romanian students; this carbohydrate deficit could prejudice the athletic performance particularly in active boys and girls. The imbalance of macronutrients is also due to the country culinary traditions, a correct nutritional education may be useful to direct one's choice towards more suitable food, preserving health without distorting traditional dietary habits.

The importance of familial, and particularly maternal, influence on the frequency of sport in the adolescents of the studied groups, seems to be little; so we think that other structures such as school, sport associations etc. should be involved in encouraging students to play sports. On this matter Romania school seems to be more involved in enhancing physical activity of their students, while decisively Italian public schools are not involved enough on this important issue (34, 35). We hope that experimental programs will be able to modify and improve existing physical educational curricula, materials and teacher training. The program "Child and Adolescent Trial for Cardiovascular Health" (27) has demonstrated that proper training and support and the modification of the school environment can affect the physical activity levels and increase the number of children and adolescent able to participate in physical activity.

The two studied groups have shown the need for some changes in order to increase physical activity in Italian adolescents and improve the quantitative and qualitative aspects of diet in Romanian. Behaviour strategies related to correct eating habits and regular physical activity are essential factors to promote a healthy lifestyle in children and adolescents and the involvement of family is essential to that end. This research represents a first approach to monitor and compare physical activity and dietary habits of young students in countries that differ in cultural, social and economical conditions.

This study underline that physical activity combined with nutritional aspects are very important factors to determiner the body weight and eventually health status. Similar data, issued from different European countries, will be helpful to design country specific programs to prevent overweight and obesity in adolescent.

References

1. Moussa MA, Skaik MB, Selwanes SB, Yaghy OY, Bin-Othman SA. Factors associated with obesity in school children. Int J Obes Relat Metab Disord 1994; 18: 513-5.
2. Serra-Majem L, Aranceta Bartrina J, Perez-Rodrigo C, Ribas-Barba L, Delgado-Rubio A. Prevalence and determinants of obesity in Spanish children and young people. Br J Nutr 2006; 96 Suppl 1: S67-72.
3. World health organization. Reducing risk, promoting healthy life. World health report 2002. Who, 2002
4. Luepker RV, Perry CL, McKinlay SM, et al. Outcomes of a field trial to improve children's dietary patterns and physical activity. The child and adolescent trial for cardiovascular health. Catch collaborative group. Jama 1996; 275: 768-76.
5. Oksuz E. Unhealthy body perception among Turkish youths: Socioeconomic status and social comparisons. Coll Antropol 2008; 32: 5-13.
6. Martin JJ, Hernandez LS, Gonzalez MG, Mendez CP, Rey Galan C, Guerrero SM. Trends in childhood and adolescent obesity prevalence in Oviedo (Asturias, Spain) 1992-2006. Acta Paediatr 2008
7. Frye C, Heinrich J. Trends and predictors of overweight and obesity in east German children. Int J Obes Relat Metab Disord 2003; 27: 963-9.
8. Baird J, Fisher D, Lucas P, Kleijnen J, Roberts H, Law C. Being big or growing fast: Systematic review of size and growth in infancy and later obesity. BMJ 2005; 331: 929.
9. Whitaker RC, Pepe MS, Wright JA, Seidel KD, Dietz WH. Early adiposity rebound and the risk of adult obesity. Pediatrics 1998; 101: E5.
10. Dietz WH. Health consequences of obesity in youth: Childhood predictors of adult disease. Pediatrics 1998; 101: 518-25.

11. Zellner K, Ulbricht G, Kromeyer-Hauschild K. Long-term trends in body mass index of children in jena, eastern Germany. Econ Hum Biol 2007; 5: 426-34.
12. Vignerova J, Blaha P, Osancova K, Roth Z. Social inequality and obesity in czech school children. Econ Hum Biol 2004; 2: 107-18.
13. Bielicki T, Szklarska A, Koziel S, Ulijaszek SJ. Changing patterns of social variation in stature in Poland: Effects of transition from a command economy to the free-market system? J Biosoc Sci 2005; 37: 427-34.
14. Humenikova L, Gates GE. Dietary intakes, physical activity, and predictors of child obesity among 4-6th graders in the Czech republic. Cent Eur J Public Health 2007; 15: 23-8.
15. Ulijaszek SJ, Koziel S. Nutrition transition and dietary energy availability in eastern Europe after the collapse of communism. Econ Hum Biol 2007; 5: 359-69.
16. Thompson PD, Buchner D, Pina IL, et al. Exercise and physical activity in the prevention and treatment of atherosclerotic cardiovascular disease: A statement from the council on clinical cardiology (subcommittee on exercise, rehabilitation, and prevention) and the council on nutrition, physical activity, and metabolism (subcommittee on physical activity). Circulation 2003; 107: 3109-16.
17. Pate RR, O'Neill JR. Summary of the American heart association scientific statement: Promoting physical activity in children and youth: A leadership role for schools. J Cardiovasc Nurs 2008; 23: 44-9.
18. Pate RR, Pratt M, Blair SN, et al. Physical activity and public health. A recommendation from the centers for disease control and prevention and the American college of sports medicine. JAMA 1995; 273: 402-7.
19. Haase A, Steptoe A, Sallis JF, Wardle J. Leisure-time physical activity in university students from 23 countries: Associations with health beliefs, risk awareness, and national economic development. Prev Med 2004; 39: 182-90.
20. Martinez-Gonzalez MA, Varo JJ, Santos JL, et al. Prevalence of physical activity during leisure time in the European union. Med Sci Sports Exerc 2001; 33: 1142-6.
21. Koziel S, Szklarska A, Bielicki T, Malina RM. Changes in the BMI of polish conscripts between 1965 and 2001: Secular and socio-occupational variation. Int J Obes (Lond) 2006; 30: 1382-8.
22. Koziel S, Welon Z, Bielicki T, Szklarska A, Ulijaszek S. The effect of the economic transition on the body mass index of conscripts in Poland. Econ Hum Biol 2004; 2: 97-106.
23. Cacciari E, Milani S, Balsamo A, et al. Italian cross-sectional growth charts for height, weight and bmi (6-20 y). Eur J Clin Nutr 2002; 56: 171-80.
24. Willett WC, Sampson L, Stampfer MJ, et al. Reproducibility and validity of a semiquantitative food frequency questionnaire. Am J Epidemiol 1985; 122: 51-65.
25. Rimm EB, Giovannucci EL, Stampfer MJ, Colditz GA, Litin LB, Willett WC. Reproducibility and validity of an expanded self-administered semiquantitative food frequency questionnaire among male health professionals. Am J Epidemiol 1992; 135: 1114-26; discussion 1127-36.
26. Booth M. Assessment of physical activity: An international perspective. Res Q Exerc Sport 2000; 71: S114-120.
27. Craig CL, Marshall AL, Sjostrom M, et al. International physical activity questionnaire: 12-country reliability and validity. Med Sci Sports Exerc 2003; 35: 1381-95.
28. Trost SG, Pate RR, Dowda M, Saunders R, Ward DS, Felton G. Gender differences in physical activity and determinants of physical activity in rural fifth grade children. J Sch Health 1996; 66: 145-50.
29. Società italiana nutrizione umana (SINU). Livelli di assunzione raccomandati di energia e nutrienti per la popolazione italiana – LARN Rome, 1996.
30. Istituto nazionale di ricerca per gli alimenti e la nutrizione (INRAN). Manuale di sorveglianza nazionale. Rome, 2003.
31. Ministero politiche agricole e forestali – istituto nazionale ricerca alimenti nutrizione linee guida per una sana alimentazione italiana, 2003.
32. O'Neil PM. Assessing dietary intake in the management of obesity. Obes Res 2001; 9 Suppl 5: 361S-366S; discussion 373S-374S.
33. Brunner E, Stallone D, Juneja M, Bingham S, Marmot M. Dietary assessment in whitehall ii: Comparison of 7 d diet diary and food-frequency questionnaire and validity against biomarkers. Br J Nutr 2001; 86: 405-14.
34. Travisi L. Legislazione-regolamentazione-organizzazione dell'educazione fisica e sportiva nella scuola italiana. Ed Centro studi per l'educazione fisica di Bologna 1961; volume II - parte prima.
35. Juliis TD. L'educazione fisica e lo sport nella scuola italiana. Ed Le Monnier, Firenze 1990.